



MÁSTER EN INGENIERÍA INDUSTRIAL

TRABAJO FIN DE MÁSTER

Unit Substation Design for Petrochemical and Lube Integration Project “LuPech” (J-18) at IOCL Gujarat Refinery

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Madrid

Julio 2023

Declaro, bajo mi responsabilidad, que el Proyecto presentado con el título ‘Unit Substation Design for Petrochemical and Lube Integration Project “LuPech” (J-18) at IOCL Gujarat Refinery’ en la ETS de Ingeniería - ICAI de la Universidad Pontificia Comillas en el curso académico 2022/2023 es de mi autoría, original e inédito y no ha sido presentado con anterioridad a otros efectos.

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Fecha: 13/07/2023

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UNIT SUBSTATION DESIGN FOR PETROCHEMICAL AND LUBE PROJECT 'LUPECH' (J-18) AT IOCL GUJARAT REFINERY

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Collaborating Entity: ICAI – Universidad Pontificia Comillas, Intecs Industrial S.A.

ABSTRACT

This Master's Thesis studies the electrical installation design for a petrochemical and lube project called 'Lupech' (J-18). This project is the expansion of an Indian Oil Corporation Limited (IOCL) refinery in the province of Gujarat, India. More specifically, the thesis will focus on the design of a unit substation, identified as 'ESS-044', which will provide electrical power supply to the following new units located at the refinery: INDMAX RFCC (Residue Fluid Catalytic Cracking) unit and LPG (Liquified Petroleum Gas) treater units.

The engineering design is done in collaboration with Intecs Industrial S.A., a Spanish corporation specialized in the development of EPC (Engineering, Procurement and Construction supervision) services. The main electrical design equipment requirements and conditions are provided in the FEED (Front-End Engineering Design) and must be perfectly followed by the contractor, Intecs Industrial. For the calculation and design of the installation, the standard calculation methods acquired by Intecs Industrial will be applied. All these methods follow the necessary regulations, both international and national. Furthermore, ETAP (Electrical Transient Analyzer Program) software is used to check results and calculations.

The main electrical equipment that will be implemented in the substation are transformers, HV (High Voltage) and MV (Medium Voltage) switchgears, capacitor banks, battery banks, PMCC (Power Motor Control Center), MCC (Motor Control Center), AC (Alternating Current) and DC (Direct Current) UPS (Uninterruptable Power Supply), LDB (Light Distribution Board), PDB (Power Distribution Board), auxiliary switchboards and VFD (Variable Frequency Drive) included into MCC's arrangement. Furthermore, there is also an estimation of the cabling system, lightning system, earthing system and lighting system.

Finally, in addition to the detailed design of the substation, a load flow and state voltage study, motor starting study, short circuit study and harmonic study of the system have been held to analyze and evaluate the performance and safety of electrical systems.

Keywords: unit substation design, refinery, electrical equipment, power supply system.

1. Introduction

Intecs Industrial S.A., a Spanish corporation specialized in the development of EPC (Engineering, Procurement and Construction supervision) services; is participating in the expansion of an Indian Oil Corporation Limited (IOCL) refinery in the province of Gujarat, India. This project will represent part of the work done with the electrical department team to develop the electrical installation for the refinery's project, also called "LuPech" (J-18) project. More specifically, the thesis will focus on the design of a unit substation, identified as 'ESS-044', which will provide electrical power supply to the following new units located at the refinery: INDMAX RFCC (Residue Fluid Catalytic Cracking) unit and LPG (Liquified Petroleum Gas) treater units. The main electrical design equipment requirements and conditions are provided in the FEED (Front-End Engineering Design) and must be perfectly followed by the contractor, Intecs Industrial.

2. Project definition

The objectives of the thesis are as follows:

- General overview of a refinery's functionalities and sections, especially for the LPG (Liquefied Petroleum Gas) treater units and INDMAX RFCC (Residue Fluid Catalytic Cracking) Unit.
- Correct application of national and international regulation standards for electrical installations.
- Development of a logical design process for the main electrical equipment and installation of the refinery's substation.

- Detailed study of the different equipment that will be installed in the substation.

For the calculation and design of the installation, the standard calculation methods acquired by Intecsa Industrial will be applied. This methodology has been developed and improved over the years, as they have used it in all their projects. All the methods follow the necessary regulations, both international and national. Before submitting all documentation, these calculations are verified and signed by the project manager. Furthermore, in many cases, ETAP (Electrical Transient Analyzer Program) software is used to check results and calculations. Other used resources are AutoCAD for the diagrams design and DIALux for the lighting calculations.

3. Electrical design basis

Substation shall be provided with 33kV GIS (Gas Insulated Switchgear) with 2 I/C and 1 B/C (two incomer and one bus coupler) with double bus configuration. The existing refinery has captive power plant with a total capacity of 217.5 MW: 6x30 MW GTGs (Gas Turbine Generators) and 3x12.5 MW STGs (Steam Turbine Generators) at 11kV and 6.9kV, and distributed to various substations at 33kV and 11kV, feeding the existing plant. The electrical power demand for the proposed units of the substation would be met from:

- An existing electrical system for BS-VI Project,
- 220kV grid by extending additional two bays at existing 220kV GIS,
- Existing substations named CGP-I and II.

A dedicated emergency system, with an EPMCC (Emergency Power Motor Control Center) shall be used for emergency loads fed from the substation. This EPMCC shall have three incomers and no bus-coupler configuration. Out of three incomers, two incomers (normal source) shall be fed from the substation itself such that the sources are fed from different power sources at the highest end. The third source (emergency source) shall be through an 11 kV/0.433 V transformer fed from the emergency network established inside the refinery. In case of an emergency from the existing network, the 11 kV feeder from the existing 11 kV switchboard (stationed nearby) shall be fed through cables up to the unit substation and step down to 415 V through dedicated distribution transformer.

All HV (High Voltage) and MV (Medium Voltage) switchboards shall generally have two sections operating independently with two incoming feeders and with bus coupler open having facility for auto-changeover in the event of failure of either of the incoming circuit breakers. The rating of bus ducts connected to breakers shall have the same continuous and short circuit rating as the connecting main bus bars of switchboards. HV bus duct shall be phase segregated type and MV bus duct shall be non-phase segregated type.

A separate AC system for critical instrument power supply shall be installed for each process unit in the control room. The AC UPS (Uninterruptable Power Supply) system shall be of redundant (non-parallel) configuration with 2x100% capacity and with dual battery banks. The system must also have a DC system with a battery charger for switchgear control and critical lighting that shall be separate for each process unit. This system shall have rectifier-cum-battery in parallel redundant configuration with dedicated battery bank. Motors shall be totally enclosed, fan cooled type and suitable for continuous use. An adequate number of welding receptacles shall be provided at suitable locations to ensure accessibility.

4. Substation design

The electrical equipment that will be implemented in the substation is summarized. The connectivity of the electrical system is outlined in the figure.

- Transformers.

There are a total of 16 transformers, classified in three types: power, distribution and lighting. All transformers, except lighting transformers, shall be three phase, oil immersed and double wound type suitable for outdoor use. Power transformers shall be with dual rating ONAN/ONAF whereas distribution transformers shall be with ONAN rating. Transformers sizing has been done following two operating conditions: firstly, for running conditions at maximum peak demand with 100% continuous load +30% intermittent load +10% stand-by load +20% margin for future load growth and, secondly, for starting conditions of largest motor. Transformer power is estimated by considering both cases. Once the transformer size is calculated, the voltage drop at the transformer secondary terminals during start-up of the highest starting current of motor at pre-loaded condition and voltage drop conditions are verified.

- HV switchgears.

There are three main HV switchgears: 33kV gas-insulated switchgear (GIS) and 6.6kV or 11kV air-insulated switchgears (AIS). Switchgears are designed to withstand the stresses caused by fault conditions, including the specified rated short circuit current, without sustaining damage.

The system has one GIS identified as 044-HT33-101. It is a high-voltage, metal-enclosed switchgear system that utilizes insulating Sulphur hexafluoride (SF6) gas for complete insulation. This GIS switchgear consists of three panels of incomers and bus coupler, eight panels of outgoing units and one metering panel with potential and current transformers. All panels include a three-position disconnect switch. Three-position disconnect is used for “disconnecting”, “earthing” and “ready-to-earth” functions. The system also comprises of three AIS equipment items: 044-HT11-101 (11 kV emergency switchgear with air-insulated design), 044-HT6-101 (6.6 kV switchgear featuring an air-insulated configuration and an auto transfer scheme) and 044-HT6-102 (6.6 kV emergency switchgear also incorporating an auto transfer scheme but with three incomers and no bus coupler in bus). In all cases, the circuit breakers used are vacuum type and designed to withstand impacts and vibrations.

- MV switchgears.

The system has four PMCCs (Power Motor Control Center) and seven MCCs (Motor Control Center), which are medium voltage switchgears composed by an aluminum single busbar system. PMCCs and MCCs have a rated insulation voltage of 1000V and operate on a three phase, four wire configuration with an operating voltage of 415V. Each switchgear includes cubicles and panels, which are combined depending on the supply needs. All switchgears have at least 2 incomer cubicles and one bus coupler cubicle with LVPCB (Low Voltage Power Circuit Breaker), potential transformer (PT) cubicle and a bus riser with PT cubicle. They will also include panels for motors, depending on the power range, and outgoing feeder panels, depending on the currents. If needed, VFDs (Variable Frequency Drive) were included in MCC’s arrangements.

- Distribution panels.

Different distribution panels have been implemented, which are identified depending on their location and their function:

- o MLDB: Main Light Distribution Board,
- o EMLDB: Emergency Main Light Distribution Board,
- o LDB: 15 Light Distribution Boards,
- o PDB: 5 Power Distribution Boards,
- o ELDB: 15 Emergency Light Distribution Boards,
- o ASB: 2 Auxiliary Switchboards,
- o DCDB: 2 Direct Current Distribution Board,
- o ACDB: 2 Alternating Current Distribution Board.

- Capacitor bank.

Two capacitor banks are added to switchboard 044-HT6-101 to reduce excessive reactive energy to the system. The required capacity rating of each capacitor bank, as well as the overvoltage and reactive power nominal characteristics are calculated. Capacitor banks will produce a resonance close to the harmonics of greater amplitude, that is why a filter reactor is also designed.

- DC (Direct Current) and AC (Alternating Current) UPS (Uninterruptable Power Supply).

Two 110V AC UPS systems will be implemented: 044-UPS-101 for critical instruments DCS (Disturbed Control System) and 044-UPS-102 for telecom and CCTV (Closed-Circuit Television) systems. The UPS systems shall have a redundant scheme with two units with individual bypass for each unit. The DC system is composed of two DC chargers: 044-DC-101 for switchgear control and 044-DC-102 for critical lighting. For all four cases, the battery’s banks cell sizing capacity are calculated following the IEEE Standard 1115-2000. Nickel-cadmium cells with a rated 1,2V/cell will be used.

Besides the electrical equipment, other systems have been estimated:

- Cabling system.

Cables shall be with stranded aluminum or copper conductor, XLPE insulated, extruded PVC inner sheathed, armored and extruded FRLS PVC outer sheathed. The power and control cables shall have the minimum cross-sectional areas and maximum voltage drop requirements, depending on the equipment. Cables will be placed as buried cables or on the cable cellar through a cable ladder. All the correction factors for these cases have been calculated. The cable sizing calculations verify the following criteria: current carrying capacity, maximum voltage drop and maximum short circuit current.

- Grounding system.

The main earthing network shall be used for earthing equipment to protect it against static electricity. The system will be an earth-grid connection that shall comprise G.I. (galvanized iron) earth electrodes interconnected through an underground network of bare earth conductors. The number of rods considered for the design of the substation is 50. The grid geometry will be rectangular and two electrodes per transformer have been considered.

- Lightning system.

The substation has been considered as a flat roof building with a lightning protection system of class II, external lightning protection will be provided through a 10x10 meters grid with a 50x6 mm G.I. strip size. Down-conductors will be distributed around the perimeter of the structure to be protected, with a 10 meters distance between them. Air-termination rods will be placed following a distance of 30 m.

- Lighting system.

Lighting analysis has been held with DIALux software. Average illumination levels with minimum lux requirements and ratios requested by the client have been maintained. Philips luminaires models were used.

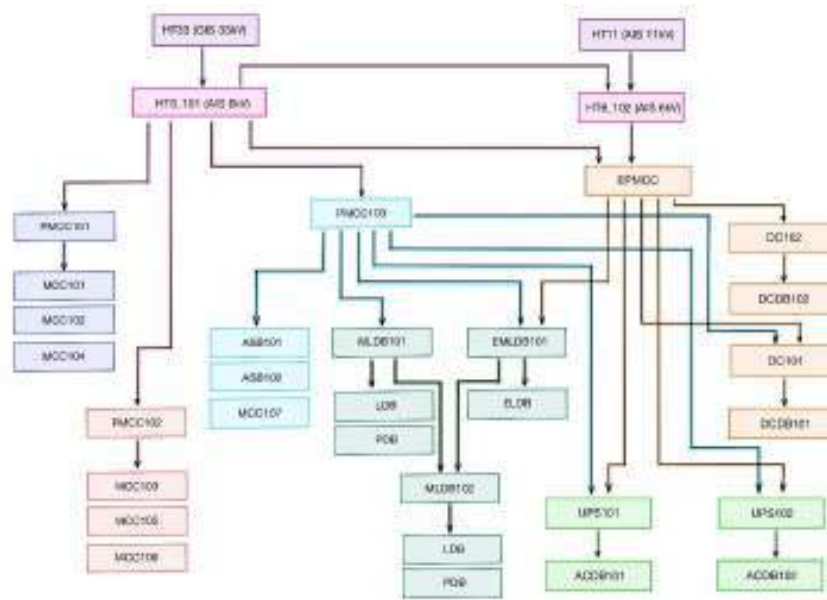


Figure. Electrical equipment connection scheme.

In addition to the detailed design of the substation, a load flow and state voltage study, motor starting study, short circuit study and harmonic study of the system have been held to analyze and evaluate the performance and safety of electrical systems. These studies have been done with ETAP software.

Three case scenarios have been identified:

- Normal operation: 044-HT33-101, PMCCs and MCCs shall have bus coupler breaker operated normally open. For MLDB and ASB switchboards, both the incomers shall be 'closed' with bus coupler in 'open' condition. EMLDB switchboard shall be operated with bus coupler in 'close' condition, and shall be fed from PMCC, incomer 1. UPS loads shall be fed from their inverter outputs. Regarding EPMCC, incomer 1 (normal source 1 from substation) shall operate normally closed. Incomer 2 (normal source 2 from substation) and the incomer 3 (fed from emergency network) shall be operated normally open.
- Contingency operation: 044-HT33-101, PMCCs and MCCs shall have bus coupler operated normally closed. MLDB, EMLDB and ASB switchboards shall be fed by one incomer. Their bus coupler shall be operated normally closed. EPMCC incomer 2 should operate normally closed. Incomer 1 (normal source 1 from substation) and the incomer 3 (fed from emergency network) shall be operated normally open. UPS loads shall be fed from bypass transformers.
- Emergency operation: Switchboard EPMCC shall be in operation and connected to load. EPMCC will be fed from 044-HT6-102, and the 044-HT6-102 will be fed from 044-HT11-101. The other switchgears and switchboards that are not connected through EPMCC or 044-HT11-101, shall be considered de-energized. UPS loads shall be fed from bypass transformers.

DISEÑO DE SUBESTACIÓN PARA EL PROYECTO PETROQUÍMICO Y LUBRICANTE 'LUPECH' (J-18) EN LA REFINERÍA DE GUJARAT DE IOCL

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RESUMEN DEL PROYECTO

Este Trabajo de Fin de Máster estudia el diseño de la instalación eléctrica para un proyecto petroquímico y de lubricantes llamado 'Lupech' (J-18). Este proyecto es la expansión de una refinería de Indian Oil Corporation Limited (IOCL) en la provincia de Gujarat, India. Más concretamente, el trabajo se centrará en el diseño de una subestación, identificada como 'ESS-044', que proporcionará suministro eléctrico a las siguientes unidades nuevas ubicadas en la refinería: unidad INDMAX RFCC (Residue Fluid Catalytic Cracking) y unidades de tratamiento de gas de petróleo licuado.

El diseño de ingeniería se realiza en colaboración con Intecs Industrial S.A., una corporación española especializada en el desarrollo de servicios EPC (Engineering, Procurement and Construction supervision). Los requisitos y condiciones principales del equipo de diseño eléctrico se proporcionan en el FEED (Front-End Engineering Design) y deben ser seguidos perfectamente por el contratista, Intecs Industrial. Para el cálculo y diseño de la instalación, se aplicarán los métodos de cálculo estándar adquiridos por Intecs Industrial. Todos estos métodos siguen las regulaciones necesarias, tanto internacionales como nacionales. Además, se utiliza el software ETAP (Electrical Transient Analyzer Program) para verificar resultados y cálculos.

Los principales equipos eléctricos que se implementarán en la subestación son transformadores, interruptores de alta y media tensión, baterías de condensadores, bancos de baterías, PMCC (Centro de Control de Motores de Potencia), MCC (Centro de Control de Motores), SAI (Sistema de Alimentación Ininterrumpida) de corriente alterna y corriente continua, cuadros de distribución de alumbrado (LDB, Light Distribution Board) y de potencia (PDB, Power Distribution Board), cuadros eléctricos auxiliares y VFDs (Variador de Frecuencia) que estarán incluidos en el arreglo de los MCCs. También se realiza una estimación del sistema de cableado, sistema de pararrayos, sistema de puesta a tierra y sistema de alumbrado.

Finalmente, además del diseño detallado de la subestación, se han llevado a cabo un estudio de flujo de cargas y voltaje, un estudio de arranque de motores, un estudio de cortocircuito y un estudio armónico del sistema para analizar y evaluar el rendimiento y la seguridad de los sistemas eléctricos.

Palabras clave: diseño de subestación, refinería, equipos eléctricos, sistema de alimentación eléctrico.

1. Introducción

Intecs Industrial S.A., corporación española especializada en el desarrollo de servicios EPC (Engineering, Procurement and Construction supervision) está participando en la ampliación de una refinería de Indian Oil Corporation Limited (IOCL) en la provincia de Gujarat, India. Este proyecto representará parte del trabajo realizado con su equipo del departamento eléctrico para desarrollar la instalación eléctrica del proyecto de la refinería, también llamado proyecto 'LuPech' (J-18). Más concretamente, este trabajo se centrará en el diseño de una subestación, identificada como 'ESS-044', que proporcionará suministro eléctrico a las siguientes unidades nuevas ubicadas en la refinería: unidad INDMAX RFCC (Residue Fluid Catalytic Cracking) y unidades de tratamiento de gas de petróleo licuado. Los principales requisitos y condiciones de los equipos eléctricos de diseño están recogidos en el FEED (Front-End Engineering Design) y deben ser perfectamente seguidos por el contratista.

2. Definición de proyecto

Los objetivos del proyecto son los siguientes:

- Descripción de las funcionalidades de la unidad INDMAX RFCC (Residue Fluid Catalytic Cracking) y las unidades de tratamiento de gas de petróleo licuado.

- Aplicación de las normas nacionales e internacionales de regulación de las instalaciones eléctricas.
- Desarrollo de un proceso lógico de diseño de los principales equipos eléctricos y de la instalación de la subestación de la refinería.
- Estudio detallado de los diferentes equipos que se instalarán en la subestación.

Para el cálculo y diseño de la instalación se aplicarán los métodos de cálculo normalizados adquiridos por Intecsa Industrial. Todos los métodos siguen la normativa necesaria, tanto internacional como nacional. Además, en muchos casos se utiliza el software ETAP (Electrical Transient Analyzer Program) para comprobar los resultados y los cálculos. Otros recursos han sido utilizados como AutoCAD para el diseño de los esquemas y DIALux para los cálculos de iluminación.

3. Bases de diseño

La subestación estará equipada con un GIS (Interruptor de Aislamiento en Gas) de 33 kV con 2 I/C (alimentadores entrantes) y 1 B/C (acoplador de bus) en configuración de doble bus. La refinería existente cuenta con un sistema de alimentación propio con una capacidad total de 217,5 MW: 6x30 MW de GTGs (Generadores de Turbina de Gas) y 3x12,5 MW de STGs (Generadores de Turbina de Vapor) a 11 kV y 6,9 kV, que distribuyen a varias subestaciones de la planta existente. La demanda de energía eléctrica para las unidades propuestas de la subestación se cubriría desde:

- Un sistema eléctrico existente para el proyecto BS-VI,
- Una red de 220kV mediante la ampliación de dos bahías adicionales en el GIS de 220kV existente,
- Dos subestaciones existentes denominadas CGP-I y II.

Para las cargas de emergencia alimentadas desde la subestación, se utilizará un sistema de emergencia dedicado con un EPMCC (Emergency Power Motor Control Center). Este EPMCC tendrá tres entradas y ninguna configuración de acoplador de bus. De las tres entradas, dos (fuente normal) se alimentarán desde la propia subestación, de forma que se alimentan desde fuentes de energía exteriores. La tercera fuente (fuente de emergencia) se realizará a través de un transformador de 11 kV/0,433 V alimentado desde la red de emergencia establecida en el interior de la refinería. En el caso de emergencia procedente de la red existente, el alimentador de 11 kV del cuadro de distribución se alimentará mediante cables hasta la subestación de la unidad y se reducirá a 415 V mediante un transformador de distribución específico.

Todos los cuadros de AT (Alta Tensión) y MT (Media Tensión) tendrán generalmente dos secciones que funcionen independientemente con dos alimentadores de entrada y con acoplador de barras abierto que permita la conmutación automática en caso de fallo de cualquiera de los interruptores de entrada. El valor nominal de los conductos de barras conectados a los disyuntores tendrá el mismo valor nominal continuo y de cortocircuito que el de las barras principales de conexión de los cuadros de distribución. Los conductos de barras de AT serán con separación de fases y los de MT serán sin separación de fases.

Se instalará un sistema de CA (Corriente Alterna) independiente en la sala de control para la alimentación de los instrumentos críticos para cada unidad de proceso. El sistema SAI (Sistema de Alimentación Ininterrumpida) de CA deberá tener una configuración redundante (no paralela) con una capacidad de 2 veces el 100% y con bancos de baterías dobles. El sistema también debe disponer de un sistema de CC (Corriente Continua) con un cargador de baterías para el control de los conmutadores y la iluminación crítica que será independiente para cada unidad de proceso. Este sistema tendrá un rectificador y una batería en configuración redundante en paralelo con un banco de baterías dedicado. Los motores serán totalmente cerrados, refrigerados por ventilador y aptos para uso continuo.

4. Diseño de la subestación

Se resumen los equipos eléctricos que se implantarán en la subestación. La conectividad del sistema eléctrico se esquematiza en la ilustración.

- Transformadores.

Hay un total de 16 transformadores, clasificados en tres tipos: potencia, distribución e iluminación. Todos los transformadores, excepto los transformadores de iluminación, serán trifásicos, sumergidos en aceite y de doble bobinado, adecuados para uso en exteriores. Los transformadores de potencia tendrán una clasificación dual ONAN/ONAF, mientras que los transformadores de distribución tendrán una clasificación ONAN. El dimensionamiento de los transformadores se ha realizado siguiendo dos condiciones de funcionamiento: en primer lugar, para demanda máxima con una carga continua del 100% + carga intermitente del 30% + carga de reserva del 10% + margen del 20% para el crecimiento futuro de la carga; y en segundo lugar, para condiciones de arranque del motor más grande. La potencia del transformador se estima teniendo en cuenta ambos casos. Una vez calculado

el tamaño del transformador, se verifica la caída de voltaje en los bornes secundarios del transformador durante el arranque con la corriente de arranque más alta del motor en condiciones precargadas y se verifican las condiciones de caída de voltaje.

- Aparamenta de alta tensión

Existen tres equipos principales de conmutación de alta tensión: interruptores de aislamiento en gas (GIS, Gas Insulated Switchgear) de 33 kV e interruptores de aire aislados (AIS, Air Insulated Switchgear) de 6,6 kV o 11 kV. Los equipos de conmutación están diseñados para resistir las tensiones causadas por condiciones de falla, incluida la corriente de cortocircuito nominal especificada, sin sufrir daños.

El sistema cuenta con un GIS identificado como 044-HT33-101. Es un sistema de conmutación de alta tensión encapsulado en metal que utiliza gas aislante de hexafluoruro de azufre (SF6) para un aislamiento completo. Este equipo de conmutación GIS consta de tres paneles de alimentación entrante y acoplador de bus, ocho paneles de unidades salientes y un panel de medición con transformadores de potencial y corriente. Todos los paneles incluyen un interruptor de desconexión de tres posiciones. El interruptor de desconexión de tres posiciones se utiliza para las funciones de "desconexión", "puesta a tierra" y "preparado para puesta a tierra". El sistema también incluye tres elementos de equipo AIS: 044-HT11-101 (interruptor de emergencia de 11 kV con diseño de aire aislado), 044-HT6-101 (equipo de conmutación de 6,6 kV con una configuración de aire aislado y un esquema de transferencia automática) y 044-HT6-102 (interruptor de emergencia de 6,6 kV que también incorpora un esquema de transferencia automática, pero con tres alimentadores entrantes y sin acoplador de bus). En todos los casos, los interruptores de circuito utilizados son de vacío y están diseñados para resistir impactos y vibraciones.

- Aparamenta de media tensión

El sistema cuenta con cuatro PMCCs (Power Motor Control Center) y siete MCCs (Motor Control Center), que son interruptores de media tensión compuestos por un sistema de barra colectora de aluminio. Los PMCCs y los MCCs tienen una tensión nominal de aislamiento de 1000V y funcionan en una configuración trifásica de cuatro hilos con una tensión de operación de 415V. Cada interruptor de media tensión incluye cubículos y paneles que se combinan según las necesidades de suministro. Todos los interruptores de media tensión tienen al menos 2 cubículos de alimentación entrante y un cubículo de acoplador de bus con un interruptor (LVPCB, Low Voltage Power Circuit Breaker), un cubículo de transformador de potencial (PT) y un alimentador de bus con un cubículo de PT. También se incluirán paneles para motores, según el rango de potencia, y paneles de salida de alimentadores, según las corrientes. Si es necesario, se incluyeron variadores de frecuencia (VFD, Variable Frequency Drive) en los arreglos de los MCCs.

- Cuadros de distribución.

Se han implementado diferentes paneles de distribución, los cuales se identifican dependiendo de su ubicación y su función:

- o MLDB (Main Light Distribution Board): cuadro principal de distribución de iluminación.
- o EMLDB (Emergency Main Light Distribution Board): cuadro principal de distribución de iluminación de emergencia.
- o LDB (Light Distribution Board): 15 cuadros de distribución de iluminación.
- o PDB (Power Distribution Board): 5 cuadros de distribución de potencia.
- o ELDB (Emergency Light Distribution Board): 15 cuadros de distribución de iluminación de emergencia.
- o ASB (Auxiliary Switchboard): 2 cuadros auxiliares.
- o DCDB (Direct Current Distribution Board): 2 cuadros de distribución de corriente continua.
- o ACDB (Alternating Current Distribution Board): 2 cuadros de distribución de corriente alterna.

- Banco de condensadores.

Se agregan dos bancos de condensadores al 044-HT6-101 para reducir el exceso de energía reactiva en el sistema. Se ha calculado la capacidad requerida de cada banco, así como las características nominales de sobretensión y potencia reactiva. Los bancos de condensadores producirán una resonancia cercana a los armónicos de mayor amplitud, por lo cual también se diseña un reactor de filtro.

- Sistema de CC y SAI de CA.

Se implementarán dos sistemas SAI de CA de 110V: 044-UPS-101 para instrumentos críticos DCS (Disturbed Control System) y 044-UPS-102 para sistemas de telecomunicaciones y CCTV (Closed-Circuit Television). Los sistemas UPS deben tener un esquema redundante con dos unidades y un bypass individual para cada unidad. El sistema de CC está compuesto por dos cargadores de CC: 044-DC-101 para el control de interruptores y 044-DC-102 para iluminación crítica. En los cuatro casos, se calcula la capacidad de las celdas de los bancos de baterías siguiendo la norma IEEE 1115-2000. Se utilizarán celdas de níquel-cadmio con una tensión nominal de 1,2V/celda.

Además del equipo eléctrico, se han estimado otros sistemas:

- Sistema de cableado

Los cables deben ser conductores de aluminio o cobre trenzado, con aislamiento de XLPE, cubierta interior de PVC extruido, blindaje y cubierta exterior de PVC extruido FRLS (libre de halógenos y retardante de llama). Los cables de alimentación y control deben tener áreas mínimas y requisitos máximos de caída de tensión, dependiendo del equipo. Los cables se colocarán como cables enterrados o en el sótano de cables a través de bandejas. Todos los factores de corrección para estos casos se han calculado. Los cálculos de dimensionamiento del cable verifican los siguientes criterios: capacidad de corriente, caída de tensión máxima y corriente de cortocircuito máxima.

- Sistema de puesta a tierra

La puesta a tierra se utilizará para conectar a tierra el equipo y protegerlo contra la electricidad estática. El sistema consistirá en una conexión de tierra en forma de red que estará compuesta por picas de hierro galvanizado interconectadas a través de una red subterránea de conductores desnudos. El número de picas considerado para el diseño de la subestación es 50. La geometría de la red será rectangular y se han considerado dos picas por transformador.

- Sistema de pararrayos

La subestación se ha considerado como un edificio de techo plano, con un sistema de protección contra rayos de clase II. Se proporcionará protección externa contra rayos a través de una malla de 10x10 metros con una banda de hierro galvanizado de 50x6mm de tamaño. También se añadirán conductores de descarga que se distribuirán alrededor del perímetro de la estructura con una distancia de 10m entre ellos. Por último, se colocarán varillas de pararrayos separadas 30m entre ellas.

- Sistema de alumbrado

Se ha realizado un análisis de iluminación con el software DIALux. Se han mantenido los niveles promedio de iluminación con los requisitos mínimos de lux y las proporciones solicitadas por el cliente. Se utilizaron modelos de luminarias Philips.

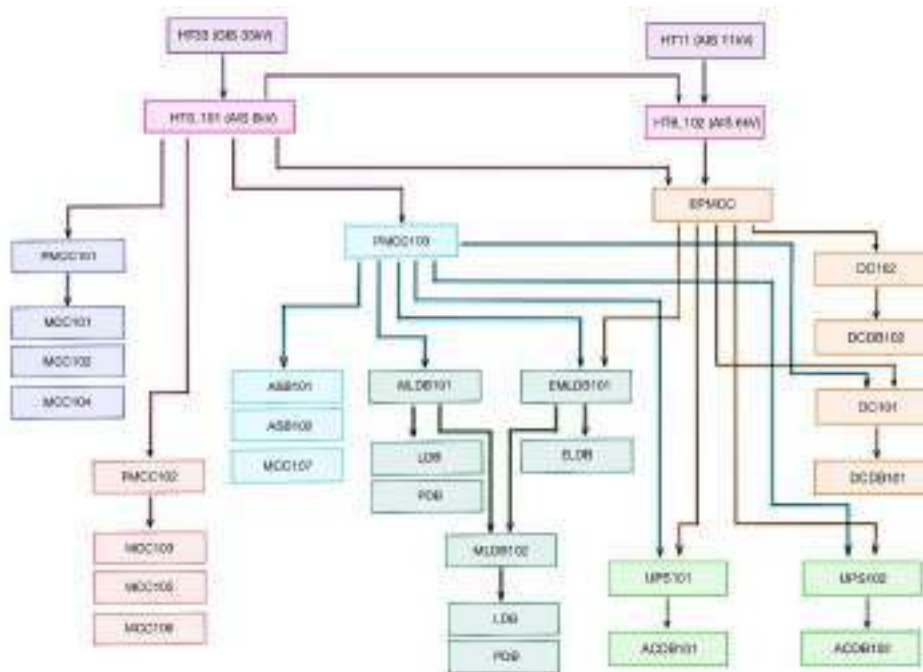


Ilustración. Esquema de conexión de los equipos eléctricos.

Además del diseño detallado de la subestación, se han llevado a cabo un estudio de flujo de carga y estado de voltaje, un estudio de arranque de motores, un estudio de cortocircuito y un estudio armónico del sistema para analizar y evaluar el rendimiento y la seguridad de los sistemas eléctricos. Estos estudios se realizaron con el software ETAP. Se han identificado tres escenarios:

- Operación normal: 044-HT33-101, PMCCs y MCCs tendrán el interruptor de acoplador de bus operado normalmente abierto. Para los cuadros de distribución MLDB y ASB, ambos alimentadores serán 'cerrados' con el acoplador de bus en condición 'abierto'. El cuadro de distribución EMLDB se operará con el acoplador de bus en condición 'cerrada' y se alimentará desde el PMCC, alimentador 1. Las cargas del sistema de alimentación ininterrumpida se alimentarán desde las salidas de los inversores. En cuanto al EPMCC, el alimentador 1 (fuente normal 1 desde la subestación) se operará normalmente cerrado. El alimentador 2 (fuente normal 2 desde la subestación) y el alimentador 3 (alimentado desde la red de emergencia) se operarán normalmente abiertos.
- Operación de contingencia: 044-HT33-101, PMCCs y MCCs tendrán el interruptor de acoplador de bus operado normalmente cerrado. Los cuadros de distribución MLDB, EMLDB y ASB se alimentarán de un alimentador. Su acoplador de bus se operará normalmente cerrado. El alimentador 2 del EPMCC deberá operar normalmente cerrado. El alimentador 1 (fuente normal 1 desde la subestación) y el alimentador 3 (alimentado desde la red de emergencia) se operarán normalmente abiertos. Las cargas del sistema de alimentación ininterrumpida se alimentarán desde transformadores de derivación.
- Operación de emergencia: El cuadro de distribución EPMCC estará en funcionamiento y conectado a la carga. EPMCC se alimentará desde el 044-HT6-102 y el 044-HT6-102 se alimentará desde el 044-HT11-101. Los otros equipos de conmutación y cuadros de distribución que no están conectados a través del EPMCC o del 044-HT11-101 se considerarán desenergizados. Las cargas del sistema de alimentación ininterrumpida se alimentarán desde transformadores de derivación.

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Acronyms

AC	Alternating Current
ACB	Air Circuit Breaker
ACDB	Alternating Current Distribution Board
AIS	Air Insulated Switchgear
ASB	Auxiliary switchboard
API	American Petroleum Institute
APFC	Automatic Power Factor Control
ATS	Automatic Transfer Switch
BIS	Bureau of Indian Standards
CBCT	Core Balance Current Transformer
CLO	Clarified Liquid Oil
CT	Current Transformer
DC	Direct Current
DCDB	Direct Current Distribution Board
DCS	Disturbed Control System
DOL	Direct-on-Line
ELCB	Earth Leakage Circuit Breaker
ECS	Electrical Control System
EMLDB	Emergency Main Light Distribution Board
ETAP	Electrical Transient Analyzer Program
EPMCC	Emergency Power Motor Control Center
ESD	Emergency Shut Down
FBT	Flyback Transformer
FEED	Front-End Engineering Design
GIS	Gas Insulated Switchgear
HCN	Heavy Cracked Naphtha
IE	Indian Electricity Rules
IEC	International Electro-Technical Commission
IEEE	Institute of Electrical and Electronics Engineers
IOCL	Indian Oil Corporation Limited
kVA	Kilo Volt Ampere
kW	Kilo Watt
LCO	Light Cycle Oil
LDB	Light Distribution Board
LPG	Liquefied Petroleum Gas
LPL	Lightning Protection Levels
LPS	Lightning Protection System

LV	Low Voltage
LVPCB	Low Voltage Power Circuit Breaker
MCC	Motor Control Center
MCCB	Moulded Case Circuit Breaker
MCB	Miniature Circuit Breaker
MDEA	Methyl-Di-Ethanol-Amine
MFM	Multifunction Meter
MFR	Multifunction Relay
MLDB	Main Light Distribution Board
MOV	Motor Operated Valve
MV	Medium Voltage
NEC	National Electric Code
NFPA	National Fire Protection Association
NGR	Neutral Ground Resistor
Ni-Cd	Nickel Cadmium
OISD	Oil Industry Safety Directorate
ONAF	Oil Natural Air Forced
ONAN	Oil Natural Air Natural
PF	Power Factor
PDB	Power Distribution Board
PMCC	Power Motor Control Center
RFCC	Residue Fluid Catalytic Cracking
SC	Short Circuit
SDG	Sustainable Development Goals
SPN	Single Phase with Neutral
THD	Total Harmonic Distortion
TPN	Triphase with Neutral
UPS	Uninterruptible Power Supply
VCB	Vacuum Circuit Breaker
VDU	Vacuum Distillation Unit
VFD	Variable Frequency Drive
VT	Voltage Transformer

Chapter 1. Project presentation

1.1. INTRODUCTION

Intecsa Industrial S.A., a Spanish corporation specialized in the development of EPC (Engineering, Procurement and Construction supervision) services; is participating in the expansion of an Indian Oil Corporation Limited (IOCL) refinery in the province of Gujarat, India. This project will represent part of the work done with the electrical department team to develop the electrical installation for the refinery's project, also called "LuPech" (J-18) project. More specifically, the report will focus on the design of a unit substation, identified as 'ESS-044', which will provide electrical power supply to the following new units located at the refinery:

- INDMAX RFCC (Residue Fluid Catalytic Cracking) Unit
- CR LPG (Cracked Liquefied Petroleum Gas) Treater Unit
- SR LPG (Straight Run Liquefied Petroleum Gas) Unit
- VDU (Vacuum Distillation Unit)

1.2. COMPANIES PRESENTATION

1.2.1. INTECSA INDUSTRIAL

Intecsa Industrial, an engineering company with more than 50 years of experience in engineering projects, specializes in the design of industrial engineering plants for national and international technological projects. It is a contractor that supplies EPC services in the following business areas:

- Upstream oil and gas
- Petroleum refining
- Petrochemicals and fine chemicals
- Fertilizers
- Cogeneration and bioenergy
- Recycling and mining

It was founded in 1965 with Dragados Industrial as the main shareholder of the company. Following the ACS Group's acquisition of Dragados Industrial in 2003, the business was subsequently integrated directly into ACS Group's Industrial Services. (Intecsa Industrial, 2022)

In 2021, ACS sold the majority of the shares of its entire industrial division, including Cobra, Intecsa Industrial, Dagrados and Initec Energía, to the French company VINCI Construction. VINCI

currently holds 51% of the voting and economic rights and ACS the remaining 49% of the company. (Mesones, 2021)

Vinci Construction is a French group specialized in construction and civil engineering. Vinci Construction groups together five divisions (Vinci Construction France, Vinci Construction International Network, Division des Grands Projets, Soletanche Freyssinet and Entrepouse) and has more than 700 consolidated companies with a turnover of 14.2 billion (48% generated outside France). (Wikipedia, 2018)

Intecs Industrial has been awarded the following certifications, with annual audits and compliance certifications: UNE-EN ISO 9001-2008 and UNE-EN ISO 14001-2004. In addition, through its policy of continuous improvement of its quality and safety programs, with research and development, the company is currently implementing an Occupational Risk Prevention System based on the OSHA 18001 standards. (Intecs Industrial, 2022)

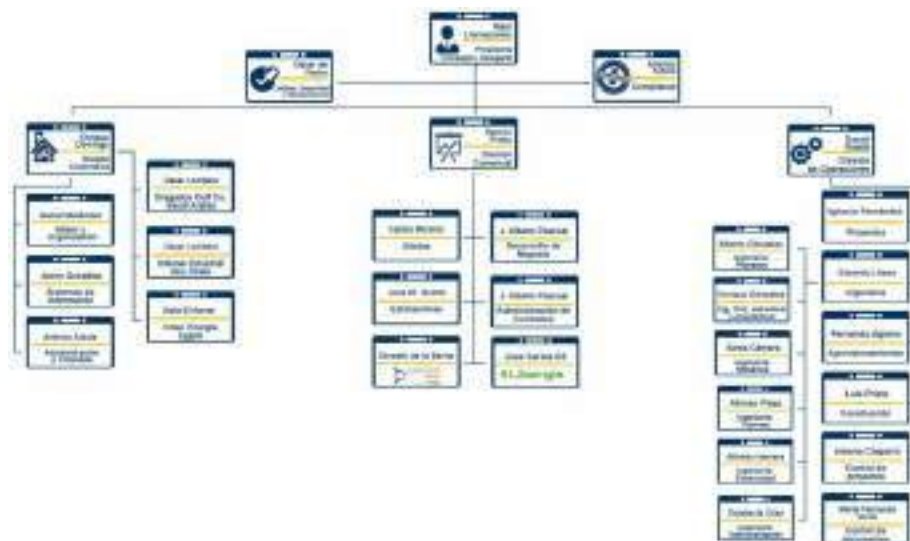


Figure 1. Organization chart of Intecs Industrial. Source: (Intecs Industrial, 2022)

The organization chart of the company is shown in Figure 1. There are six main departments in the Operations team. These departments are Project Management, Engineering, Construction, Supplies, Project Control and Documents Control. The engineering department is further divided into several branches, depending on the specialty of the work teams. It is composed of: Process Engineering, Civil Engineering, Mechanical Engineering, Piping Engineering, Electrical Engineering, and Instrumentation Engineering. All these teams work together to develop the detailed designs for the industrial plants. This project report will focus on the work done with the electrical engineering team.

1.2.2. INDIAN OIL CORPORATION LIMITED

Indian Oil Corporation Limited (IOCL) is one of India's Maharatna national oil companies. Maharatna companies are central public sector undertakings (CPSU), owned by the Government of

India. In the case of IOCL, its operations are overseen by the Ministry of Petroleum and Natural Gas. The company has business interests in the entire hydrocarbon sector: from pipeline transportation, downstream operations, petrochemicals, refining, alternative energy sources and exploration and production of crude oil and gas. The company is also broadly expanded with subsidiaries in Sri Lanka, Mauritius, the UAE, Sweden, USA and The Netherlands; working along over 15 joint ventures with reputed business partners from India and abroad to explore global opportunities. (Indian Oil Corporation Ltd., 2023)

IOCL owns over 34,000 fuel stations spread across India, fueling around 30 million Indians every day and has a petrochemical production capacity of nearly 3200 KTA (kilo tons per annum). The company is also undertaking research in hydrogen technologies, with the purpose of setting green hydrogen plants at IOCL refineries in Mathura and Panipat.

IOCL is investing in renewable energy projects and has a solar photovoltaic capacity of around 70 MW and wind capacity of 168 MW, with a total renewable energy capacity of nearly 240 MW. (Indian Oil Corporation Ltd., 2023)

1.3. IOCL GUJARAT REFINERY

The Gujarat Refinery, located near the city of Vadodara, in the province of Gujarat; was created in 1965. The refinery is owned and operated by India's refining company IOCL and has a crude oil processing capacity of 13.7 Mtpa (million tonnes per annum). (Indian Oil Corporation Ltd., 2023) Since then, there have been a series of capacity expansion projects and the addition of new units over the years. The IOCL board approved the implementation of a petrochemical and lube integration ("LuPech") project at the Gujarat refinery in September 2020. The project cost is estimated to be approximately \$2.42bn. (NS Energy, 2020)

1.3.1 LUPECH (J-18) PROJECT

The refinery capacity will be expanded from 13.7 Mtpa to 18 Mtpa, as well as a 0.5 Mtpa polypropylene plant and a 0.27 Mtpa lube oil base stock (LOBS) unit will be installed as part of the refinery's expansion. Among the new units to be installed as part of the project includes:

- 2.5 Mtpa Vacuum Distillation unit (VDU)
- 65,000 tpa SR LPG (Straight Run Liquefied Petroleum Gas) unit
- 2.7 Mtpa INDMAX RFCC (Residue Fluid Catalytic Cracking) unit
- CR LPG (Cracked Liquefied Petroleum Gas) treater unit
- 0.58 Mtpa propylene recovery unit (PRU)
- 0.5 Mtpa polypropylene unit
- 110,000 tpa OCTAMAX unit

- 0.8 Mtpa naphtha splitter unit
- 0.36 Mtpa naphtha hydrotreater unit
- 0.36 Mtpa isomerization unit
- 270,000 tpa LOBS unit

Also, as part of the project, a 3 Mtpa atmospheric distillation unit-5 (AU-V), a hydrocracker unit (HCU), and a BS-VI norms (Bharat Stage emission standards) FCC GDS (Fluid Catalytic Cracking Gasoline De-Sulphurization) unit will also undergo revamp, whose capacity will be increased to 7.3 Mtpa, 1.5 Mtpa, and 0.7 Mtpa respectively. (NS Energy, 2020)

A plan showing the entire refinery is attached on the following page. In red, there are indicated the facilities where the new units of the LuPech project will be implemented.

1.4 PROJECT SCOPE

1.4.1. OBJECTIVES

The objectives of the project are as follows:

- General overview of a refinery's functionalities and sections, especially for the LPG treater units and INDMAX RFCC Unit.
- Correct application of national and international regulation standards for electrical installations.
- Development of a logical design process for the main electrical equipment and installation of the refinery's substation.
- Detailed study of the different equipment that will be installed in the substation.

1.4.2. METHODOLOGY

For the calculation and design of the installation, the standard calculation methods acquired by Intecsa Industrial will be applied. This methodology has been developed and improved over the years, as they have used it in all their projects. All the methods follow the necessary regulations, both international and national. Before submitting all documentation, these calculations are verified and signed by the project manager. Furthermore, in many cases, ETAP (Electrical Transient Analyzer Program) calculation program is used to check results and calculations.

1.4.3. USED RESOURCES

For the proper development of the project, the computer softwares that will be used are ETAP, AutoCad for the design of the diagrams design and DIALux for the lighting calculations. As it has

previously explained, ETAP is a software tool for modeling and simulation of electrical systems simulation software tool used by electrical engineers.

1.4.4. HARMONIZATION WITH SUSTAINABLE DEVELOPMENT GOALS (SDGs)

The United Nations' Sustainable Development Goals (United Nations Organisation, 2015) that this project follows are:

- Goal 8: Decent work and economic growth

A huge amount of jobs will be generated in the region as a result of the construction and operation of the refinery. There will be a need for workers from a variety of disciplines throughout the construction phase, including engineers, technicians, workers, and support staff. This employment opportunity will provide a source of income for local workers and help the enhancement of their living conditions. As soon as the refinery begins functioning, steady and well-paying jobs will be created to maintain the plant's daily operations. In addition, the refinery could promote regional economic growth by bringing investments related to the oil and gas industries and encouraging the development of local support industries and supply chains.

- Goal 9: Industry, Innovation, and Infrastructure

The development of a critical and technologically advanced infrastructure is essential for the construction of the refinery. This includes building processing units, systems for storing and transporting refined products, as well as using innovative technologies and production processes to maximize efficiency and production. The refinery will not only become a pillar of the country's energy infrastructure, but it will also encourage industry innovation. The use of cleaner and more environmentally friendly technologies in the refinery's operations may reduce the impact on the environment by aligning with a cutting-edge, responsible approach to energy and fuel production.

- Goal 12: Responsible consumption and production

To ensure that the refinery's development is sustainable and respectful with local communities and the environment, responsible use and production are essential. In this sense, it is crucial to develop responsible practices and technologies that reduce the use of natural resources and minimize the production of waste and pollutant emissions. Utilizing cleaner and more efficient technology in the refinery may help decrease the operation's overall environmental effect and carbon footprint. Additionally, the proper implementation of environmental and social management programs may guarantee that the project benefits the nearby communities and promotes a long-term sustainable development.

1.4.5. STRUCTURE OF THE REPORT

The structure of the project will be following the main points of research and design for the electrical installation, which are:

- Refinery's units overview
- Electrical design basis analysis
- Equipment design
 - o Main equipment description
 - o Load flow calculation
 - o Short circuit calculation
 - o Motor starting study
 - o Harmonic study
- Cabling system
- Substation grounding
- Lightning protection
- Lighting calculation

Chapter 2. Refinery's units overview

2.1. INTRODUCTION

As indicated in the first chapter, the Lupech (J-18) project is composed of the development of many different treatment units at the IOCL refinery in Gujarat. In the case of this master's project, the substation designed in detail will feed the RFCC unit and LPG treater units. Therefore, a brief description of these two units and their processes will be given in this chapter.

2.2. FCC PROCESS DESCRIPTION

An FCC (Fluidized Catalytic Cracking) unit in a refinery is a key process used to convert heavy crude oil materials into lighter, more valuable products, such as gasoline, diesel and LPG. The process is described in the following Figure 2.

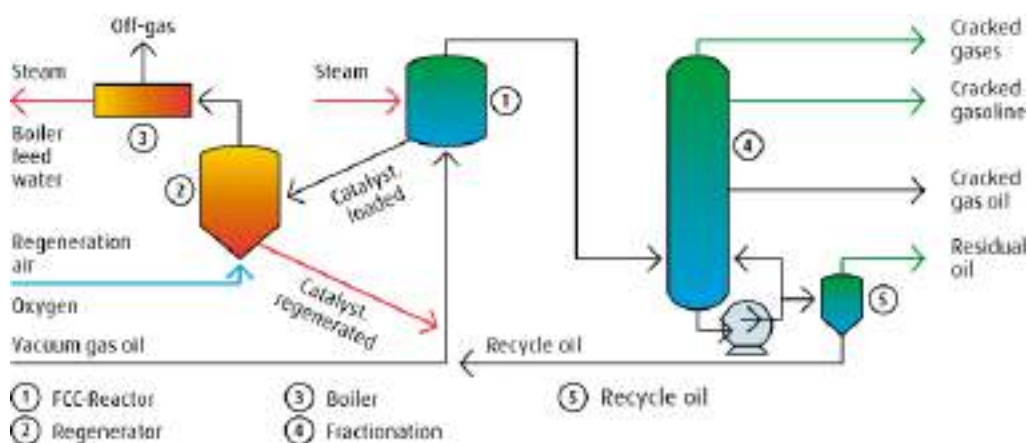


Figure 2. FCC process diagram. Source: (Linde Group, 2023)

The process starts with the feedstock feed, which can be vacuum residue such as vacuum gas oil or other similar heavy products. This feed is preheated and pumped into the feed injection system. At this point the catalyst is added to the initial feed, which is fed from the regenerator. The feed material and catalyst mixture is fed into the cracking reactor, which is a tall tower or riser. Here, the feed material is subjected to high temperatures and pressures in the presence of the catalyst. The long-chain hydrocarbon molecules are broken into smaller, lighter molecules. After the cracking reaction, the coke-laden catalyst is removed from the reactor and sent to the regenerator. The regenerated catalyst is recirculated from the regenerator back to the reactor for reuse, which will be reintroduced into the initial feed. Here, the coke is burned in the presence of air or oxygen, releasing heat. This heat regenerates the catalyst by burning the coke and prepares it for reuse in the process. After the cracking reaction, the other products are fed into the fractionation tower where the resulting products,

such as gasoline, diesel, LPG and coke, are separated. This system includes distillation columns and gas recovery units to separate and collect the different products.

2.3. INDMAX RFCC UNIT AND LPG TREATER UNIT PROCESSES SPECIFICATIONS

In the case of the INDMAX RFCC unit, feed to the main fractionator is the hot vapor that comes from the reactor stripper vessel of the FCC Unit which enters the bottom section of the mains fractionator. The hot vapor from the reactor vessel is transported to the fractionator by single line. The FCC fractionator is equipped with structured packing and valve trays sections.

Vapor from the reactor stripper vessel is fractionated in the main fractionator to produce the following products:

- Wet gas
- Overhead liquid
- Heavy cracked naphtha (HCN)
- Light cycle oil (LCO)
- Clarified liquid oil (CLO)

In addition, to recirculate these products, a pumping system is added to the process:

- Main column bottom pump-around (MCB PA)
- LCO pump-around (LCO PA)
- HCN pump-around (HCN PA)
- HCO pump around (HCO PA)

The fractionator process in the refinery consists of several stages to separate and obtain various products. Hot steam is used which is cooled by a return stream MCB PA. This return stream not only cools the steam but is also used to preheat the fresh feed to the FCC unit and generate high pressure steam. A crucial part of the process is the removal of coke particles from the feed before entering the main fractionator bottoms pump by installing a coke trap at the bottom of the fractionator. The cooled MCB PA is reintroduced to the main fractionator above the packing section, along with internal backflow from the upper tray. In addition, a portion of the MCB PA stream is further cooled by generating medium pressure steam in the MCB PA/MP steam generator (1803-E-207A/B). This cooling flow is used to control the temperature of the main fractionator bottoms at the bottom of the tower, thus preventing the formation of coke and fouling in the MCB PA circuit. The MCB PA flow rate is controlled by a flow controller in the return line, while the bottom level is controlled by varying the CLO product rate. In addition, fractionation valve trays are used above the packed bed to control the temperature of the HCO PA. The HCO PA and internal reflux are drawn from the top tray of the total skimmer by the HCO PA pumps (P-204 A/B/C). The internal reflux is returned to the tower,

while the HCO PA is used as the heating medium for the Debutanizer reboiler (E-218A/B). The HCO PA return temperature is controlled by a bypass through E-218A/B.

As for the light cycle oil (LCO), it is drawn along with the Lean sponge oil from a total tower skimmer pan. The LCO PA is circulated using LCO PA pumps (P-202 A/B/C). Internal backflow from the pump discharge is sent back to the pan below the skimming pan. The LCO PA and light oil are used together in the feed preheater (E-225) and the Deethanizer reboiler (E-216A/B).

As for the HCN product, it is extracted from the main fractionator by flow control and undergoes steam stripping in the HCN stripper (C-202) to remove the lighter components. As with the LCO stripper, medium pressure steam is used for stripping. Subsequently, the HCN product is pumped to the off-site facility using HCN product pumps (P-201A/B), after passing through a water cooler (E-202A/B), the flow of which is controlled by a level control of the HCN stripper. Finally, the hot LCO product is combined with the hot HCN product to direct the hot combined product to the OSBL.

Vapor from the main fractionator overhead is partially condensed in the fractionator overhead air condenser. Wash water is introduced at the inlet (intermittently) to avoid salt deposition on the air cooler tubes. However, as the fractionator overhead contains a large amount of steam from reactor area, continuous water wash is not envisaged. The partially condensed vapor and liquid mixture is received in the fractionator reflux drum (V-201) where the hydrocarbon liquid, hydrocarbon vapor and water are settled and separated in different phases. Water pumped by sour water pumps, P-208A/B, and cooled in sour water cooler E-208.

Other important process units are the Deethanizer stripper and Debutanizer. The function of the Deethanizer stripper (C-005) is to strip off ethane and light ends (C2 components) from the high-pressure separator liquid to meet the final LPG product specification. The function of the Debutanizer (C-206) is to fractionate the Deethanizer bottoms to produce LPG and stabilized gasoline. Two reboilers (one using the HCO PA as the heating medium (E-218A/B), and the other using HP steam (E-219)) supplies the required reboiling heat for the Debutanizer. Finally, the product is sent to the LPG and offgas scrubber. The function of amine treatment of LPG and off gases is to remove acid gases (H₂S and CO₂) using 35 wt% Methyl-Di-Ethanol-Amine (MDEA). Lean amine is pumped to desired pressure by lean amine pumps (P-222 A/B). It is then split into two users – LPG contactor and off-gas scrubber, both streams on flow control.

Chapter 3. Electrical design basis

3.1. INTRODUCTION

In this chapter, the main electrical design equipment and conditions of the installation are explained. These requirements are made by the client, Indian Oil Corporation, at the beginning of the project development and must be perfectly followed by the contractor, Intecsa Industrial. Therefore, the whole design made on this report will follow these conditions, but also the international and Indian electrical standards.

3.2. SITE CONDITIONS

The refinery's environmental conditions must be taken into account for the design, the site conditions are indicated in Table 1. In addition, it should be noted that as a refinery is designed, hazardous and explosive zone areas must also be considered in the electrical design.

A	Maximum Ambient temperature	47 °C
B	Minimum Ambient temperature	4.4 °C
C	Equipment design temperature	47 °C / 4.4 °C
D	Min. Temperature for battery sizing	4 °C
E	Min. Temperature for Electrical Heat Tracing	4 °C
F	Altitude above mean sea level	< 1000 m
G	Maximum Relative humidity	89%
H	Environmental condition	Tropical, humid and corrosive atmosphere found in refineries.

Table 1. Refinery's site conditions.

3.3. CODES AND STANDARDS

Design, selection and installation of electrical systems and equipment shall be in accordance with the following standards:

- Project and technical specification
- Project drawings and other documents
- Indian Electricity (IE) Rules
- API (American Petroleum Institute) standards
- Bureau of Indian Standards (BIS)
- IEC (International Electro-Technical Commission) standards
- IEEE (Institute of Electrical and Electronics Engineers) standards

- OISD (Oil Industry Safety Directorate) standards
- NEC (National Electric Code)
- NFPA (National Fire Protection Association)

The main codes and standards considered as minimum requirement are as follows. IEC specifications shall be followed where equivalent IS are not available in specific cases. Latest version of these shall be followed (Table 2).

IS-732	Code of practice for electrical wiring installations
IS-1180	Outdoor type Oil Immersed Distribution transformers, up to and including 2500 kVA, 33kV
IS-1255	Code of practice for installation and maintenance of power cables up to and including 33 kV rating
IS-2026	Power Transformers
IS-2705	Current Transformers
IS-3043	Code of practice for earthing
IS-3070 Part - 3	Lightning Arresters for Alternating Current Systems - Metal Oxide Lightning Arresters without Gaps
IS-16227	Instrument Transformers
IS-3646	Code of practice for Interior Illumination
IS/IEC-60071	Application guide for Insulation Coordination
IS-3842	Application guide for electrical relays for ac systems
IS-4146	Application guide for voltage transformers
IS-4201	Application guide for current transformers
IS-5216	Guide for safety procedures and practices in electrical work
IS-5571	Guide for selection and installation of electrical equipment for hazardous areas
IS-5572	Classification of hazardous areas other than mines having flammable gases & vapour for Electrical installations
IS-6665	Code of practice for Industrial Lighting
IS-7689	Guide for Control of undesirable static electricity
IS-8478	Application guide for on-load tap changers
IS-9676	Reference ambient temperature for electrical equipment
IS-10028	Code of practice for selection, installation & maintenance of transformer
IS-10118	Code of practice for selection, installation & maintenance for switchgear & control gear
IS-11171	Dry-Type Power Transformers
IS-12360	Voltage bands for electrical installations including preferred voltages and frequencies
IS-13234	Guide for short circuit calculations in three phase AC Systems
IS / IEC 60079-0	Electrical apparatus for explosive gas atmosphere – General requirements
IS / IEC 60079-1	Equipment protection flameproof enclosures “d”
IS / IEC 60079-7	Electrical apparatus for explosive gas atmosphere - Increased safety ‘e’
IS / IEC 60079-15	Electrical apparatus for explosive gas atmosphere – construction, test and marking of type of protection ‘n’ electrical apparatus
IEC / IS 60529	Degrees of Protection Provided by Enclosures (IP Code)
IEC / IS 60947	Low voltage switchgear and control gear. Set of standards
IEC 61000	Electromagnetic Compatibility (EMC). Set of standards
IS / IEC 61241	Electrical apparatus for use in the presence of combustible dust

IEC / IS 61439	Low-voltage switchgear and control gear assemblies. Set of standards
IS / IEC 62271	High-voltage switchgear and control gear -All applicable parts
IS / IEC 62305	Protection Against Lightning
IEC 60076	Power Transformers
IEC 60099-4	Surge arresters – Part 4 : Metal-oxide surge arresters without gaps for AC systems
IEEE 519	Recommended practice and requirements for harmonics control in Electrical Power Systems
IEEE 1115	IEEE Recommended Practice for Sizing Nickel-Cadmium Batteries for Stationary Applications
OISD-110	Recommended practices on static electricity
OISD-113	Classification of areas for electrical installations at hydrocarbon processing and handling facilities
OISD-147	Inspection and safe practices during electrical installation
OISD-149	Design aspects for safety in electrical system
OISD-173	Fire prevention and protection system for electrical installations
OISD-180	Lightning protection
SP-30	National Electrical Code (NEC), BIS Publication

Table 2. Main codes and standards used.

3.4. POWER SUPPLY DISTRIBUTION SYSTEM

Substation shall be provided with 33kV GIS (Gas Insulated Switchgear) with 2 I/C and 1 B/C (two incomer and one bus coupler) with double bus configuration. As the substation is considered for feeding multiple process units, the 33kV GIS shall be considered as common switchgear and the downstream equipment for individual process units like power transformers, HV switchgears, distribution transformers, MV switchgears, AC and DC UPS, etc. shall be grouped in such a way that the single process unit can be taken out for maintenance without disturbing power feed to other process unit.

The existing refinery has captive power plant with a total capacity of 217.5 MW: 6x30 MW GTGs (Gas Turbine Generators) and 3x12.5 MW STGs (Steam Turbine Generators) at 11kV and 6.9kV and distributed to various substations at 33kV and 11kV, feeding the existing plant. The electrical power demand for the proposed units of the substation would be met from:

- An existing electrical system for BS-VI Project
- 220kV grid by extending additional two bays at existing 220kV GIS
- Existing substations named CGP-I and II

3.4.1. EMERGENCY POWER

A dedicated EPMCC (Emergency Power Motor Control Center) shall be used for emergency loads fed from the substation. This EPMCC shall have three incomers and no bus-coupler configuration. Out of three incomers, two incomers (normal source) shall be fed from the substation itself such that

the sources are fed from different power sources at the highest end. The third source (emergency source) shall be through an 11 kV/0.433 V transformer fed from the emergency network established inside the refinery. In case of emergency from existing network, the 11 kV feeder from the existing 11 kV switchboard (stationed nearby) shall be fed through cables (by necessary expansion or utilizing spare feeder at existing 11kV board) up to the unit substation and step down to 415 V through dedicated distribution transformer.

EPMCC shall operate on the substation normal sources and tripping of first substation source (Normal Source-1) will automatically transfer to the other incomer (Normal Source-2) from the substation. Tripping of the substation normal sources shall initiate automatic transfer to the incomer fed from emergency network.

In case of emergency load requirement at both 6.6kV and 415V level in substation, the 11kV emergency supply from nearby substation shall be stepped down to 6.6kV and further distribution shall be made inside substation by 6.6kV Emergency switchboard, 6.9kV/0.433kV distribution transformer and 415V EPMCC.

3.4.2. CAPACITY OF EMERGENCY SYSTEM

Electrical system shall be designed as per process operating philosophy in peak load condition. Peak load shall be calculated as per the following calculations.

$$\text{Peak Load} = (\text{Continuous load} \cdot X) + (\text{Intermittent load} \cdot Y) + (\text{Stand-by load} \cdot Z)$$

Where the coincidence factors X, Y and Z shall be considered as 100, 30 and 10 respectively.

All transformers and switchgears shall be rated considering 20% future growth margins. Spare feeders of at least one number or 20% of each type of outgoing feeder, whichever is more shall be provided at each bus section.

Short circuit studies shall be carried out to decide the short circuit level of the system at different voltage levels. Capacitor banks of suitable rating shall be provided to improve the system power factor to 0.98 lag. Capacitor banks shall be connected and rated at 6.6kV voltage level. Short circuit level at 33kV power source: 40kA for 3 sec. 33kV system is solidly earthed and earth fault current shall be considered suitable for all 33kV electrical equipment and cables.

3.4.3. VOLTAGE AND FREQUENCY VARIATION

The voltage and frequency variations for motors that will be taken into account are indicated in Table 3 for AC systems. For DC System (at system output terminals) the variation will be $\pm 5\%$ and for AC UPS system (at system output terminals), the variation will be $\pm 1\%$.

A	Voltage	+ 10% - 12.5% at 220kV, + 6% - 9% at 33kV, 11kV & 6.6kV and + 6% at MV System
B	Frequency	± 3%

Table 3. AC system voltage and frequency variations for motors.

3.4.4. UTILIZATION VOLTAGE

The following tables (Table 4 and Table 5) show a general overview of the voltages estimated for the electrical installation and equipment's.

A	Primary HV Distribution Voltage	33 kV
B	Secondary HV Distribution Voltage	6.6 kV /11 kV
C	Primary HV distribution system neutral	Solidly earthed
D	Secondary HV distribution system neutral	Resistance earthed (NGR)
E	HV motor voltage	6.6 kV (above 160 kW)
F	MV motor voltage	0.18 kW to 160 kW (240 V AC for motor rating < 0.18 kW)
G	Battery chargers Incoming Power Supply	415 V AC, TPN
H	UPS System Incoming Power Supply	415 V AC, TPN
I	AC lighting / Power Panels and Auxiliary Boards Incoming Power Supply	415 V AC, TPN
J	Welding Receptacles	415 V AC, TPN
K	Bulk loads like Process Heaters etc.	415 V AC, TPN
L	Normal Lighting / Emergency Lighting	240 V AC, SPN
M	Convenience outlets and auxiliaries to Process consumers such as lube oil heater.	240 V AC, SPN
N	DC Motor	As per equipment supplier standard (DC system by equipment supplier with DCDB, battery bank etc)
O	MOVs	415 V AC, TP

Table 4. Utilization voltaje.

A	Normal Instrumentation Power Supply	240 V AC
B	Critical Instrumentation Power Supply	110 V AC UPS
C	Switchgear protection-control power supply	110 V DC
D	Critical lighting power supply	110 V DC

Table 5. Utilization voltage for critical supplies.

3.5. SUBSTATION DESIGN REQUIREMENTS

The refinery is composed of the units already introduced in chapter 1. Based on their location, the envisaged substations are shown in Table 6. In the case of this project, the design will be specifically on Substation-044.

Sr. no.	Feeding substation	Process units
A	Substation-041	New Atmospheric Vacuum Distillation (AVU) Unit
B	Substation-042	Circulating Cooling Water Cells (CT-1 & CT-2) Propylene Recovery Unit (PRU) OCTOMAX
C	Substation-043	LOBS Product Tanks/Truck Loading/Propylene Bullet/LPG Bullet Area
D	Substation-044	INDMAX FCC Unit CR LPG Treater Unit CR LPG Treater Unit New VDU AU-V Revamp
E	Substation-045	MS Block (NHT/ISOM/NSU) Utility Block (DM Plant/ZLD/CPU/New Boiler/BFW De-Aerator System/Compressed Air & N2 Package)
F	Substation-046	Polypropylene Unit (PPU)
G	Substation-047	New ETP
H	Substation-048	Sulphur Block: Sulphur Recovery Unit (SRU) Amine Regeneration Unit (ARU) Sour Water Stripper Unit (SWS)
I	Substation-049	LOBS Unit LOBS Feed / Product Tanks
J	Existing Substations	Raw Water System MTO / NHT Tanks CA/IA Packages

Table 6. Refinery's envisaged substations.

Following the indications of the electrical engineering team, in which the dimensions and weights of the electrical equipment are indicated, the substation building will be designed by the civil engineering team. It shall be located near the load centers but away from hazardous areas, as per standards. The substation building shall be sized to take care of present needs and to maintain adequate clearances between equipment for ease of maintenance. The building, based on double story construction, will have in total four floors and a roof. The ground floor and second floor will be cable galleries. The first and third floors will each have a switchgear room to accommodate all switchboards.

Partition walls between transformer bays and the end wall of the last bay shall be of fireproof type and shall extend at least 600 mm above the height of the equipment. The height of the bay shall be decided to facilitate maintenance and easy removal of equipment and requirements of natural ventilation. Transformer bays shall have well drained floor, surfaced with gravel or other suitable

material. Each bay shall be provided with a 2.5 m high removable chain link fence with a lockable gate at the open side.

The battery rooms shall be ventilated type, provided with minimum two fans and louvered opening in opposite wall/door and water connection with sink. The floor of the battery room and walls up to 1.5m height shall have acid/alkaline resistant protective epoxy coating. Light fittings in this room shall be chemical resistant and flameproof type. Substation shall be maintained at a positive pressure through pressurization system in the switchgear rooms. It is to be ensured that the inlet air of the pressurized system shall be free from moisture and hazardous mixtures. The pressurization/air conditioning ducts shall not be laid above the switchgear panels. Air filtration unit air suction inlet shall be located at a higher elevation instead of ground level to minimize the ingress of dust with hydrocarbon detectors.

3.6. EQUIPMENT DESIGN REQUIREMENTS

3.6.1 HV AND MV SWITCHBOARDS

All normal switchboards shall generally have two sections operating independently with two incoming feeders and with bus coupler open having facility for auto-changeover in the event of failure of either of the incoming circuit breakers. All HV switchboards shall have fast acting bus transfer scheme (based on phasor sensing). Along with FBT, auto changeover on dead bus shall be provided as backup. Auto changeover shall be blocked on loss of power on both the incomers.

The generator incomer shall be rated w.r.t. maximum power output of the generator set over entire operating temperature range and transformer incomer shall be rated at least equal to forced cooled rating of transformer or 110% of ONAN rating as applicable. Switchboards shall be suitable for monitoring and control from remote through ECS system. All relays shall be numerical type with communication facility on IEC 61850 protocol.

An independent process unit will be fed from an independent and separate 6.6kV switchboard and PMCC. Marshalling cabinet shall be provided for DCS / PLC interfacing.

Hard contacts of the breaker shall be used for providing interlocks in the schemes mainly for auto change over, tripping, feedback, closing and process interlocks. In the absence of sufficient hard contacts, latched contactors and relays must be used for contact multiplication.

3.6.1.1. HV switchboard

33kV GIS shall be double bus with bus coupler facility. Circuit breaker feeders shall have a rating of at least 125% of the maximum continuous rating of the connected motors. Circuit breakers for capacitors shall have a current rating of at least 135% of the capacitor rated current. Circuit breakers

capability to interrupt applicable capacitive current shall be specifically verified. At least one number of each rating and type or 20%, whichever is more shall be provided as spare on each bus section.

All HV transformers and motor feeders shall be provided with CBCT (Core Balance Current Transformer) for sensitive earth fault protection. Surge arrestors provided in the vacuum circuit breakers of motor feeders shall be metal oxide type. All > 6.6kV switchgear shall be provided with double bus coupler (in series) to facilitate maintenance of each bus section individually with bus coupler breaker. One breaker shall be provided with an auto changeover (ACO) and the other shall be considered only for isolation purposes (manual).

3.6.1.2. *MV switchboard*

All MV switchboards are described in Table 7.

Circuit breakers for capacitors shall have a current rating of at least 135% of the capacitor rated current. Circuit breakers' capability to interrupt applicable capacitive current shall be specifically verified. At least one number of each rating and type or 20%, whichever is more shall be provided as spare on each bus section. MV switchboard shall be provided with 4-pole circuit breaker in bus coupler.

A	<u>Execution</u>	
(i)	MV switch board a) Breaker panels b) Contactor feeders	Draw-out / Single front
(ii)	Auxiliary Switch Board	Fixed: Single Front
(iii)	Main Lighting Distribution Board	Fixed: Single Front
(iv)	Small package switchboard (HVAC, Pressurization system etc.)	Compartmentalized fixed type
B	<u>Motors</u>	
(i)	PMCC	55 kW and above, up to 160 kW
(ii)	MCC	less than 55 kW
C	<u>Motor Starter Type</u>	
(i)	Air circuit breaker with motor protection relay	For motors 55 kW and above, up to 160 kW
(ii)	Contactor, MCCB with short circuit release, Compact microprocessor based communicable motor protection relay with over load & ELR, through CBCT for sensitive earth fault protection	Less than 55 kW
D	<u>Outgoing feeder type</u>	
(i)	MCCB with in-built E/F release	Up to 100 Amp
(ii)	MCCB with shunt trip for earth fault protection using CBCT with ELR	More than 100 Amp and less than 630 Amp
(iii)	Air circuit Breaker (ACB)	For feeders rated 630 Amp and above
E	<u>Motor Controls</u>	
(i)	Auto / OFF / Manual switch	Control Room
(ii)	Local / OFF / Remote switch	Near motor in Local control station
(iii)	Normal / Standby switch	Control Room
(iv)	Process interlock	Control Room
(v)	Reacceleration equipment	Switchgear in substation

Table 7. MV switchboards description.

3.6.2. HV AND MV BUS DUCTS

The rating of bus ducts connected to breakers shall have the same continuous and short circuit rating as that of the connecting main bus bars of switchboards. Also, the bus duct bar material shall be same as that used for switchgear bus bar.

HV busduct shall be phase segregated type, and MV busduct shall be non-phase segregated type.

Flexible expansion joints to be provided at equipment ends for thermal expansion. Outdoor busduct shall be IP55.

Breather connection shall be done from the bottom only instead of side and top of the bus duct. Seal-off bushing to be provided at the entry of the bus duct into the substation building.

3.6.3. CAPACITOR BANK

Capacitor banks shall be indoor type connected to the switchboards via circuit breakers with APFC (Automatic Power Factor Control). A suitable dry type reactor (6% impedance) with insulation class F and temperature rise limited to B shall be provided for HV capacitor banks. Capacitor banks shall be with necessary discharge resistors to reduce the terminal voltage of each unit to a value equal to or less than 50 V in 5 minutes. Capacitor banks shall be sized with 20% future margin.

3.6.4. AC UPS SYSTEM

A separate AC system for critical instrument power supply shall be installed for each process unit in the control room. UPS shall be of redundant (non-parallel) configuration with 2 x 100% capacity and with dual battery banks. Neutral shall be earthed for the UPS.

The UPS system shall be provided with ACDB with two I/C & one B/C (through ATS at DCS PDB) scheme with 100% redundancy of feeders on each section. The UPS system shall be specific to each process unit. Two units shall not be fed from the same UPS system.

Each module shall consist of rectifier transformer, rectifier-cum charger, inverter, filter circuit, static switches, bypass transformer, facility for manual transfer between inverter supply and bypass line, facility for bypassing inverter and switch for maintenance, set of batteries adequate to supply required rated output for two hours.

ATS based fast load transfer scheme shall be provided at downstream DCS PDB. Each ATS at DCS PDB shall have two incoming feeders from two different sections of UPS ACDB. Outgoing feeders shall have suitable rating of isolation transformers.

It shall be possible to select the preferred source for each ATS. Preferred sources shall be selected such that the load on both UPS systems at upstream end remains almost balanced. In case of failure of one of the preferred sources, ATS shall transfer the load to standby source without break.

3-Ph 415V bypass input supply of both the UPS systems shall be from the common source so that 110VAC output of both UPS systems shall remain synchronized with each other and synchronized (no break) transfer (<4ms) can be achieved at downstream ATS in case of failure of the running / preferred source of the ATS.

AC distribution board shall be single front and non-draw-out type.

3.6.5. DC SYSTEM

Battery chargers for switchgear control and critical lighting shall be separate for each process unit and stationed in AC room of substation. For DCDBs, 20% spare feeders minimum one of each rating on both DBs shall be provided. Battery chargers shall be provided with tap cell connection to take care of interruption of float charger when other charger is being used to boost charge the battery bank. Meters shall be provided on battery chargers for monitoring of leakage current.

3.6.6. SWITCHGEAR CONTROL

A separate DC system for switchgear control shall be installed for each process unit in substation. DC system for switchgear control shall be with rectifier-cum-battery in parallel redundant configuration with dedicated battery bank. The rectifier shall work in float charging mode and off-line boost charging mode.

Dual DCDB with a coupler switch shall be provided. The loads shall be distributed accordingly on the two DCDBs giving redundancy in supply to critical loads. DCDB shall be single front, non-draw-out type.

3.6.7. MOTORS

Motors shall be totally enclosed, fan cooled type as far as possible and suitable for continuous use, except for applications such as crane, hoist motors, soot blowers, etc. that may be rated for the required duty cycle. High voltage motors shall be suitable for starting under specified load conditions with 80% of the rated voltage at the terminals and medium voltage motors shall be suitable for starting under specified load conditions with 75% of the rated voltage at the terminals. Motor winding and bearing temperature sensing wiring shall be wired to numerical relay on switchgear for alarm and tripping.

Redundant / Duplex thermistors (temperature detectors) shall be provided on VFD driven motors and shall be wired up to VFD panel thermistor relay. The facility of display of motor temperature shall be made on VFD panel for breaker operated motors.

Energy efficient motors IE2 shall be used for MV application.

Motors	High Voltage	415 Volts
(i) Indoor	IP-55	IP-55
(ii) Outdoor	IP-55	IP-55
Insulation class	F (Temp. Rise limited to B)	F (Temp. Rise limited to B)
Anti-condensation heater	Yes	30 kW and above
Additional canopy (outdoor motors)	Yes	Yes
Design voltage / frequency variation	$\pm 10\% / \pm 3\%$	$\pm 10\% / \pm 3\%$
Combined voltage & frequency variation	$\pm 10\%$	$\pm 10\%$

Table 8. Motors description.

3.6.8. VARIABLE FREQUENCY DRIVE (VFD)

A.	Bypass feature required	Yes
B.	VFD rated output voltage	Suitable for driven equipment motor rating
C.	MV VFD	Motor kW rating up to 315 kW (to be verified through studies)
D.	HV VFD	Motor rating more than 315 kW (to be verified through studies)

Table 9. VDF description.

Bypass for VFD shall be provided as a standard practice unless not recommended from process or driven equipment operation point of view. Only screened type signal cables are to be considered in VSD applications. The cables shall be properly laid away from the power cable to prevent interference. Sine wave filter shall be provided in output of all VFDs to prevent harmonics. Minimum Speed (VFD Frequency) limiter settings shall be done in VFDs to avoid over-heating of VFD motor on low speed.

3.6.9. WELDING SOCKETS AND CONVENIENCE RECEPTACLES

An adequate number of welding receptacles shall be provided at suitable locations to ensure accessibility with a 50-meter length of cable to any point in the process area. These shall be rated for 63A, 4 pin suitable for 415V, 3 phase system.

A maximum two numbers of welding sockets shall be connected to one feeder.

Feeders for socket outlets shall be provided with a miniature circuit breaker, with earth fault protection 30 mA. Source cubicle Tag no shall be marked on the cover of field receptacles for easy isolation.

In every transformer one of 100A outlet shall be provided for oil filtration and other maintenance. Adequate number of three-pin sockets for hand lamps and portable tools shall be provided at suitable

locations to ensure accessibility with a 15-meter length of cable to all manholes of process equipment and other important areas in the process units. These shall be 16A, 3 pin, 240V single phase. In hazardous areas, hand lamps shall be rated for 24V. Accordingly, 240/24V transformers shall be provided either in the socket or in a separate flameproof enclosure.

Feeders for socket outlets shall be provided with a miniature circuit breaker, with earth fault protection 30 mA. Source cubicle Tag no shall be marked on the cover of field receptacles for easy isolation.

Chapter 4. Equipment design

4.1. INTRODUCTION

In this chapter, the main equipment design will be presented and explained. As it was already mentioned, there's a preliminary estimation of the main electrical equipment provided in the FEED (Front-End Engineering Design) single line diagrams. Therefore, the chapter will focus on the load flow calculation, motor starting study, harmonic study and short circuit calculations, which will verify that the FEED electrical system topology proposed is correct and will allow to size the transformers. Also, there will be a detailed explanation of every equipment used in the substation. The FEED takes place at the beginning phases of an engineering project. The needs and technical specifications of the project are detailed. It includes gathering and analyzing data, determining the technical and financial viability, identifying hazards, and creating the first drawings and conceptions.

4.2. GENERAL ELECTRICAL EQUIPMENT DESCRIPTION

The electrical equipment that will be implemented in the substation are:

- Transformers
- HV and MV switchgears
- Capacitor and battery banks
- PMCC: Power Motor Control Center
- MCC: Motor Control Center
- EPMCC: Emergency Power Motor Control Center
- AC UPS: Alternating Current Uninterruptable Power Supply
- DC UPS: Direct Current Uninterruptable Power Supply
- DCDB: Direct Current Distribution Board
- ACDB: Alternating Current Distribution Board
- ASB: Auxiliary switchboard
- MLDB: Main Light Distribution Board
- EMLDB: Emergency Main Light Distribution Board
- LDB: Light Distribution Board
- PDB: Power Distribution Board
- ELDB: Emergency Light Distribution Board
- VFD: Variable Frequency Drive (included into MCC's arrangement)

A first scheme of the connections of this equipment is shown in the following Figure 3. The equipment will be described in more detail throughout this chapter. A detailed description list of all the equipment implemented is provided in Table 10, Table 11 and Table 12.

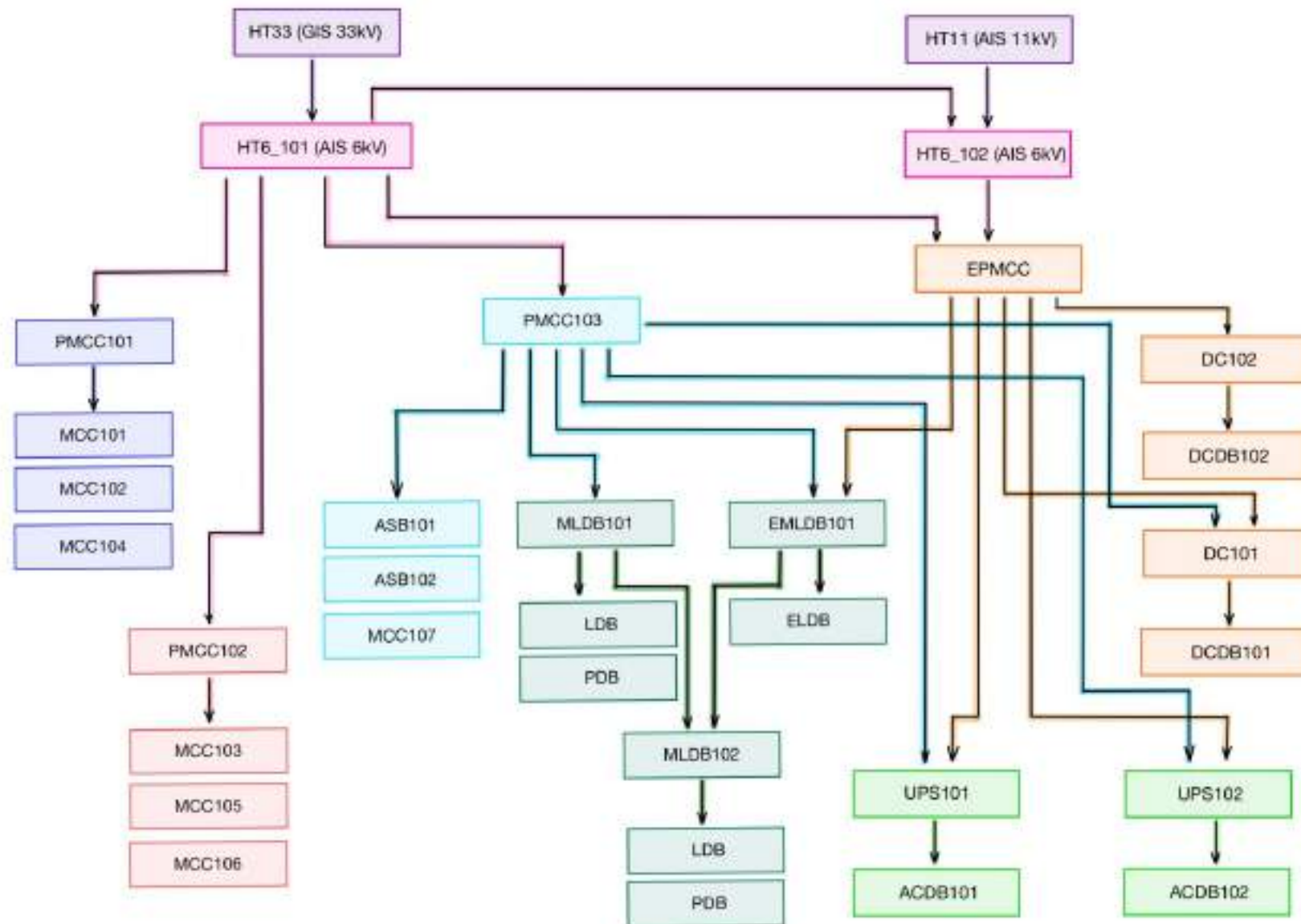


Figure 3. Electrical equipment connection scheme.

		ELECTRICAL EQUIPMENT LIST																	
PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPech” (J-18)																		
CLIENT:	INDIAN OIL CORPORATION LIMITED																		
EQUIPMENT TAG	DESCRIPTION	RATED VOLTAGE (V)	PHASE	RATED POWER	RATED CURRENT (A)	LOCATION	SIZE / UNIT (mm)			WEIGHT (kg)									
				(kVA)			Length	Width	Height										
044-TR-101 A	33/6.9kV POWER TRAF0 FROM 044-HT33-101	33000	3	20000	-	ESS-044	6550	3680	4750	33500									
044-TR-101 B	33/6.9kV POWER TRAF0 FROM 044-HT33-101	33000	3	20000	-	ESS-044	6550	3680	4750	33500									
044-TR-106 A	11/6.9kV POWER TRAF0 FROM 044-HT11-101	11000	3	3150	-	ESS-044	4400	2747	3350	10500									
044-TR-102 A	6.6/0.433kV DISTRIBUTION TRAF0 FROM 044-HT6-101	415	3	2500	-	ESS-044	4200	3200	3100	10100									
044-TR-102 B	6.6/0.433kV DISTRIBUTION TRAF0 FROM 044-HT6-101	415	3	2500	-	ESS-044	4200	3200	3100	10100									
044-TR-103 A	6.6/0.433kV DISTRIBUTION TRAF0 FROM 044-HT6-101	415	3	2500	-	ESS-044	4200	3200	3100	10100									
044-TR-103 B	6.6/0.433kV DISTRIBUTION TRAF0 FROM 044-HT6-101	415	3	2500	-	ESS-044	4200	3200	3100	10100									
044-TR-104 A	6.6/0.433kV DISTRIBUTION TRAF0 FROM 044-HT6-101	415	3	2500	-	ESS-044	4200	3200	3100	10100									
044-TR-104 B	6.6/0.433kV DISTRIBUTION TRAF0 FROM 044-HT6-101	415	3	2500	-	ESS-044	4200	3200	3100	10100									
044-TR-105 A	6.6/0.433kV DISTRIBUTION TRAF0 FROM 044-HT6-101	415	3	1600	-	ESS-044	4000	2800	3100	7550									
044-TR-105 B	6.6/0.433kV DISTRIBUTION TRAF0 FROM 044-HT6-101	415	3	1600	-	ESS-044	4000	2800	3100	7550									
044-TR-105 C	6.6/0.433kV DISTRIBUTION TRAF0 FROM 044-HT6-101	415	3	1600	-	ESS-044	4000	2800	3100	7550									
044-TR-107 A	415/433V LIGHTING TRAF0 FROM PMCC-103	415/433	3	200	-	ESS-044	1500	1220	1500	1300									
044-TR-107 B	415/433V LIGHTING TRAF0 FROM PMCC-103	415/433	3	200	-	ESS-044	1500	1220	1500	1300									
044-TR-108 A	415/433V EMERGENCY LIGHTING TRAF0 FROM EPMCC-101	415/433	3	100	-	ESS-044	1500	1100	1320	1060									
044-TR-108 B	415/433V EMERGENCY LIGHTING TRAF0 FROM EPMCC-101	415/433	3	100	-	ESS-044	1500	1100	1320	1060									
044-NGR-101 A	NGR FOR POWER TRANSFORMER 044-TR-101 A	2000 (L-N)	3	-	400 (10 s)	ESS-044	1210	1200	2050	600									
044-NGR-101 B	NGR FOR POWER TRANSFORMER 044-TR-101 B	2000 (L-N)	3	-	400 (10 s)	ESS-044	1210	1200	2050	600									
044-NGR-106 A	NGR FOR POWER TRANSFORMER 044-TR-106 A	630 (L-N)	3	-	300 (10 s)	ESS-044	1210	1200	2050	600									
044-HT33-101	33kV GIS SWITCHGEAR	33000	3	-	1250	ESS-044	7700	2700	2700	30000									
044-HT11-101	11kV AIS SWITCHGEAR	11000	3	-	630	ESS-044	5200	2235	2600	25000									
044-HT6-101	6.6kV AIS SWITCHGEAR	6600	3	-	2000	ESS-044	38900	2235	2600	36000									
044-HT6-102	6.6kV AIS SWITCHGEAR	6600	3	-	630	ESS-044	9750	2235	2600	15000									
044-CB-101 A	CAPACITOR BANK WITH APFC	6600	3	2400	-	ESS-044	4500	2200	2300	4000									
044-CB-101 B	CAPACITOR BANK WITH APFC	6600	3	2400	-	ESS-044	4500	2200	2300	4000									
044-PMCC-101	415V PMCC	415	3+N	-	4000	ESS-044	17800	1300	2200	10000									
044-PMCC-102	415V PMCC	415	3+N	-	4000	ESS-044	18400	1300	2200	10000									
044-PMCC-103	415V PMCC	415	3+N	-	4000	ESS-044	23700	1300	2200	1200									
044-EPMCC-101	415V EPMCC	415	3+N	-	3150	ESS-044	17500	1300	2200	12000									
044-MCC-101	415V MCC	415	3+N	-	800	ESS-044	16900	1300	2200	600									
044-MCC-102	415V MCC	415	3+N	-	800	ESS-044	10200	1300	2200	600									
044-MCC-103	415V MCC	415	3+N	-	800	ESS-044	10200	1300	2200	600									
044-MCC-104	415V MCC	415	3+N	-	800	ESS-044	10400	1300	2200	600									
044-MCC-105	415V MCC	415	3+N	-	800	ESS-044	10900	1300	2200	600									
044-MCC-106	415V MCC	415	3+N	-	800	ESS-044	14000	1300	2200	600									
044-MCC-107	415V MCC	415	3+N	-	800	ESS-044	10400	1300	2200	600									
044-BD-101 A	6.6kV BUS DUCT	6600	3	-	2000	ESS-044	-	800	400	-									

Table 10. Electrical equipment list (part 1).

 		ELECTRICAL EQUIPMENT LIST									
PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPech” (J-18)										
CLIENT:	INDIAN OIL CORPORATION LIMITED										
EQUIPMENT TAG	DESCRIPTION	RATED VOLTAGE (V)	PHASE	RATED POWER (kVA)	RATED CURRENT (A)	LOCATION	SIZE / UNIT (mm)			WEIGHT (kg)	
							Length	Width	Height		
044-BD-101 B	6.6kV BUS DUCT	6600	3	-	2000	ESS-044	-	800	400	-	
044-BD-102 A	415V BUS DUCT	415	3	-	4000	ESS-044	-	600	300	-	
044-BD-102 B	415V BUS DUCT	415	3	-	4000	ESS-044	-	600	300	-	
044-BD-103 A	415V BUS DUCT	415	3	-	4000	ESS-044	-	600	300	-	
044-BD-103 B	415V BUS DUCT	415	3	-	4000	ESS-044	-	600	300	-	
044-BD-104 A	415V BUS DUCT	415	3	-	4000	ESS-044	-	600	300	-	
044-BD-104 B	415V BUS DUCT	415	3	-	4000	ESS-044	-	600	300	-	
044-BD-105 A	415V BUS DUCT	415	3	-	3200	ESS-044	-	600	300	-	
044-BD-105 B	415V BUS DUCT	415	3	-	3200	ESS-044	-	600	300	-	
044-BD-105 C	415V BUS DUCT	415	3	-	3200	ESS-044	-	600	300	-	
044-UPS-101	Uninterruptible Power Supply System (UPS for DCS/ECS System)	415/110	3+N	100	-	RFCC Control Room					
044-ACDB-101	Uninterruptible Power Supply System (UPS for DCS/ECS System) Distribution Panel	110	1+N	-	1250	RFCC Control Room					
044-UPS-102	Uninterruptible Power Supply System (UPS for Telec, CCTV, PAGA & FDAS)	415/110	3+N	25	-	RFCC Control Room					
044-ACDB-102	Uninterruptible Power Supply System (UPS for Telec, CCTV, PAGA & FDAS) Distribution Panel	110	1+N	-	250	RFCC Control Room					
044-DC-101	110V DC UPS (SWITCHGEAR CONTROL)	415 AC/110 DC	3+N	50	-	ESS-044	3000	800	2000	200	
044-DC-102	110V DC UPS (CRITICAL LIGHTING)	415 AC/110 DC	3+N	50	-	ESS-044	3000	800	2000	200	
044-DCDB-101	110V DC UPS BOARD (SWITCHGEAR CONTROL)	110 DC	DC	-	630	ESS-044	3000	800	2000	200	
044-DCDB-102	110V DC UPS BOARD (CRITICAL LIGHTING)	110 DC	DC	-	630	ESS-044	3000	800	2000	200	
044-BB-101A	BATTERY BANK FOR 044-DC-101	110 DC	DC	-	630	ESS-044	2480	1030	1500	NA	
044-BB-101B	BATTERY BANK FOR 044-DC-101	110 DC	DC	-	630	ESS-044	2480	1030	1500	NA	
044-BB-102	BATTERY BANK FOR 044-DC-102	110 DC	DC	-	630	ESS-044	2480	1030	1500	NA	
044-ASB-101	415V AUXILIARY SERVICE BOARD (ASB)	415	3+N	-	630	ESS-044	5600	1300	2200	400	
044-ASB-102	415V AUXILIARY SERVICE BOARD (ASB)	415	3+N	-	630	ESS-044	5600	1300	2200	400	
044-MLDB-101	415V MAIN LIGHTING DISTRIBUTION BOARD FROM	415	3+N	-	200	ESS-044	4300	800	1800	500	
044-EMLDB-101	415V EMERGEGRNCY LIGHTING DISTRIBUTION BOARD	415	3+N	-	100	ESS-044	3300	800	1800	500	
044-EMLDB-102	415V EMERGEGRNCY LIGHTING DISTRIBUTION BOARD	415	3+N	-	100	ESS-044	3300	800	1800	500	
044-LDB-101	LIGHTING DISTRIBUTION BOARD	415	3+N	-	63	ESS-044	1000	200	400	-	
044-LDB-102	LIGHTING DISTRIBUTION BOARD	415	3+N	-	63	ESS-044	1000	200	400	-	
044-LDB-103	LIGHTING DISTRIBUTION BOARD	415	3+N	-	63	ESS-044	1000	200	400	-	
044-LDB-104	LIGHTING DISTRIBUTION BOARD	415	3+N	-	63	ESS-044	1000	200	400	-	
044-LDB-105	LIGHTING DISTRIBUTION BOARD	415	3+N	-	63	OUTDOOR	1000	200	400	-	
044-LDB-106	LIGHTING DISTRIBUTION BOARD	415	3+N	-	63	OUTDOOR	1000	200	400	-	
044-LDB-107	LIGHTING DISTRIBUTION BOARD	415	3+N	-	63	OUTDOOR	1000	200	400	-	
044-LDB-108	LIGHTING DISTRIBUTION BOARD	415	3+N	-	63	OUTDOOR	1000	200	400	-	
044-LDB-109	LIGHTING DISTRIBUTION BOARD	415	3+N	-	63	OUTDOOR	1000	200	400	-	
044-LDB-110	LIGHTING DISTRIBUTION BOARD	415	3+N	-	63	OUTDOOR	1000	200	400	-	
044-LDB-111	LIGHTING DISTRIBUTION BOARD	415	3+N	-	63	OUTDOOR	1000	200	400	-	

Table 11. Electrical equipment list (part 2).

		ELECTRICAL EQUIPMENT LIST								
PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPech” (J-18)									
CLIENT:	INDIAN OIL CORPORATION LIMITED									
EQUIPMENT TAG	DESCRIPTION	RATED VOLTAGE (V)	PHASE	RATED POWER	RATED CURRENT (A)	LOCATION	SIZE / UNIT (mm)			WEIGHT (kg)
				(kVA)			Length	Width	Height	
044-LDB-112	LIGHTING DISTRIBUTION BOARD	415	3+N	-	63	OUTDOOR	1000	200	400	-
044-LDB-113	LIGHTING DISTRIBUTION BOARD	415	3+N	-	63	OUTDOOR	1000	200	400	-
044-LDB-114	LIGHTING DISTRIBUTION BOARD	415	3+N	-	63	OUTDOOR	1000	200	400	-
044-LDB-115	LIGHTING DISTRIBUTION BOARD	415	3+N	-	63	OUTDOOR	1000	200	400	-
044-PDB-101	POWER DISTRIBUTION BOARD	415	3+N	-	125	ESS-044	1000	200	400	-
044-PDB-102	POWER DISTRIBUTION BOARD	415	3+N	-	125	ESS-044	1000	200	400	-
044-PDB-103	POWER DISTRIBUTION BOARD	415	3+N	-	125	ESS-044	1000	200	400	-
044-PDB-104	POWER DISTRIBUTION BOARD	415	3+N	-	125	ESS-044	1000	200	400	-
044-PDB-105	POWER DISTRIBUTION BOARD	415	3+N	-	125	OUTDOOR	1000	200	400	-
044-ELDB-101	EMERGENCY LIGHTING DISTRIBUTION BOARD	415	3+N	-	63	ESS-044	1000	200	400	-
044-ELDB-102	EMERGENCY LIGHTING DISTRIBUTION BOARD	415	3+N	-	63	ESS-044	1000	200	400	-
044-ELDB-105	EMERGENCY LIGHTING DISTRIBUTION BOARD	415	3+N	-	63	OUTDOOR	1000	200	400	-
044-ELDB-106	EMERGENCY LIGHTING DISTRIBUTION BOARD	415	3+N	-	63	OUTDOOR	1000	200	400	-
044-ELDB-107	EMERGENCY LIGHTING DISTRIBUTION BOARD	415	3+N	-	63	OUTDOOR	1000	200	400	-
044-ELDB-108	EMERGENCY LIGHTING DISTRIBUTION BOARD	415	3+N	-	63	OUTDOOR	1000	200	400	-
044-ELDB-109	EMERGENCY LIGHTING DISTRIBUTION BOARD	415	3+N	-	63	OUTDOOR	1000	200	400	-
044-ELDB-110	EMERGENCY LIGHTING DISTRIBUTION BOARD	415	3+N	-	63	OUTDOOR	1000	200	400	-
044-ELDB-111	EMERGENCY LIGHTING DISTRIBUTION BOARD	415	3+N	-	63	OUTDOOR	1000	200	400	-
044-ELDB-112	EMERGENCY LIGHTING DISTRIBUTION BOARD	415	3+N	-	63	OUTDOOR	1000	200	400	-
044-ELDB-113	EMERGENCY LIGHTING DISTRIBUTION BOARD	415	3+N	-	63	OUTDOOR	1000	200	400	-
044-ELDB-114	EMERGENCY LIGHTING DISTRIBUTION BOARD	415	3+N	-	63	OUTDOOR	1000	200	400	-
044-ELDB-115	EMERGENCY LIGHTING DISTRIBUTION BOARD	415	3+N	-	63	OUTDOOR	1000	200	400	-
VFD-ACM-201 A1	VFD PANEL in 044-MCC-102	415	3			-	400	600	2100	900
VFD-ACM-201 B1	VFD PANEL in 044-MCC-102	415	3			-	400	600	2100	900
VFD-ACM-201 C1	VFD PANEL in 044-MCC-102	415	3			-	400	600	2100	900
VFD-ACM-201 D1	VFD PANEL in 044-MCC-102	415	3			-	400	600	2100	900
VFD-ACM-201 D2	VFD PANEL in 044-MCC-102	415	3			-	400	600	2100	900
VFD-ACM-201 E1	VFD PANEL in 044-MCC-102	415	3			-	400	600	2100	900
VFD-ACM-201 F1	VFD PANEL in 044-MCC-102	415	3			-	400	600	2100	900
VFD-ACM-201 G1	VFD PANEL in 044-MCC-102	415	3			-	400	600	2100	900
VFD-ACM-201 H1	VFD PANEL in 044-MCC-102	415	3			-	400	600	2100	900
VFD-ACM-201 J1	VFD PANEL in 044-MCC-102	415	3			-	400	600	2100	900
VFD-ACM-201 K1	VFD PANEL in 044-MCC-103	415	3			-	400	600	2100	900
VFD-ACM-201 L1	VFD PANEL in 044-MCC-103	415	3			-	400	600	2100	900
VFD-ACM-201 M1	VFD PANEL in 044-MCC-103	415	3			-	400	600	2100	900
VFD-ACM-201 N1	VFD PANEL in 044-MCC-103	415	3			-	400	600	2100	900
VFD-ACM-201 P1	VFD PANEL in 044-MCC-103	415	3			-	400	600	2100	900
VFD-ACM-201 Q1	VFD PANEL in 044-MCC-103	415	3			-	400	600	2100	900
VFD-ACM-201 R1	VFD PANEL in 044-MCC-103	415	3			-	400	600	2100	900
VFD-ACM-202 A1	VFD PANEL in 044-MCC-104	415	3			-	400	600	2100	900

Table 12. Electrical equipment list (part 3).

4.2.1. LOAD FLOW STUDY

Load flow study has been made through two methods: ETAP simulations and direct calculation. The first input data that has been provided for the equipment is summarized in Table 13.

POWER GRID							
TAG		kA	kV	%R	%X	Connection	
CGP-1 Max. Short-Circuit Level 3-Ph X/R= 14		37,5	33	0,38953	5,45344	Y	
CGP-1 min. Short-Circuit Level 3-Ph X/R= 14		10	33	1,2465	17,450	Y	
CGP-1 Max. Short-C. Level 3-Ph (Emergency), X/R= 14		35	11	1,0684	14,958	Y	
CGP-1 min. Short-C. Level 3-Ph (Emergency), X/R= 14		10	11	0,38953	5,45344	Y	
TRANSFORMER							
TAG	PHASE	kVA	Prim. V	Sec. V	%Z	X1/R1	Connection
044-TR-101A	3-PH	20000	33000	6900	10,0	20	Dyn1
044-TR-101B	3-PH	20000	33000	6900	10,0	20	Dyn1
044-TR-102A	3-PH	2500	6600	433	8,50	13	Dyn11
044-TR-102B	3-PH	2500	6600	433	8,50	13	Dyn11
044-TR-103A	3-PH	2500	6600	433	8,50	13	Dyn11
044-TR-103B	3-PH	2500	6600	433	8,50	13	Dyn11
044-TR-104A	3-PH	2500	6600	433	8,50	13	Dyn11
044-TR-104B	3-PH	2500	6600	433	8,50	13	Dyn11
044-TR-105A	3-PH	1600	6600	433	6,25	10	Dyn11
044-TR-105B	3-PH	1600	6600	433	6,25	10	Dyn11
044-TR-105C	3-PH	1600	6600	433	6,25	10	Dyn11
044-TR-106A	3-PH	3150	11000	6900	7,25	10	YNyn0
044-TR-107A	3-PH	200	415	433	4,0	1,5	YNd1
044-TR-107B	3-PH	200	415	433	4,0	1,5	YNd1
044-TR-108A	3-PH	100	415	433	4,0	1,5	YNd1
044-TR-108B	3-PH	100	415	433	4,0	1,5	YNd1
ASYNCHRONOUS MOTORS							
LRC= 500% for all HV motors.		PF @ LRC= 25-30%					
LRC= 720% for all MV motors.		PF @ LRC= 20-25%					
CAPACITOR BANKS							
TAG	PHASE	kVAR	Prim. V	Sec. V	FLA	Xc (Ω)	Connection
CAP1	3-PH	2400	6600	-	210	18,15	Y
CAP1	3-PH	2400	6600	-	210	18,15	Y

Table 13. Main input data for ETAP design.

Starting with the ETAP simulation, the load flow simulations are performed for three cases as described:

- **Case 1: Normal Operation.**

044-HT33-101, HV and MV switchgears (MCCs and PMCCs) shall be provided with auto changeover facility between the two incomers and its bus coupler, the bus coupler breaker shall be operated normally open. All HV switchboards shall have fast acting bus transfer scheme (based on phasor sensing). For MLDB and ASB switchboards, normally both the incomers shall be 'closed' with bus coupler in 'open' condition. EMLDB switchboard shall be operated with bus coupler in 'close' condition, and shall be fed from PMCC, incomer 1. UPS loads shall be fed from their inverter outputs. For Emergency Switchboard EPMCC, the incomer 1 (normal source 1 from substation) shall operate normally closed. The incomer 2 (normal source 2 from substation) and the incomer 3 (fed from emergency network) shall be operated normally open. All loads are operating based on their operating load. HV capacitor bank at 6600V is in service.

- **Case 2: Contingency Operation.**

044-HT33-101, HV and MV switchgears (MCCs and PMCCs) shall be fed from one incomer, their bus coupler shall be operated normally closed. MLDB, EMLDB and ASB switchboards shall be fed by one incomer. Their bus coupler shall be operated normally closed. For Emergency Switchboard EPMCC the incomer 2 (normal source 2 from substation) shall operate normally closed. Incomer 1 (normal source 1 from substation) and the incomer 3 (fed from emergency network) shall be operated normally open. UPS loads shall be fed from bypass transformers. All loads are operating based on their operating load. HV capacitor bank at 6600V is in service.

- **Case 3: Emergency Operation.**

Switchboard 044-EPMCC-101 shall be in operation and connected to load. EPMCC will be fed from the Emergency Switchboard 044-HT6-102, and the 044-HT6-102 will be fed from 044-HT11-101. The other switchgears, switchboards, not connected through EPMCC and 044-HT11-101, shall be considered de-energized. UPS loads shall be fed from bypass transformers. All loads are operating based on their operating load. HV capacitor bank at 6600V is in service.

As a result, the following tables (Table 14 and Table 15) indicate the total demand and maximum power obtained through the three simulations. During normal operation, each transformer shall be loaded up to 40%, and outage of one transformer, the other transformer shall be loaded up to 80%. The results are in accordance with the specifications.

CASES	TOTAL DEMAND (kW)	TOTAL APPARENT LOSSES (kW)
CASE 1	23438,3	176,9
CASE 2	23366	248,3
CASE 3	2372,5	15,5

Table 14. Total power demand and losses. Source: ETAP results.

POWER AND DISTRIBUTION TRANSFORMERS	NOMINAL RATING (kVA)	SWITCHGEAR/ SWITCHBOARD	TRANSFORMER'S MAXIMUM POWER (kVA)					
			PRESENT LOAD					
			CASE 1		CASE 2		CASE 3	
			Normal Operation	LOADING (%)	Contingency Operation	LOADING (%)	Emergency Operation	LOADING (%)
044-TR-101A	20 MVA	044-HT6-101A	6048,7	30,4	10803,1	49,8	-	-
044-TR-101B	20 MVA	044-HT6-101B	4813,5	21,9	-	-	-	-
044-TR-102A	2500 kVA	044-PMCC-101A	1201,5	48,1	2394,9	77,5	-	-
044-TR-102B	2500 kVA	044-PMCC-101B	1190,5	47,6	-	-	-	-
044-TR-103A	2500 kVA	044-PMCC-102A	1122,1	44,9	2290,6	73,8	-	-
044-TR-103B	2500 kVA	044-PMCC-102B	1175,6	47	-	-	-	-
044-TR-104A	2500 kVA	044-PMCC-103A	1326,5	53,1	2375,3	66,6	-	-
044-TR-104B	2500 kVA	044-PMCC-103B	1246,9	49,9	-	-	-	-
044-TR-105 A	1600 kVA	044-EPMCC-101	364,1	22,8	818,6	39	-	-
044-TR-105 B	1600 kVA	044-EPMCC-101	-	-	-	-	-	-
044-TR-105 C	1600 kVA	044-EPMCC-101	363,4	22,7	-	-	792,3	49,5
044-TR-106 A	3150 kVA	044-HT6-102	-	-	-	-	1412,2	35,9

Table 15. Transformer's power and loading. Source: ETAP results

Steady state voltage tolerances have also been verified. Voltage variation ranges will be according to the following criteria:

- 220kV: (+10%, -12.5%)
- 33kV: (+6%, -9.0%)
- 11kV, 6kV and 415V: (+6%, -6%)
- DC system: $\pm 5\%$
- AC system: $\pm 1\%$

ETAP voltage results are indicated on the following two tables (Table 16 and Table 17). Voltage variations are also in accordance with the specifications.

BUS IDENTIFICATION		NOMINAL VOLTAGE (kV)	ADMITTED RANGE (%)	STEADY STATE VOLTAGE		
				(% NOMINAL)		
				CASE 1	CASE 2	CASE 3
				Normal Operation	Contingency Operation	Emergency Operation
044-HT33-101	Bus A	33	(+6%, -9%)	91,91%	99,83%	-
	Bus B	33	(+6%, -9%)	99,92%	99,83%	-
044-HT11-101	-	11	(+6%, -6%)	99,93%	99,93%	99,86%
044-HT6-101	Bus A	6	(+6%, -6%)	104,20%	103,90%	-
	Bus B	6,6	(+6%, -6%)	104,60%	103,90%	-
044-HT6-102	-	6,6	(+6%, -6%)	99,63%	99,39%	98,50%
AU-V REVAMP UNIT	Bus A	6,6	(+6%, -6%)	101,70%	98,73%	-
	Bus B	6,6	(+6%, -6%)	101,70%	98,73%	-
VDU UNIT	Bus A	6,6	(+6%, -6%)	101,60%	98,47%	-
	Bus B	6,6	(+6%, -6%)	101,60%	98,47%	-
044-PMCC-101	Bus A	0,415	(+6%, -6%)	104,20%	101,30%	-
	Bus B	0,415	(+6%, -6%)	104,50%	101,30%	-
044-PMCC-102	Bus A	0,415	(+6%, -6%)	104,30%	102,00%	-
	Bus B	0,415	(+6%, -6%)	104,60%	102,00%	-
044-PMCC-103	Bus A	0,415	(+6%, -6%)	99,13%	96,59%	-
	Bus B	0,415	(+6%, -6%)	104,30%	96,59%	-
044-EPMCC-101	-	0,415	(+6%, -6%)	105,20%	104,10%	103,10%
044-MCC-101	Bus A	0,415	(+6%, -6%)	104,00%	101,30%	-
	Bus B	0,415	(+6%, -6%)	104,30%	101,30%	-
044-MCC-102	Bus A	0,415	(+6%, -6%)	103,90%	101,20%	-
	Bus B	0,415	(+6%, -6%)	104,20%	101,20%	-
044-MCC-103	Bus A	0,415	(+6%, -6%)	104,10%	101,50%	-
	Bus B	0,415	(+6%, -6%)	104,40%	101,50%	-
044-MCC-104	Bus A	0,415	(+6%, -6%)	104,00%	101,30%	-
	Bus B	0,415	(+6%, -6%)	104,30%	101,30%	-
044-MCC-105	Bus A	0,415	(+6%, -6%)	104,20%	101,70%	-
	Bus B	0,415	(+6%, -6%)	104,50%	101,70%	-
044-MCC-106	Bus A	0,415	(+6%, -6%)	104,10%	101,60%	-
	Bus B	0,415	(+6%, -6%)	104,50%	101,60%	-
044-MCC-107	Bus A	0,415	(+6%, -6%)	98,99%	96,32%	-
	Bus B	0,415	(+6%, -6%)	104,20%	96,32%	-
044-ASB-101	Bus A	0,415	(+6%, -6%)	98,98%	96,38%	-
	Bus B	0,415	(+6%, -6%)	104,20%	96,38%	-
044-ASB-102	Bus A	0,415	(+6%, -6%)	99,04%	96,42%	-
	Bus B	0,415	(+6%, -6%)	104,20%	96,42%	-

Table 16. Equipment's state voltage (part 1). Source: ETAP results.

BUS IDENTIFICATION		NOMINAL VOLTAGE (kV)	ADMITTED RANGE (%)	STEADY STATE VOLTAGE		
				(% NOMINAL)		
				CASE 1	CASE 2	CASE 3
				Normal Operation	Contingency Operation	Emergency Operation
044-MLDB-101	Bus A	0,415	(+6%, -6%)	105,50%	102,20%	-
	Bus B	0,415	(+6%, -6%)	105,40%	102,20%	-
044-MLDB-102	Bus A	0.415	(+6%, -6%)	104,70%	99,33%	98,43%
	Bus B	0.415	(+6%, -6%)	102,00%	99,33%	98,43%
044-EMLDB-101	Bus A	0,415	(+6%, -6%)	102,50%	100,50%	99,63%
	Bus B	0,415	(+6%, -6%)	102,50%	100,50%	99,63%
044-LDB-101	-	0,415	(+6%, -6%)	104,70%	101,50%	-
044-LDB-102	-	0,415	(+6%, -6%)	103,40%	100,20%	-
044-LDB-103	-	0,415	(+6%, -6%)	102,90%	100,40%	-
044-LDB-104	-	0,415	(+6%, -6%)	103,70%	100,40%	-
044-LDB-105	-	0,415	(+6%, -6%)	104,50%	101,30%	-
044-LDB-106	-	0,415	(+6%, -6%)	103,30%	98,02%	97,13%
044-LDB-107	-	0,415	(+6%, -6%)	101,00%	98,30%	97,41%
044-LDB-108	-	0,415	(+6%, -6%)	103,60%	98,30%	97,41%
044-LDB-109	-	0,415	(+6%, -6%)	103,80%	100,50%	-
044-LDB-110	-	0,415	(+6%, -6%)	103,00%	99,72%	-
044-LDB-111	-	0,415	(+6%, -6%)	102,90%	99,64%	-
044-LDB-112	-	0,415	(+6%, -6%)	103,00%	99,72%	-
044-LDB-113	-	0,415	(+6%, -6%)	101,50%	98,30%	-
044-LDB-114	-	0,415	(+6%, -6%)	102,10%	98,93%	-
044-LDB-115	-	0,415	(+6%, -6%)	103,90%	100,60%	-
044-LDB-116	-	0,415	(+6%, -6%)	103,20%	97,98%	97,09%
044-LDB-117	-	0,415	(+6%, -6%)	100,60%	97,98%	97,09%
044-PDB-101	-	0,415	(+6%, -6%)	104,60%	101,30%	-
044-PDB-102	-	0,415	(+6%, -6%)	104,10%	100,90%	-
044-PDB-103	-	0,415	(+6%, -6%)	103,60%	100,40%	-
044-PDB-104	-	0,415	(+6%, -6%)	103,20%	100,10%	-
044-PDB-105	-	0,415	(+6%, -6%)	102,20%	99,08%	-
044-ELDB-101	-	0,415	(+6%, -6%)	102,10%	100,10%	99,21%
044-ELDB-102	-	0,415	(+6%, -6%)	101,30%	99,30%	98,39%
044-ELDB-103	-	0,415	(+6%, -6%)	101,70%	99,76%	98,85%
044-ELDB-104	-	0,415	(+6%, -6%)	100,20%	98,28%	97,39%
044-ELDB-105	-	0,415	(+6%, -6%)	101,60%	99,66%	98,75%
044-ELDB-106	-	0,415	(+6%, -6%)	101,90%	99,92%	99,01%
044-ELDB-107	-	0,415	(+6%, -6%)	98,92%	96,99%	96,11%
044-ELDB-108	-	0,415	(+6%, -6%)	100,40%	98,48%	97,59%
044-ELDB-109	-	0,415	(+6%, -6%)	101,50%	9,50%	98,60%
044-ELDB-110	-	0,415	(+6%, -6%)	101,00%	98,99%	98,09%
044-ELDB-111	-	0,415	(+6%, -6%)	99,32%	97,38%	96,50%
044-ELDB-112	-	0,415	(+6%, -6%)	101,00%	98,99%	98,09%
044-ELDB-113	-	0,415	(+6%, -6%)	101,00%	98,99%	98,09%
044-ELDB-114	-	0,415	(+6%, -6%)	100,40%	98,48%	97,59%
044-ELDB-115	-	0,415	(+6%, -6%)	99,42%	97,48%	96,60%

Table 17. Equipment's state (part 2). Source: ETAP results.

Secondly, the following tables (from Table 18 to Table 36) indicate the second method for load flow estimation in normal operation. Direct calculation was made with load data provided by the client and according to specifications.

							ELECTRICAL LOAD CALCULATIONS										
PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPech” (J-18)						SWITCHBOARD: 044-HT33-101										
CLIENT:	INDIAN OIL CORPORATION LIMITED																
ITEM	LOAD DESCRIPTION	LOAD TYPE	LOAD SERVICE	SCHEME TYPE	FED FROM	BUSBAR	RATED VOLTAGE (KV)	N° PH	LOAD DUTY	SIMULTANEITY FACTOR	ABSORBED MECANIC POWER (KW)	MOTOR RATED POWER (KW)	LOAD FACTOR	EFFICIENCY at rated load	POWER FACTOR at operating load	OPERATING CONUMED ELECTRICAL LOAD	
A	B	C	D	E	F	G	H	I	J	K	L	M	N=L/M	O	R	MW U=L/P	MVA V=U/R
DOWNSTREAM LOADS																	
044-TR-101A	33KV/6.9KV POWER TRANSFORMER	CONTROLLED-FEEDER		-	044-HT33-101	BUS A	33	3PH	C	-	-	-	-	-	0,84	7,028	8,367
044-TR-101B	33KV/6.9KV POWER TRANSFORMER	CONTROLLED-FEEDER		-	044-HT33-101	BUS B	33	3PH	S	-	-	-	-	-	0,84	7,028	8,367
044-TR-109A	33KV/6.9KV POWER TRANSFORMER (NEW VDU UNIT CONTRACTOR SCOPE)	CONTROLLED-FEEDER		-	044-HT33-101	BUS A	33	3PH	S	-	-	-	-	-	0,84	5,20	6,19
044-TR-109B	33KV/6.9KV POWER TRANSFORMER (NEW VDU UNIT CONTRACTOR SCOPE)	CONTROLLED-FEEDER		-	044-HT33-101	BUS B	33	3PH	C	-	-	-	-	-	0,84	5,20	6,19
044-TR-114A	33KV/6.9KV POWER TRANSFORMER (AU-V REVAMP UNIT CONTRACTOR SCOPE)	CONTROLLED-FEEDER		-	044-HT33-101	BUS A	33	3PH	S	-	-	-	-	-	0,84	6,30	7,50
044-TR-114B	33KV/6.9KV POWER TRANSFORMER (AU-V REVAMP UNIT CONTRACTOR SCOPE)	CONTROLLED-FEEDER		-	044-HT33-101	BUS B	33	3PH	C	-	-	-	-	-	0,84	6,30	7,50

TOTAL CONTINUOUS LOAD	a	18,53	22,06
TOTAL INTERMITTENT LOAD	b	0,00	0,00
INTERMITTENT LOAD CONSIDERED = INTERMITENT LOAD * SIMULTANEITY	c=b*30%	0,00	0,00
TOTAL STANDBY LOAD	d	18,53	22,06
STANDBY LOAD CONSIDERED = STANDBY LOAD * SIMALTANEITY LOAD	e=d*10%	1,85	2,21
TOTAL LOAD	f=a+c+e	20,38	24,26
TOTAL LOAD WITH FUTURE 20% LOAD	g=120%*f	24,46	29,12

Table 18. 044-HT33-101 load calculation.

							ELECTRICAL LOAD CALCULATIONS													
PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPech” (J-18)						SWITCHBOARD: 044-HT11-101													
CLIENT:	INDIAN OIL CORPORATION LIMITED																			
ITEM	LOAD DESCRIPTION	LOAD TYPE	LOAD SERVICE	SCHEME TYPE	FED FROM	BUSBAR	RATED VOLTAGE (KV)	N° PH	LOAD DUTY	SIMULTANEITY FACTOR	ABSORBED MECHANIC POWER (KW)	MOTOR RATED POWER (KW)	LOAD FACTOR	EFFICIENCY at rated load	EFFICIENCY at operating load	POWER FACTOR at operating load	OPERATING CONUNED ELECTRICAL LOAD			
A	B	C	D	E	F	G	H	I	J	K	L	M	N=L/M	O	P	R	U=L/P	V=U/R		
044-TR-111C	11KV/0.433KV POWER TRANSFORMER (NEW VDU & AU-V REVAMP UNIT)	CONTROLLED-FEEDER	Normal	-	044-HT11-101	BUS A	11	3PH	C	-	-	-	-	-	-	0,84	1050,00	1250,00		
DOWNSTREAM LOADS																				
044-TR-106A	11KV/6.9KV POWER TRANSFORMER	CONTROLLED-FEEDER	Emergency	-	044-HT11-101	BUS A	11	3PH	C	-	-	-	-	-	-	0,84	552,13	657,29		
																TOTAL CONTINUOUS LOAD		a	1602,13	1907,29
																TOTAL LOAD		b	1602,13	1907,29
																TOTAL LOAD WITH FUTURE 20% LOAD		c=b*120%	1922,55	2288,75

Table 19. 044-HT-101 load calculation.

 							ELECTRICAL LOAD CALCULATIONS															
PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPeeh” (J-18)						SWITCHBOARD: 044-HT6-101															
CLIENT:	INDIAN OIL CORPORATION LIMITED																					
ITEM	LOAD DESCRIPTION	LOAD TYPE	LOAD SERVICE	SCHEME TYPE	FED FROM	BUSBAR	RATED VOLTAGE (V)	N° PH	LOAD DUTY	SIMULTANEITY FACTOR	ABSORBED MECHANIC POWER (KW)	MOTOR RATED POWER (KW)	LOAD FACTOR	EFFICIENCY at rated load	EFFICIENCY at operating load	POWER FACTOR at rated load	POWER FACTOR at operating load	RATED CONSUMED ELECTRICAL LOAD		OPERATING CONUMED ELECTRICAL LOAD		
A	B	C	D	E	F	G	H	I	J	K	L	M	N=L/M	O	P	Q	R	S=M/O	T=S/Q	KW U=L/P	Kvar V	KVA W=U/R
1803-PM-101 A	HOT FRESH FEED PUMPS	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS A	6600	3PH	C	100	197,9	225	0,880	0,942	0,938	0,890	0,890	238,85	268,37	210,98	108,09	237,06
1803-PM-101 B	HOT FRESH FEED PUMPS	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS B	6600	3PH	S	10	197,9	225	0,880	0,942	0,938	0,890	0,890	238,85	268,37	210,98	108,09	237,06
1803-PM-202 A	LCO PUMPAROUND PUMP	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS A	6600	3PH	C	100	244,0	290	0,841	0,936	0,933	0,840	0,817	309,83	368,84	261,53	184,45	320,04
1803-PM-202 B	LCO PUMPAROUND PUMP	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS B	6600	3PH	C	100	244,0	290	0,841	0,936	0,933	0,840	0,817	309,83	368,84	261,53	184,45	320,04
1803-PM-202 C	LCO PUMPAROUND PUMP	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS B	6600	3PH	S	10	244,0	290	0,841	0,936	0,933	0,840	0,817	309,83	368,84	261,53	184,45	320,04
1803-PM-204 A	HCO PUMPAROUND PUMP	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS A	6600	3PH	C	100	169,0	210	0,805	0,930	0,928	0,830	0,806	225,81	272,06	182,19	133,80	226,04
1803-PM-204 B	HCO PUMPAROUND PUMP	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS A	6600	3PH	C	100	169,0	210	0,805	0,930	0,928	0,830	0,806	225,81	272,06	182,19	133,80	226,04
1803-PM-204 C	HCO PUMPAROUND PUMP	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS B	6600	3PH	S	10	169,0	210	0,805	0,930	0,928	0,830	0,806	225,81	272,06	182,19	133,80	226,04
1803-PM-205 A	MAIN FRACTIONATOR BOTTOM PUMP	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS A	6600	3PH	S	10	482,0	550	0,876	0,952	0,955	0,850	0,845	577,73	679,68	504,71	319,41	597,29
1803-PM-205 B	MAIN FRACTIONATOR BOTTOM PUMP	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS B	6600	3PH	C	100	482,0	550	0,876	0,952	0,955	0,850	0,845	577,73	679,68	504,71	319,41	597,29
1803-PM-213 A	DEETHANIZER STRIPPER CHARGE PUMP	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS A	6600	3PH	S	10	232,6	250	0,930	0,930	0,926	0,830	0,808	268,82	323,88	251,08	182,82	310,59
1803-PM-213 B	DEETHANIZER STRIPPER CHARGE PUMP	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS B	6600	3PH	C	100	232,6	250	0,930	0,930	0,926	0,830	0,808	268,82	323,88	251,08	182,82	310,59
1803-PM-214 A	GASOLINE RECYCLE PUMP	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS A	6600	3PH	S	10	146,54	170	0,862	0,925	0,919	0,880	0,862	183,78	208,85	159,46	93,77	184,98
1803-PM-214 B	GASOLINE RECYCLE PUMP	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS B	6600	3PH	C	100	146,54	170	0,862	0,925	0,919	0,880	0,862	183,78	208,85	159,46	93,77	184,98
1803-PM-222 A	LEAN AMINE PUMP	MOTOR (DOL)	Normal	2/M1	044-HT6-101	BUS A	6600	3PH	C	100	241,3	275	0,877	0,938	0,936	0,880	0,868	293,18	333,16	257,69	147,42	296,88
1803-PM-222 B	LEAN AMINE PUMP	MOTOR (DOL)	Normal	2/M1	044-HT6-101	BUS B	6600	3PH	S	10	241,3	275	0,877	0,938	0,936	0,880	0,868	293,18	333,16	257,69	147,42	296,88
1803-X-107-K-001A	WGS OXIDATION BLOWER PUMP	MOTOR (DOL)	Normal	-	044-HT6-101	BUS A	6600	3PH	C	100	147,0	200	0,735	0,930	0,930	0,830	0,830	215,05	259,10	158,06	106,22	190,44
1803-X-107-K-001B	WGS OXIDATION BLOWER PUMP	MOTOR (DOL)	Normal	-	044-HT6-101	BUS B	6600	3PH	C	100	147,0	200	0,735	0,930	0,930	0,830	0,830	215,05	259,10	158,06	106,22	190,44
1803-X-107-K-001C	WGS OXIDATION BLOWER PUMP	MOTOR (DOL)	Normal	-	044-HT6-101	BUS A	6600	3PH	S	10	147,0	200	0,735	0,930	0,930	0,830	0,830	215,05	259,10	158,06	106,22	190,44
DOWNSTREAM LOADS																						
044-HT6-102 A	044-HT6-102 INCOMER 1 (6,6 KV EMERGENCY PANEL)	CONTROLLED-FEEDER	Normal	-	044-HT6-101	BUS A	6600	3PH	C	100	462,03	462,03	1	1	1	0,89	0,89	462,03	519,14	462,03	236,71	519,14
044-HT6-102 B	044-HT6-102 INCOMER 2 (6,6 KV EMERGENCY PANEL)	CONTROLLED-FEEDER	Normal	-	044-HT6-101	BUS B	6600	3PH	S	10	462,03	462,03	1	1	1	0,89	0,89	462,03	519,14	462,03	236,71	519,14
044-TR-102A	DISTRIBUTION TRANSFORMER 6.6 / 0.433 kV (044-PMCC-101)	CONTROLLED-FEEDER	Normal	-	044-HT6-101	BUS A	6600	3PH	C	100	1577,37	2144	0,736	0,98	0,98	0,875	0,875	2187,76	2500,29	1609,56	890,54	1839,49
044-TR-102B	DISTRIBUTION TRANSFORMER 6.6 / 0.433 kV (044-PMCC-101)	CONTROLLED-FEEDER	Normal	-	044-HT6-101	BUS B	6600	3PH	S	10	1577,37	2144	0,736	0,98	0,98	0,875	0,875	2187,76	2500,29	1609,56	890,54	1839,49
044-TR-103A	DISTRIBUTION TRANSFORMER 6.6 / 0.433 kV (044-PMCC-102)	CONTROLLED-FEEDER	Normal	-	044-HT6-101	BUS A	6600	3PH	C	100	1527,45	2144	0,712	0,98	0,98	0,88	0,88	2187,76	2486,09	1558,63	841,26	1771,17
044-TR-103B	DISTRIBUTION TRANSFORMER 6.6 / 0.433 kV (044-PMCC-102)	CONTROLLED-FEEDER	Normal	-	044-HT6-101	BUS B	6600	3PH	S	10	1521,81	2144	0,710	0,98	0,98	0,88	0,88	2187,76	2486,09	1552,87	838,15	1764,62
044-TR-104A	DISTRIBUTION TRANSFORMER 6.6 / 0.433 kV (044-PMCC-103)	CONTROLLED-FEEDER	Normal	-	044-HT6-101	BUS A	6600	3PH	C	100	1659,47	2144	0,774	0,98	0,98	0,875	0,875	2187,76	2500,29	1693,34	936,89	1935,24
044-TR-104B	DISTRIBUTION TRANSFORMER 6.6 / 0.433 kV (044-PMCC-103)	CONTROLLED-FEEDER	Normal	-	044-HT6-101	BUS B	6600	3PH	S	10	1659,47	2144	0,774	0,98	0,98	0,875	0,875	2187,76	2500,29	1693,34	936,89	1935,24
044-CB-101A	HV CAPACITOR BANK	CAPACITOR	Normal	-	044-HT6-101	BUS A	6600	3PH	C	100	-2400	-2400	1	1	1	0	0	0,00	2400,00	0,00	-2400,00	2400,00
044-CB-101B	HV CAPACITOR BANK	CAPACITOR	Normal	-	044-HT6-101	BUS B	6600	3PH	C	100	-2400	-2400	1	1	1	0	0	0,00	2400,00	0,00	-2400,00	2400,00
																		TOTAL CONTINUOUS LOAD				
																		a	7523,05	-194,14	7525,55	
																		b	0,00	0,00	0,00	
																		INTERMITTENT LOAD CONSIDERED = INTERMITTENT LOAD * SIMULTANEITY FACTOR				
																		c=b*30%	0,00	0,00	0,00	
																		TOTAL NORMAL RUNNING LOAD				
																		d=a+c	7523,05	-194,14	7525,55	
																		TOTAL STANDBY LOAD				
																		e	7303,50	4178,28	8414,22	
																		STANDBY LOAD CONSIDERED = STANDBY LOAD * SIMALTANEITY FACTOR				
																		f=e*10%	730,35	417,83	841,42	
																		TOTAL PEAK LOAD				
																		g=a+c+f	8253,40	223,68	8366,97	
																		TOTAL LOAD WITH FUTURE 20% LOAD				
																		h=120%*g	9904,08	268,42	10040,37	

Table 20. 044-HT6-101 load calculation.

							ELECTRICAL LOAD CALCULATIONS														
PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPech” (J-18)						SWITCHBOARD: 044-HT6-102														
CLIENT:	INDIAN OIL CORPORATION LIMITED																				
SWITCHBOARD: 044-HT6-102																					
ITEM	LOAD DESCRIPTION	LOAD TYPE	LOAD SERVICE	SCHEME TYPE	FED FROM	BUSBAR	RATED VOLTAGE (V)	N° PH	LOAD DUTY	SIMULTANEITY FACTOR	ABSORBED MECHANIC POWER (KW)	MOTOR RATED POWER (KW)	LOAD FACTOR	EFFICIENCY at rated load	EFFICIENCY at operating load	POWER FACTOR at rated load	POWER FACTOR at operating load	RATED CONSUMED ELECTRICAL LOAD		OPERATING CONUNED ELECTRICAL LOAD	
																		KW	KVA	KW	KVA
A	B	C	D	E	F	G	H	I	J	K	L	M	N=L/M	O	P	Q	R	S=M/O	T=S/Q	U=L/P	V=U/R
1803-PM-609 A	HP BOILER FEED WATER PUMP	MOTOR (DOL)	Emergency	3/M20	044-HT6-102	BUS A	6600	3PH	C	100	216,0	275,00	0,785	0,938	0,935	0,88	0,86	293,18	333,16	231,02	268,62
1803-PM-609 B	HP BOILER FEED WATER PUMP	MOTOR (DOL)	Emergency	3/M20	044-HT6-102	BUS A	6600	3PH	C	100	216,0	275,00	0,785	0,938	0,935	0,88	0,86	293,18	333,16	231,02	268,62
1803-PM-609 C	HP BOILER FEED WATER PUMP	MOTOR (DOL)	Emergency	3/M20	044-HT6-102	BUS A	6600	3PH	S	10	216,0	275,00	0,785	0,938	0,935	0,88	0,86	293,18	333,16	231,02	268,62
DOWNSTREAM LOADS																					
044-TR-105 C	EMERGENCY DISTRIBUTION TRANSFORMER 6.6 / 0.433 kV (044-EPMCC-101)	CONTROLLED-FEEDER	Emergency	-	044-HT6-102	BUS A	6600	3PH	S	10	799,06	1715	0,466	0,98	0,98	0,875	0,875	1750,00	2000,00	815,36	931,84

TOTAL CONTINUOUS LOAD	a	462,03	537,25
TOTAL INTERMITTENT LOAD	b	0,00	0,00
INTERMITTENT LOAD CONSIDERED = INTERMITTENT LOAD * SIMULTANEITY FACTOR	c=b*30%	0,00	0,00
TOTAL NORMAL RUNNING LOAD	d=a+c	462,03	537,25
TOTAL STANDBY LOAD	e	1046,38	1200,47
STANDBY LOAD CONSIDERED = STANDBY LOAD * SIMULTANEITY FACTOR	f=e*10%	104,64	120,05
TOTAL PEAK LOAD	g=a+c+f	566,67	657,29
TOTAL LOAD WITH FUTURE 20% LOAD	h=120%*g	680,00	788,75

Table 21. 044-HT6-102 load calculation.

							ELECTRICAL LOAD CALCULATIONS																	
PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPech” (J-18)						SWITCHBOARD: 044-PMCC-101																	
CLIENT:	INDIAN OIL CORPORATION LIMITED																							
ITEM	LOAD DESCRIPTION	LOAD TYPE	Load Service	SCHEME TYPE	FED FROM	BUSBAR	RATED VOLTAGE (V)	N° PH	LOAD DUTY	SIMULTANEITY FACTOR	ABSORBED MECHANIC POWER (KW)	MOTOR RATED POWER (KW)	LOAD FACTOR	EFFICIENCY at rated load	EFFICIENCY at operating load	POWER FACTOR at rated load	POWER FACTOR at operating load	RATED CONSUMED ELECTRICAL LOAD		OPERATING CONUNED ELECTRICAL LOAD				
A	B	C	D	E	F	G	H	I	J	K	L	M	N=L/M	O	P	Q	R	KW S=M/O	KVA T=S/Q	KW U=L/P	KVA V=U/R			
1803-PM-102 A	COLD FRESH FEED PUMP	MOTOR (DOL)	Normal	3/M20	044-PMCC-101	BUS A	415	3PH	C	100	85,59	110,00	0,778	0,943	0,929	0,88	0,85	116,65	132,56	92,13	108,39			
1803-PM-102 B	COLD FRESH FEED PUMPS	MOTOR (DOL)	Normal	3/M20	044-PMCC-101	BUS B	415	3PH	S	10	85,59	110,00	0,778	0,943	0,929	0,88	0,85	116,65	132,56	92,13	108,39			
1803-PM-206 A	CLO PRODUCT PUMP	MOTOR (DOL)	Normal	3/M20	044-PMCC-101	BUS B	415	3PH	C	100	121,00	150,00	0,807	0,956	0,952	0,86	0,84	156,90	182,45	127,10	151,31			
1803-PM-206 B	CLO PRODUCT PUMP	MOTOR (DOL)	Normal	3/M20	044-PMCC-101	BUS A	415	3PH	S	10	121,00	150,00	0,807	0,956	0,952	0,86	0,84	156,90	182,45	127,10	151,31			
1803-PM-207 A	FRACTIONATOR REFLUX PUMP	MOTOR (DOL)	Normal	3/M20	044-PMCC-101	BUS A	415	3PH	C	100	115,39	132,00	0,874	0,947	0,947	0,87	0,95	139,39	160,22	121,85	128,67			
1803-PM-207 B	FRACTIONATOR REFLUX PUMP	MOTOR (DOL)	Normal	3/M20	044-PMCC-101	BUS B	415	3PH	S	10	115,39	132,00	0,874	0,947	0,947	0,87	0,95	139,39	160,22	121,85	128,67			
1803-PM-217 A	PRIMARY ABSORBER BOTTOM PUMP	MOTOR (DOL)	Normal	3/M20	044-PMCC-101	BUS B	415	3PH	C	100	105,20	132,00	0,797	0,947	0,94	0,87	0,85	139,39	160,22	111,91	131,66			
1803-PM-217 B	PRIMARY ABSORBER BOTTOM PUMP	MOTOR (DOL)	Normal	3/M20	044-PMCC-101	BUS A	415	3PH	S	10	105,20	132,00	0,797	0,947	0,94	0,87	0,85	139,39	160,22	111,91	131,66			
1803-PM-224 A	HCN PUMPAROUND PUMP	MOTOR (DOL)	Normal	3/M20	044-PMCC-101	BUS A	415	3PH	C	100	43,77	75,00	0,584	0,940	0,921	0,84	0,79	79,79	94,98	47,52	60,46			
1803-PM-224 B	HCN PUMPAROUND PUMP	MOTOR (DOL)	Normal	3/M20	044-PMCC-101	BUS B	415	3PH	S	10	43,77	75,00	0,584	0,940	0,921	0,84	0,79	79,79	94,98	47,52	60,46			
OXTM - A	OXIDATION TANK MIXER MOTORS A (1803-X-107)	MOTOR (DOL)	Normal	-	044-PMCC-101	BUS A	415	3PH	C	100	75,00	75,00	1	0,953	0,953	0,88	0,95	78,70	89,43	78,70	82,58			
OXTM - B	OXIDATION TANK MIXER MOTORS B (1803-X-107)	MOTOR (DOL)	Normal	-	044-PMCC-101	BUS B	415	3PH	C	100	75,00	75,00	1	0,953	0,953	0,88	0,95	78,70	89,43	78,70	82,58			
OXTM - C	OXIDATION TANK MIXER MOTORS C (1803-X-107)	MOTOR (DOL)	Normal	-	044-PMCC-101	BUS A	415	3PH	S	10	75,00	75,00	1	0,953	0,953	0,88	0,95	78,70	89,43	78,70	82,58			
DOWNSTREAM LOADS																								
044-MCC-101 A	044-MCC-101 INCOMER 1	CONTROLLED-FEEDER	Normal	-	044-PMCC-101	BUS A	415	3PH+N	C	100	246,66	315	0,783	1	1	0,88	0,88	315	357,95	246,66	280,29			
044-MCC-101 B	044-MCC-101 INCOMER 2	CONTROLLED-FEEDER	Normal	-	044-PMCC-101	BUS B	415	3PH+N	S	10	246,66	315	0,783	1	1	0,88	0,88	315	357,95	246,66	280,29			
044-MCC-102 A	044-MCC-102 INCOMER 1	CONTROLLED-FEEDER	Normal	-	044-PMCC-101	BUS A	415	3PH+N	C	100	377,15	398,5	0,946	1	1	0,88	0,88	398,5	452,84	377,15	428,58			
044-MCC-102 B	044-MCC-102 INCOMER 2	CONTROLLED-FEEDER	Normal	-	044-PMCC-101	BUS B	415	3PH+N	S	10	377,15	398,5	0,946	1	1	0,88	0,88	398,5	452,84	377,15	428,58			
044-MCC-104 A	044-MCC-104 INCOMER 1	CONTROLLED-FEEDER	Normal	-	044-PMCC-101	BUS A	415	3PH+N	C	100	295,64	398,5	0,742	1	1	0,88	0,88	398,5	452,84	295,64	335,95			
044-MCC-104 B	044-MCC-104 INCOMER 2	CONTROLLED-FEEDER	Normal	-	044-PMCC-101	BUS B	415	3PH+N	S	10	295,64	398,5	0,742	1	1	0,88	0,88	398,5	452,84	295,64	335,95			
																		TOTAL CONTINUOUS LOAD				a	1577,37	1790,48
																		TOTAL INTERMITTENT LOAD				b	0,00	0,00
																		INTERMITTENT LOAD CONSIDERED = INTERMITENT LOAD * SIMULTANEITY FACTOR				c=b*30%	0,00	0,00
																		TOTAL NORMAL RUNNING LOAD				d=a+c	1577,37	1790,48
																		TOTAL STANDBY LOAD				e	1498,67	1707,90
																		STANDBY LOAD CONSIDERED = STANDBY LOAD * SIMALTANEITY LOAD				f=e*10%	149,87	170,79
																		TOTAL PEAK LOAD				g=a+c+f	1727,23	1961,27
																		TOTAL LOAD WITH FUTURE 20% LOAD				h=120%*g	2072,68	2353,53

Table 22. 044-PMCC-101 load calculation.

 							ELECTRICAL LOAD CALCULATIONS														
PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPech” (J-18)						SWITCHBOARD: 044-PMCC-102														
CLIENT:	INDIAN OIL CORPORATION LIMITED																				
ITEM	LOAD DESCRIPTION	LOAD TYPE	LOAD SERVICE	SCHEME TYPE	FED FROM	BUSBAR	RATED VOLTAGE (V)	N° PH	LOAD DUTY	SIMULTANEITY FACTOR	ABSORBED MECHANIC POWER (KW)	MOTOR RATED POWER (KW)	LOAD FACTOR	EFFICIENCY at rated load	EFFICIENCY at operating load	POWER FACTOR at rated load	POWER FACTOR at operating load	RATED CONSUMED ELECTRICAL LOAD		OPERATING CONUNED ELECTRICAL LOAD	
A	B	C	D	E	F	G	H	I	J	K	L	M	N=L/M	O	P	Q	R	S=M/O	KVA T=S/Q	KW U=L/P	KVA V=U/R
1803-PM-215 A	PRIMARY ABSORBER INTERCOOLER-I PUMP	MOTOR (DOL)	Normal	3/M20	044-PMCC-102	BUS A	415	3PH	C	100	54,07	75,00	0,721	0,938	0,93	0,88	0,86	79,96	90,86	58,14	67,60
1803-PM-215 B	PRIMARY ABSORBER INTERCOOLER-I PUMP	MOTOR (DOL)	Normal	3/M20	044-PMCC-102	BUS B	415	3PH	S	10	54,07	75,00	0,721	0,938	0,93	0,88	0,86	79,96	90,86	58,14	67,60
1803-PM-216 A	PRIMARY ABSORBER INTERCOOLER-II PUMPS	MOTOR (DOL)	Normal	3/M20	044-PMCC-102	BUS B	415	3PH	C	100	70,03	110,00	0,637	0,945	0,9252	0,87	0,83	116,40	133,80	75,69	91,33
1803-PM-216 B	PRIMARY ABSORBER INTERCOOLER-II PUMPS	MOTOR (DOL)	Normal	3/M20	044-PMCC-102	BUS A	415	3PH	S	10	70,03	110,00	0,637	0,945	0,9252	0,87	0,83	116,40	133,80	75,69	91,33
1803-PM-218 A	DEBUTANIZER REFLUX PUMP	MOTOR (DOL)	Normal	3/M20	044-PMCC-102	BUS A	415	3PH	C	100	97,22	132,00	0,737	0,947	0,94	0,87	0,85	139,39	160,22	103,43	121,68
1803-PM-218 B	DEBUTANIZER REFLUX PUMP	MOTOR (DOL)	Normal	3/M20	044-PMCC-102	BUS B	415	3PH	S	10	97,22	132,00	0,737	0,947	0,94	0,87	0,85	139,39	160,22	103,43	121,68
1803-PM-219 A	LPG PRODUCT PUMP	MOTOR (DOL)	Normal	3/M20	044-PMCC-102	BUS B	415	3PH	C	100	115,20	160,00	0,720	0,948	0,9316	0,90	0,86	168,78	187,53	123,66	144,60
1803-PM-219 B	LPG PRODUCT PUMP	MOTOR (DOL)	Normal	3/M20	044-PMCC-102	BUS A	415	3PH	S	10	115,20	160,00	0,720	0,948	0,9316	0,90	0,86	168,78	187,53	123,66	144,60
1803-X-107-P-003 A	WGS SPRAY TOWER PUMP	MOTOR (DOL)	Normal	3/M20	044-PMCC-102	BUS A	415	3PH	C	100	117,00	132,00	0,886	0,953	0,953	0,88	0,88	138,51	157,40	122,77	139,51
1803-X-107-P-003 B	WGS SPRAY TOWER PUMP	MOTOR (DOL)	Normal	3/M20	044-PMCC-102	BUS B	415	3PH	S	10	117,00	132,00	0,886	0,953	0,953	0,88	0,88	138,51	157,40	122,77	139,51
1803-X-107-P-003 C	WGS SPRAY TOWER PUMP	MOTOR (DOL)	Normal	-	044-PMCC-102	BUS A	415	3PH	C	100	117,00	132,00	0,886	0,953	0,953	0,88	0,88	138,51	157,40	122,77	139,51
1803-X-107-P-004 A	WGS FILTERING MODULE PUMP	MOTOR (DOL)	Normal	-	044-PMCC-102	BUS B	415	3PH	C	100	73,00	90,00	0,811	0,953	0,953	0,88	0,88	94,44	107,32	76,60	87,05
1803-X-107-P-004 B	WGS FILTERING MODULE PUMP	MOTOR (DOL)	Normal	-	044-PMCC-102	BUS A	415	3PH	S	10	73,00	90,00	0,811	0,953	0,953	0,88	0,88	94,44	107,32	76,60	87,05
DOWNSTREAM LOADS																					
044-MCC-103 A	044-MCC-103 INCOMER 1	CONTROLLED-FEEDER	Normal	-	044-PMCC-102	BUS A	415	3PH+N	C	100	377,15	398,5	0,946	1	1	0,88	0,88	398,5	452,84	377,15	428,58
044-MCC-103 B	044-MCC-103 INCOMER 2	CONTROLLED-FEEDER	Normal	-	044-PMCC-102	BUS B	415	3PH+N	S	10	377,15	398,5	0,946	1	1	0,88	0,88	398,5	452,84	377,15	428,58
044-MCC-105 A	044-MCC-105 INCOMER 1	CONTROLLED-FEEDER	Normal	-	044-PMCC-102	BUS A	415	3PH+N	C	100	192,73	398,5	0,484	1	1	0,88	0,88	398,5	452,84	192,73	219,01
044-MCC-105 B	044-MCC-105 INCOMER 2	CONTROLLED-FEEDER	Normal	-	044-PMCC-102	BUS B	415	3PH+N	S	10	192,73	398,5	0,484	1	1	0,88	0,88	398,5	452,84	192,73	219,01
044-MCC-106 A	044-MCC-106 INCOMER 1	CONTROLLED-FEEDER	Normal	-	044-PMCC-102	BUS A	415	3PH+N	C	100	274,51	398,5	0,689	1	1	0,88	0,88	398,5	452,84	274,51	311,95
044-MCC-106 B	044-MCC-106 INCOMER 2	CONTROLLED-FEEDER	Normal	-	044-PMCC-102	BUS B	415	3PH+N	S	10	274,51	398,5	0,689	1	1	0,88	0,88	398,5	452,84	274,51	311,95

TOTAL CONTINUOUS LOAD	a	1527,45	1750,82
TOTAL INTERMITTENT LOAD	b	0,00	0,00
INTERMITTENT LOAD CONSIDERED = INTERMITTENT LOAD * SIMULTANEITY FACTOR	c=b*30%	0,00	0,00
TOTAL NORMAL RUNNING LOAD	d=a+c	1527,45	1750,82
TOTAL STANDBY LOAD	e	1404,68	1611,30
STANDBY LOAD CONSIDERED = STANDBY LOAD * SIMALTANEITY LOAD	f=e*10%	140,47	161,13
TOTAL PEAK LOAD	g=a+c+f	1667,92	1911,95
TOTAL LOAD WITH FUTURE 20% LOAD	h=120%*g	2001,51	2294,34

Table 23. 044-PMCC-102 load calculation.

							ELECTRICAL LOAD CALCULATIONS															
PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LuPech" (J-18)						SWITCHBOARD: 044-PMCC-103															
CLIENT:	INDIAN OIL CORPORATION LIMITED																					
ITEM	LOAD DESCRIPTION	LOAD TYPE	Load Service	SCHEME TYPE	FED FROM	BUSBAR	RATED VOLTAGE (V)	N° PH	LOAD DUTY	SIMULTANEITY FACTOR	ABSORBED MECHANIC POWER (KW)	MOTOR RATED POWER (KW)	LOAD FACTOR	EFFICIENCY at rated load	EFFICIENCY at operating load	POWER FACTOR at rated load	POWER FACTOR at operating load	RATED CONSUMED ELECTRICAL LOAD	OPERATING CONSUMED ELECTRICAL LOAD			
A	B	C	D	E	F	G	H	I	J	K	L	M	N=L/M	O	P	Q	R	KW S-M/O	KVA T-S/O	KW U-L/P	KVA V-L/P	
1803-PM-203 A	LCO PRODUCT PUMP	MOTOR (DOL)	Normal	3/M20	044-PMCC-103	BUS A	415	3PH	C	100	41,74	55,00	0,759	0,932	0,921	0,87	0,85	59,01	67,83	45,32	53,32	
1803-PM-203 B	LCO PRODUCT PUMP	MOTOR (DOL)	Normal	3/M20	044-PMCC-103	BUS B	415	3PH	S	10	41,74	55,00	0,759	0,932	0,921	0,87	0,85	59,01	67,83	45,32	53,32	
1803-PM-212 A	COMPRESSOR INTERSTAGE LIQUID PUMP	MOTOR (DOL)	Normal	3/M20	044-PMCC-103	BUS B	415	3PH	C	100	52,22	75,00	0,696	0,938	0,928	0,88	0,85	79,96	90,86	56,27	66,20	
1803-PM-212 B	COMPRESSOR INTERSTAGE LIQUID PUMP	MOTOR (DOL)	Normal	3/M20	044-PMCC-103	BUS A	415	3PH	S	10	52,22	75,00	0,696	0,938	0,928	0,88	0,85	79,96	90,86	56,27	66,20	
1803-PM-220 A	LEAN OIL PUMP	MOTOR (DOL)	Normal	3/M20	044-PMCC-103	BUS A	415	3PH	C	100	57,20	75,00	0,763	0,938	0,931	0,88	0,86	79,96	90,86	61,46	71,34	
1803-PM-220 B	LEAN OIL PUMP	MOTOR (DOL)	Normal	3/M20	044-PMCC-103	BUS B	415	3PH	S	10	57,20	75,00	0,763	0,938	0,931	0,88	0,86	79,96	90,86	61,46	71,34	
1803-PM-209 A	DISTILLATE DRUM LIQUID PUMP	MOTOR (DOL)	Normal	3/M20	044-PMCC-103	BUS B	415	3PH	C	100	101,60	132,00	0,770	0,946	0,933	0,89	0,87	139,53	156,78	108,88	124,92	
1803-PM-209 B	DISTILLATE DRUM LIQUID PUMP	MOTOR (DOL)	Normal	3/M20	044-PMCC-103	BUS A	415	3PH	S	10	101,60	132,00	0,770	0,946	0,933	0,89	0,87	139,53	156,78	108,88	124,92	
1803-PM-225 A	RICH AMINE PUMP	MOTOR (DOL)	Normal	3/M20	044-PMCC-103	BUS A	415	3PH	C	100	50,96	75,00	0,679	0,94	0,923	0,84	0,80	79,79	94,98	55,19	68,64	
1803-PM-225 B	RICH AMINE PUMP	MOTOR (DOL)	Normal	3/M20	044-PMCC-103	BUS B	415	3PH	S	10	50,96	75,00	0,679	0,94	0,923	0,84	0,80	79,79	94,98	55,19	68,64	
1803-X-205-P-006A	REGENERATED CAUSTIC PUMPS (CR LPG TREATMENT PACKAGE)	MOTOR (DOL)	Normal	-	044-PMCC-103	BUS A	415	3PH	C	100	72,50	90,00	0,806	0,950	0,950	0,87	0,87	94,74	108,89	76,32	87,72	
1803-X-205-P-006B	REGENERATED CAUSTIC PUMPS (CR LPG TREATMENT PACKAGE)	MOTOR (DOL)	Normal	-	044-PMCC-103	BUS B	415	3PH	S	10	72,50	90,00	0,806	0,950	0,950	0,87	0,87	94,74	108,89	76,32	87,72	
1803-X-205-P-010A	LPG BOOSTER PUMPS (CR LPG TREATMENT PACKAGE)	MOTOR (DOL)	Normal	-	044-PMCC-103	BUS A	415	3PH	C	100	101,00	125,00	0,808	0,950	0,950	0,87	0,87	131,58	151,24	106,32	122,20	
1803-X-205-P-010B	LPG BOOSTER PUMPS (CR LPG TREATMENT PACKAGE)	MOTOR (DOL)	Normal	-	044-PMCC-103	BUS B	415	3PH	S	10	101,00	125,00	0,808	0,950	0,950	0,87	0,87	131,58	151,24	106,32	122,20	
DOWNSTREAM LOADS																						
044-ASB-101 A	044-ASB-101 (WELDINGSOCKETS) INCOMER 1	FEEDER	Normal	-	044-PMCC-103	BUS A	415	3PH+N	S	10	181,61	181,61	1,00	0,98	0,98	0,88	0,88	185,32	210,59	185,32	210,59	
044-ASB-101 B	044-ASB-101 (WELDINGSOCKETS) INCOMER 2	FEEDER	Normal	-	044-PMCC-103	BUS B	415	3PH+N	S	10	181,61	181,61	1,00	0,98	0,98	0,88	0,88	185,32	210,59	185,32	210,59	
044-ASB-102 A	044-ASB-102 (WELDINGSOCKETS) INCOMER 1	FEEDER	Normal	-	044-PMCC-103	BUS A	415	3PH+N	S	10	202,07	202,07	1,00	0,98	0,98	0,88	0,88	206,19	234,31	206,19	234,31	
044-ASB-102 B	044-ASB-102 (WELDINGSOCKETS) INCOMER 2	FEEDER	Normal	-	044-PMCC-103	BUS B	415	3PH+N	S	10	202,07	202,07	1,00	0,98	0,98	0,88	0,88	206,19	234,31	206,19	234,31	
ESS-044-HVAC-1	ESS-044 HVAC MCC INCOMER 1	FEEDER	Normal	-	044-PMCC-103	BUS A	415	3PH+N	C	100	450,0	450	1,00	0,98	0,98	0,9	0,9	459,18	510,20	459,18	510,20	
ESS-044-HVAC-2	ESS-044 HVAC MCC INCOMER 2	FEEDER	Normal	-	044-PMCC-103	BUS B	415	3PH+N	S	10	450,0	450	1,00	0,98	0,98	0,9	0,9	459,18	510,20	459,18	510,20	
044-MCC-107 A	044-MCC-107 INCOMER 1	CONTROLLED-FEEDER	Normal	-	044-PMCC-103	BUS A	415	3PH+N	C	100	390,53	398,5	0,98	1	1	0,88	0,88	398,5	452,84	390,53	443,78	
044-MCC-107 B	044-MCC-107 INCOMER 2	CONTROLLED-FEEDER	Normal	-	044-PMCC-103	BUS B	415	3PH+N	S	10	390,53	398,5	0,98	1	1	0,88	0,88	398,5	452,84	390,53	443,78	
044-UPS-101 A	044-UPS 101 NOM. POWER 100 kVA (DCS/ESD) INCOMER 1 - CHARGER	CONTROLLED-FEEDER	Normal	-	044-PMCC-103	BUS A	415	3PH+N	S	10	100,0	100	1,00	1	1	0,88	0,88	100	113,64	100,00	113,64	
044-UPS-101 C	044-UPS 101 NOM. POWER 100 kVA (DCS/ESD) INCOMER 3 - CHARGER	CONTROLLED-FEEDER	Normal	-	044-PMCC-103	BUS B	415	3PH+N	S	10	100,0	100	1,00	1	1	0,88	0,88	100	113,64	100,00	113,64	
044-UPS-102 A	044-UPS 102 NOM. POWER 25 kVA (TELECOM, CCTV, PAGING & FDAS SYSTEM) INCOMER 1 - CHARGER	CONTROLLED-FEEDER	Normal	-	044-PMCC-103	BUS A	415	3PH+N	S	10	25,0	25	1,00	1	1	0,88	0,88	25	28,41	25,00	28,41	
044-UPS-102 C	044-UPS 102 NOM. POWER 25 kVA (TELECOM, CCTV, PAGING & FDAS SYSTEM) INCOMER 3 - CHARGER	CONTROLLED-FEEDER	Normal	-	044-PMCC-103	BUS B	415	3PH+N	S	10	25,0	25	1,00	1	1	0,88	0,88	25	28,41	25,00	28,41	
044-DC-101 A	044-DC 101 NOM. POWER 50 kVA (SWITCHGEAR CONTROL) INCOMER 1	CONTROLLED-FEEDER	Normal	-	044-PMCC-103	BUS A	415	3PH+N	S	10	50,0	50	1,00	1	1	0,88	0,88	50	56,82	50,00	56,82	
044-TR-107 A	MAIN LIGHTING TRANSFORMER 0,415 / 0,433 kV (044-MLDB-101)	CONTROLLED-FEEDER	Normal	-	044-PMCC-103	BUS A	415	3PH+N	C	100	200,0	200	1,00	1	1	1	1	200	200,00	200,00	200,00	
044-TR-107 B	MAIN LIGHTING TRANSFORMER 0,415 / 0,433 kV (044-MLDB-101)	CONTROLLED-FEEDER	Normal	-	044-PMCC-103	BUS B	415	3PH+N	S	10	200,0	200	1,00	1	1	1	1	200	200,00	200,00	200,00	
044-TR-108 A	EMERGENCY LIGHTING TRANSFORMER 415/ 433 V (044-EMLDB-101)	CONTROLLED-FEEDER	Normal	-	044-PMCC-103	BUS B	415	3PH+N	C	100	100,0	100	1,00	1	1	1	1	100	100,00	100,00	100,00	
																		TOTAL CONTINUOUS LOAD		a	1659,47	1648,33
																		TOTAL INTERMITTENT LOAD		b	0,00	0,00
																		INTERMITTENT LOAD CONSIDERED = INTERMITTENT LOAD * SIMULTANEITY FACTOR		c=b*30%	0,00	0,00
																		TOTAL NORMAL RUNNING LOAD		d=a+c	1659,47	1648,33
																		TOTAL STANDBY LOAD		e	2642,49	2979,03
																		STANDBY LOAD CONSIDERED = STANDBY LOAD * SIMULTANEITY LOAD		f=e*10%	264,25	297,90
																		TOTAL PEAK LOAD		g=a+c+f	1923,72	2146,23
																		TOTAL LOAD WITH FUTURE 20% LOAD		h=120%*g	2308,46	2575,48

Table 24. 044-PMCC-103 load calculation.

ELECTRICAL LOAD CALCULATIONS

 						ELECTRICAL LOAD CALCULATIONS																
PROJECT:		EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LaPech” (J-18)										SWITCHBOARD: 044-EPMCC-101										
CLIENT:		INDIAN OIL CORPORATION LIMITED																				
ITEM	LOAD DESCRIPTION	LOAD TYPE	LOAD SERVICE	SCHEME TYPE	FED FROM	BUSBAR	RATED VOLTAGE (V)	N° PH	LOAD DUTY	SIMULTANEITY FACTOR	ABSORBED MECHANIC POWER (KW)	MOTOR RATED POWER (KW)	LOAD FACTOR	EFFICIENCY at rated load	EFFICIENCY at operating load	POWER FACTOR at rated load	POWER FACTOR at operating load	RATED CONSUMED ELECTRICAL LOAD		OPERATING CONUNMED ELECTRICAL LOAD		
																		KW	KVA	KW	KVA	
A	B	C	D	E	F	G	H	I	J	K	L	M	N=L/M	O	P	Q	R	S=M/O	T=S/Q	U=L/P	V=U/R	
1803-PM-603	HEAVY HC CLOSED BLOWDOWN DRUM PUMP	MOTOR (DOL)	Emergency	3/M102	044-EPMCC-101	BUS A	415	3PH	I	30	11.63	15.00	0.775	0.98	0.88	0.88	15.31	17.39	11.87	13.49		
1803-PM-604 A	FLARE KOD PUMP	MOTOR (DOL)	Emergency	4/M60	044-EPMCC-101	BUS A	415	3PH	I	30	17.50	30.00	0.583	0.92	0.907	0.84	0.77	32.61	38.82	19.30	25.13	
1803-PM-604 B	FLARE KOD PUMP	MOTOR (DOL)	Emergency	4/M60	044-EPMCC-101	BUS A	415	3PH	I	30	17.50	30.00	0.583	0.92	0.907	0.84	0.77	32.61	38.82	19.30	25.13	
1803-PM-608 A	FLUSHING OIL DRUM PUMP	MOTOR (DOL)	Emergency	4/M60	044-EPMCC-101	BUS A	415	3PH	C	100	44.50	55.00	0.809	0.98	0.980	0.88	0.88	56.12	63.78	45.41	51.60	
1803-PM-608 B	FLUSHING OIL DRUM PUMP	MOTOR (DOL)	Emergency	4/M60	044-EPMCC-101	BUS A	415	3PH	S	10	44.50	55.00	0.809	0.98	0.980	0.88	0.88	56.12	63.78	45.41	51.60	
1803-P-226 A	CORROSION INHIBITOR INJECTION PUMP MOTOR (1803-X-202)	MOTOR (DOL)	Emergency	-	044-EPMCC-101	BUS A	415	3PH	C	100	0.37	0.37	1.000	0.963	0.963	0.90	0.90	0.38	0.43	0.38	0.43	
1803-P-227 A	CORROSION INHIBITOR INJECTION PUMP MOTOR (1803-X-202)	MOTOR (DOL)	Emergency	-	044-EPMCC-101	BUS A	415	3PH	C	100	0.37	0.37	1.000	0.963	0.963	0.90	0.90	0.38	0.43	0.38	0.43	
1803-P-228 A	CORROSION INHIBITOR INJECTION PUMP MOTOR (1803-X-202)	MOTOR (DOL)	Emergency	-	044-EPMCC-101	BUS A	415	3PH	C	100	0.37	0.37	1.000	0.963	0.963	0.90	0.90	0.38	0.43	0.38	0.43	
1803-P-226 S	CORROSION INHIBITOR INJECTION PUMP MOTOR (1803-X-202, SPARE IN WAREHOUSE)	MOTOR (DOL)	Emergency	-	044-EPMCC-101	BUS A	415	3PH	S	10	0.37	0.37	1.000	0.963	0.963	0.90	0.90	0.38	0.43	0.38	0.43	
1803-P-227 S	CORROSION INHIBITOR INJECTION PUMP MOTOR (1803-X-202, SPARE IN WAREHOUSE)	MOTOR (DOL)	Emergency	-	044-EPMCC-101	BUS A	415	3PH	S	10	0.37	0.37	1.000	0.963	0.963	0.90	0.90	0.38	0.43	0.38	0.43	
1803-P-228 S	CORROSION INHIBITOR INJECTION PUMP MOTOR (1803-X-202, SPARE IN WAREHOUSE)	MOTOR (DOL)	Emergency	-	044-EPMCC-101	BUS A	415	3PH	S	10	0.37	0.37	1.000	0.963	0.963	0.90	0.90	0.38	0.43	0.38	0.43	
1803-P-229 A	AMMONIUM POLYSULPHIDE DOSING PUMP MOTOR (1803-X-203)	MOTOR (DOL)	Emergency	-	044-EPMCC-101	BUS A	415	3PH	C	100	0.37	0.37	1.000	0.963	0.963	0.90	0.90	0.38	0.43	0.38	0.43	
1803-P-229 S	AMMONIUM POLYSULPHIDE DOSING PUMP MOTOR (1803-X-203, SPARE IN WAREHOUSE)	MOTOR (DOL)	Emergency	-	044-EPMCC-101	BUS A	415	3PH	S	10	0.37	0.37	1.000	0.963	0.963	0.90	0.90	0.38	0.43	0.38	0.43	
1803-P-230 A	ANTIFOAM INJECTION PUMP MOTOR (1803-X-204)	MOTOR (DOL)	Emergency	-	044-EPMCC-101	BUS A	415	3PH	C	100	0.37	0.37	1.000	0.963	0.963	0.90	0.90	0.38	0.43	0.38	0.43	
1803-P-230 S	ANTIFOAM INJECTION PUMP MOTOR (1803-X-204, SPARE IN WAREHOUSE)	MOTOR (DOL)	Emergency	-	044-EPMCC-101	BUS A	415	3PH	S	10	0.37	0.37	1.000	0.963	0.963	0.90	0.90	0.38	0.43	0.38	0.43	
1803-P-231 A	PHOSPHATE INJECTION PUMP MOTOR (1803-X-601)	MOTOR (DOL)	Emergency	-	044-EPMCC-101	BUS A	415	3PH	C	100	0.37	0.37	1.000	0.963	0.963	0.90	0.90	0.38	0.43	0.38	0.43	
1803-P-231 S	PHOSPHATE INJECTION PUMP MOTOR (1803-X-601, SPARE IN WAREHOUSE)	MOTOR (DOL)	Emergency	-	044-EPMCC-101	BUS A	415	3PH	S	10	0.37	0.37	1.000	0.963	0.963	0.90	0.90	0.38	0.43	0.38	0.43	
1803-P-232 A	PHOSPHATE INJECTION PUMP MOTOR (1803-X-601)	MOTOR (DOL)	Emergency	-	044-EPMCC-101	BUS A	415	3PH	C	100	0.37	0.37	1.000	0.963	0.963	0.90	0.90	0.38	0.43	0.38	0.43	
1803-P-232 S	PHOSPHATE INJECTION PUMP MOTOR (1803-X-601, SPARE IN WAREHOUSE)	MOTOR (DOL)	Emergency	-	044-EPMCC-101	BUS A	415	3PH	S	10	0.37	0.37	1.000	0.963	0.963	0.90	0.90	0.38	0.43	0.38	0.43	
1803-P-233 A	NEUTRALISING AMINE INJECTION PUMP MOTOR (1803-X-604)	MOTOR (DOL)	Emergency	-	044-EPMCC-101	BUS A	415	3PH	C	100	0.37	0.37	1.000	0.963	0.963	0.90	0.90	0.38	0.43	0.38	0.43	
1803-P-233 S	NEUTRALISING AMINE INJECTION PUMP MOTOR (1803-X-604, SPARE IN WAREHOUSE)	MOTOR (DOL)	Emergency	-	044-EPMCC-101	BUS A	415	3PH	S	10	0.37	0.37	1.000	0.963	0.963	0.90	0.90	0.38	0.43	0.38	0.43	
1803-P-234 A	OXYGEN SCAVENGER DOSING PUMP MOTOR (1803-X-605)	MOTOR (DOL)	Emergency	-	044-EPMCC-101	BUS A	415	3PH	C	100	0.37	0.37	1.000	0.963	0.963	0.90	0.90	0.38	0.43	0.38	0.43	
1803-P-234 S	OXYGEN SCAVENGER DOSING PUMP MOTOR (1803-X-605, SPARE IN WAREHOUSE)	MOTOR (DOL)	Emergency	-	044-EPMCC-101	BUS A	415	3PH	S	10	0.37	0.37	1.000	0.963	0.963	0.90	0.90	0.38	0.43	0.38	0.43	
1803-X-105-P-2	COOLING OIL PUMP MOTOR (MAB 1803-K-101)	MOTOR (DOL)	Emergency	-	044-EPMCC-101	BUS A	415	3PH	C	100	1.00	1.50	0.667	0.963	0.963	0.90	0.90	1.56	1.73	1.04	1.15	
1803-X-105-P-1	AUXILIARY LUBE OIL PUMP MOTOR (MAB 1803-K-101)	MOTOR (DOL)	Emergency	-	044-EPMCC-101	BUS A	415	3PH	C	100	1.00	1.50	0.667	0.963	0.963	0.90	0.90	1.56	1.73	1.04	1.15	
1803-X-105-FD-1	OIL MIST FAN MOTOR (MAB 1803-K-101)	MOTOR (DOL)	Emergency	-	044-EPMCC-101	BUS A	415	3PH	C	100	1.00	1.50	0.667	0.963	0.963	0.90	0.90	1.56	1.73	1.04	1.15	
1803-X-105-P-5	JACKING OIL PUMP MOTOR (MAB 1803-K-101)	MOTOR (DOL)	Emergency	-	044-EPMCC-101	BUS A	415	3PH	C	100	1.00	1.50	0.667	0.963	0.963	0.90	0.90	1.56	1.73	1.04	1.15	
Hold	ST ROTOR TURNING GEAR MOTOR (MAB 1803-K-101)	MOTOR (Soft-Start)	Emergency	-	044-EPMCC-101	BUS A	415	3PH	C	100	0.12	0.18	0.667	0.963	0.963	0.90	0.90	0.19	0.21	0.12	0.14	
1803-K-201-P-2	COOLING OIL PUMP MOTOR (WGC 1803-K-201)	MOTOR (DOL)	Emergency	-	044-EPMCC-101	BUS A	415	3PH	C	100	1.00	1.50	0.667	0.963	0.963	0.90	0.90	1.56	1.73	1.04	1.15	
1803-K-201-P-1	AUXILIARY LUBE OIL PUMP MOTOR (WGC 1803-K-201)	MOTOR (DOL)	Emergency	-	044-EPMCC-101	BUS A	415	3PH	C	100	1.00	1.50	0.667	0.963	0.963	0.90	0.90	1.56	1.73	1.04	1.15	
1803-K-201-FD-1	OIL MIST FAN MOTOR (WGC 1803-K-201)	MOTOR (DOL)	Emergency	-	044-EPMCC-101	BUS A	415	3PH	C	100	1.00	1.50	0.667	0.963	0.963	0.90	0.90	1.56	1.73	1.04	1.15	
1803-K-201-P-5	JACKING OIL PUMP MOTOR (WGC 1803-K-201)	MOTOR (DOL)	Emergency	-	044-EPMCC-101	BUS A	415	3PH	C	100	1.00	1.50	0.667	0.963	0.963	0.90	0.90	1.56	1.73	1.04	1.15	
Hold	ST ROTOR TURNING GEAR MOTOR (WGC 1803-K-201)	MOTOR (Soft-Start)	Emergency	-	044-EPMCC-101	BUS A	415	3PH	C	100	0.12	0.18	0.667	0.963	0.963	0.90	0.90	0.19	0.21	0.12	0.14	
1803-K-201-P-3	CONTROL OIL PUMP 1 (WGC 1803-K-201)	CONTROLLED-FEEDER	Emergency	-	044-EPMCC-101	BUS A	415	3PH	C	100	2.20	3.00	0.733	0.96	0.96	0.90	0.90	3.13	3.47	2.29	2.55	
1803-K-201-P-4	CONTROL OIL PUMP 2 (WGC 1803-K-201)	CONTROLLED-FEEDER	Emergency	-	044-EPMCC-101	BUS A	415	3PH	S	10	2.20	3.00	0.733	0.96	0.96	0.90	0.90	3.13	3.47	2.29	2.55	
1803-K-105-P-3	CONTROL OIL PUMP 1 (MAB 1803-K-101)	CONTROLLED-FEEDER	Emergency	-	044-EPMCC-101	BUS A	415	3PH	C	100	2.20	3.00	0.733	0.96	0.96	0.90	0.90	3.13	3.47	2.29	2.55	
1803-K-105-P-4	CONTROL OIL PUMP 2 (MAB 1803-K-101)	CONTROLLED-FEEDER	Emergency	-	044-EPMCC-101	BUS A	415	3PH	S	10	2.20	3.00	0.733	0.96	0.96	0.90	0.90	3.13	3.47	2.29	2.55	
1803-PM-610 A	FIRE WATER BOOSTER PUMP	MOTOR (DOL)	Emergency	-	044-EPMCC-101	BUS A	415	3PH	C	100	134.00	160.00	0.838	0.95	0.95	0.90	0.90	168.42	187.13	141.05	156.73	
1803-PM-610 B	FIRE WATER BOOSTER PUMP	MOTOR (DOL)	Emergency	-	044-EPMCC-101	BUS A	415	3PH	S	10	134.00	160.00	0.838	0.95	0.95	0.90	0.90	168.42	187.13	141.05	156.73	
DOWNSTREAM LOADS																						
CR-HVAC-1	CONTROL ROOM HVAC MCC INCOMER 1	CONTROLLED-FEEDER	Normal	-	044-EPMCC-101	BUS A	415	3PH+N	C	100	140.00	140	1.00	0.98	0.98	0.9	0.9	142.86	158.73	142.86	158.73	
CR-HVAC-2	CONTROL ROOM HVAC MCC INCOMER 2	FEEDER	Normal	-	044-EPMCC-101	BUS B	415	3PH+N	S	10	140.00	140	1.00	0.98	0.98	0.9	0.9	142.86	158.73	142.86	158.73	
044-DC-102	044-DC 102 NOM. POWER 50 KVA (CRITICAL LIGHTING) CHARGER INCOMER	FEEDER	Normal	-	044-EPMCC-101	BUS A	415	3PH+N	C	100	50.00	50	1.00	1	1	0.88	0.88	50.00	56.82	50.00	56.82	
044-DC-101B	044-DC 101 NOM. POWER 50 KVA (SWITCHGEAR CONTROL) INCOMER 2 - CHARGER	FEEDER	Normal	-	044-EPMCC-101	BUS B	415	3PH+N	C	100	50.00	50	1.00	1	1	0.88	0.88	50.00	56.82	50.00	56.82	
044-UPS-101B	044-UPS 101 (INSTR LOAD DCS YESD) INCOMER 2 - BYPASS TRANSFORMER	FEEDER	Normal	-	044-EPMCC-101	BUS A	415	3PH+N	C	100	100.0	100	1.00	1	1	0.88	0.88	100.00	113.64	100.00	113.64	
044-UPS-101D	044-UPS 101 (INSTR LOAD DCS YESD) INCOMER 4 - BYPASS TRANSFORMER	FEEDER	Normal	-	044-EPMCC-101	BUS B	415	3PH+N	C	100	100.0	100	1.00	1	1	0.88	0.88	100.00	113.64	100.00	113.64	
044-UPS-102B	044-UPS 102 (TELECOM, CCTV, PAGING & FDAS SYSTEM) INCOMER 2 - BYPASS TRANSFORMER	FEEDER	Normal	-	044-EPMCC-101	BUS A	415	3PH+N	C	100	25.00	25	1.00	1	1	0.88	0.88	25	28.41	25.00	28.41	
044-UPS-102D	044-UPS 102 (TELECOM, CCTV, PAGING & FDAS SYSTEM) INCOMER 4 - BYPASS TRANSFORMER	FEEDER	Normal	-	044-EPMCC-101	BUS B	415	3PH+N	C	100	25.00	25	1.00	1	1	0.88	0.88	25	28.41	25.00	28.41	
044-TR-108B	EMERGENCY LIGHTING TRANSFORMER 0.415 / 0.433 kV (044-EMLD8-101)	FEEDER	Normal	-	044-EPMCC-101																	

TOTAL CONTINUOUS LOAD	a	783.92	883.22
TOTAL INTERMITTENT LOAD	b	50.46	63.74
INTERMITTENT LOAD CONSIDERED =			
INTERMITTENT LOAD * SIMULTANEITY FACTOR	c=b*30%	15.14	19.12
TOTAL NORMAL RUNNING LOAD	d=a+c	799.06	902.35
TOTAL STANDBY LOAD	e	337.36	375.99
STANDBY LOAD CONSIDERED =	f=e*10%	33.74	37.60
STANDBY LOAD * SIMILATANEITY LOAD			
TOTAL PEAK LOAD	g=a+d+f	832.79	939.95
TOTAL LOAD WITH FUTURE 20% LOAD	h=g*120%	899.25	1127.94

 							ELECTRICAL LOAD CALCULATIONS														
PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPech” (J-18)						SWITCHBOARD: 044-MCC-101														
CLIENT:	INDIAN OIL CORPORATION LIMITED																				
ITEM	LOAD DESCRIPTION	LOAD TYPE	LOAD SERVICE	SCHEME TYPE	FED FROM	BUSBAR	RATED VOLTAGE (V)	N° PH	LOAD DUTY	SIMULTANEITY FACTOR	ABSORBED MECHANIC POWER (KW)	MOTOR RATED POWER (KW)	LOAD FACTOR	EFFICIENCY at rated load	EFFICIENCY at operating load	POWER FACTOR at rated load	POWER FACTOR at operating load	RATED CONSUMED ELECTRICAL LOAD		OPERATING CONSUMED ELECTRICAL LOAD	
																		KW	KVA	KW	KVA
A	B	C	D	E	F	G	H	I	J	K	L	M	N=L/M	O	P	Q	R	S=M/O	T=S/Q	U=L/P	V=U/R
1803-PM-201 A	HCN PRODUCT PUMP	MOTOR (DOL)	Normal	3/M20	044-MCC-101	BUS A	415	3PH	C	100	19,01	30,00	0,634	0,92	0,92	0,84	0,84	32,61	38,82	20,66	24,60
1803-PM-201 B	HCN PRODUCT PUMP	MOTOR (DOL)	Normal	3/M20	044-MCC-101	BUS B	415	3PH	S	10	19,01	30,00	0,634	0,92	0,92	0,84	0,84	32,61	38,82	20,66	24,60
1803-PM-208 A	REFLUX DRUM SOUR WATER PUMP	MOTOR (DOL)	Normal	3/M20	044-MCC-101	BUS B	415	3PH	C	100	16,23	22,00	0,738	0,913	0,903	0,91	0,88	24,10	26,48	17,97	20,42
1803-PM-208 B	REFLUX DRUM SOUR WATER PUMP	MOTOR (DOL)	Normal	3/M20	044-MCC-101	BUS A	415	3PH	S	10	16,23	22,00	0,738	0,913	0,903	0,91	0,88	24,10	26,48	17,97	20,42
1803-PM-210 A	DISTILLATE DRUM SOUR WATER PUMP	MOTOR (DOL)	Normal	3/M20	044-MCC-101	BUS A	415	3PH	C	100	9,49	15,00	0,633	0,903	0,884	0,86	0,83	16,61	19,32	10,74	12,97
1803-PM-210 B	DISTILLATE DRUM SOUR WATER PUMP	MOTOR (DOL)	Normal	3/M20	044-MCC-101	BUS B	415	3PH	S	10	9,49	15,00	0,633	0,903	0,884	0,86	0,83	16,61	19,32	10,74	12,97
1803-PM-211 A	COMPRESSOR SUCTION KO DRUM PUMP	MOTOR (DOL)	Normal	3/M10Z	044-MCC-101	BUS A	415	3PH	I	30	1,91	5,50	0,347	0,87	0,820	0,80	0,68	6,32	7,90	2,33	3,43
1803-PM-223 A	SOUR WATER PUMP	MOTOR (DOL)	Normal	3/M20	044-MCC-101	BUS B	415	3PH	C	100	27,54	37,00	0,744	0,925	0,92	0,90	0,88	40,00	44,44	29,93	34,02
1803-PM-223 B	SOUR WATER PUMP	MOTOR (DOL)	Normal	3/M20	044-MCC-101	BUS A	415	3PH	S	10	27,54	37,00	0,744	0,925	0,92	0,90	0,88	40,00	44,44	29,93	34,02
1803-PM-601 A	CLOSED BLOWDOWN DRUM PUMP	MOTOR (DOL)	Normal	3/M10Z	044-MCC-101	BUS A	415	3PH	I	30	11,63	15,00	0,775	0,98	0,980	0,88	0,88	15,31	17,39	11,87	13,49
1803-PM-602 A	AMINE DRAIN DRUM PUMP	MOTOR (DOL)	Normal	3/M10Z	044-MCC-101	BUS A	415	3PH	I	30	8,13	11,00	0,739	0,98	0,98	0,88	0,88	11,22	12,76	8,30	9,43
1803-PM-606 A	SUSPECT CONDENSATE PUMP	MOTOR (DOL)	Normal	3/M20	044-MCC-101	BUS A	415	3PH	C	100	10,17	15,00	0,678	0,903	0,89	0,86	0,84	16,61	19,32	11,43	13,60
1803-PM-606 B	SUSPECT CONDENSATE PUMP	MOTOR (DOL)	Normal	3/M20	044-MCC-101	BUS B	415	3PH	S	10	10,17	15	0,678	0,903	0,89	0,86	0,84	16,61	19,32	11,43	13,60
1803-PM-611 A	CONTAMINATED RAIN WATER SEWER PUMP	MOTOR (DOL)	Normal	4/M60	044-MCC-101	BUS A	415	3PH	I	30	31,34	45	0,696	0,98	0,98	0,90	0,9	45,92	51,02	31,98	35,53
1803-PM-611 B	CONTAMINATED RAIN WATER SEWER PUMP	MOTOR (DOL)	Normal	4/M60	044-MCC-101	BUS B	415	3PH	I	30	31,34	45	0,696	0,98	0,98	0,90	0,90	45,92	51,02	31,98	35,53
1803-PM-612 A	OILY WATER SEWER PUMP	MOTOR (DOL)	Normal	3/M10Z	044-MCC-101	BUS A	415	3PH	I	30	8,72	15	0,581	0,98	0,98	0,88	0,88	15,31	17,39	8,90	10,11
1803-AM-1001	CORROSION INHIBITOR DRUM AGITATOR MOTOR	MOTOR (DOL)	Normal	-	044-MCC-101	BUS A	415	3PH	I	30	0,67	1,1	0,609	0,963	0,963	0,90	0,90	1,14	1,27	0,70	0,77
1803-AM-1002	AMMONIUM POLYSULPHIDE DRUM AGTATOR MOTOR	MOTOR (DOL)	Normal	-	044-MCC-101	BUS B	415	3PH	I	30	0,67	1,1	0,609	0,963	0,963	0,90	0,90	1,14	1,27	0,70	0,77
1803-AM-1003	ANTIFOAM DRUM AGITATOR MOTOR	MOTOR (DOL)	Normal	-	044-MCC-101	BUS A	415	3PH	I	30	0,67	1,1	0,609	0,963	0,963	0,90	0,90	1,14	1,27	0,70	0,77
1803-AM-1004	PHOSPHATE DRUM AGITATOR MOTOR	MOTOR (DOL)	Normal	-	044-MCC-101	BUS B	415	3PH	I	30	0,67	1,1	0,609	0,963	0,963	0,9	0,9	1,14	1,27	0,70	0,77
1803-AM-1005	NEUTRALISING AMINE DRUM AGITATOR MOTOR	MOTOR (DOL)	Normal	-	044-MCC-101	BUS A	415	3PH	I	30	0,67	1,1	0,609	0,963	0,963	0,9	0,9	1,14	1,27	0,70	0,77
1803-AM-1006	OXYGEN SCAVENGER DRUM AGITATOR MOTOR	MOTOR (DOL)	Normal	-	044-MCC-101	BUS B	415	3PH	I	30	0,67	1,1	0,609	0,963	0,963	0,9	0,9	1,14	1,27	0,70	0,77
1803-ACM-206 A1	GASOLINE RECYCLE AIR COOLER FAN-1	MOTOR (DOL)	Normal	2/M5	044-MCC-101	BUS A	415	3PH	C	100	19,2	22	0,873	0,963	0,963	0,9	0,9	22,85	25,38	19,94	22,15
1803-ACM-206 B1	GASOLINE RECYCLE AIR COOLER FAN-2	MOTOR (DOL)	Normal	2/M5	044-MCC-101	BUS B	415	3PH	C	100	19,2	22	0,873	0,963	0,963	0,9	0,9	22,85	25,38	19,94	22,15
1803-ACM-206 A2	GASOLINE RECYCLE AIR COOLER FAN-3	MOTOR (DOL)	Normal	2/M5	044-MCC-101	BUS A	415	3PH	C	100	19,2	22	0,873	0,963	0,963	0,9	0,9	22,85	25,38	19,94	22,15
1803-ACM-206 B2	GASOLINE RECYCLE AIR COOLER FAN-4	MOTOR (DOL)	Normal	2/M5	044-MCC-101	BUS B	415	3PH	C	100	19,2	22	0,873	0,963	0,963	0,9	0,9	22,85	25,38	19,94	22,15
1803-ACM-208 A	LCO PRODUCT AIR COOLER FAN-1	MOTOR (DOL)	Normal	2/M5	044-MCC-101	BUS A	415	3PH	C	100	7,2	11	0,655	0,963	0,963	0,9	0,9	11,42	12,69	7,48	8,31
1803-ACM-208 B	LCO PRODUCT AIR COOLER FAN-1	MOTOR (DOL)	Normal	2/M5	044-MCC-101	BUS B	415	3PH	C	100	7,2	11	0,655	0,963	0,963	0,9	0,9	11,42	12,69	7,48	8,31
1803-ACM-208 C	LCO PRODUCT AIR COOLER FAN-3	MOTOR (DOL)	Normal	2/M5	044-MCC-101	BUS B	415	3PH	C	100	7,2	11	0,655	0,963	0,963	0,9	0,9	11,42	12,69	7,48	8,31
1803-K-201-F-2	HEATER-2 (WET GAS COMPRESSOR 1803-K-102)	FEEDER	Normal	-	044-MCC-101	BUS B	415	3PH	C	100	23	30	0,767	0,963	0,963	0,9	0,90	31,15	34,61	23,88	26,54
DOWNSTREAM LOADS NOT APPLICABLE																					

TOTAL CONTINUOUS LOAD	a	216,80	245,68
TOTAL INTERMITTENT LOAD	b	99,52	112,15
INTERMITTENT LOAD CONSIDERED =	c=b*30%	29,86	33,65
INTERMITTENT LOAD * SIMULTANEITY FACTOR	d=a+c	246,66	279,33
TOTAL NORMAL RUNNING LOAD	e	90,73	105,61
TOTAL STANDBY LOAD	f=e*10%	9,07	10,56
STANDBY LOAD CONSIDERED =	g=a+c+f	255,73	289,89
TOTAL PEAK LOAD	h=120%*g	306,87	347,86
TOTAL LOAD WITH FUTURE 20% LOAD			

Table 26. 044-MCC-101 load calculation.

							ELECTRICAL LOAD CALCULATIONS														
PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPech” (J-18)						SWITCHBOARD: 044-MCC-102														
CLIENT:	INDIAN OIL CORPORATION LIMITED																				
ITEM	LOAD DESCRIPTION	LOAD TYPE	LOAD SRVICE	SCHEME TYPE	FED FROM	BUSBAR	RATED VOLTAGE (V)	N° PH	LOAD DUTY	SIMULTANEITY FACTOR	ABSORBED MECANIC POWER (KW)	MOTOR RATED POWER (KW)	LOAD FACTOR	EFFICIENCY at rated load	EFFICIENCY at operating load	POWER FACTOR at rated load	POWER FACTOR at operating load	RATED CONSUMED ELECTRICAL LOAD		OPERATING CONUME ELECTRICAL LOAD	
																		KW S=M/O	KVA T=S/Q	KW U=L/P	KVA V=U/R
A	B	C	D	E	F	G	H	I	J	K	L	M	N=L/M	O	P	Q	R				
1803-ACM-201A1	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-1	MOTOR (VSD)	Normal	1/M3	044-MCC-102	BUS A	415	3PH	C	100	22,70	30,00	0,757	0,963	0,963	0,90	0,90	31,15	34,61	23,57	26,19
1803-ACM-201A2	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-2	MOTOR (DOL)	Normal	2/M5	044-MCC-102	BUS B	415	3PH	C	100	22,70	30,00	0,757	0,963	0,963	0,90	0,90	31,15	34,61	23,57	26,19
1803-ACM-201 B1	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-3	MOTOR (VSD)	Normal	1/M3	044-MCC-102	BUS A	415	3PH	C	100	22,70	30,00	0,757	0,963	0,963	0,90	0,90	31,15	34,61	23,57	26,19
1803-ACM-201 C1	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-4	MOTOR (VSD)	Normal	1/M3	044-MCC-102	BUS B	415	3PH	C	100	22,70	30,00	0,757	0,963	0,963	0,90	0,90	31,15	34,61	23,57	26,19
1803-ACM-201 B2	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-5	MOTOR (DOL)	Normal	2/M5	044-MCC-102	BUS A	415	3PH	C	100	22,70	30,00	0,757	0,963	0,963	0,90	0,90	31,15	34,61	23,57	26,19
1803-ACM-201 C2	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-6	MOTOR (DOL)	Normal	2/M5	044-MCC-102	BUS B	415	3PH	C	100	22,70	30,00	0,757	0,963	0,963	0,90	0,90	31,15	34,61	23,57	26,19
1803-ACM-201 D1	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-7	MOTOR (VSD)	Normal	1/M3	044-MCC-102	BUS A	415	3PH	C	100	22,70	30,00	0,757	0,963	0,963	0,90	0,90	31,15	34,61	23,57	26,19
1803-ACM-201 E1	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-8	MOTOR (VSD)	Normal	1/M3	044-MCC-102	BUS B	415	3PH	C	100	22,70	30,00	0,757	0,963	0,963	0,90	0,90	31,15	34,61	23,57	26,19
1803-ACM-201 D2	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-9	MOTOR (DOL)	Normal	2/M5	044-MCC-102	BUS A	415	3PH	C	100	22,70	30,00	0,757	0,963	0,963	0,90	0,90	31,15	34,61	23,57	26,19
1803-ACM-201 E2	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-10	MOTOR (DOL)	Normal	2/M5	044-MCC-102	BUS B	415	3PH	C	100	22,70	30,00	0,757	0,963	0,963	0,90	0,90	31,15	34,61	23,57	26,19
1803-ACM-201 F1	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-11	MOTOR (VSD)	Normal	1/M3	044-MCC-102	BUS A	415	3PH	C	100	22,70	30,00	0,757	0,963	0,963	0,90	0,90	31,15	34,61	23,57	26,19
1803-ACM-201 G1	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-12	MOTOR (VSD)	Normal	1/M3	044-MCC-102	BUS B	415	3PH	C	100	22,70	30,00	0,757	0,963	0,963	0,90	0,90	31,15	34,61	23,57	26,19
1803-ACM-201 H1	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-13	MOTOR (VSD)	Normal	1/M3	044-MCC-102	BUS A	415	3PH	C	100	22,70	30,00	0,757	0,963	0,963	0,90	0,90	31,15	34,61	23,57	26,19
1803-ACM-201 F2	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-14	MOTOR (DOL)	Normal	2/M5	044-MCC-102	BUS B	415	3PH	C	100	22,70	30,00	0,757	0,963	0,963	0,90	0,90	31,15	34,61	23,57	26,19
1803-ACM-201 G2	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-15	MOTOR (DOL)	Normal	2/M5	044-MCC-102	BUS A	415	3PH	C	100	22,70	30,00	0,757	0,963	0,963	0,90	0,90	31,15	34,61	23,57	26,19
1803-ACM-201 J1	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-16	MOTOR (VSD)	Normal	1/M3	044-MCC-102	BUS B	415	3PH	C	100	22,70	30,00	0,757	0,963	0,963	0,90	0,90	31,15	34,61	23,57	26,19
DOWNSTREAM LOADS																					
NOT APPLICABLE																					

TOTAL CONTINUOUS LOAD	a	377,15	419,06
TOTAL INTERMITTENT LOAD	b	0,00	0,00
INTERMITTENT LOAD CONSIDERED =			
INTERMITTENT LOAD * SIMULTANEITY FACTOR	c=b*30%	0,00	0,00
TOTAL NORMAL RUNNING LOAD	d=a+c	377,15	419,06
TOTAL STANDBY LOAD	e	0,00	0,00
STANDBY LOAD CONSIDERED =			
STANDBY LOAD * SIMULTANEITY FACTOR	f=e*10%	0,00	0,00
TOTAL PEAK LOAD	g=a+c+f	377,15	419,06
TOTAL LOAD WITH FUTURE 20% LOAD	h=120%*g	452,59	502,87

Table 27. 044-MCC-102 load calculation.

							ELECTRICAL LOAD CALCULATIONS																
PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPech” (J-18)						SWITCHBOARD: 044-MCC-103																
CLIENT:	INDIAN OIL CORPORATION LIMITED																						
ITEM	LOAD DESCRIPTION	LOAD TYPE	LOAD SERVICE	SCHEME TYPE	FED FROM	BUSBAR	RATED VOLTAGE (V)	N° PH	LOAD DUTY	SIMULTANEITY FACTOR	ABSORBED MECHANIC POWER (KW)	MOTOR RATED POWER (KW)	LOAD FACTOR	EFFICIENCY at rated load	EFFICIENCY at operating load	POWER FACTOR at rated load	POWER FACTOR at operating load	RATED CONSUMED ELECTRICAL LOAD		OPERATING CONSUMED ELECTRICAL LOAD			
A	B	C	D	E	F	G	H	I	J	K	L	M	N=L/M	O	P	Q	R	S=M/O	T=S/Q	U=L/P	V=U/R		
1803-ACM-201 K1	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-17	MOTOR (DOL)	Normal	1/M3	044-MCC-103	BUS A	415	3PH	C	100	22,70	30,00	0,757	0,963	0,963	0,90	0,90	31,15	34,61	23,57	26,19		
1803-ACM-201 H2	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-18	MOTOR (DOL)	Normal	2/M5	044-MCC-103	BUS B	415	3PH	C	100	22,70	30,00	0,757	0,963	0,963	0,90	0,90	31,15	34,61	23,57	26,19		
1803-ACM-201 J2	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-19	MOTOR (DOL)	Normal	2/M5	044-MCC-103	BUS A	415	3PH	C	100	22,70	30,00	0,757	0,963	0,963	0,90	0,90	31,15	34,61	23,57	26,19		
1803-ACM-201 L1	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-20	MOTOR (DOL)	Normal	1/M3	044-MCC-103	BUS B	415	3PH	C	100	22,70	30,00	0,757	0,963	0,963	0,90	0,90	31,15	34,61	23,57	26,19		
1803-ACM-201 M1	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-21	MOTOR (DOL)	Normal	1/M3	044-MCC-103	BUS A	415	3PH	C	100	22,70	30,00	0,757	0,963	0,963	0,90	0,90	31,15	34,61	23,57	26,19		
1803-ACM-201 K2	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-22	MOTOR (DOL)	Normal	2/M5	044-MCC-103	BUS B	415	3PH	C	100	22,70	30,00	0,757	0,963	0,963	0,90	0,90	31,15	34,61	23,57	26,19		
1803-ACM-201 L2	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-23	MOTOR (DOL)	Normal	2/M5	044-MCC-103	BUS A	415	3PH	C	100	22,70	30,00	0,757	0,963	0,963	0,90	0,90	31,15	34,61	23,57	26,19		
1803-ACM-201 M2	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-24	MOTOR (DOL)	Normal	2/M5	044-MCC-103	BUS B	415	3PH	C	100	22,70	30,00	0,757	0,963	0,963	0,90	0,90	31,15	34,61	23,57	26,19		
1803-ACM-201 N1	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-25	MOTOR (DOL)	Normal	1/M3	044-MCC-103	BUS A	415	3PH	C	100	22,70	30,00	0,757	0,963	0,963	0,90	0,90	31,15	34,61	23,57	26,19		
1803-ACM-201 P1	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-26	MOTOR (DOL)	Normal	1/M3	044-MCC-103	BUS B	415	3PH	C	100	22,70	30,00	0,757	0,963	0,963	0,90	0,90	31,15	34,61	23,57	26,19		
1803-ACM-201 N2	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-27	MOTOR (DOL)	Normal	2/M5	044-MCC-103	BUS A	415	3PH	C	100	22,70	30,00	0,757	0,963	0,963	0,90	0,90	31,15	34,61	23,57	26,19		
1803-ACM-201 P2	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-28	MOTOR (DOL)	Normal	2/M5	044-MCC-103	BUS B	415	3PH	C	100	22,70	30,00	0,757	0,963	0,963	0,90	0,90	31,15	34,61	23,57	26,19		
1803-ACM-201 Q1	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-29	MOTOR (DOL)	Normal	1/M3	044-MCC-103	BUS A	415	3PH	C	100	22,70	30,00	0,757	0,963	0,963	0,90	0,90	31,15	34,61	23,57	26,19		
1803-ACM-201 R1	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-30	MOTOR (DOL)	Normal	1/M3	044-MCC-103	BUS B	415	3PH	C	100	22,70	30,00	0,757	0,963	0,963	0,90	0,90	31,15	34,61	23,57	26,19		
1803-ACM-201 Q2	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-31	MOTOR (DOL)	Normal	2/M5	044-MCC-103	BUS A	415	3PH	C	100	22,70	30,00	0,757	0,963	0,963	0,90	0,90	31,15	34,61	23,57	26,19		
1803-ACM-201 R2	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-32	MOTOR (DOL)	Normal	2/M5	044-MCC-103	BUS B	415	3PH	C	100	22,70	30,00	0,757	0,963	0,963	0,90	0,90	31,15	34,61	23,57	26,19		
DOWNSTREAM LOADS																							
NOT APPLICABLE																							

TOTAL CONTINUOUS LOAD	a	377,15	419,06
TOTAL INTERMITTENT LOAD	b	0,00	0,00
INTERMITTENT LOAD CONSIDERED =			
INTERMITTENT LOAD * SIMULTANEITY FACTOR	c=b*30%	0,00	0,00
TOTAL NORMAL RUNNING LOAD	d=a+c	377,15	419,06
TOTAL STANDBY LOAD	e	0,00	0,00
STANDBY LOAD CONSIDERED =			
STANDBY LOAD * SIMULTANEITY LOAD	f=e*10%	0,00	0,00
TOTAL PEAK LOAD	g=a+c+f	377,15	419,06
TOTAL LOAD WITH FUTURE 20% LOAD	h=120%*g	452.59	502.87

Table 28. 044-MCC-103 load calculation.

 							ELECTRICAL LOAD CALCULATIONS														
PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPech” (J-18)						SWITCHBOARD: 044-MCC-104														
CLIENT:	INDIAN OIL CORPORATION LIMITED																				
ITEM	LOAD DESCRIPTION	LOAD TYPE	LOAD SERVICE	SCHEME TYPE	FED FROM	BUSBAR	RATED VOLTAGE (V)	N° PH	LOAD DUTY	SIMULTANEITY FACTOR	ABSORBED MECHANIC POWER (KW)	MOTOR RATED POWER (KW)	LOAD FACTOR	EFFICIENCY at rated load	EFFICIENCY at operating load	POWER FACTOR at rated load	POWER FACTOR at operating load	RATED CONSUMED ELECTRICAL LOAD		OPERATING CONUNED ELECTRICAL LOAD	
																		KW S=M/O	KVA T=S/Q	KW U=L/P	KVA V=U/R
A	B	C	D	E	F	G	H	I	J	K	L	M	N=L/M	O	P	Q	R	S=M/O	T=S/Q	U=L/P	V=U/R
1803-ACM-202 A1	LCO PUMPAROUND AIR COOLER FAN-1	MOTOR (DOL)	Normal	2/M5	044-MCC-104	BUS A	415	3PH	C	100	1.35	2.20	0,614	0,963	0,963	0,90	0,90	2.28	2.54	1.40	1.56
1803-ACM-202 B1	LCO PUMPAROUND AIR COOLER FAN-2	MOTOR (DOL)	Normal	1/M3	044-MCC-104	BUS B	415	3PH	C	100	1.35	2.20	0,614	0,963	0,963	0,90	0,90	2.28	2.54	1.40	1.56
1803-ACM-207 A1	DEBUTANIZER OVERHEAD AIR CONDENSER FAN-1	MOTOR (DOL)	Normal	2/M5	044-MCC-104	BUS A	415	3PH	C	100	13.20	15.00	0,880	0,963	0,963	0,90	0,90	15.58	17.31	13.71	15.23
1803-ACM-207 B1	DEBUTANIZER OVERHEAD AIR CONDENSER FAN-2	MOTOR (DOL)	Normal	2/M5	044-MCC-104	BUS B	415	3PH	C	100	13.20	15.00	0,880	0,963	0,963	0,90	0,90	15.58	17.31	13.71	15.23
1803-ACM-207 C1	DEBUTANIZER OVERHEAD AIR CONDENSER FAN-3	MOTOR (DOL)	Normal	2/M5	044-MCC-104	BUS B	415	3PH	C	100	13.20	15.00	0,880	0,963	0,963	0,90	0,90	15.58	17.31	13.71	15.23
1803-ACM-207 D1	DEBUTANIZER OVERHEAD AIR CONDENSER FAN-4	MOTOR (DOL)	Normal	2/M5	044-MCC-104	BUS A	415	3PH	C	100	13.20	15.00	0,880	0,963	0,963	0,90	0,90	15.58	17.31	13.71	15.23
1803-ACM-207 A2	DEBUTANIZER OVERHEAD AIR CONDENSER FAN-5	MOTOR (DOL)	Normal	2/M5	044-MCC-104	BUS B	415	3PH	C	100	13.20	15.00	0,880	0,963	0,963	0,90	0,90	15.58	17.31	13.71	15.23
1803-ACM-207 B2	DEBUTANIZER OVERHEAD AIR CONDENSER FAN-6	MOTOR (DOL)	Normal	2/M5	044-MCC-104	BUS A	415	3PH	C	100	13.20	15.00	0,880	0,963	0,963	0,90	0,90	15.58	17.31	13.71	15.23
1803-ACM-207 C2	DEBUTANIZER OVERHEAD AIR CONDENSER FAN-7	MOTOR (DOL)	Normal	2/M5	044-MCC-104	BUS B	415	3PH	C	100	13.20	15.00	0,880	0,963	0,963	0,90	0,90	15.58	17.31	13.71	15.23
1803-ACM-207 D2	DEBUTANIZER OVERHEAD AIR CONDENSER FAN-8	MOTOR (DOL)	Normal	2/M5	044-MCC-104	BUS A	415	3PH	C	100	13.20	15.00	0,880	0,963	0,963	0,90	0,90	15.58	17.31	13.71	15.23
1803-ACM-601 A	CONDENSATE FLASH DRUM AIR COOLER FAN-1	MOTOR (DOL)	Normal	2/M5	044-MCC-104	BUS B	415	3PH	C	100	2.00	2.20	0,909	0,963	0,963	0,90	0,90	2.28	2.54	2.08	2.31
1803-ACM-601 B	CONDENSATE FLASH DRUM AIR COOLER FAN-2	MOTOR (DOL)	Normal	2/M5	044-MCC-104	BUS A	415	3PH	C	100	2.00	2.20	0,909	0,963	0,963	0,90	0,90	2.28	2.54	2.08	2.31
1803-ACM-204 A1	COMPRESSOR INTERSTAGE AIR CONDENSER FAN-1	MOTOR (DOL)	Normal	2/M5	044-MCC-104	BUS A	415	3PH	C	100	32,40	37,00	0,876	0,963	0,963	0,90	0,90	38,42	42,69	33,64	37,38
1803-ACM-204 B1	COMPRESSOR INTERSTAGE AIR CONDENSER FAN-2	MOTOR (DOL)	Normal	2/M5	044-MCC-104	BUS B	415	3PH	C	100	20,00	30,00	0,667	0,963	0,963	0,90	0,90	31,15	34,61	20,77	23,08
1803-ACM-204 C1	COMPRESSOR INTERSTAGE AIR CONDENSER FAN-3	MOTOR (DOL)	Normal	2/M5	044-MCC-104	BUS A	415	3PH	C	100	20,00	30,00	0,667	0,963	0,963	0,90	0,90	31,15	34,61	20,77	23,08
1803-ACM-204 D1	COMPRESSOR INTERSTAGE AIR CONDENSER FAN-4	MOTOR (DOL)	Normal	2/M5	044-MCC-104	BUS B	415	3PH	C	100	20,00	30,00	0,667	0,963	0,963	0,90	0,90	31,15	34,61	20,77	23,08
1803-ACM-204 A2	COMPRESSOR INTERSTAGE AIR CONDENSER FAN-5	MOTOR (DOL)	Normal	2/M5	044-MCC-104	BUS A	415	3PH	C	100	20,00	30,00	0,667	0,963	0,963	0,90	0,90	31,15	34,61	20,77	23,08
1803-ACM-204 B2	COMPRESSOR INTERSTAGE AIR CONDENSER FAN-6	MOTOR (DOL)	Normal	2/M5	044-MCC-104	BUS B	415	3PH	C	100	20,00	30,00	0,667	0,963	0,963	0,90	0,90	31,15	34,61	20,77	23,08
1803-ACM-204 C2	COMPRESSOR INTERSTAGE AIR CONDENSER FAN-7	MOTOR (DOL)	Normal	2/M5	044-MCC-104	BUS A	415	3PH	C	100	20,00	30,00	0,667	0,963	0,963	0,90	0,90	31,15	34,61	20,77	23,08
1803-ACM-204 D2	COMPRESSOR INTERSTAGE AIR CONDENSER FAN-8	MOTOR (DOL)	Normal	2/M5	044-MCC-104	BUS B	415	3PH	C	100	20,00	30,00	0,667	0,963	0,963	0,90	0,90	31,15	34,61	20,77	23,08
DOWNSTREAM LOADS																					
NOT APPLICABLE																					

TOTAL CONTINUOUS LOAD	a	295,64	328,49
TOTAL INTERMITTENT LOAD	b	0,00	0,00
INTERMITTENT LOAD CONSIDERED =	c=b*30%	0,00	0,00
INTERMITTENT LOAD * SIMULTANEITY FACTOR	d=a+c	295,64	328,49
TOTAL NORMAL RUNNING LOAD	e	0,00	0,00
TOTAL STANDBY LOAD	f=e*10%	0,00	0,00
STANDBY LOAD CONSIDERED =	g=a+c+f	295,64	328,49
TOTAL PEAK LOAD	h=120%*g	354,77	394,18
TOTAL LOAD WITH FUTURE 20% LOAD			

Table 29. 044-MCC-104 load calculation.

							ELECTRICAL LOAD CALCULATIONS														
PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPech” (J-18)						SWITCHBOARD: 044-MCC-105														
CLIENT:	INDIAN OIL CORPORATION LIMITED																				
ITEM	LOAD DESCRIPTION	LOAD TYPE	LOAD SERVICE	SCHEME TYPE	FED FROM	BUSBAR	RATED VOLTAGE (V)	N° PH	LOAD DUTY	SIMULTANEITY FACTOR	ABSORBED MECHANIC POWER (KW)	MOTOR RATED POWER (KW)	LOAD FACTOR	EFFICIENCY at rated load	EFFICIENCY at operating load	POWER FACTOR at rated load	POWER FACTOR at operating load	RATED CONSUMED ELECTRICAL LOAD		OPERATING CONUMED ELECTRICAL LOAD	
A	B	C	D	E	F	G	H	I	J	K	L	M	N=L/M	O	P	Q	R	KW S=M/O	KVA T=S/Q	KW U=L/P	KVA V=U/R
1803-ACM-205 A1	HIGH PRESSURE AIR CONDENSER FAN-1	MOTOR (DOL)	Normal	2/M5	044-MCC-105	BUS A	415	3PH	C	100	11,60	15,00	0,773	0,963	0,963	0,90	0,90	15,58	17,31	12,05	13,38
1803-ACM-205 B1	HIGH PRESSURE AIR CONDENSER FAN-2	MOTOR (DOL)	Normal	2/M5	044-MCC-105	BUS B	415	3PH	C	100	11,60	15,00	0,773	0,963	0,963	0,90	0,90	15,58	17,31	12,05	13,38
1803-ACM-205 C1	HIGH PRESSURE AIR CONDENSER FAN-3	MOTOR (DOL)	Normal	2/M5	044-MCC-105	BUS A	415	3PH	C	100	11,60	15,00	0,773	0,963	0,963	0,90	0,90	15,58	17,31	12,05	13,38
1803-ACM-205 D1	HIGH PRESSURE AIR CONDENSER FAN-4	MOTOR (DOL)	Normal	2/M5	044-MCC-105	BUS B	415	3PH	C	100	11,60	15,00	0,773	0,963	0,963	0,90	0,90	15,58	17,31	12,05	13,38
1803-ACM-205 E1	HIGH PRESSURE AIR CONDENSER FAN-5	MOTOR (DOL)	Normal	2/M5	044-MCC-105	BUS A	415	3PH	C	100	11,60	15,00	0,773	0,963	0,963	0,90	0,90	15,58	17,31	12,05	13,38
1803-ACM-205 F1	HIGH PRESSURE AIR CONDENSER FAN-6	MOTOR (DOL)	Normal	2/M5	044-MCC-105	BUS B	415	3PH	C	100	11,60	15,00	0,773	0,963	0,963	0,90	0,90	15,58	17,31	12,05	13,38
1803-ACM-205 G1	HIGH PRESSURE AIR CONDENSER FAN-7	MOTOR (DOL)	Normal	2/M5	044-MCC-105	BUS A	415	3PH	C	100	11,60	15,00	0,773	0,963	0,963	0,90	0,90	15,58	17,31	12,05	13,38
1803-ACM-205 H1	HIGH PRESSURE AIR CONDENSER FAN-8	MOTOR (DOL)	Normal	2/M5	044-MCC-105	BUS B	415	3PH	C	100	11,60	15,00	0,773	0,963	0,963	0,90	0,90	15,58	17,31	12,05	13,38
1803-ACM-205 A2	HIGH PRESSURE AIR CONDENSER FAN-9	MOTOR (DOL)	Normal	2/M5	044-MCC-105	BUS A	415	3PH	C	100	11,60	15,00	0,773	0,963	0,963	0,90	0,90	15,58	17,31	12,05	13,38
1803-ACM-205 B2	HIGH PRESSURE AIR CONDENSER FAN-10	MOTOR (DOL)	Normal	2/M5	044-MCC-105	BUS B	415	3PH	C	100	11,60	15,00	0,773	0,963	0,963	0,90	0,90	15,58	17,31	12,05	13,38
1803-ACM-205 C2	HIGH PRESSURE AIR CONDENSER FAN-11	MOTOR (DOL)	Normal	2/M5	044-MCC-105	BUS A	415	3PH	C	100	11,60	15,00	0,773	0,963	0,963	0,90	0,90	15,58	17,31	12,05	13,38
1803-ACM-205 D2	HIGH PRESSURE AIR CONDENSER FAN-12	MOTOR (DOL)	Normal	2/M5	044-MCC-105	BUS B	415	3PH	C	100	11,60	15,00	0,773	0,963	0,963	0,90	0,90	15,58	17,31	12,05	13,38
1803-ACM-205 E2	HIGH PRESSURE AIR CONDENSER FAN-13	MOTOR (DOL)	Normal	2/M5	044-MCC-105	BUS A	415	3PH	C	100	11,60	15,00	0,773	0,963	0,963	0,90	0,90	15,58	17,31	12,05	13,38
1803-ACM-205 F2	HIGH PRESSURE AIR CONDENSER FAN-14	MOTOR (DOL)	Normal	2/M5	044-MCC-105	BUS B	415	3PH	C	100	11,60	15,00	0,773	0,963	0,963	0,90	0,90	15,58	17,31	12,05	13,38
1803-ACM-205 G2	HIGH PRESSURE AIR CONDENSER FAN-15	MOTOR (DOL)	Normal	2/M5	044-MCC-105	BUS A	415	3PH	C	100	11,60	15,00	0,773	0,963	0,963	0,90	0,90	15,58	17,31	12,05	13,38
1803-ACM-205 H2	HIGH PRESSURE AIR CONDENSER FAN-16	MOTOR (DOL)	Normal	2/M5	044-MCC-105	BUS B	415	3PH	C	100	11,6	15	0,773	0,963	0,963	0,90	0,90	15,58	17,31	12,05	13,38
DOWNSTREAM LOADS NOT APPLICABLE																					

TOTAL CONTINUOUS LOAD	a	192,73	214,15
TOTAL INTERMITTENT LOAD	b	0,00	0,00
INTERMITTENT LOAD CONSIDERED = INTERMITTENT LOAD * SIMULTANEITY FACTOR	c=b*30%	0,00	0,00
TOTAL NORMAL RUNNING LOAD	d=a+c	192,73	214,15
TOTAL STANDBY LOAD	e	0,00	0,00
STANDBY LOAD CONSIDERED = STANDBY LOAD * SIMULTANEITY LOAD	f=e*10%	0,00	0,00
TOTAL PEAK LOAD	g=a+c+f	192,73	214,15
TOTAL LOAD WITH FUTURE 20% LOAD	h=120%*g	231,28	256,97

Table 30. 044-MCC-105 load calculation.

 							ELECTRICAL LOAD CALCULATIONS																
PROJECT:		EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPech” (J-18)					SWITCHBOARD: 044-MCC-106																
CLIENT:		INDIAN OIL CORPORATION LIMITED																					
ITEM	LOAD DESCRIPTION	LOAD TYPE	Load Service	SCHEME TYPE	FED FROM	BUSBAR	RATED VOLTAGE (V)	N° PH	LOAD DUTY	SIMULTANEITY FACTOR	ABSORBED MECHANIC POWER (KW)	MOTOR RATED POWER (KW)	LOAD FACTOR	EFFICIENCY at rated load	EFFICIENCY at operating load	POWER FACTOR at rated load	POWER FACTOR at operating load	RATED CONSUMED ELECTRICAL LOAD		OPERATING CONUMED ELECTRICAL LOAD			
A	B	C	D	E	F	G	H	I	J	K	L	M	N=L/M	O	P	Q	R	KW S=M/O	KVA T=S/Q	KW U=L/P	KVA V=U/R		
1803-MOV-2305	WASTE HEAT BOILER INLET WHB-101	MOV	Normal	-	044-MCC-106	BUS A	415	3PH	I	30	3,00	3,00	1,000	1	1	0,95	0,95	3,00	3,16	3,00	3,16		
1803-MOV-2306	WASTE HEAT BOILER OUTLET WHB-101	MOV	Normal	-	044-MCC-106	BUS B	415	3PH	I	30	3,00	3,00	1,000	1	1	0,95	0,95	3,00	3,16	3,00	3,16		
1803-MOV-4001	HC VAP RECTR OVRHD TO FRACTIONATOR C-201	MOV	Normal	-	044-MCC-106	BUS A	415	3PH	I	30	3,00	3,00	1,000	1	1	0,95	0,95	3,00	3,16	3,00	3,16		
1803-MOV-5801	WGC 1ST STAGE COMPRESSOR SUCTION	MOV	Normal	-	044-MCC-106	BUS B	415	3PH	I	30	11,00	15,00	0,733	1	1	0,95	0,95	15,00	15,79	11,00	11,58		
1803-MOV-5802	WGC 1ST STAGE COMPRESSOR DISCHARGE	MOV	Normal	-	044-MCC-106	BUS A	415	3PH	I	30	11,00	15,00	0,733	1	1,000	0,95	0,95	15,00	15,79	11,00	11,58		
1803-MOV-5803	WGC 2ND STAGE COMPRESSOR SUCTION	MOV	Normal	-	044-MCC-106	BUS B	415	3PH	I	30	11,00	15,00	0,733	1	1,000	0,95	0,95	15,00	15,79	11,00	11,58		
1803-MOV-5804	WGC 2ND STAGE COMPRESSOR DISCHARGE	MOV	Normal	-	044-MCC-106	BUS A	415	3PH	I	30	11,00	15,00	0,733	1	1,000	0,95	0,95	15,00	15,79	11,00	11,58		
1803-X-106 A	WHB PURGE AIR FAN	MOTOR (DOL)	Normal	-	044-MCC-106	BUS A	415	3PH	C	100	36,70	45,00	0,816	0,963	0,963	0,90	0,90	46,73	51,92	38,11	42,34		
1803-X-106 B	WHB PURGE AIR FAN	MOTOR (DOL)	Normal	-	044-MCC-106	BUS B	415	3PH	S	10	36,70	45,00	0,816	0,963	0,963	0,90	0,90	46,73	51,92	38,11	42,34		
1803-X-106 LRSB	WHB SOOT BLOWER POWER PANEL	FEEDER	Normal	-	044-MCC-106	BUS A	415	3PH	C	100	11,52	14,50	0,794	0,963	0,963	0,90	0,90	15,06	16,73	11,96	13,29		
1803-X-106 MOV A	WHB MAIN STEAM STOP VALVE (MSSV)	MOV	Normal	-	044-MCC-106	BUS B	415	3PH	I	30	11,00	15,00	0,733	0,963	0,963	0,90	0,90	15,58	17,31	11,42	12,69		
1803-X-106 MOV B	WHB BYPASS MSSV	MOV	Normal	-	044-MCC-106	BUS A	415	3PH	I	30	11,00	15,00	0,733	0,963	0,963	0,90	0,90	15,58	17,31	11,42	12,69		
1803-X-106 MOV C	WHB STARTUP VENT VALVE	MOV	Normal	-	044-MCC-106	BUS B	415	3PH	I	30	11,00	15,00	0,733	0,963	0,963	0,90	0,90	15,58	17,31	11,42	12,69		
1803-X-107-P001A	CAUSTIC BOOSTER PUMP (WGS PACKAGE)	MOTOR (DOL)	Normal	-	044-MCC-106	BUS A	415	3PH	C	100	1,10	1,50	0,733	0,953	0,953	0,88	0,88	1,57	1,79	1,15	1,31		
1803-X-107-P001B	CAUSTIC BOOSTER PUMP (WGS PACKAGE)	MOTOR (DOL)	Normal	-	044-MCC-106	BUS B	415	3PH	S	10	1,10	1,50	0,733	0,953	0,953	0,88	0,88	1,57	1,79	1,15	1,31		
1803-X-107-P002A	MAKE-UP WATER BOOSTER PUMP (WET GAS SCRUBBER PACKAGE)	MOTOR (DOL)	Normal	-	044-MCC-106	BUS A	415	3PH	C	100	14	22	0,636	0,953	0,953	0,88	0,88	23,08	26,23	14,69	16,69		
1803-X-107-P002B	MAKE-UP WATER BOOSTER PUMP (WET GAS SCRUBBER PACKAGE)	MOTOR (DOL)	Normal	-	044-MCC-106	BUS B	415	3PH	S	10	14	22	0,636	0,953	0,953	0,88	0,88	23,08	26,23	14,69	16,69		
1803-X-107-P005A	COAGULANT METERING PUMP (WGS PACKAGE)	MOTOR (DOL)	Normal	-	044-MCC-106	BUS A	415	3PH	C	100	0,6	1,5	0,400	0,953	0,953	0,88	0,88	1,57	1,79	0,63	0,72		
1803-X-107-P005B	COAGULANT METERING PUMP (WGS PACKAGE)	MOTOR (DOL)	Normal	-	044-MCC-106	BUS B	415	3PH	S	10	0,6	1,5	0,400	0,953	0,953	0,88	0,88	1,57	1,79	0,63	0,72		
1803-X-107-P007A	EFFLUENT FILTER SUPPLY PUMP (WET GAS SCRUBBER PACKAGE)	MOTOR (DOL)	Normal	-	044-MCC-106	BUS A	415	3PH	C	100	17,6	22	0,800	0,953	0,953	0,88	0,88	23,08	26,23	18,47	20,99		
1803-X-107-P007B	EFFLUENT FILTER SUPPLY PUMP (WET GAS SCRUBBER PACKAGE)	MOTOR (DOL)	Normal	-	044-MCC-106	BUS B	415	3PH	S	10	17,6	22	0,800	0,953	0,953	0,88	0,88	23,08	26,23	18,47	20,99		
1803-X-107-P006A	FILTRATE PUMP (WGS PACKAGE)	MOTOR (DOL)	Normal	-	044-MCC-106	BUS A	415	3PH	C	100	2,25	3,7	0,608	0,953	0,953	0,88	0,88	3,88	4,41	2,36	2,68		
1803-X-107-P006B	FILTRATE PUMP (WGS PACKAGE)	MOTOR (DOL)	Normal	-	044-MCC-106	BUS B	415	3PH	S	10	2,25	3,7	0,608	0,953	0,953	0,88	0,88	3,88	4,41	2,36	2,68		
Hold	UNIT CONTROL PANEL NON UPS FOR MAB	FEEDER	Normal	-	044-MCC-106	BUS B	415	3PH+N	C	100	23	30	0,767	0,963	0,963	0,9	0,9	31,15	34,61	23,88	26,54		
Hold	INLET GUIDE VANE FOR MAB	FEEDER	Normal	-	044-MCC-106	BUS A	415	3PH+N	C	100	23	30	0,767	0,963	0,963	0,9	0,9	31,15	34,61	23,88	26,54		
1803-X-105-F-1	HEATER-1 FOR MAB	FEEDER	Normal	-	044-MCC-106	BUS B	415	3PH+N	C	100	23	30	0,767	0,963	0,963	0,9	0,9	31,15	34,61	23,88	26,54		
1803-X-105-F-2	HEATER-2 FOR MAB	FEEDER	Normal	-	044-MCC-106	BUS A	415	3PH+N	C	100	23	30	0,767	0,963	0,963	0,9	0,9	31,15	34,61	23,88	26,54		
Hold	UNIT CONTROL PANEL NON UPS FOR WGC	FEEDER	Normal	-	044-MCC-106	BUS B	415	3PH+N	C	100	23	30	0,767	0,963	0,963	0,9	0,9	31,15	34,61	23,88	26,54		
1803-K-201-F-1	HEATER-1 FOR WGC	FEEDER	Normal	-	044-MCC-106	BUS A	415	3PH+N	C	100	23	30	0,767	0,963	0,963	0,9	0,9	31,15	34,61	23,88	26,54		
1803-K-105-P-3	CONTROL OIL PUMP1 FOR MAB	MOTOR (DOL)	Normal	-	044-MCC-106	BUS A	415	3PH	C	100	2,5	3	0,833	0,963	0,963	0,9	0,9	3,12	3,46	2,60	2,88		
1803-K-105-P-4	CONTROL OIL PUMP2 FOR MAB	MOTOR (DOL)	Normal	-	044-MCC-106	BUS B	415	3PH	S	10	2,5	3	0,833	0,963	0,963	0,9	0,9	3,12	3,46	2,60	2,88		
1803-K-201-P-3	CONTROL OIL PUMP1 FOR WGC	MOTOR (DOL)	Normal	-	044-MCC-106	BUS A	415	3PH	C	100	2,5	3	0,833	0,963	0,963	0,9	0,9	3,12	3,46	2,60	2,88		
1803-K-201-P-4	CONTROL OIL PUMP2 FOR WGC	MOTOR (DOL)	Normal	-	044-MCC-106	BUS B	415	3PH	S	10	2,5	3	0,833	0,963	0,963	0,9	0,9	3,12	3,46	2,60	2,88		
Hold	MAIN AIR BLOWER TURNING GEAR MOTOR	MOTOR (DOL)	Normal	-	044-MCC-106	BUS B	415	3PH	C	100	12	15	0,8	0,963	0,963	0,9	0,90	15,58	17,31	12,46	13,85		
DOWNSTREAM LOADS NOT APPLICABLE																							
TOTAL CONTINUOUS LOAD																		a	248,33	276,87			
TOTAL INTERMITTENT LOAD																		b	87,27	93,86			
INTERMITTENT LOAD CONSIDERED = INTERMITTENT LOAD * SIMULTANEITY FACTOR																		c=b*30%	26,18	28,16			
TOTAL NORMAL RUNNING LOAD																		d=a+c	274,51	305,03			
TOTAL STANDBY LOAD																		e	80,61	90,50			
STANDBY LOAD CONSIDERED = STANDBY LOAD * SIMALTANEITY LOAD																		f=e*10%	8,06	9,05			
TOTAL PEAK LOAD																		g=a+c+f	282,57	314,08			
TOTAL LOAD WITH FUTURE 20% LOAD																		h=120%*g	339,09	376,89			

Table 31. 044-MCC-106 load calculation.

 							ELECTRICAL LOAD CALCULATIONS														
PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPech” (J-18)						SWITCHBOARD: 044-ASB-101														
CLIENT:	INDIAN OIL CORPORATION LIMITED																				
ITEM	LOAD DESCRIPTION	LOAD TYPE	LOAD SERVICE	SCHEME TYPE	FED FROM	BUSBAR	RATED VOLTAGE (V)	N° PH	LOAD DUTY	SIMULTANEITY FACTOR	ABSORBED MECHANIC POWER (KW)	MOTOR RATED POWER (KW)	LOAD FACTOR	EFFICIENCY at rated load	EFFICIENCY at operating load	POWER FACTOR at rated load	POWER FACTOR at operating load	RATED CONSUMED ELECTRICAL LOAD		OPERATING CONUMED ELECTRICAL LOAD	
A	B	C	D	E	F	G	H	I	J	K	L	M	N=L/M	O	P	Q	R	KW S=M/O	KVA T=S/Q	KW U=L/P	KVA V=U/R
HB-001-01	HYDRO BLASTING-1 FOR RFCC UNIT	FEEDER	Normal	-	044-ASB-101	BUS A	415	3PH+N	S	10	288	110	2,618	1	1	1	1	110	110	288	288
HB-002-01	HYDRO BLASTING-2 FOR RFCC UNIT	FEEDER	Normal	-	044-ASB-101	BUS B	415	3PH+N	S	10	288	110	2,618	1	1	1	1	110	110	288	288
TRS-101A	100A SOCKET FOR 044-TR-101A	FEEDER	Normal	-	044-ASB-101	BUS A	415	3PH+N	S	10	45	45	1	1	1	1	1	45	45	45	45
TRS-101B	101A SOCKET FOR 044-TR-101B	FEEDER	Normal	-	044-ASB-101	BUS B	415	3PH+N	S	10	45	45	1	1	1	1	1	45	45	45	45
TRS-106A	100A SOCKET FOR 044-TR-106A	FEEDER	Normal	-	044-ASB-101	BUS A	415	3PH+N	S	10	45	45	1	1	1	1	1	45	45	45	45
TRS-102A	100A SOCKET FOR 044-TR-102A	FEEDER	Normal	-	044-ASB-101	BUS B	415	3PH+N	S	10	45	45	1	1	1	1	1	45	45	45	45
TRS-102B	101A SOCKET FOR 044-TR-102B	FEEDER	Normal	-	044-ASB-101	BUS A	415	3PH+N	S	10	45	45	1	1	1	1	1	45	45	45	45
TRS-103A	100A SOCKET FOR 044-TR-103A	FEEDER	Normal	-	044-ASB-101	BUS B	415	3PH+N	S	10	45	45	1	1	1	1	1	45	45	45	45
TRS-103B	101A SOCKET FOR 044-TR-103B	FEEDER	Normal	-	044-ASB-101	BUS A	415	3PH+N	S	10	45	45	1	1	1	1	1	45	45	45	45
TRS-104A	100A SOCKET FOR 044-TR-104A	FEEDER	Normal	-	044-ASB-101	BUS B	415	3PH+N	S	10	45	45	1	1	1	1	1	45	45	45	45
TRS-104B	101A SOCKET FOR 044-TR-104B	FEEDER	Normal	-	044-ASB-101	BUS A	415	3PH+N	S	10	45	45	1	1	1	1	1	45	45	45	45
TRS-105A	100A SOCKET FOR 044-TR-105A	FEEDER	Normal	-	044-ASB-101	BUS B	415	3PH+N	S	10	45	45	1	1	1	1	1	45	45	45	45
TRS-105B	101A SOCKET FOR 044-TR-105B	FEEDER	Normal	-	044-ASB-101	BUS A	415	3PH+N	S	10	45	45	1	1	1	1	1	45	45	45	45
TRS-105C	102A SOCKET FOR 044-TR-105C	FEEDER	Normal	-	044-ASB-101	BUS B	415	3PH+N	S	10	45	45	1	1	1	1	1	45	45	45	45
1803-X-702 A	SUBSTATION LIFT MOTOR A	FEEDER	Normal	-	044-ASB-101	BUS A	415	3PH+N	C	100	10	10	1	1	1	1	1	10	10	10	10
1803-X-702 B	SUBSTATION LIFT MOTOR B	FEEDER	Normal	-	044-ASB-101	BUS B	415	3PH+N	I	30	10	10	1	1	1	1	1	10	10	10	10
1803-PM-613	DRAIN PUMP 2	FEEDER	Normal	-	044-ASB-101	BUS B	415	3PH	S	10	10	10	1	1	1	1	1	10	10	10	10
1803-PM-614	DRAIN PUMP 1	FEEDER	Normal	-	044-ASB-101	BUS A	415	3PH	I	30	10	15	0.67	1	1	1	1	15	15	10	10
1803-X-109	EOT CRANE 1	FEEDER	Normal	-	044-ASB-102	BUS A	416	3PH	I	30	10	15	0.67	1	1	1	1	15	15	10	10
1803-X-206	EOT CRANE 2	FEEDER	Normal	-	044-ASB-101	BUS B	415	3PH	I	30	37	37	1	1	1	1	1	37	37	37	37
DOWNSTREAM LOADS																					
NOT APPLICABLE																					

TOTAL CONTINUOUS LOAD	a	10,00	10,00
TOTAL INTERMITTENT LOAD	b	67,00	67,00
30% OF INTERMITTENT LOAD	c=b*30%	20,10	20,10
HIGHEST INTERMITTENT LOAD	d	37,00	37,00
INTERMITTENT LOAD CONSIDERED	e=max(c,d)	37,00	37,00
TOTAL STANDBY LOAD	f	1126,00	1126,00
10% OF STANDBY LOAD	g = f*10%	112,60	112,60
HIGHEST STANDBY LOAD	h	288,00	288,00
STANDBY LOAD CONSIDERED	i=max(g,h)	288,00	288,00
TOTAL PEAK LOAD	j=a++i	335,00	335,00
TOTAL LOAD WITH FUTURE 20% LOAD	m=120%*j	402,00	402,00

Table 32. 044-ASB-101 load calculation.

 							ELECTRICAL LOAD CALCULATIONS														
PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPech” (J-18)						SWITCHBOARD: 044-ASB-102														
CLIENT:	INDIAN OIL CORPORATION LIMITED																				
ITEM	LOAD DESCRIPTION	LOAD TYPE	LOAD SERVICE	SCHEME TYPE	FED FROM	BUSBAR	RATED VOLTAGE (V)	N° PH	LOAD DUTY	SIMULTANEITY FACTOR	ABSORBED MECHANIC POWER (KW)	MOTOR RATED POWER (KW)	LOAD FACTOR	EFFICIENCY at rated load	EFFICIENCY at operating load	POWER FACTOR at rated load	POWER FACTOR at operating load	RATED CONSUMED ELECTRICAL LOAD		OPERATING CONUMED ELECTRICAL LOAD	
A	B	C	D	E	F	G	H	I	J	K	L	M	N=L/M	O	P	Q	R	KW S=M/O	KVA T=SI/Q	KW U=L/P	KVA V=U/R
1803-WO-101	Welding Socket at SS-044 ground floor (max. 2 socket per feeder, 63 A, 4 pin)	FEEDER	Normal	-	044-ASB-102	BUS A	415	3PH+N	S	10	45	45	1	1	1	1,00	1,00	45	45	45	45,0
1803-WO-102	Welding Socket at second floor (max. 2 socket per feeder, 63 A, 4 pin)	FEEDER	Normal	-	044-ASB-102	BUS A	415	3PH+N	S	10	45	45	1	1	1	1,00	1,00	45	45	45	45,0
1803-WO-103	Welding Socket at RFCC CRR (max. 2 socket per feeder, 63 A, 4 pin)	FEEDER	Normal	-	044-ASB-102	BUS A	415	3PH+N	S	10	45	45	1	1	1	1,00	1,00	45	45	45	45,0
1803-WO-104	Welding Socket at laydown area (max. 2 socket per feeder, 63 A, 4 pin)	FEEDER	Normal	-	044-ASB-102	BUS A	415	3PH+N	S	10	45	45	1	1	1	1,00	1,00	45	45	45	45,0
1803-WO-105	Welding Socket at deluge house (max. 2 socket per feeder, 63 A, 4 pin)	FEEDER	Normal	-	044-ASB-102	BUS A	415	3PH+N	S	10	45	45	1	1	1	1,00	1,00	45	45	45	45,0
1803-WO-106	Welding Socket at CR LPG treater unit (max. 2 socket per feeder, 63 A, 4 pin)	FEEDER	Normal	-	044-ASB-102	BUS A	415	3PH+N	S	10	45	45	1	1	1	1,00	1,00	45	45	45	45,0
1803-WO-107	Welding Socket at recirculation pumps (max. 2 socket per feeder, 63 A, 4 pin)	FEEDER	Normal	-	044-ASB-102	BUS A	415	3PH+N	S	10	45	45	1	1	1	1,00	1,00	45	45	45	45,0
1803-WO-108	Welding Socket at Deethenizer and debutanizer area (max. 2 socket per feeder, 63 A, 4 pin)	FEEDER	Normal	-	044-ASB-102	BUS A	415	3PH+N	S	10	45	45	1	1	1	1,00	1,00	45	45	45	45,0
1803-WO-109	Welding Socket AT Reactor & Regenerator area (max. 2 socket per feeder, 63 A, 4 pin)	FEEDER	Normal	-	044-ASB-102	BUS B	415	3PH+N	S	10	45	45	1	1	1	1,00	1,00	45	45	45	45,0
1803-WO-110	Welding Socket Wet Gas Scrubber area (max. 2 socket per feeder, 63 A, 4 pin)	FEEDER	Normal	-	044-ASB-102	BUS B	415	3PH+N	S	10	45	45	1	1	1	1,00	1,00	45	45	45	45,0
1803-WO-111	Welding Socket Flue Gas Waste Heat Boiler area (max. 2 socket per feeder, 63 A, 4 pin)	FEEDER	Normal	-	044-ASB-102	BUS B	415	3PH+N	S	10	45	45	1	1	1	1,00	1,00	45	45	45	45,0
1803-WO-112	Welding Socket at Recirculation Pumps (max. 2 socket per feeder, 63 A, 4 pin)	FEEDER	Normal	-	044-ASB-102	BUS B	415	3PH+N	S	10	45	45	1	1	1	1,00	1,00	45	45	45	45,0
044-NON-UPS DB-1	NON UPS DB-1 (CONTROL ROOM)	FEEDER	Normal	-	044-ASB-102	BUS A	415	3PH+N	C	100	37	37	1	1	1	0,95	0,95	37	39	37	38,9
044-NON-UPS DB-2	NON UPS DB-2 (CONTROL ROOM)	FEEDER	Normal	-	044-ASB-102	BUS A	415	3PH+N	C	100	37	37	1	1	1	0,95	0,95	37	39	37	38,9
DOWNSTREAM LOADS																					
Not applicable																					

TOTAL CONTINUOUS LOAD	a	74,00	77,89
TOTAL INTERMITTENT LOAD	b	0,00	0,00
30% OF INTERMITTENT LOAD	c=b*30%	0,00	0,00
HIGHEST INTERMITTENT LOAD	d	0,00	0,00
INTERMITTENT LOAD CONSIDERED	e=max(c,d)	0,00	0,00
TOTAL STANDBY LOAD	f	540,00	540,00
10% OF STANDBY LOAD	g = f*10%	54,00	54,00
HIGHEST STANDBY LOAD	h	45,00	45,00
STANDBY LOAD CONSIDERED	i=max(g,h)	54,00	54,00
TOTAL LOAD	j=a+e+i	128,00	131,89
TOTAL LOAD WITH FUTURE 20% LOAD	m=120%*i	153,60	158,27

Table 33. 044-ASB-102 load calculation.

							ELECTRICAL LOAD CALCULATIONS																
PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPech” (J-18)						SWITCHBOARD: 044-EMLDB-101																
CLIENT:	INDIAN OIL CORPORATION LIMITED																						
ITEM	LOAD DESCRIPTION	LOAD TYPE	LOAD SERVICE	SCHEME TYPE	FED FROM	BUSBAR	RATED VOLTAGE (V)	N° PH	LOAD DUTY	SIMULTANEITY FACTOR	ABSORBED MECHANIC POWER (KW)	MOTOR RATED POWER (KW)	LOAD FACTOR	EFFICIENCY at rated load	EFFICIENCY at operating load	POWER FACTOR at rated load	POWER FACTOR at operating load	RATED CONSUMED ELECTRICAL LOAD		OPERATING CONUMED ELECTRICAL LOAD			
																		KW	KVA	KW	KVA		
A	B	C	D	E	F	G	H	I	J	K	L	M	N=L/M	O	P	Q	R	S=M/O	T=S/Q	U=L/P	V=U/R		
044-ELDB-101	INDOOR ELDB IN SS-044 THIRD FLOOR	FEEDER	Emergency	415	044-EMLDB-101	BUS B	415	3PH+N	C	100	2,00	2,00	1	1	1	0,95	0,95	2	2,11	2,00	2,11		
044-ELDB-102	OUTDOOR ELDB AT LAYDOWN AREA	FEEDER	Emergency	415	044-EMLDB-101	BUS B	415	3PH+N	C	100	2,00	2,00	1	1	1	0,95	0,95	2	2,11	2,00	2,11		
044-ELDB-103	INDOOR ELDB IN CRR-	FEEDER	Emergency	415	044-EMLDB-101	BUS A	415	3PH+N	C	100	4,00	4,00	1	1	1	0,95	0,95	4	4,21	4,00	4,21		
044-ELDB-104	INDOOR ELDB IN SS-044 GROUND FLOOR	FEEDER	Emergency	415	044-EMLDB-101	BUS A	415	3PH+N	C	100	2,00	2,00	1	1	1	0,95	0,95	2	2,11	2,00	2,11		
044-ELDB-105	INDOOR ELDB IN SS-044 FIRST FLOOR	FEEDER	Emergency	415	044-EMLDB-101	BUS B	415	3PH+N	C	100	2,00	2,00	1	1	1	0,95	0,95	2	2,11	2,00	2,11		
044-ELDB-106	INDOOR ELDB IN SS-044 SECOND FLOOR	FEEDER	Emergency	415	044-EMLDB-101	BUS A	415	3PH+N	C	100	2,00	2,00	1	1	1	0,95	0,95	2	2,11	2,00	2,11		
044-ELDB-107	OUTDOOR ELDB AT DELUGE HOUSE	FEEDER	Emergency	415	044-EMLDB-101	BUS A	415	3PH+N	C	100	2,00	2,00	1	1	1	0,95	0,95	2	2,11	2,00	2,11		
044-ELDB-108	OUTDOOR ELDB AT LPG TREATEER UNIT	FEEDER	Emergency	415	044-EMLDB-101	BUS B	415	3PH+N	C	100	2,00	2,00	1	1	1	0,95	0,95	2	2,11	2,00	2,11		
044-ELDB-109	OUTDOOR ELDB AT RECIRCULATION PUMPS	FEEDER	Emergency	415	044-EMLDB-101	BUS A	415	3PH+N	C	100	2,00	2,00	1	1	1	0,95	0,95	2	2,11	2,00	2,11		
044-ELDB-110	OUTDOOR ELDB AT DEETHENIZER AND DEBUTANIZER AREA	FEEDER	Emergency	415	044-EMLDB-101	BUS B	415	3PH+N	C	100	2,00	2,00	1	1	1	0,95	0,95	2	2,11	2,00	2,11		
044-ELDB-111	OUTDOOR ELDB AT REACTOR & REGENERATOR AREA	FEEDER	Emergency	415	044-EMLDB-101	BUS A	415	3PH+N	C	100	2,00	2,00	1	1	1	0,95	0,95	2	2,11	2,00	2,11		
044-ELDB-112	OUTDOOR ELDB AT WET GAS SCRUBBER AREA	FEEDER	Emergency	415	044-EMLDB-101	BUS B	415	3PH+N	C	100	2,00	2,00	1	1	1	0,95	0,95	2	2,11	2,00	2,11		
044-ELDB-113	OUTDOOR ELDB AT FLUE GAS WH BOILER AREA	FEEDER	Emergency	415	044-EMLDB-101	BUS A	415	3PH+N	C	100	2,00	2,00	1	1	1	0,95	0,95	2	2,11	2,00	2,11		
044-ELDB-114	OUTDOOR ELDB STREET LIGHT AT PIPERACK (WEST)	FEEDER	Emergency	415	044-EMLDB-101	BUS B	415	3PH+N	C	100	2,00	2,00	1	1	1	0,95	0,95	2	2,11	2,00	2,11		
044-ELDB-115	OUTDOOR ELDB STREET LIGHT AT PIPERACK (EAST)	FEEDER	Emergency	415	044-EMLDB-101	BUS A	415	3PH+N	C	100	2,00	2,00	1	1	1	0,95	0,95	2	2,11	2,00	2,11		
DOWNSTREAM LOADS																							
044-MLDB-102	SECURITY GATE BUILDING INCOMER 1	FEEDER	Emergency	-	044-EMLDB-101	BUS B	415	3PH+N	C	100	30,00	50	1	1	1	0,95	0,95	50	52,63	30,00	31,58		
																		TOTAL CONTINUOUS LOAD		a	62,00	65,26	
																		TOTAL INTERMITTENT LOAD		b	0,00	0,00	
																		30% OF INTERMITTENT LOAD		c=b*30%	0,00	0,00	
																		HIGHEST INTERMITTENT LOAD		d	0,00	0,00	
																		INTERMITTENT LOAD CONSIDERED		e=max(c,d)	0,00	0,00	
																		TOTAL STANDBY LOAD		f	0,00	0,00	
																		10% OF STANDBY LOAD		g = f*10%	0,00	0,00	
																		HIGHEST STANDBY LOAD		h	0,00	0,00	
																		STANDBY LOAD CONSIDERED		i=max(g,h)	0,00	0,00	
																		TOTAL PEAK LOAD		j=a+e+i	62,00	65,26	
																		TOTAL LOAD WITH FUTURE 20% LOAD		m=120%*j	74,40	78,32	

Table 34. 044-EMLDB-101 load calculation.

							ELECTRICAL LOAD CALCULATIONS														
PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPech” (J-18)						SWITCHBOARD: 044-MLDB-101														
CLIENT:	INDIAN OIL CORPORATION LIMITED																				
ITEM	LOAD DESCRIPTION	LOAD TYPE	LOAD SERVICE	SCHEME TYPE	FED FROM	BUSBAR	RATED VOLTAGE (V)	N° PH	LOAD DUTY	SIMULTANEITY FACTOR	ABSORBED MECHANIC POWER (KW)	MOTOR RATED POWER (KW)	LOAD FACTOR	EFFICIENCY at rated load	EFFICIENCY at operating load	POWER FACTOR at rated load	POWER FACTOR at operating load	RATED CONSUMED ELECTRICAL LOAD		OPERATING CONSUMED ELECTRICAL LOAD	
A	B	C	D	E	F	G	H	I	J	K	L	M	N=L/M	O	P	Q	R	KW S=M/O	KVA T=S/Q	KW U=L/P	KVA V=U/R
044-LDB-104	INDOOR LDB IN SS-044 GROUND FLOOR	FEEDER	Normal	-	044-MLDB-101	BUS A	415	3PH+N	C	100	3,00	3,00	1	1	1	0,95	0,95	3,00	3,16	3,00	3,16
044-LDB-105	INDOOR LDB IN SS-044 FIRST FLOOR	FEEDER	Normal	-	044-MLDB-101	BUS B	415	3PH+N	C	100	3,00	3,00	1	1	1	0,95	0,95	3,00	3,16	3,00	3,16
044-LDB-101	INDOOR LDB IN SS-044 THIRD FLOOR	FEEDER	Normal	-	044-MLDB-101	BUS B	415	3PH+N	C	100	3,00	3,00	1	1	1	0,95	0,95	3,00	3,16	3,00	3,16
044-LDB-103	INDOOR LDB IN CRR-	FEEDER	Normal	-	044-MLDB-101	BUS A	415	3PH+N	C	100	3,00	3,00	1	1	1	0,95	0,95	3,00	3,16	3,00	3,16
044-LDB-102	OUTDOOR LDB AT LAYDOWN AREA	FEEDER	Normal	-	044-MLDB-101	BUS B	415	3PH+N	C	100	5,00	5,00	1	1	1	0,95	0,95	5,00	5,26	5,00	5,26
044-LDB-109	OUTDOOR LDB AT RECIRCULATION PUMPS	FEEDER	Normal	-	044-MLDB-101	BUS A	415	3PH+N	C	100	5,00	5,00	1	1	1	0,95	0,95	5,00	5,26	5,00	5,26
044-LDB-110	OUTDOOR LDB AT DEETHENIZER AND DEBUTANIZER AREA	FEEDER	Normal	-	044-MLDB-101	BUS A	415	3PH+N	C	100	5,00	5,00	1	1	1	0,95	0,95	5,00	5,26	5,00	5,26
044-LDB-111	OUTDOOR LDB AT REACTOR & REGENERATOR AREA	FEEDER	Normal	-	044-MLDB-101	BUS A	415	3PH+N	C	100	5,00	5,00	1	1	1	0,95	0,95	5,00	5,26	5,00	5,26
044-LDB-112	OUTDOOR LDB AT WET GAS SCRUBBER AREA	FEEDER	Normal	-	044-MLDB-101	BUS A	415	3PH+N	C	100	5,00	5,00	1	1	1	0,95	0,95	5,00	5,26	5,00	5,26
044-LDB-113	OUTDOOR LDB AT FLUE GAS WH BOILER AREA	FEEDER	Normal	-	044-MLDB-101	BUS A	415	3PH+N	C	100	5,00	5,00	1	1	1	0,95	0,95	5,00	5,26	5,00	5,26
044-LDB-114	OUTDOOR LDB STREET LIGHT AT PIPERACK (WEST)	FEEDER	Normal	-	044-MLDB-101	BUS B	415	3PH+N	C	100	4,00	4,00	1	1	1	0,95	0,95	4,00	4,21	4,00	4,21
044-LDB-115	OUTDOOR LDB STREET LIGHT AT PIPERACK (EAST)	FEEDER	Normal	-	044-MLDB-101	BUS A	415	3PH+N	C	100	4,00	4,00	1	1	1	0,95	0,95	4,00	4,21	4,00	4,21
044-PDB-104	INDOOR PDB IN SS-044 GROUND FLOOR	FEEDER	Normal	-	044-MLDB-101	BUS B	415	3PH+N	C	100	4,00	4,00	1	1	1	0,95	0,95	4,00	4,21	4,00	4,21
044-PDB-103	INDOOR PDB IN SS-044 FIRST FLOOR	FEEDER	Normal	-	044-MLDB-101	BUS A	415	3PH+N	C	100	4,00	4,00	1	1	1	0,95	0,95	4,00	4,21	4,00	4,21
044-PDB-102	INDOOR PDB IN SS-044 SECOND FLOOR	FEEDER	Normal	-	044-MLDB-101	BUS B	415	3PH+N	C	100	4,00	4,00	1	1	1	0,95	0,95	4,00	4,21	4,00	4,21
044-PDB-101	INDOOR PDB IN SS-044 THIRD FLOOR	FEEDER	Normal	-	044-MLDB-101	BUS A	415	3PH+N	C	100	4,00	4,00	1	1	1	0,95	0,95	4,00	4,21	4,00	4,21
044-PDB-105	INDOOR PDB IN CRR-	FEEDER	Normal	-	044-MLDB-101	BUS B	415	3PH+N	C	100	20,00	20,00	1	1	1	0,95	0,95	20,00	21.05	20,00	21.05
DOWNSTREAM LOADS																					
044-MLDB-102	SECURITY GATE BUILDING INCOMER 1	FEEDER	Normal	-	044-MLDB-101	BUS B	415	3PH+N	C	100	17,40	50	0,348	1	1	0,95	0,95	50	52.63	17,40	18,32
																		TOTAL CONTINUOUS LOAD			
																		a	103.40	108.84	
																		b	0.00	0.00	
																		c=b*30%	0.00	0.00	
																		d	0.00	0.00	
																		e=max(c,d)	0.00	0.00	
																		f	0.00	0.00	
																		g = f*10%	0.00	0.00	
																		h	0.00	0.00	
																		i=max(g,h)	0.00	0.00	
																		j=a+e+i	103.40	108.84	
																		m=120%*i	124.08	130.61	

Table 35. 044-MLDB-101 load calculation.

							ELECTRICAL LOAD CALCULATIONS														
PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPech” (J-18)						SWITCHBOARD: 044-MLDB-102														
CLIENT:	INDIAN OIL CORPORATION LIMITED																				
ITEM	LOAD DESCRIPTION	LOAD TYPE	LOAD SERVICE	SCHEME TYPE	FED FROM	BUSBAR	RATED VOLTAGE (V)	N° PH	LOAD DUTY	SIMULTANEITY FACTOR	ABSORBED MECHANIC POWER (KW)	MOTOR RATED POWER (KW)	LOAD FACTOR	EFFICIENCY at rated load	EFFICIENCY at operating load	POWER FACTOR at rated load	POWER FACTOR at operating load	RATED CONSUMED ELECTRICAL LOAD		OPERATING CONSUMED ELECTRICAL LOAD	
A	B	C	D	E	F	G	H	I	J	K	L	M	N=L/M	O	P	Q	R	KW S=M/O	KVA T=S/Q	KW U=L/P	KVA V=U/R
044-LDB-117	Normal Lighting Panel	FEEDER	Normal	-	044-MLDB-102	BUS B	415	3PH+N	C	100	2,20	2,20	1	1	1	0,96	0,96	2,20	2,29	2,20	2,29
044-LDB-116	Normal Lighting Panel	FEEDER	Normal	-	044-MLDB-102	BUS A	415	3PH+N	C	100	2,20	2,20	1	1	1	0,96	0,96	2,20	2,29	2,20	2,29
044-LDB-106	PDB for Sockets Distribution (Ground floor)	FEEDER	Normal	-	044-MLDB-102	BUS A	415	3PH+N	C	100	3,00	3,00	1,00	1	1	0,95	0,95	3,00	3,16	3,00	3,16
044-LDB-107	PDB for split AC and sockets (First floor)	FEEDER	Normal	-	044-MLDB-102	BUS B	415	3PH+N	C	100	5,00	5,00	1,00	1	1	0,98	0,98	5,00	5,10	5,00	5,10
044-LDB-108	PDB for Instrumentation Loads (Ground floor)	FEEDER	Normal	-	044-MLDB-102	BUS A	415	3PH+N	C	100	5,00	5,00	1	1	1	1,00	1,00	5,00	5,00	5,00	5,00
DOWNSTREAM LOADS																					

DOWNSTREAM LOADS

TOTAL CONTINUOUS LOAD	a	17,40	17,84
TOTAL INTERMITTENT LOAD	b	0,00	0,00
30% OF INTERMITTENT LOAD	c=b*30%	0,00	0,00
HIGHEST INTERMITTENT LOAD	d	0,00	0,00
INTERMITTENT LOAD CONSIDERED	e=max(c,d)	0,00	0,00
TOTAL STANDBY LOAD	f	0,00	0,00
10% OF STANDBY LOAD	g = f*10%	0,00	0,00
HIGHEST STANDBY LOAD	h	0,00	0,00
STANDBY LOAD CONSIDERED	i=max(g,h)	0,00	0,00
TOTAL PEAK LOAD	j=a+e+i	17,40	17,84
TOTAL LOAD WITH FUTURE 20% LOAD	m=120%*j	20,88	21,41

Table 36. 044-MLDB-102 load calculation.

4.2.2. TRANSFORMERS

There are three types of transformers: power, distribution and lighting. The substation transformers' characteristics and description are indicated in Table 37.

All transformers except lighting transformers shall be three phase, oil immersed, double wound type suitable for outdoor use, unless otherwise specified. Transformers shall have a design lifetime of at least 25 years. During outage of one transformer, other healthy transformer shall be loaded to 80% of rated capacity. The maximum rating of distribution transformers shall be 2 MVA. Due consideration shall be given to the starting current of large motors. Transformers shall be suitable for continuous operation at full load for at least 40,000 hours without maintenance requiring the transformer to be de-energized. The system supply voltage and frequency will not vary more than:

- Voltage: +6% or -9% at 33000V; +6% or -6% at 6900V
- Frequency: +3% or -3%

The effect of rapid changes in ambient temperature shall also be incorporated in the design. The maximum/minimum ambient temperature shall be 47°C/4.4°C. The relative humidity shall be taken to be 89 %, maximum. The atmosphere shall be regarded as dusty, sulphureous, saliferous and corrosive, as commonly encountered in petrochemical installations in close proximity to the sea.

The main transformer tank and any attached compartment, piping, etc., that is subject to operating pressures shall be designed to withstand, without permanent deformation, pressures 25% greater than the maximum operating pressures resulting from the system of liquid preservation used.

At least one manhole shall be provided in the cover. Manholes shall be located and sized to permit changeout of bushings and provide adequate access for visual inspection. Tank grounding provisions shall consist of two ground pads, welded on the base or on the tank wall near the base. One additional ground pad shall be furnished near each neutral bushing. The temperature of each winding shall be determined by one set of measurements per phase by means of thermistors or Pt100 resistance type temperature detectors. These measuring elements shall be interchangeable. The leads shall be brought out to a terminal box located on the outside of the transformer enclosure. The thermistors shall be of the positive temperature coefficient (PTC) type. The thermistors or resistance elements shall be supplied complete with the auxiliary equipment necessary to initiate remote alarms/trips via voltage free changeover contacts. The thermistors or resistance elements shall be designed and located in such a manner as to avoid the transfer of over-voltages to auxiliary or external connections.

An externally operated tap changer, for de-energized operation, shall be provided on the high voltage winding. The tap changer handle shall be operated from base level, shall have provisions for padlocking, and shall provide visible indication of the tap position without unlocking. For a given winding, the number 1 or the letter A shall assigned to the tap providing the maximum ratio of transformation. The tap changer shall have five positions with four 2.5% full capacity taps, two above and two below rated high voltage. Transformer shall have a minimum rating of 10 VA and an accuracy class 5P20.

Type	Item	Description
Power transformer	TR-101 A	Oil-immersed, three-phase; 33/6,9 kV, 20 MVA; ONAN/ONAF; Z=10%; Dyn1.
	TR-101 B	
	TR-106 A	Oil-immersed, three-phase; 11/6,9 kV, 3150 kVA; ONAN/ONAF; Z=7,25%; YnYn0
Distribution transformer	TR-102 A	Oil-immersed, three-phase; 6,6/433 V; 2500 KVA; ONAN; Z=8.5%; Dyn11.
	TR-102 B	
	TR-103 A	
	TR-103 B	
	TR-104 A	
	TR-104 B	
	TR-105 A	Oil-immersed, three-phase, 6,6/433 V, 1600 kVA, ONAN, Z=6,25%, Dyn11.
	TR-105 B	
	TR-105 C	
Lighting transformer	TR-107 A	Dry; three-phase; 415/433 kV; 100 kVA; Z=4%; YnD1.
	TR-107 B	
	TR-108 A	
	TR-108 B	

Table 37. Transformers' description.

4.2.2.1. Power transformers requirements

Power transformers shall comply with IEC 60076 and IS 2026. The power transformers shall be for outdoor operation and designed to operate without protective shelter. The power transformers shall be with dual rating ONAN/ONAF. ONAN rating shall be considered for the present load. ONAF rating shall take care of 25% future load requirement. The oil system may utilize a sealed main oil tank and have an auxiliary oil tank called a conservator. A silica gel breather connected to the air space in the conservator tank shall be furnished. The conservator shall be fitted with Buchholz relays, having both alarm and trip contacts. The core construction shall be three-limb core-type transformer. Windings shall be uniformly insulated. Transformer windings should be high conductivity electrolytic copper. The winding arrangement shall be Dyn1 for 044-TR-101 A/B and YNyn0 for 044-TR-106A. The transformers shall be naturally air cooled (ONAN) but designed and equipped so that fans can be fitted later to allow a minimum increase in rating of 25 % (ONAF). The tap changer handle shall be operated from base level, shall have provisions for padlocking, and shall provide visible indication of the tap position without unlocking. The winding terminations at 33000V or 11000V side (HV) shall be through bushings. Single core phase cable terminations shall be provided with brass or bronze compression type cable glands, mounted on a non-magnetic gland plate. The winding terminations at 6900V side shall be through bus duct.

4.2.2.2. Distribution transformers requirements

The distribution transformers shall be designed, fabricated, inspected, tested, guaranteed according to the standards IEC 60076-1 to IEC 60076-7. Distribution transformers shall be with ONAN rating, which shall include 20% future loads. Windings shall be uniformly insulated. Transformer windings should be high conductivity electrolytic copper. The winding arrangement shall be Dyn11. The winding terminations at 6600V side shall be through bushings. Single core phase cable terminations shall be

provided with brass or bronze compression type cable glands, mounted on a non-magnetic gland plate. The winding terminations at 433V side shall be through bus duct.

4.2.2.3. Transformers calculation

The rating requirement of each transformer is calculated for the below two operating conditions:

- Operating condition 1: As per the design basis, maximum peak demand shall be 100% continuous load +30% intermittent load +10% Stand-by load +20% margin for future load growth.
- Operating condition 2: Starting of largest motor (with other loads running). The final rating of transformer is selected to meet the “maximum” requirement of the above two operating conditions.

For each transformer calculation, the operating load estimated during the load flow calculation will be taken. Case-1 calculation is the total load with a 20% margin. Case-2 calculation corresponds with the highest load at the largest motor. For this calculation, starting and running conditions were considered. The starting load motor is the absorbed motor power times the limiting condition for the largest motor start-up, which is 6.6 (6 times + 10% positive tolerance) for distribution transformers and 5.5 (5 times + 10% positive tolerance) for power transformers. According to IS-2026, an overloading factor of 1.5 must be added. The final transformer power is selected by considering both cases. Once the transformer size is calculated, the voltage drop at the transformer secondary terminals during star-up of the highest starting current of motor at pre-loaded condition is verified.

As per IS 2026 and depending on the transformer’s rated power, the impedance Z in % will be:

- For 20 MVA: Z=10%
- For 3.15 MVA: Z=7.25%
- For 2.5 MVA: Z=8.5%
- For 1.6 MVA: Z=6.5%

To the final calculation, an -10% tolerance is added to the transformer’s impedance. The starting load current and power of the motor to be considered is:

$$I_{ST} = 6 \cdot I_{FL} = 6 \cdot \frac{P}{V_n \cdot \cos \varphi \cdot \eta \cdot \sqrt{3}}$$

$$S_{KVA} = V_n \cdot I_{ST} \cdot \sqrt{3}$$

The final voltage drop at the transformer secondary terminals will be:

$$\text{Voltage drop} = \frac{S_{KVA} \cdot 100 + 90\% \cdot S_{load}}{S_{KVA} + 90\% \cdot S_{load} + S_{Short Circuit}}$$

Where,

- P is power in kW of largest motor.
- η is efficiency at rated load motor.
- $\cos \varphi$ is nominal power factor for rated load motor.
- V_n is nominal voltage in kV.
- S_{load} is starting motor’s power in KVA.
- $S_{Short Circuit}$ 3-ph short circuit capacity of transformer in KVA.

 		TRANSFORMER SIZING CALCULATIONS
PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPech” (J-18)	
CLIENT:	INDIAN OIL CORPORATION LIMITED	
POWER TRANSFORMERS (044-TR-101 A & B)		
A	Connected Load in KVA	8366,97
B = A * 1,2	Total Load including 20% future spare in KVA - (Case-1)	10040,36
C	Largest Motor in 044-PMCC-101	1803-PM-205: MAIN FRACTIONATOR BOTTOM PUMP
D	KW of Largest Motor	480,00
E = D / (Efficiency * Power Factor)	Largest Motor Absorbed Apparent Power in KVA	593,18
F	Largest Motor Stating Method	DOL
G	Limiting Condition for Largest Motor Start-up	5,50
H = E * G	Starting Load of Largest Motor in KVA	3262,48
I = A - E	Running base Load During Starting of Largest Motor in KVA	7773,79
J = H + I	Total Load during Starting of Largest Motor in KVA - (Case-2a)	11036,27
K = J / 1,5	Effective requirement of operating condition with overloading factor of 1.5 times (As per IS 2026-7 Table-4) in KVA - (Case-2b)	7357,52
L	Transformer Selected by considering Case-1 and Case - 2b in KVA	20000,00
M = B / L * 100	% Loading during Normal Running - (Case-1)	50,20
N = J / L * 100	% Loading during Largest Motor Starting - (Case-2a)	55,18
O = K / L * 100	% Loading during Largest Motor Starting - (Case-2b)	36,79

Table 38. Transformers TR-101 calculation (part 1).

 		TRANSFORMER SIZING CALCULATIONS: TR-101	
PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPech” (J-18)		
CLIENT:	INDIAN OIL CORPORATION LIMITED		
VOLTAGE DROP AT TRANSFORMER SECONDARY TERMINALS DURING START-UP OF THE HIGHEST STARTING CURRENT OF MOTOR (PRE-LOADED CONDITION)			
ID	DESCRIPTION	RATINGS	UNIT
Largest motor: data and calculations			
Largest Motor connected to TR-101: 1803-PM-205 (MAIN FRACTIONATOR BOTTOM PUMP)			
P	Largest Motor Load from Load List	480	KW
Vn	Nominal Volatge	6,6	KV
Cos ϕ 1	Nominal Power factor at Load Factor	0,85	-
η	Efficiency at Load Factor	0,952	-
$IFL=P/(Vn \cdot Cos \phi 1 \cdot \eta \cdot 1,732)$	Full Load Current (Line)	51,89	A
IST=6*IFL	Starting Current as per IS325	311,35	A
Cos ϕ 2	Starting Power Factor	0,2	-
Skva= $Vn \cdot IST \cdot 1,732$	Starting KVA	3559,07	KVA
Skw= $Skva \cdot Cos \phi 2$	Starting KW	711,81	KW
20 MVA Transformer			
A	Selected Transformer Rating	20000	KVA
B	Transformer Impedance (Z in %) as per IS 2026	10	%
C	Primary Voltage of Transformer (Delta)	33	KV
D	Secondary Voltage of Transformer No-Load (Star)	6,9	KV
E=B*90%	Rated Impedance with Negative Tolerance(+/- 10%)	0,09	Pu
F	Pu Impedance of Transformer	0,45	Pu
G=(Base MVA)/F*1000	3-Ph Short Circuit Capacity of Transformer	22222,22	KVA
H	Base Load of Transformer excluding Highest Rated Motor	7773,79	KVA
I=H*90%	Base Load of Transformer (Considering 90% of Transformer Rating)	18000	KVA
Voltage drop calculation			
$H=(Skva \cdot 100+I)/(Skva+I+G)$	%Voltage Drop at Transformer secondary terminals(Pre-loaded condition)	1,53	%
K=D*J	Voltage drop at Transformer Terminals	105,83	V
L=D-K	Voltage at Transformer Secondary Terminals (Pre-Loaded Condition)	6794,17	V

Table 39. Transformers TR-101 calculation (part 2).

 		TRANSFORMER SIZING CALCULATIONS
PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPech” (J-18)	
CLIENT:	INDIAN OIL CORPORATION LIMITED	
DISTRIBUTION TRANSFORMERS (044-TR-106A)		
A	Connected Load in KVA	657,29
B = A * 1,2	Total Load including 20% future spare in KVA - (Case-1)	788,75
C	Largest Motor in 044-PMCC-101	1803-PM-609 A: HP BOILER FEED WATER PUMP
D	KW of Largest Motor	275,00
E = D / (Efficiency * Power Factor)	Largest Motor Absorbed Apparent Power in KVA	324,51
F	Largest Motor Stating Method	DOL
G	Limiting Condition for Largest Motor Start-up	5,50
H = E * G	Starting Load of Largest Motor in KVA	1784,79
I = A - E	Running base Load During Starting of Largest Motor in KVA	332,78
J = H + I	Total Load during Starting of Largest Motor in KVA - (Case-2a)	2117,57
K = J / 1,5	Effective requirement of operating condition with overloading factor of 1.5 times (As per IS 2026-7 Table-4) in KVA - (Case-2b)	1411,71
L	Transformer Selected by considering Case-1 and Case - 2b in KVA	3150,00
M = B / L * 100	% Loading during Normal Running - (Case-1)	19,72
N = J / L * 100	% Loading during Largest Motor Starting - (Case-2a)	52,94
O = K / L * 100	% Loading during Largest Motor Starting - (Case-2b)	35,29

Table 40. Transformer TR-106 calculation (part 1).

  IndianOil		TRANSFORMER SIZING CALCULATIONS: TR-106	
PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPech” (J-18)		
CLIENT:	INDIAN OIL CORPORATION LIMITED		
VOLTAGE DROP AT TRANSFORMER SECONDARY TERMINALS DURING START-UP OF THE HIGHEST STARTING CURRENT OF MOTOR (PRE-LOADED CONDITION)			
ID	DESCRIPTION	RATINGS	UNIT
Largest motor: data and calculations			
Largest Motor connected to TR-106: 1803-PM-609 A (HP BOILER FEED WATER PUMP)			
P	Largest Motor Load from Load List	275	KW
Vn	Nominal Volatge	6,6	KV
Cos ϕ 1	Nominal Power factor at Load Factor	0,88	-
η	Efficiency at Load Factor	0,938	-
$IFL=P/(Vn*\cos \phi 1*\eta*1,732)$	Full Load Current (Line)	29,14	A
IST=6*IFL	Starting Current as per IS325	174,87	A
Cos ϕ 2	Starting Power Factor	0,2	-
$Skva=Vn*IST*1,732$	Starting KVA	1998,93	KVA
$Skw=Skva*\cos \phi 2$	Starting KW	399,79	KW
3150 kVA Transformer			
A	Selected Transformer Rating	3150	KVA
B	Transformer Impedance (Z in %) as per IS 2026	7,25	%
C	Primary Voltage of Transformer (Delta)	11	KV
D	Secondary Voltage of Transformer No-Load (Star)	6,9	KV
$E=B*90\%$	Rated Impedance with Negative Tolerance(+/- 10%)	0,06525	Pu
F	Pu Impedance of Transformer	2,071428571	Pu
$G=(Base\ MVA)/F*1000$	3-Ph Short Circuit Capacity of Transformer	48275,86	KVA
H	Base Load of Transformer excluding Highest Rated Motor	332,78	KVA
$I=H*90\%$	Base Load of Transformer (Considering 90% of Transformer Rating)	2835	KVA
Voltage drop calculation			
$H=(Skva*100+I)/(Skva+I+G)$	%Voltage Drop at Transformer secondary terminals(Pre-loaded condition)	3,82	%
$K=D*J$	Voltage drop at Transformer Terminals	263,38	V
$L=D-K$	Voltage at Transformer Secondary Terminals (Pre-Loaded Condition)	6636,62	V

Table 41. Transformer TR-106 calculation (part 2).

  IndianOil		TRANSFORMER SIZING CALCULATIONS
PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPech” (J-18)	
CLIENT:	INDIAN OIL CORPORATION LIMITED	
DISTRIBUTION TRANSFORMERS (044-TR-102 A & B)		
A	Connected Load in KVA	1961,30
$B = A * 1,2$	Total Load including 20% future spare in KVA - (Case-1)	2353,56
C	Largest Motor in 044-PMCC-101	1803-PM-206: CLO PRODUCT PUMP
D	KW of Largest Motor	150,00
$E = D / (\text{Efficiency} * \text{Power Factor})$	Largest Motor Absorbed Apparent Power in KVA	182,45
F	Largest Motor Stating Method	DOL
G	Limiting Condition for Largest Motor Start-up	6,60
$H = E * G$	Starting Load of Largest Motor in KVA	1204,15
$I = A - E$	Running base Load During Starting of Largest Motor in KVA	1778,85
$J = H + I$	Total Load during Starting of Largest Motor in KVA - (Case-2a)	2983,00
$K = J / 1,5$	Effective requirement of operating condition with overloading factor of 1.5 times (As per IS 2026-7 Table-4) in KVA - (Case-2b)	1988,67
L	Transformer Selected by considering Case-1 and Case - 2b in KVA	2500,00
$M = B / L * 100$	% Loading during Normal Running - (Case-1)	94,14
$N = J / L * 100$	% Loading during Largest Motor Starting - (Case-2a)	119,32
$O = K / L * 100$	% Loading during Largest Motor Starting - (Case-2b)	79,55

Table 42. Transformer TR-102 calculation (part 1).

				TRANSFORMER SIZING CALCULATIONS: TR-102
PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPech” (J-18)			
CLIENT:	INDIAN OIL CORPORATION LIMITED			
VOLTAGE DROP AT TRANSFORMER SECONDARY TERMINALS DURING START-UP OF THE HIGHEST STARTING CURRENT OF MOTOR (PRE-LOADED CONDITION)				
ID	DESCRIPTION	RATINGS	UNIT	
Largest motor: data and calculations				
Largest Motor connected to TR-102: 1803-PM-206 (CLO PRODUCT PUMP)				
P	Largest Motor Load from Load List	150,00	KW	
Vn	Nominal Volatge	0,415	KV	
Cos ϕ 1	Nominal Power factor at Load Factor	0,86	-	
η	Efficiency at Load Factor	0,956	-	
IFL=P/(Vn*Cos ϕ 1* η *1,732)	Full Load Current (Line)	253,83	A	
IST=6*IFL	Starting Current as per IS325	1522,97	A	
Cos ϕ 2	Starting Power Factor	0,2	-	
Skva=Vn*IST*1,732	Starting KVA	1094,68	KVA	
Skw=Skva*Cos ϕ 2	Starting KW	218,94	KW	
2500 kVA Transformer				
A	Selected Transformer Rating	2500	KVA	
B	Transformer Impedance (Z in %) as per IS 2026	8,5	%	
C	Primary Voltage of Transformer (Delta)	6,6	KV	
D	Secondary Voltage of Transformer No-Load (Star)	0,433	KV	
E=B*90%	Rated Impedance with Negative Tolerance(+/- 10%)	0,0765	Pu	
F	Pu Impedance of Transformer	3,06	Pu	
G=(Base MVA)/F*1000	3-Ph Short Circuit Capacity of Transformer	32679,74	KVA	
H	Base Load of Transformer excluding Highest Rated Motor	1773,74	KVA	
I=H*90%	Base Load of Transformer (Considering 90% of Transformer Rating)	2250	KVA	
Voltage drop calculation				
H=(Skva*100+I)/(Skva+I+G)	%Voltage Drop at Transformer secondary terminals(Pre-loaded condition)	3,10	%	
K=D*J	Voltage drop at Transformer Terminals	13,43	V	
L=D-K	Voltage at Transformer Secondary Terminals (Pre-Loaded Condition)	419,57	V	

Table 43. Transformer TR-102 calculation (part 2).

 		TRANSFORMER SIZING CALCULATIONS
PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPech” (J-18)	
CLIENT:	INDIAN OIL CORPORATION LIMITED	
DISTRIBUTION TRANSFORMERS (044-TR-103 A & B)		
A	Connected Load in KVA	1961,27
B = A * 1,2	Total Load including 20% future spare in KVA - (Case-1)	2353,52
C	Largest Motor in 044-PMCC-102	1803-PM-219: LPG PRODUCT PUMP
D	KW of Largest Motor	160,00
E = D / (Efficiency * Power Factor)	Largest Motor Absorbed Apparent Power in KVA	187,53
F	Largest Motor Stating Method	DOL
G	Limiting Condition for Largest Motor Start-up	6,60
H = E * G	Starting Load of Largest Motor in KVA	1237,69
I = A - E	Running base Load During Starting of Largest Motor in KVA	1773,74
J = H + I	Total Load during Starting of Largest Motor in KVA - (Case-2a)	3011,43
K = J / 1,5	Effective requirement of operating condition with overloading factor of 1.5 times (As per IS 2026-7 Table-4) in KVA - (Case-2b)	2007,62
L	Transformer Selected by considering Case-1 and Case - 2b in KVA	2500,00
M = B / L * 100	% Loading during Normal Running - (Case-1)	94,14
N = J / L * 100	% Loading during Largest Motor Starting - (Case-2a)	120,46
O = K / L * 100	% Loading during Largest Motor Starting - (Case-2b)	80,30

Table 44. Transformer TR-103 calculation (part 1).

		TRANSFORMER SIZING CALCULATIONS: TR-103	
PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPech” (J-18)		
CLIENT:	INDIAN OIL CORPORATION LIMITED		
VOLTAGE DROP AT TRANSFORMER SECONDARY TERMINALS DURING START-UP OF THE HIGHEST STARTING CURRENT OF MOTOR (PRE-LOADED CONDITION)			
ID	DESCRIPTION	RATINGS	UNIT
Largest motor: data and calculations			
Largest Motor connected to TR-103: 1803-PM-219 (LPG PRODUCT PUMP)			
P	Largest Motor Load from Load List	160,00	KW
Vn	Nominal Volatge	0,415	KV
Cos ϕ 1	Nominal Power factor at Load Factor	0,90	-
η	Efficiency at Load Factor	0,948	-
$IFL=P/(V_n \cdot \cos \phi 1 \cdot \eta \cdot 1,732)$	Full Load Current (Line)	260,90	A
IST=6*IFL	Starting Current as per IS325	1565,40	A
Cos ϕ 2	Starting Power Factor	0,2	-
Skva=Vn*IST*1,732	Starting KVA	1125,18	KVA
Skw=Skva*Cos ϕ 2	Starting KW	225,04	KW
2500 kVA transformer			
A	Selected Transformer Rating	2500	KVA
B	Transformer Impedance (Z in %) as per IS 2026	8,5	%
C	Primary Voltage of Transformer (Delta)	6,6	KV
D	Secondary Voltage of Transformer No-Load (Star)	0,433	KV
E=B*90%	Rated Impedance with Negative Tolerance(+/- 10%)	0,0765	Pu
F	Pu Impedance of Transformer	3,06	Pu
G=(Base MVA)/F*1000	3-Ph Short Circuit Capacity of Transformer	32679,74	KVA
H	Base Load of Transformer excluding Highest Rated Motor	1773,74	KVA
I=H*90%	Base Load of Transformer (Considering 90% of Transformer Rating)	2250	KVA
Voltage drop calculation			
$H=(Skva \cdot 100 + I)/(Skva + I + G)$	%Voltage Drop at Transformer secondary terminals(Pre-loaded condition)	3,18	%
K=D*J	Voltage drop at Transformer Terminals	13,78	V
L=D-K	Voltage at Transformer Secondary Terminals (Pre-Loaded Condition)	419,22	V

Table 45. Transformer TR-103 calculation (part 2).

		 IndianOil	TRANSFORMER SIZING CALCULATIONS
PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPech” (J-18)		
CLIENT:	INDIAN OIL CORPORATION LIMITED		
DISTRIBUTION TRANSFORMERS (044-TR-104 A & B)			
A	Connected Load in KVA	2146,25	
B = A * 1,2	Total Load including 20% future spare in KVA - (Case-1)	2575,50	
C	Largest Motor in 044-PMCC-103	1803-PM-209: DISTILLATE DRUM LIQUID PUMP	
D	KW of Largest Motor	132,00	
E = D / (Efficiency * Power Factor)	Largest Motor Absorbed Apparent Power in KVA	156,78	
F	Largest Motor Stating Method	DOL	
G	Limiting Condition for Largest Motor Start-up	6,60	
H = E * G	Starting Load of Largest Motor in KVA	1034,75	
I = A - E	Running base Load During Starting of Largest Motor in KVA	1989,47	
J = H + I	Total Load during Starting of Largest Motor in KVA - (Case-2a)	3024,22	
K = J / 1,5	Effective requirement of operating condition with overloading factor of 1.5 times (As per IS 2026-7 Table-4) in KVA - (Case-2b)	2016,15	
L	Transformer Selected by considering Case-1 and Case - 2b in KVA	2500,00	
M = B / L * 100	% Loading during Normal Running - (Case-1)	103,02	
N = J / L * 100	% Loading during Largest Motor Starting - (Case-2a)	120,97	
O = K / L * 100	% Loading during Largest Motor Starting - (Case-2b)	80,65	

Table 46. Transformer TR-104 calculation (part 1).

  IndianOil		TRANSFORMER SIZING CALCULATIONS: TR-104	
PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPech” (J-18)		
CLIENT:	INDIAN OIL CORPORATION LIMITED		
VOLTAGE DROP AT TRANSFORMER SECONDARY TERMINALS DURING START-UP OF THE HIGHEST STARTING CURRENT OF MOTOR (PRE-LOADED CONDITION)			
ID	DESCRIPTION	RATINGS	UNIT
Largest motor: data and calculations			
Largest Motor connected to TR-104: 1803-PM-209 (DISTILLATE DRUM LIQUID PUMP)			
P	Largest Motor Load from Load List	132,00	KW
Vn	Nominal Volatge	0,415	KV
Cos ϕ_1	Nominal Power factor at Load Factor	0,89	-
η	Efficiency at Load Factor	0,946	-
$IFL=P/(Vn*\cos \phi_1*\eta*1,732)$	Full Load Current (Line)	218,12	A
$IST=6*IFL$	Starting Current as per IS325	1308,72	A
Cos ϕ_2	Starting Power Factor	0,2	-
$Skva=Vn*IST*1,732$	Starting KVA	940,68	KVA
$Skw=Skva*\cos \phi_2$	Starting KW	188,14	KW
2500 kVA transformer			
A	Selected Transformer Rating	2500	KVA
B	Transformer Impedance (Z in %) as per IS 2026	8,5	%
C	Primary Voltage of Transformer (Delta)	6,6	KV
D	Secondary Voltage of Transformer No-Load (Star)	0,433	KV
$E=B*90\%$	Rated Impedance with Negative Tolerance(+/- 10%)	0,0765	Pu
F	Pu Impedance of Transformer	3,06	Pu
$G=(Base\ MVA)/F*1000$	3-Ph Short Circuit Capacity of Transformer	32679,74	KVA
H	Base Load of Transformer excluding Highest Rated Motor	1773,74	KVA
$I=H*90\%$	Base Load of Transformer (Considering 90% of Transformer Rating)	2250	KVA
Voltage drop calculation			
$H=(Skva*100+I)/(Skva+I+G)$	%Voltage Drop at Transformer secondary terminals(Pre-loaded condition)	2,69	%
$K=D*J$	Voltage drop at Transformer Terminals	11,63	V
$L=D-K$	Voltage at Transformer Secondary Terminals (Pre-Loaded Condition)	421,37	V

Table 47. Transformer TR-104 calculation (part 2).

		 IndianOil	TRANSFORMER SIZING CALCULATIONS
PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPech” (J-18)		
CLIENT:	INDIAN OIL CORPORATION LIMITED		
DISTRIBUTION TRANSFORMERS (044-TR-105 A, B & C)			
A	Connected Load in KVA	939,95	
B = A * 1,2	Total Load including 20% future spare in KVA - (Case-1)	1127,94	
C	Largest Motor in 044-PMCC-103	1803-PM-610: FIRE WATER BOOSTER PUMP	
D	KW of Largest Motor	160,00	
E = D / (Efficiency * Power Factor)	Largest Motor Absorbed Apparent Power in KVA	187,13	
F	Largest Motor Stating Method	DOL	
G	Limiting Condition for Largest Motor Start-up	6,60	
H = E * G	Starting Load of Largest Motor in KVA	1235,09	
I = A - E	Running base Load During Starting of Largest Motor in KVA	752,82	
J = H + I	Total Load during Starting of Largest Motor in KVA - (Case-2a)	1987,90	
K = J / 1,5	Effective requirement of operating condition with overloading factor of 1.5 times (As per IS 2026-7 Table-4) in KVA - (Case-2b)	1325,27	
L	Transformer Selected by considering Case-1 and Case - 2b in KVA	1600,00	
M = B / L * 100	% Loading during Normal Running - (Case-1)	70,50	
N = J / L * 100	% Loading during Largest Motor Starting - (Case-2a)	124,24	
O = K / L * 100	% Loading during Largest Motor Starting - (Case-2b)	82,83	

Table 48. Transformer TR-105 calculation (part 1).

  IndianOil		TRANSFORMER SIZING CALCULATIONS: TR-105	
PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPech” (J-18)		
CLIENT:	INDIAN OIL CORPORATION LIMITED		
VOLTAGE DROP AT TRANSFORMER SECONDARY TERMINALS DURING START-UP OF THE HIGHEST STARTING CURRENT OF MOTOR (PRE-LOADED CONDITION)			
ID	DESCRIPTION	RATINGS	UNIT
Largest motor: data and calculations			
Largest Motor connected to TR-105: 1803-PM-610 (FIRE WATER BOOSTER PUMP)			
P	Largest Motor Load from Load List	160	KW
Vn	Nominal Volatge	0,415	KV
Cos ϕ 1	Nominal Power factor at Load Factor	0,9	-
η	Efficiency at Load Factor	0,95	-
IFL=P/(Vn*Cos ϕ 1* η *1,732)	Full Load Current (Line)	260,35	A
IST=6*IFL	Starting Current as per IS325	1562,10	A
Cos ϕ 2	Starting Power Factor	0,2	-
Skva=Vn*IST*1,732	Starting KVA	1122,81	KVA
Skw=Skva*Cos ϕ 2	Starting KW	224,56	KW
1600 kVA transformer			
A	Selected Transformer Rating	1600	KVA
B	Transformer Impedance (Z in %) as per IS 2026	6,25	%
C	Primary Voltage of Transformer (Delta)	6,6	KV
D	Secondary Voltage of Transformer No-Load (Star)	0,433	KV
E=B*90%	Rated Impedance with Negative Tolerance(+/- 10%)	0,05625	Pu
F	Pu Impedance of Transformer	3,515625	Pu
G=(Base MVA)/F*1000	3-Ph Short Circuit Capacity of Transformer	28444,44	KVA
H	Base Load of Transformer excluding Highest Rated Motor	752,82	KVA
I=H*90%	Base Load of Transformer (Considering 90% of Transformer Rating)	1440	KVA
Voltage drop calculation			
H=(Skva*100+I)/(Skva+I+G)	%Voltage Drop at Transformer secondary terminals(Pre-loaded condition)	3,67	%
K=D*J	Voltage drop at Transformer Terminals	15,88	V
L=D-K	Voltage at Transformer Secondary Terminals (Pre-Loaded Condition)	417,12	V

Table 49. Transformer TR-105 calculation (part 2).

4.2.3. SWITCHGEARS

4.2.3.1. 33kV gas-insulated switchgear (GIS)

Gas-Insulated Switchgear is a high-voltage, metal-enclosed switchgear system that utilizes insulating Sulphur hexafluoride (SF₆) gas for partial or complete insulation. It is designed for indoor installation with a nominal voltage of 33 kV and a service frequency of 50 Hz. The GIS is characterized by its hermetically sealed pressure systems, ensuring maximum supply reliability and personnel safety. This GIS system complies with the relevant standards, including IEC 62271 and IEC 60694.

The rated nominal current is 1250A, and it has a rated short-time withstand current of 40kA for 3 seconds and a rated peak-withstand current of 100kA. The switchgear consists of three panels of 1250A incomers and bus coupler, eight panels of 800A outgoing units, and one metering panel. All panels include a three-position disconnect switch.

The GIS system incorporates various instrument transformers, including current transformers (CTs) and voltage transformers (VTs). CTs are used in the incoming and outgoing feeder panels, as well as in the bus coupler panel. VTs are installed in the outgoing and incoming feeder panels and bus coupler panels. The VTs are arranged outside the primary enclosure, and their adaptation and removal can be done without intervening in the primary compartment.

The metering panel incorporates two three-phase potential transformers, one for each bus. The incomer panels include three sets of protective CTs, one set of CT for metering, an ammeter selector switch, a voltmeter selector switch, a multifunction meter (MFM), a multifunction relay (MFR) with communication facility, two lockout relays with handles for manual resetting, and a three-phase potential transformer.

The bus coupler panel features three sets of protective current transformers, one set of CTs for metering, an ammeter selector switch, an MFM, an MFR with communication facility, and a lockout relay with handles for manual resetting.

Each of the three outgoing panels comprises three sets of protective CTs, one set of current transformers for metering, an ammeter selector switch, an MFM, an MFR for transformer protection with communication facility, and a lockout relay with handles for manual resetting.

The GIS system meets various technical requirements. The switchgear and its components are enclosed in grounded aluminum metal enclosures. The construction is designed to withstand the forces generated by the operation of the circuit breaker without distortion. It is capable of withstanding fault conditions up to the specified short-circuit current without damage.

The switchgear housings are sealed pressure systems, ensuring maintenance-free operation and reduced operating costs. A continuous ground bus runs along the length of the switchgear group for reliable grounding. The front of each switchgear section consists of four separate compartments for different components, such as protective relays, controls, terminal blocks, and operation mechanisms.

The circuit breakers in the GIS system are vacuum type and designed to withstand impacts and vibrations. They are equipped with a shield to protect the moving contact activating rod from molten metal sputtering during switching operations. The circuit breaker mechanisms are motor charged, stored-energy type, with a spring-charged indicator. These mechanisms are trip-free and operate from a 110VDC control power source.

The three-position disconnecter is used for connection to/disconnection from the busbar system, earthing and short-circuiting the outgoing feeder –together with the vacuum circuit-breaker. Three-position switch are design for:

- Only permissible operations are possible due to logical mechanical interlocks. Separate operating shafts for the “DISCONNECTING”, “EARTHING” and “READY-TO-EARTH” functions.
- The three-position switch shall have motor operating mechanism power rated at 110VDC.
- Same sense of rotation for the switching operations of the “CLOSE” or “OPEN” functions.

4.2.3.2. 6.6kV and 11kV air-insulated switchgears (AIS)

The high-voltage, air-insulated vacuum circuit breaker switchgear is designed to meet IEC 62271 and all relevant standards. Its metal-enclosed construction is capable of withstanding the forces generated by the repeated opening and closing of the circuit breaker without distortion. The switchgear is also designed to withstand the stresses caused by fault conditions, including the specified rated short circuit current, without sustaining damage. All operations of the switchgear are accessible from the front side, and it is designed for bottom entry access for cable termination.

The system comprises of three AIS equipment items: 044-HT11-101, 044-HT6-101, and 044-HT6-102. The 044-HT11-101 is an 11 kV emergency switchgear with an air-insulated design. It operates at a frequency of 50 Hz and has a rated nominal current of 630 A. The switchgear is capable of withstanding short-time currents of up to 40 kA for 1 second and peak currents of up to 100 kA. Moving on to the 044-HT6-101, it is a 6.6 kV switchgear featuring an air-insulated configuration and an auto transfer scheme (ATS). This equipment item has a rated nominal current of 2000 A and can withstand short-time currents of up to 40 kA for 1 second, along with peak currents of up to 100 kA. Lastly, we have the 044-HT6-102, which is a 6.6 kV emergency switchgear also incorporating an auto transfer scheme (ATS) but with three incomers and no bus coupler in bus. It shares similar specifications as the 044-HT11-101, including a rated nominal current of 630 A, rated short-time withstand current of 40 kA for 1 second, and a rated peak-withstand current of 100 kA.

The circuit breakers employed are of the vacuum type and are built to withstand impacts and vibrations under both rated and short-circuit current conditions.

The switchgear includes MFM that are microprocessor-based and suitable for three-wire systems. For monitoring incoming main circuit breakers and feeder circuit breakers, the MFMs are mounted on the low voltage cabinet and equipped with the IEC 61850 communication protocol. Additionally, MFM with communication capabilities using the Modbus TCP/IP protocol are installed in all incoming and outgoing feeders for energy management. These MFMs provide various metering parameters such as current (A), voltage (V), frequency (F), active power (kW), reactive power (kVAR), apparent power (kVA), energy consumption (kWh), and power factor (PF).

The protective relaying system consists of microprocessor-based three-phase relays, which are UL-Listed or UL-Recognized. The relays offer several functionalities, including a graphic mimic display that visually indicates the position of the circuit breaker (OPEN/CLOSED), protection function trip, and metering data. The user can create custom single-line displays using a user-configurable Human Machine Interface with unlimited screens. Key locking mechanisms are implemented to prevent unauthorized switching, whether local or remote. The relays are capable of internally performing main-tie-main auto-transfer and auto-restore functions and offer programmable logic capabilities for protection and control systems. They also feature a modular communications processor that allows for field changes between ETH Modbus, Profinet, ETH DNP3.0, and IEC 61850 protocols. The relays support RS-485, RJ45, or fiber-optic communications and provide comprehensive sequence-of-events recording with millisecond time stamping. They also offer oscillography (waveform) capture with configurable pre- and post-fault data capture times.

Moreover, the relays provide four or more protection settings groups and allow for easy addition or removal of additional function protections required for specific applications, such as transformer protection or breaker protection.

4.2.3.3. MV switchgears

The system has four PMCC, which are medium voltage switchgear composed by an aluminum single busbar system designed for a rated frequency of 50 Hz. PMCCs have a rated insulation voltage of 1000V~ and operate on a 3-phase, 4-wire configuration with an operating voltage of 415V. PMCCs are capable of withstanding a rated impulse voltage of 12 kV. They have a rated nominal current of 4000A and can withstand a short-time current of 65 kA for 1 second, along with a rated peak withstand current of 143 kA. The degree of protection for these switchgears is external IP 42 and internal IP 2X. The entry of cables is facilitated through a top bus duct for incoming connections and a bottom cable for outgoing connections. Additionally, these switchgears provide rear access for maintenance purposes.

Also, the system has seven MCC, which are medium voltage switchgear composed by an aluminum single busbar system and operates at a rated frequency of 50 Hz. It has a rated insulation voltage of 1000V~,

with a 3-phase, 4-wire configuration and an operating voltage of 415V. The switchgear is designed to withstand impulses up to 12 kV and has a rated nominal current of 800A. It can withstand a short-time current of 65 kA for 1 second and a peak current of 143 kA. The degree of protection for the switchgear is IP 42 externally and IP 2X internally, offering reliable shielding. It utilizes a 4b form of separation with metal partitioning. Cables enter from the top for incoming connections and from the bottom for outgoing connections, while rear access is provided for maintenance purposes.

Each switchgear includes cubicles and panels, which are combined depending on the supply needs. The possible cubicles and panels are as follows:

1. Incomer cubicles, in which each should consist of one air circuit breaker (LVPCB), three sets of protective current transformers, one set of current transformers for metering, one ammeter selector switch, one ammeter, one voltmeter selector switch, one voltmeter, one MFM, one multifunction relay with communication facility (MFR), two lockout relays with handles for manual resetting, one three-phase potential transformer, indicating lamps, and a space heater.
2. A bus coupler cubicle with one LVPCB, one set of protective current transformers, one set of current transformers for metering, one ammeter selector switch, one ammeter, one MFM, one MFR, one lockout relay with handles for manual resetting, indicating lamps, and a space heater.
3. A bus PT (potential transformer) cubicle that includes one three-phase PT, one MFR, one voltmeter selector switch, one voltmeter, indicating lamps, and a space heater.
4. A bus riser with PT cubicle consisting of one three-phase PT, one MFR, one voltmeter selector switch, one voltmeter, indicating lamps, and a space heater.
5. Panels for motors with a power range of 55 kW to 160 kW. Each panel contains one LVPCB, one set of protective CTs, one set of CTs for metering, one relay for motor protection (MPR), two lockout relays with handles for manual resetting, one MFM, one ammeter selector switch, one ammeter, indicating lamps, and a space heater.
6. Panels for motors with a power range of 30 kW to 55 kW. Each panel contains one LVPCB, one control transformer, one set of protective current transformers, one set of current transformers for metering, one relay for motor protection (MPR), one ammeter selector switch, one ammeter, indicating lamps, and a space heater.
7. Panels for motors with a power range under 30 kW, equipped with a Direct-On-Line (DOL) starter. These panels include the following components: one motor circuit protector (HMCP), one 3-phase contactor appropriate for the motor rating, one single-phase PT, one set of protective CTs, one set of CT for metering with an ammeter, one MPR, one CT for ground fault detection, an emergency stop button, indicating lamps, and a space heater.
8. Outgoing feeder panels with currents above 630A that include one LVPCB, one set of protective CTs, one set of CTs for metering, one ammeter selector switch, one ammeter, one MFM, one MFR, 1 lockout relay with handles for manual resetting, indicating lamps, and a space heater.

9. Outgoing feeder panels with currents between 100A and 630A consisting of one molded case circuit breaker (MCCB), one ground fault current transformer (CT), one ground fault relay (50G), indicating lamps, and a space heater.
10. Outgoing feeder panels with currents up to 100A that include one molded case circuit breaker (MCCB), indicating lamps, and a space heater.
11. Panels for VFD motor with bypass (<55kW) that include one molded case circuit breaker (MCCB), indicating lamps, space heater, and VFD.

Each MV switchgear is designed with different cubicles, depending on the needs. The possible combinations and quantities required for each equipment are summarized in the following two tables (Table 50 and Table 51).

		PMCC-101	PMCC-102	PMCC-103	EPMCC
1	Incomer cubicle	2	2	2	3
2	Bus-coupler cubicle	1	1	1	-
3	Bus Power Transformer (PT) cubicle	1	1	1	1
4	Bus riser with PT cubicle	1	1	1	-
5	Panels for 55kW < P < 160kW motors	17	19	18	6
6	Panels for 30kW < P < 55kW motors	-	-	-	3
7	Panels for P < 30kW motors	-	-	-	35
8	Outgoing feeder panels 630A < I	8	8	10	-
9	Outgoing feeder panels 100A < I < 630A	-	-	9	6
10	Outgoing feeder panels I < 100A	-	-	6	6
11	Panels for VDF motor with bypass	-	-	-	-

Table 50. PMCC switchgears panels and cubicles composition.

		MCC-101	MCC-102	MCC-103	MCC-104	MCC-105	MCC-106	MCC-107
1	Incomer cubicle	2	2	2	2	2	2	2
2	Bus-coupler cubicle	1	1	1	1	1	1	1
3	Bus Power Transformer (PT) cubicle	1	1	1	1	1	1	1
4	Bus riser with PT cubicle	1	1	1	1	1	1	1
5	Panels for 55kW < P < 160kW motors	-	-	-	-	-	-	-
6	Panels for 30kW < P < 55kW motors	27	9	9	10	-	4	6
7	Panels for P < 30kW motors	12	-	-	15	30	17	26
8	Outgoing feeder panels 630A < I	-	-	-	-	-	-	-
9	Outgoing feeder panels 100A < I < 630A	-	-	-	-	-	-	-
10	Outgoing feeder panels I < 100A	-	-	-	-	-	11	-
11	Panels for VDF motor with bypass	-	11	11	2	-	-	-

Table 51. MCC switchgears panels and cubicles composition.

4.2.4. DISTRIBUTION PANELS

Distribution panels are summarized and describe on the following Table 52.

ITEM	Function	DESCRIPTION
044-ASB-101	Auxiliary Service Board	Low voltage switchgear, aluminium single bus bar system, rated frequency 50 Hz, 3 phase, 4 wire, operating voltage 415V, rated nominal current 630A, rated short-time withstand current 50 kA – 1 sec, rated peak withstand current 105 kA; degree of protection: external IP 42, internal from IP 2X; form of separation 4b, metal partitioning; rear access, painting RAL 7035.
044-ASB-102	Auxiliary Service Board	
044-MLDB-101	Main Lighting Distribution Board	Low voltage switchgear, aluminium single bus bar system, rated frequency 50 Hz, 3 phase, 4 wire, operating voltage 415V, rated nominal current 200A, rated short-time withstand current 25 kA – 1 sec, rated peak withstand current 52.5 kA; degree of protection: external IP 42, internal from IP 2X; form of separation 4b, metal partitioning; rear access, painting RAL 7035.
044-EMLDB-101	Emergency Lighting Distribution Board	Low voltage switchgear, aluminium single bus bar system, rated frequency 50 Hz, 3 phase, 4 wire, operating voltage 415V, rated nominal current 100A, rated short-time withstand current 25 kA – 1 sec, rated peak withstand current 52.5 kA; degree of protection: external IP 42, internal from IP 2X; form of separation 4b, metal partitioning; rear access, painting RAL 7035.
044-LDB-101	Indoor LDB in SS-044 third floor	Low voltage switchgear, aluminium single bus bar system, rated frequency 50 Hz, 3 phase, 4 wire, operating voltage 415V, rated nominal current 63A, rated short-time withstand current 10 kA – 1 sec, rated peak withstand current 15 kA; degree of protection: external IP 42, internal from IP 2X; form of separation 4b, metal partitioning; entry of cables: top with bus duct for incoming, bottom with cable for outgoing; rear access, painting RAL 7035.
044-LDB-102	Outdoor LDB at Laydown area	
044-LDB-103	Indoor LDB in CRR	
044-LDB-104	Indoor LDB in SS-044 ground floor	
044-LDB-105	Indoor LDB in SS-044 first floor	
044-LDB-106	Indoor LDB in SS-044 second floor	
044-LDB-107	Outdoor LDB at Deluge house	
044-LDB-108	Outdoor LDB at LPG treater unit	
044-LDB-109	Outdoor LDB at recirculation pumps	
044-LDB-110	Outdoor LDB at Deethenizer and Debutanizer area	
044-LDB-111	Outdoor LDB at reactor & regenerator are	
044-LDB-112	Outdoor LDB at Wet Gas Scrubber area	
044-LDB-113	Outdoor LDB at flue gas WH Boiler area	
044-LDB-114	Outdoor LDB street light at piperack (West)	
044-LDB-115	Outdoor LDB street light at piperack (East)	
044-PDB-101	Indoor PDB in SS-044 third floor	Low voltage switchgear, aluminum single bus bar system, rated frequency 50 Hz, 3 phase, 4 wire, operating voltage 415V, rated nominal current 125A, rated short-time withstand current 10 kA – 1 sec, rated peak withstand current 15 kA; degree of protection: external IP 42, internal from IP 2X; form of separation 4b, metal partitioning; entry of cables: top with bus duct for incoming, bottom with cable for outgoing; rear access, painting RAL 7035.
044-PDB-102	Indoor PDB in SS-044 second floor	
044-PDB-103	Indoor PDB in SS-044 first floor	
044-PDB-104	Indoor PDB in SS-044 ground floor	
044-PDB-105	Indoor PDB IN CRR	
044-ELDB-101	Indoor ELDB in SS-044 third floor	Low voltage switchgear, aluminum single bus bar system, rated frequency 50 Hz, 3 phase, 4 wire, operating voltage 415V, rated nominal current 63A, rated short-time withstand current 10 kA – 1 sec, rated peak withstand current 15 kA; degree of protection: external IP 42, internal from IP 2X; form of separation 4b, metal partitioning; entry of cables: top with bus duct for incoming, bottom with cable for outgoing; rear access, painting RAL 7035.
044-ELDB-102	Outdoor ELDB at Laydown area	
044-ELDB-103	Indoor ELDB IN CRR	
044-ELDB-104	Indoor ELDB in SS-044 ground floor	
044-ELDB-105	Indoor ELDB in SS-044 first floor	
044-ELDB-106	Indoor ELDB in SS-044 second floor	
044-ELDB-107	Outdoor ELDB at Deluge house	
044-ELDB-108	Outdoor ELDB at LPG treater unit	
044-ELDB-109	Outdoor ELDB at recirculation pumps	
044-ELDB-110	Outdoor ELDB at Deethenizer and Debutanizer area	
044-ELDB-111	Outdoor ELDB at reactor & regenerator area	
044-ELDB-112	Outdoor ELDB at Wet Gas Scrubber area	
044-ELDB-113	Outdoor ELDB at flue gas WH Boiler area	
044-ELDB-114	Outdoor ELDB street light at piperack (West)	
044-ELDB-115	Outdoor ELDB street light at piperack (East)	

Table 52. Distribution panels description.

4.2.5. DC AND AC UPS

As it has been indicated in the design basis specifications, the substation has 110V AC and DC systems. The battery banks and battery chargers' specifications will be determined. The main description of the equipment is made in the following Table 53.

ITEM	Function	DESCRIPTION
044-UPS-101	110V AC UPS - for critical instrument PRU and OCTOMAX unit (DCS/ESD system)	The UPS shall have redundant scheme with two units with individual bypass for each unit. Copper single busbar system, rated frequency 50 Hz, power incoming 3 phase, 415V, upstream protection MCCB, dual redundant operating conditions, rating 60 kVA, 110VAC, 1 phase; battery-charger with 60 min for autonomy time, and battery banks for each unit; degree of protection IP 42; entry of cables: bottom, with front access; and painting RAL 7035.
044-UPS-102	110V AC UPS - for telecom, CCTV, paging and FDAS system PRU and OCTOMAX unit.	The UPS shall have redundant scheme with two units with individual bypass for each unit. Copper single busbar system, rated frequency 50 Hz, 3 phase, operating voltage 415V, upstream protection MCCB, dual redundant operating conditions, rating 15 kVA, 110VAC, 1 phase; battery-charger with 120 minutes for CCTV & FDAS and 8 hours for Telecom & Paging, for autonomy time respectively; degree of protection IP 42; entry of cables: bottom, with front access; and painting RAL 7035.
044-ACDB-101	Distribution board for UPS-101	Board feeders from AC Distribution Board-ACDB will be switch-fuses and type of remote signal RS485, 110 VAC, 50Hz, 800A, 1PH+N, Cu. Upstream protection MCCB – 800A, interlock between incomers and bus coupler, 2 ATS – Automatic transfer switch; and 4 transformers 110/110V, 60kVA, 1 phase, (2 for each busbar), natural air-cooled, dry type.
044-ACDB-102	Distribution board for UPS-102	Board feeders from AC Distribution Board-ACDB will be switch-fuses and type of remote signal RS485, 110 VAC, 50Hz, 200A, 1PH+N, Cu. Upstream protection MCCB – 200A, interlock between incomers and bus coupler, 2 ATS – Automatic transfer switch; and 4 transformers 110/110V, 15kVA, 1 phase, (2 for each bus bar), natural air-cooled, dry type.
044-DC-101	DC charger for switchgear control	Copper single busbar system, rated frequency 50 Hz, 3 phase, operating voltage 415V, upstream protection MCCB, out power 55 KVA; 2 battery-charger for each UPS with sizing 100%; 2 battery with 60 min for battery life time; type per board feeders from DCDB will be sfu with semiconductor fuses and type of remote signal RS485; degree of protection IP 42; entry of cables: bottom, with front access; and painting RAL 7035.
044-DC-102	DC charger for critical lighting	Copper single busbar system, rated frequency 50 Hz, 3 phase, operating voltage 415V, upstream protection MCCB, out power 10 KVA; 1 battery-charger for each UPS with sizing 100%; 1 battery with 120 min for battery life time; type per board feeders from DCDB will be sfu with semiconductor fuses and type of remote signal RS485; degree of protection IP 42; entry of cables: bottom, with front access; and painting RAL 7035.

Table 53. DC and AC UPS description.

4.2.5.1. Battery and cell characteristics

The Nickel Cadmium battery shall be suitable for float duty operation with a constant voltage permanently applied to its terminals which is sufficient to maintain it in a state close to full charge and shall be designed to supply load in the event of normal power supply failure. The standard rated ampere hour capacity of the battery shall be at a reference temperature of 27°C, constant current discharge at 5 hours rate (C₅) and an end cell voltage of 1,0 V/cell. Ampere hour of the battery shall be selected based with the corrections factor and parameters of design. Number of cells and end cell voltage shall be decided by the vendor based on maximum permissible voltage to the load when batteries are float charged while feeding the load and minimum DC system voltage. The battery shall be suitable for being quick charged to fully charged condition from fully discharged condition within 8 hours. The battery's cell characteristic are summarized in Table 54.

Cell characteristic	Nickel- Cadmium
Rated cell voltage	1.2 V/cell
Minimum cell voltage for A.C. (cell design)	1.0 V/cell
Minimum cell voltage for A.C. (battery bank sizing)	1.16 V/cell
Floating charge voltage (U _{ch})	1.42 V/cell
Capacity reference times	5 hours
Maximum capacity per cell	1000 Ah
Minimum expected life	20 years
Overcharge tolerance	Moderate
Self-discharge in a month	20%
Cycle Life (to 80% of initial capacity)	1500
Operating temperature (discharge only)	-40°C +60°C

Table 54. Battery cell characteristics.

A battery bank is usually composed by:

1. A number of identical cells connected in series to obtain the battery banks voltage.
2. A number of identical size of cells to have the required capacity if the single cell capacity is not enough.

The capacity of a cell in ampere-hours is the same as the capacity in ampere-hours of a single cell. If cells of sufficient large capacity are not available, then two or more strings, of equal number of series connected cells, may be connected to obtain the necessary capacity. The ampere-hour capacity of such a battery string is the sum of the ampere-hour capacities of the strings. The following factors could change the capacity of the battery according to following considerations:

- The available capacity decreases as its temperature decreases.
- The available capacity decreases as the discharge rate increases.
- The minimum specified cell voltage at any time during the battery discharge cycle limits the available capacity.
- The charging method can affect the available capacity.

The number of cells required must be calculated. This number is the highest value resulting by the application of the following equations:

$$N = \frac{U_{min}}{U_{cell}} = \frac{99V}{1.05 V/cell} = 94.29 \cong 95 \text{ Cells}$$

$$U_{max.c} = N \cdot U_{ch} = 95 \cdot 1.47 = 139.65 V > 121V$$

Where,

- N is the number of cells referred to minimum voltage rounded down to next lowest number.
- $U_{max,c} = 121 V$ is the corrected maximum voltage.
- $U_{min} = 99 V$ is the minimum allowable system voltage.
- $U_{ch} = 1.47 V$ is the cell voltage required for satisfactory charging.
- $U_{cell} = 1.05 V/cell$ is the end of discharge voltage, according to cell specifications.

A voltage stabilizer is required distribution bar if both the following equations are met:

$$N_2 \geq N_1$$

$$U_{max.c} \geq U_{max}$$

Therefore, a voltage stabilizer of the AC and DC distribution system is required. In this case the number of cells is 95.

Another battery's aspect that must be considered is the battery duty cycle. This is a time versus current diagram indicating the trend of the current required by the loads in the time during which the battery shall be able to give all the energy necessary to perform the required operations. The current shall be referenced to the voltage of the distribution section of the UPS downstream the switch for AC UPS and DC UPS:

- 044-ACDB-101
- 044-ACDB-102
- 044-DCDB-101
- 044-DCDB-102

The discharge time is in turn divided into shorter periods corresponding to significant variations of the absorbed current. Therefore, one period is defined as the time during which the absorbed current remains constant. If the absorbed load is constant throughout all the period of discharge, the subdivision in shorter periods is no longer necessary.

For the correct application of the sizing procedures stated in the standards IEEE Std 485 and IEEE Std 1115, it is necessary to define the sections of a duty cycle. One section is defined as the sum in time of all the periods from the beginning of the duty cycle and differs from the previous section by adding the time

of the successive period. Therefore, the first section is equal to the first period while the last section corresponds to the whole time of the duty cycle. The time in a duty cycle is indicated in minutes while the current is indicated in ampere. The most common discharge periods are 30 minutes, 60 minutes and 120 minutes.

4.2.5.2. *Correction factors*

The nickel cadmium battery capacity is influenced by temperature, aging, design margin and diversity factors.

4.2.5.2.1. **Temperature factor**

The available capacity of Nickel Cadmium cells is affected both by operating temperature and by the discharge time of each period of the duty cycle. The standard temperature for Nickel Cadmium cell capacity is still +25°C. The capacity of the Nickel Cadmium cells remains constant for temperature above the value of +25°C.

Table 55 lists Nickel Cadmium cell size correction factors T_t for various temperatures less than 25°C in relation to the time of discharge. This value is an estimation according to standard IEEE std. 1115, the correct values of the correction factor T_t for Nickel Cadmium cells are given by the cell manufacturers in their technical documentation. By the other way, it pointed out that the values given by the manufacturer are enough close to the values given by the IEEE standard and, in any case never worst.

Discharge minutes	Temperature in °C									
	-23	-18	-12	-6,7	0	4,4	10	16	21	25
0.02	3,75	2,55	2,05	1,7	1,4	1,2	1,2	1,1	1,1	1
0.08	3,7	2,5	2	1,6	1,4	1,2	1,2	1,1	1,1	1
0.17	3,45	2,4	1,95	1,6	1,4	1,2	1,2	1,1	1,1	1
0.33	3,35	2,37	1,92	1,6	1,3	1,2	1,2	1,1	1,1	1
0.50	3,3	2,35	1,9	1,6	1,3	1,2	1,2	1,1	1,1	1
0.67	3,24	2,31	1,88	1,6	1,3	1,2	1,2	1,1	1,1	1
0.83	3,19	2,28	1,86	1,6	1,3	1,2	1,2	1,1	1,1	1
1	3,15	2,25	1,85	1,6	1,3	1,2	1,2	1,1	1,1	1
2	2,96	2,14	1,77	1,5	1,3	1,2	1,2	1,1	1,1	1
3	2,85	2,08	1,73	1,5	1,3	1,2	1,2	1,1	1,1	1
4	2,77	2,03	1,7	1,5	1,3	1,2	1,2	1,1	1,1	1
5	2,72	2	1,67	1,5	1,3	1,2	1,2	1,1	1,1	1
6	2,67	1,97	1,65	1,5	1,3	1,2	1,2	1,1	1,1	1
7	2,63	1,95	1,64	1,5	1,3	1,2	1,2	1,1	1,1	1
8	2,6	1,93	1,62	1,4	1,3	1,2	1,2	1,1	1,1	1
9	2,57	1,91	1,61	1,4	1,3	1,2	1,2	1,1	1,1	1
10	2,55	1,9	1,6	1,4	1,3	1,2	1,2	1,1	1,1	1
20	2,15	1,67	1,47	1,4	1,2	1,2	1,1	1,1	1	1
30	1,95	1,55	1,4	1,3	1,2	1,2	1,1	1,1	1	1
40	1,82	1,5	1,36	1,3	1,2	1,2	1,1	1,1	1	1

Table 55. Cell temperature correction factor. Source: IEEE-1115.

4.2.5.2.2. Design margin factor

A design capacity margin of 20% shall be foreseen, adding a percentage factor, including provision for improper maintenance, recent discharge conditions, and ambient temperature lower than anticipated, future loads increasing or a combination of these factors.

4.2.5.2.3. Aging factor

Cells performances are relatively stable throughout most of its life but begins to decline with increasing rapidity in its latter stages with the “knee” of its life versus performance curve at 80% of its rated performance. Even though Nickel Cadmium cells main manufacturers recommend neglecting any ageing factor, the standard IEEE-1115 recommends a 1.25 aging factor, which will be considered.

4.2.5.2.4. Diversity Factor

It is a matter of common experience that the simultaneous operation of all installed loads of a given installation never occurs in practice, there is always some degree of diversity, and this fact is taken into account. This factor is defined in IEC 60050 as the ratio of the simultaneous maximum demand of a group of electrical appliances or consumers within a specified period, to the sum of their individual maximum demands within the same period. As per this definition, the value is always ≤ 1 and can be expressed as a percentage. IEC 61439-2 also states that, in the absence of an agreement between the assembly manufacturer (panel builder) and user concerning the actual load currents (diversity factors), the assumed loading of the outgoing circuits of the assembly or group of outgoing circuits may be based on the values indicated in Table 56. The diversity factor to be considered for calculations will be $DF=1$ for motor with power higher than 100kW.

Type of load	Assumed loading factor
Distribution - 2 and 3 circuits	0,9
Distribution - 5 and 5 circuits	0,8
Distribution - 6 and 9 circuits	0,7
Distribution - 10 and more circuits	0,6
Electric actuator	0,2
Motors < 100kW	0,8
Motors > 100kW	1

Table 56. Diversity factor. Source: IEC 61439-2.

4.2.5.3. Sizing of cell and battery bank capacity

In compliance with the sizing methods stated in the standards IEEE std. 1184 and IEEE Std. 1115, it is required to calculate the uncorrected capacity F_s for each section in which the duty cycle is divided. The uncorrected capacity F_s of one section is obtained with the following equation:

$$F_S = \sum_{p=1}^{p=N_p} (A_p - A_{p-1}) \cdot K_t \cdot T_t \cdot t$$

Where,

- F_S is the cell size uncorrected for temperature, aging and design margin.
- S is the section of the duty cycle being analysed.
- N_p is the number of periods in the duty cycle.
- p is the period to be analysed.
- A_p is the value of the amperes required for period p .
- A_{p-1} is the value of amperes required for previous period $p-1$.
- T is the time in minutes from the beginning of period p through the end of section S .
- T_t is the temperature correction factor at t minute, based on electrolyte temperature at the start of the duty cycle.
- K_t is the capacity rating factor for a given cell at the t minute discharge rate, at +25°C, referred to selected end-of-discharge voltage.

Once the calculation is done for each section, the value of maximum uncorrected capacity shall be selected which assumes the function of $\max(F_S)$ in the next section.

The random uncorrected cell capacity is given by the following equation:

$$F_R = A_R \cdot K_t \cdot T_t \cdot t_r$$

Where,

- A_R is the value of amperes required for random load.
- t_r is the time in minutes for the random load.
- T_t is the temperature correction factor at t minute, based on electrolyte temperature at the start of the random load.
- K_t is the capacity rating factor for a given cell at the t minute discharge rate, at +25°C, referred to selected end-of-discharge voltage. This value will be calculated for each case.

The minimum cell size is based on the following equation:

$$F = (\max F_S + F_R) \cdot DM \cdot AF$$

Where,

- $\max F_S$ is the maximum uncorrected cell capacity.
- F_R is the random uncorrected cell capacity.
- DM is the design margin factor.

- AF is the aging factor.

The battery manufacturer declares the battery number of cycles and life in year referred to an ambient temperature of 25°C. In general, the nominal life is 20 years for Nickel Cadmium battery banks.

For temperature lower than 25°C, it is possible to use the function of voltage compensation consisting of monitoring the ambient temperature with an ambient probe and by increasing accordingly the charging voltage. This charging voltage value has not any influence on the calculation of number of cells. For temperature higher than 25°C, the adjusted battery life in years is given by the following equation:

$$L_A = \frac{L_f}{T_1 + \sum_{i=2}^N \frac{100 \times T_i}{K_{fi}}}$$

Where,

- L_f is the battery life in months.
- T_1 is the period in months / year working at a temperature ≤ 25 °C.
- T_i is the (N-1) periods in months / year working at a specific temperature above 25 °C.
- K_{fi} is the correction factor as defined in Table 57.

Ambient temperature	Correction factor
°C	%
25	100
28	91
30	89
33	85
35	80
38	75
40	72
43	69
45	65

Table 57. Correction factor for battery life versus ambient temperature. Source: IEEE-1184

There are three different cases identified for the estimation of the expected life for the batteries.

Case 1:

- First period: 6 months at temperature ≤ 25 °C
- Second period: 3 months at temperature between 25 °C and 30 °C
- Third period: 1 month at temperature between 30 °C and 33 °C
- Fourth period: 1 month at temperature between 33 °C and 35 °C
- Five period: 1 month at temperature between 43 °C and 45 °C

$$L_A = \frac{240}{6 + \frac{100 \cdot 3}{89} + \frac{100 \cdot 1}{85} + \frac{100 \cdot 1}{80} + \frac{100 \cdot 1}{65}} = \frac{240}{13,34} = 18 \text{ years}$$

Case 2 where a conservative and controlled temperature of 25 °C in battery room would maintain a battery life expectancy near of the 20 years (first period with 12 months at temperature ≤ 25 °C). The adjusted battery life in years is as follow: $L_A = \frac{240}{0 + \frac{100 \cdot 12}{100}} = 20 \text{ years}$.

Case 3 where an atypical event occurs.

- First period: 5 months at temperature of 27 °C
- Second period: 1 months at temperature of 30 °C
- Third period: 1 month at temperature of 33 °C
- Fourth period: 2 months at temperature of 35 °C
- Five period: 3 months at temperature of 45 °C

The adjusted battery life in years is as follow:

$$L_A = \frac{240}{\frac{100 \cdot 5}{94,4} + \frac{100 \cdot 1}{89} + \frac{100 \cdot 1}{85} + \frac{100 \cdot 2}{80} + \frac{100 \cdot 3}{65}} = \frac{240}{14,71} = 16,31 \text{ years}$$

To summarize the results obtained for each battery, Table 58 indicates the selected batteries for each DC and AC UPS.

Battery parameters																	
Item	Cell Type	C5 Ah	Hours							Minutes					Seconds		
UPS-101	KBM 580 P	580	59	73	115	187	271	348	476	667	778	857	973	1170	1624	1827	2157
UPS-102	KBM 400 P	400	40	50	79	129	187	240	328	460	537	591	671	807	1120	1260	1487
DC-101	KBM 369 P	369	37	46	73	119	173	221	303	425	495	546	619	745	1033	1163	1372
DC-102	KBM 138 P	138	14	17	27	45	65	83	113	159	185	204	231	278	386	435	513

Table 58. Selected battery cells parameters.

These explained calculations have been followed for the four systems located at the substation: UPS-101, UPS-102, DC-101 and DC-102. The following tables represent the calculations and results obtained. First, the parameters for each item and the expected load current are estimated, according to the client. Secondly, the capacity rating factor is calculated. This factor depends on the rated capacity parameters of the selected battery in Table 58. According to IEEE Std.1115-2000 annex C, K_t factor is the ratio between the current in A and the discharge capacity in Ah. If the desired discharge time is not indicated in the manufacturer's parameters, an interpolation must be done:

$$K_t = K_{t2} \cdot \frac{(K_{t2} - K_{t1}) \cdot (t_2 - t_1)}{(t_2 - t_1)}$$

Once the capacity and the K_t factor are estimated, the final calculation for each battery sizing is done.

4.2.5.3.1. UPS-101 sizing

044-UPS-101 / AC UPS System for DCS/ESD
Redundancy: 100%
Type of redundancy: Dual redundant with individual bypass
Type of UPS: IGBT
Battery Configuration: 2 x 100%
Back-up time: 60 mins
Battery type: Ni – Cd
Battery execution: Single up to 600 Ah, Parallel bank above 600 Ah
Inverter bypass: Through voltage stabilizer
Bypass transfer control: Auto / Manual
Future margin: 20%
UPS output supply: Single phase
UPS distribution system: Each branch circuit shall have fused disconnect switch. The fuse shall be fast clearing type. The largest branch circuit load shall not exceed 25% of the UPS system rating

Table 59. 044-UPS-101 description.

Kt Factor calculation							
Desired discharge time t(h)	Time t1(h)	Time t2(min)	Amperes for t1(h)	Amperes for t2(min)	Factor Kt1 for time t1(min)	Factor Kt2 for time t2(min)	Factor Kt for desired discharge time t1(h)
1	1	-	476	-	-	-	1,218

Capacity calculation				
Section	Loads	Total Ampers (A)	Duration T (h)	Capacity Removed (Ah)
1	L1	687,86	1	687,86
Total capacity in Ah				687,86
Rated capacity in Ah				580

Table 60. 044-UPS-101 Kt factor and rated capacity calculation.

Once the total current required and Kt factor are defined (Table 62 and Table 60), it is possible to estimate the rated capacity of the battery (Table 61) by following the IEEE Std.1115-2000 cell sizing methodology. After calculation, the selected battery for 044-UPS-101 is 1390 Ah.

110V AC UPS calculation															
Ni-Cd CELLS															
PERIOD		LOAD (AMPS)		CHANGE IN LOAD (AMPS)		DURATION OF PERIOD (MIN.)		TIME TO END OF CYCLE (MIN)		CAPACITY FACTOR (KT)		TEMP. CORR. FACTOR		RATED AMP-HOUR (AH)	
														(+) VALUE	(-) VALUE
SECTION 1															
1	A1=	687,86	A1-0=	687,86	M1=	60,00	T=M1=	60,0	1,218	1,0	838,15				
											SUBTOTAL	838,15			
SECTION 1:											TOTAL	838,15			

MAXIMUM SECTION (AH)	838,15
RANDOM SECTION SIZE (AS NOT SPECIFIED, 10% CONSIDERED) (AH)	83,81
UNCORRECTED SIZE (AH)	921,96
DESIGN FACTOR	120%
AGING FACTOR	1,25
TOTAL REQUIRED CELL SIZE (AH)	1382,94
SELECTED BATTERIES (AH)	1390.00

Table 61. 044-UPS-101 cell sizing calculation.

S. NO	RFCC FEEDERS DESCRIPTION	Power (KVA)	Quantity	Total (KVA)	Load factor	Backup time (H)	Section 1
RACK ROOM							
1	System cabinet (DCS)	0,50	6	3,00	100%	1 HOUR	3,00
2	Marshalling cabinet (DCS)	0,40	12	4,80	100%	1 HOUR	4,80
3	System cabinet (ESD)	0,50	4	2,00	100%	1 HOUR	2,00
4	Marshalling cabinet (ESD)	0,40	8	3,20	100%	1 HOUR	3,20
5	System cabinet (GDS)	0,50	1	0,50	100%	1 HOUR	0,50
6	Marshalling cabinet (GDS)	0,40	2	0,80	100%	1 HOUR	0,80
7	MMS cabinet	0,40	6	2,40	100%	1 HOUR	2,40
8	Network cabinet	0,40	4	1,60	100%	1 HOUR	1,60
9	Package cabinet	0,50	3	1,50	100%	1 HOUR	1,50
10	PDB cabinet	0,10	5	0,50	100%	1 HOUR	0,50
OPERATOR ROOM							
1	Operator Console with 24" LED monitor	0,40	2	0,80	100%	1 HOUR	0,80
2	Hard wired console for ESD	0,10	4	0,40	100%	1 HOUR	0,40
3	Operator Console with 24" LED monitor	0,40	5	2,00	100%	1 HOUR	2,00
4	F&G operator console	0,40	3	1,20	100%	1 HOUR	1,20
5	MMS (CMS) console	0,40	1	0,40	100%	1 HOUR	0,40
6	Package console	0,60	3	1,80	100%	1 HOUR	1,80
7	PA console	0,60	1	0,60	100%	1 HOUR	0,60
8	Printers	0,20	2	0,40	100%	1 HOUR	0,40
ENGINEERING ROOM							
1	DCS engineering station	0,24	5	1,20	100%	1 HOUR	1,20
2	ESD engineering station	0,24	5	1,20	100%	1 HOUR	1,20
3	ESD-SOE cabinet	0,20	1	0,20	100%	1 HOUR	0,20
4	Historian engineering station	0,40	1	0,40	100%	1 HOUR	0,40
5	AMS engineering station	0,40	2	0,80	100%	1 HOUR	0,80
6	AMDAS cabinet	0,60	1	0,60	100%	1 HOUR	0,60
7	SOE Station with Printer	0,20	1	0,20	100%	1 HOUR	0,20
RFCC NON DCS							
1	CEMS	1,20	1	1,20	100%	1 HOUR	1,20
2	Nucleonic fonic level transmitter	0,48	1	0,48	100%	1 HOUR	0,48
3	Magnetic flow meter	0,01	1	0,01	100%	1 HOUR	0,01
4	Ultrasonic trasonic flow meter	0,01	4	0,04	100%	1 HOUR	0,04
5	Thermal mass flow meter	0,01	1	0,01	100%	1 HOUR	0,01
OTHERS							
1	Main Air Blower Unit Control Panel-UPS1	5,85	1,00	5,85	1,00	1 HOUR	5,85
2	Main Air Blower Unit Control Panel-UPS2	5,85	1,00	5,85	1,00	1 HOUR	5,85
3	Main Wet Gas Compressor Control Panel-UPS1	5,85	1,00	5,85	1,00	1 HOUR	5,85
4	Main Wet Gas Compressor Control Panel-UPS2	5,85	1,00	5,85	1,00	1 HOUR	5,85
5	Analyzer Transmitter O2	0,02	1,00	0,02	1,00	1 HOUR	0,02
6	Analyzer Transmitter CO	0,02	1,00	0,02	1,00	1 HOUR	0,02
7	Analyzer Transmitter HC	0,00	1,00	0,00	1,00	1 HOUR	0,00
8	CEMS shelter	0,00	1,00	0,00	1,00	1 HOUR	0,00
9	Magnetic Flow meter	0,01	1,00	0,01	1,00	1 HOUR	0,01
10	Magnetic Flow meter	0,01	1,00	0,01	1,00	1 HOUR	0,01
11	Ultrasonic Flow meter	0,02	1,00	0,02	1,00	1 HOUR	0,02
12	Ultrasonic Flow meter	0,02	1,00	0,02	1,00	1 HOUR	0,02
13	Ultrasonic Flow meter	0,02	1,00	0,02	1,00	1 HOUR	0,02
14	Ultrasonic Flow meter	0,02	1,00	0,02	1,00	1 HOUR	0,02
15	Nucleonic Level Transmitter	0,02	1,00	0,02	1,00	1 HOUR	0,02
16	Hydra Step Level Transmitter	0,02	1,00	0,02	1,00	1 HOUR	0,02
17	Hydra Step Level Transmitter	0,02	1,00	0,02	1,00	1 HOUR	0,02
18	Hydra Step Level Transmitter	0,02	1,00	0,02	1,00	1 HOUR	0,02
19	Hydra Step Level Transmitter	0,02	1,00	0,02	1,00	1 HOUR	0,02
20	Hydra Step Level Transmitter	0,02	1,00	0,02	1,00	1 HOUR	0,02
21	LG-1 (Waste Heat Boiler)	0,09	1,00	0,09	1,00	1 HOUR	0,09
22	LG-2 (Waste Heat Boiler)	0,09	1,00	0,09	1,00	1 HOUR	0,09
23	EDLI (Waste Heat Boiler)	0,02	1,00	0,02	1,00	1 HOUR	0,02
24	Soot blower PLC Panel (Waste Heat Boiler)	4,97	1,00	4,97	1,00	1 HOUR	4,97
Total Load (KVA)							63,05
Total Load (VA)							63053,72
Total load with margin factor (KVA)							75664,46
Total Current (A)							687,86
Diversity Factor (DF)							100%
Required Current (A)							687,86

Table 62. 044-UPS-101 loads calculation.

4.2.5.3.2. UPS-102 sizing

044-UPS-102 / AC UPS System for Telecom, CCTV, Paging & FDAS
Redundancy: 100%
Type of redundancy: Dual redundant with individual bypass
Type of UPS: IGBT
Battery Configuration: 2 x 100%
Back-up time: For CCTV & FDAS - 120 mins, For Telecom & Paging - 8 Hours, (Common battery with suitable duty cycle to meet above backup time)
Battery type: Ni – Cd
Battery execution: Single up to 600 Ah, Parallel bank above 600 Ah
Inverter bypass: Through voltage stabilizer
Bypass transfer control: Auto / Manual
Future margin: 20%
UPS output supply: Single phase
UPS distribution system: Each branch circuit shall have fused disconnect switch. The fuse shall be fast clearing type. The largest branch circuit load shall not exceed 25% of the UPS system rating.

Table 63. 044-UPS-102 description.

S. NO	RFCC FEEDERS DESCRIPTION	Power (KVA)	Quantity	Total (KVA)	Load Factor	Backup time (H)	Period T1 (to 120 min)	Period T2 (to 120 min)
1	CCTV CABINET	2,00	1,00	2,00	1,00	2 HOUR	2,00	0
2	PA CABINET - COMMON	2,00	1,00	2,00	1,00	2 HOUR	2,00	0
3	BFAP CABINET - COMMON	2,00	1,00	2,00	1,00	2 HOUR	2,00	0
4	CCTV PANEL SUB STATION	2,00	1,00	2,00	1,00	2 HOUR	2,00	0
5	TELECOM & PAGA PANEL SUBSTATION	2,00	1,00	2,00	1,00	8 HOUR	2,00	2,00
6	FIRE ALARM PANEL SUBSTATION	2,00	1,00	2,00	1,00	2 HOUR	2,00	0
Total Load in KVA							12,00	2,00
Total Load in VA							12000,00	2000,00
Total load with margin factor (KVA)							14400,00	2400,00
Total Current (A)							130,91	21,82
Diversity Factor (DF)							100%	100%
Required Current (A)							130,91	21,82

Table 64. 044-UPS-102 loads calculation.

Kt Factor calculation							
Desired discharge time t(h)	Time t1(h)	Time t2(min)	Amperes for t1(h)	Amperes for t2(min)	Factor Kt1 for time t1(min)	Factor Kt2 for time t2(min)	Factor Kt for desired discharge time t1(h)
8	8	-	50	-	-	-	8,000
6	8	5	50	79,3	8	5,04	6,029
2	2	-	187	-	-	-	2,139

Capacity calculation				
Period	Loads	Total Ampers (A)	Duration T (min)	Capacity Removed (Ah)
1	L1	130,91	120	261,82
2	L2	21,82	360	130,91
Total capacity in Ah				392,73
Rated capacity in Ah				400

Table 65. 044-UPS-102 Kt factor and rated capacity calculation.

Once the total current required and Kt factor are defined (Table 64 and Table 65), it is possible to estimate the rated capacity of the battery (Table 66) by following the IEEE Std.1115-2000 cell sizing methodology. After calculation, the selected battery for UPS-102 is 650 Ah.

110V AC UPS calculation												
Ni-Cd CELLS												
PERIOD	LOAD (AMPS)		CHANGE IN LOAD (AMPS)		DURATION OR PERIOD (MIN.)		TIME TO END OF CYCLE (MIN)		CAPACITY FACTOR (KT)	TEMP. CORR. FACTOR	RATED AMP-HOUR (AH)	
											(+) VALUE	(-) VALUE
SECTION1-FIRST PERIOD ONLY-IF A2 GREATER THAN A1, GO TO SECTION2												
1	A1=	130,91	A1-0=	130,91	M1=	120,00	T=M1=	120,00	2,139	1	280,02	-
										SUBTOTAL	280,02	-
SECTION 1:										TOTAL	280,02	
SECTION2-FIRST TWO PERIOD ONLY-IF A3 GREATER THAN A2, GO TO SECTION3												
1	A1=	130,91	A1-0=	130,91	M1=	120,00	T=M1+M2=	480,0	8,000	1	1047,27	-
2	A2=	21,82	A2-A1=	-109,09	M2=	360,00	T=M2=	360,0	6,029	1	-	-657,76
										SUBTOTAL	1047,27	-657,76
SECTION 2:										TOTAL	389,52	

MAXIMUM SECTION (AH)	389,5
RANDOM SECTION SIZE (AS NOT SPECIFIED, 10% CONSIDERED) (AH)	39,0
UNCORRECTED SIZE (AH)	428,5
DESIGN FACTOR	120%
AGING FACTOR	1,3
REQUIRED CELL SIZE (AH)	642,70
SELECTED BATTERY (AH)	650,0

Table 66. 044-UPS-102 cell sizing calculation.

4.2.5.3.3. DC-101 sizing

044-DC-101 / Switchgear Control
Voltage: 110V DC
System configuration: Parallel redundant
Battery Configuration: 2 x 100%
Battery Type: Ni-Cd
Battery backup time: 60 minutes
Future margin: 20%

Table 67. 044-DC-101 description.

Kt Factor calculation							
Desired discharge time	Time t1(min)	Time t2(min)	Amperes for t1(min)	Amperes for t2(min)	Factor Kt1 for time t1(min)	Factor Kt2 for time t2(min)	Factor Kt for desired discharge time t1(h)
60	60	-	303	-	1,218	-	1,218
59	60	30	303	425	1,218	0,868	1,206
58	60	30	303	425	1,218	0,868	1,195
1	1,0	-	1033	-	0,357	-	0,357

Capacity calculation				
Period	Loads	Total Ampers (A)	Duration T(min)	Capacity Removed (Ah)
1	L1	190,03	1	3,17
2	L2	363,11	58	351,00
3	L3	190,03	1	3,17
Total capacity in Ah				357,34
Rated capacity in Ah				369

Table 68. 044-DC-101 Kt factor and rated capacity calculation.

BOARD NO.	TYPE OF FEEDER	Quantity	Load Values (W)															T1 Load (first min.)	T2 Load (2 min. to 59 min.)	T3 Load (Last Min)
			CB SPRING MOTOR	CLOSE COIL-1	TRIP COIL-1	TRIP COIL-2	MAIN RELAY	64R	51G	86	87	AUX RELAY	ANNUNCIATOR	LED	HOUR METER	MAIN RELAY2	ETHERNET SWITCH			
PMCC-101	IC	2	140	33	33	33	18	6	6	12	18	60	15	8	-	-	28	820	342	820
	BC	1	140	33	33	33	18	-	-	12	18	50	-	8	-	-	-	345	106	345
	OG TRAF0/ACB	4	140	33	33	33	18	-	-	12	18	50	-	8	-	-	-	1380	424	1380
	OG MOTOR	14	140	33	33	33	18	-	-	12	-	40	15	8	1	-	-	4662	1316	4662
PMCC-102	IC	2	140	33	33	33	18	6	6	12	18	40	15	8	-	-	28	780	302	780
	BC	1	140	33	33	33	18	-	-	12	18	50	-	8	-	-	-	345	106	345
	OG TRAF0/ACB	4	140	33	33	33	18	-	-	12	18	50	-	8	-	-	-	1380	424	1380
	OG MOTOR	18	140	33	33	33	18	-	-	12	-	40	15	8	1	-	28	6498	2196	6498
PMCC-103	IC	2	140	33	33	33	18	6	6	12	18	40	15	8	-	-	-	724	246	724
	BC	1	140	33	33	33	18	-	-	12	18	50	-	8	-	-	-	345	106	345
	OG TRAF0/ACB	13	140	33	33	33	18	-	-	12	18	50	-	8	-	-	-	4485	1378	4485
	OG MOTOR	19	140	33	33	33	18	-	-	12	-	40	15	8	1	-	-	6327	1786	6327
EPMCC-101	IC	3	140	33	33	33	18	6	6	12	-	40	15	8	-	-	28	1116	399	1116
	OG TRAF0/ACB	2	140	33	33	33	18	6	6	12	18	40	15	8	-	-	-	724	246	724
	OG MOTOR	48	140	-	33	33	18	-	-	12	-	40	15	8	1	-	-	14400	4512	14400
MCC-101	IC	2	140	33	33	33	18	6	6	12	-	40	15	8	-	-	28	744	266	744
	BC	1	140	33	33	-	18	-	-	6	-	60	-	6	-	-	-	296	90	296
	OG TRAF0/ACB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0
	OG MOTOR	42	-	-	-	-	18	-	-	6	-	20	15	8	1	18	28	4788	4788	4788
MCC-102	IC	2	140	33	33	33	18	6	6	12	-	40	15	8	-	-	-	688	210	688
	BC	1	140	33	33	-	18	-	-	6	-	60	-	6	-	-	-	296	90	296
	OG TRAF0/ACB	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0
	OG MOTOR	19	-	-	-	-	18	-	-	6	-	20	15	8	1	18	-	1634	1634	1634
MCC-103	IC	2	140	33	33	33	18	6	6	12	-	40	15	8	-	-	28	744	266	744
	BC	1	140	33	33	33	18	-	-	6	-	60	-	6	-	-	-	329	90	329
	OG TRAF0/ACB	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0
	OG MOTOR	19	-	-	-	-	18	-	-	6	-	20	15	8	1	18	-	1634	1634	1634
MCC-104	IC	2	140	33	33	33	18	6	6	12	-	40	15	8	-	-	28	744	266	744
	BC	1	140	33	33	-	18	-	-	6	-	60	-	6	-	-	-	296	90	296
	OG TRAF0/ACB	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0
	OG MOTOR	23	-	-	-	-	18	-	-	6	-	20	15	8	1	18	-	1978	1978	1978
MCC-105	IC	2	140	33	33	33	18	6	6	12	-	40	15	8	-	-	28	744	266	744
	BC	1	140	33	33	-	18	-	-	6	-	60	-	6	-	-	-	296	90	296
	OG TRAF0/ACB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0
	OG MOTOR	19	-	-	-	-	18	-	-	6	-	20	15	8	1	18	-	1634	1634	1634
MCC-106	IC	2	140	33	33	33	18	6	6	12	-	40	15	8	-	-	28	744	266	744
	BC	1	140	33	33	-	18	-	-	6	-	60	-	6	-	-	-	296	90	296
	OG TRAF0/ACB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0
	OG MOTOR	28	-	33	-	-	18	-	-	6	-	20	15	8	1	18	-	3332	2408	3332
33kV GIS	IC	2	140	33	33	33	18	6	6	12	18	40	15	8	-	-	28	780	302	780
	BC	1	140	33	33	33	18	-	-	12	18	50	-	8	-	-	-	345	106	345
	OG TRAF0	8	140	33	33	-	18	-	-	12	18	50	-	8	-	-	-	2496	848	2496
11kV AIS	IC	1	140	33	33	33	18	6	6	12	18	40	15	8	-	-	28	390	151	390
	OG TRAF0	3	140	33	33	-	18	-	-	12	18	50	-	8	-	-	-	936	318	936
6.6kV - AIS 101	IC	2	140	33	33	33	18	6	6	12	18	40	15	8	-	-	28	780	302	780
	BC	2	140	33	33	33	18	-	-	12	18	50	-	8	-	-	-	690	212	690
	OG TRAF0	15	140	33	33	-	18	-	-	12	18	50	-	8	-	-	-	4680	1590	4680
	OG MOTOR	23	140	33	33	33	18	-	-	12	-	40	15	8	1	-	-	7659	2162	7659
6.6kV - AIS 102	IC	3	140	33	33	33	18	6	6	12	18	40	15	8	-	-	28	1170	453	1170
	OG TRAF0	2	140	33	33	-	18	-	-	12	18	50	-	8	-	-	-	624	212	624
	OG MOTOR	3	140	33	33	33	18	-	-	12	-	40	15	8	1	-	-	999	282	999
Total Load (W)														87097	36983	87097				
Total load with margin factor (W)														104516,4	44379,6	104516,4				
Total Current (A)														950,149	403,451	950,149				
Diversity Factor (DF)														20%	90%	20%				
Required Current (A)														190,030	363,106	190,030				

Table 69. 044-DC-101 loads calculation.

Once the total current required and Kt factor are defined (Table 69 and Table 68), it is possible to estimate the rated capacity of the battery (Table 70) by following the IEEE Std.1115-2000 cell sizing methodology. After calculation, the selected battery for UPS-102 is 723 Ah.

110V DC UPS												
Ni-Cd CELLS												
PERIOD	LOAD (AMPS)		CHANGE IN LOAD (AMPS)		DURATION OF PERIOD (MIN.)		TIME TO END OF CYCLE (MIN)		CAPACITY FACTOR (KT)	TEMP. CORR. FACTOR	RATED AMP-HOUR (AH)	
											(+) VALUE	(-) VALUE
SECTION1-FIRST PERIOD ONLY-IF A2 GREATER THAN A1, GO TO SECTION2												
1	A1=	190,03	A1-0=	190,03	M1=	1,00	T=M1=	1,00	0,357	1	67,88	-
										SUBTOTAL	67,88	-
SECTION 1:										TOTAL	67,88	
SECTION2-FIRST TWO PERIOD ONLY-IF A3 GREATER THAN A2, GO TO SECTION3												
1	A1=	190,03	A1-0=	190,03	M1=	1,00	T=M1+M2=	59,0	1,206	1	229,21	-
2	A2=	363,11	A2-A1=	173,08	M2=	58,00	T=M2=	58,0	1,195	1	206,74	-
										SUBTOTAL	435,95	-
SECTION 2:										TOTAL	435,95	
SECTION3-FIRST THREE PERIOD ONLY-												
1	A1=	190,03	A1-0=	190,03	M1=1	1,00	T=M1+M2+M3=60	60,00	1,218	1	231,42	-
2	A2=	363,11	A2-A1=	173,08	M2=58	58,00	T=M2+M3=59	59,00	1,206	1	208,76	-
3	A3=	190,03	A3-A2=	-173,08	M3=1	1,00	T=M3=1	1,00	0,357	1	-	-61,82
										SUBTOTAL	440,18	-61,82
SECTION 3 :										TOTAL	378,36	

MAXIMUM SECTION (AH)	435,95
RANDOM SECTION SIZE (AS NOT SPECIFIED, 10% CONSIDERED) (AH)	43,6
UNCORRECTED SIZE (AH)	479,5
DESIGN FACTOR	120%
AGING FACTOR	1,25
REQUIRED CELL SIZE (AH)	719,3
SELECTED BATTERY (AH)	723,0

Table 70. 044-DC-101 cell sizing calculation.

4.2.5.3.4. DC-102 sizing

044-DC-102 / Critical Lighting
D.C. loads critical lighting system.
Voltage: 110V DC
System configuration: Non-redundant
Battery Configuration: 1 x 100%
Battery Type: Ni-Cd
Battery backup time: 120 minutes
Future margin: 20%

Table 71. 044-DC-102 description.

S. NO	RFCC FEEDERS DESCRIPTION	Power (KVA)	QUANTITY	TOTAL (KVA)	LOAD FACTOR	BACKUP TIME (H)	Period T1 (to 120 min)
1	PROCESS AREA CLDB-1	1,00	1,00	1,00	1,00	2 HOUR	1,00
2	PROCESS AREA CLDB-2	1,00	1,00	1,00	1,00	2 HOUR	1,00
3	PROCESS AREA CLDB-3	1,00	1,00	1,00	1,00	2 HOUR	1,00
4	SUBSTATION CLDB-1	1,00	1,00	1,00	1,00	2 HOUR	1,00
5	SUBSTATION CLDB-2	1,00	1,00	1,00	1,00	2 HOUR	1,00
6	CONTROL ROOM CLDB-1	1,00	1,00	1,00	1,00	2 HOUR	1,00
Total Load in KVA							6,00
Total Load in VA							6000,00
Total load with margin factor (KVA)							7200,00
Total Current (A)							65,45
Diversity Factor (DF)							100%
Required Current (A)							65,45

Table 72. 044-DC-102 loads calculation.

Kt Factor calculation							
Desired discharge time t(h)	Time t1(h)	Time t2(min)	Amperes for t1(h)	Amperes for t2(min)	Factor Kt1 for time t1(min)	Factor Kt2 for time t2(min)	Factor Kt for desired discharge time t1(h)
2	2	-	64,6	-	-	-	2,136

Capacity calculation				
Period	Loads	Total Ampers (A)	Duration T (h)	Capacity Removed (Ah)
1	L1	65,45	2	130,91
Total capacity in Ah				130,91
Rated capacity in Ah				138

Table 73. 044-DC-101 Kt factor and rated capacity calculation.

Once the total current required and Kt factor are defined (Table 72 and Table 73), it is possible to estimate the rated capacity of the battery (Table 74) by following the IEEE Std.1115-2000 cell sizing methodology. After calculation, the selected battery for UPS-102 is 723 Ah.

110V DC UPS												
Ni-Cd CELLS												
PERIOD	LOAD (AMPS)		CHANGE IN LOAD (AMPS)		DURATION OF PERIOD (MIN.)		TIME TO END OF CYCLE (MIN)		CAPACITY FACTOR (KT)	TEMP. CORR. FACTOR	RATED AMP-HOUR (AH)	
											(+) VALUE	(-) VALUE
SECTION1-FIRST PERIOD ONLY-IF A2 GREATER THAN A1, GO TO SECTION2												
1	A1=	65,45	A1-0=	65,45	M1=	120,00	T=M1=	120,00	2,136	1	139,83	-
										SUBTOTAL	139,83	
SECTION 1:										TOTAL	139,83	

MAXIMUM SECTION (AH)	139,8
RANDOM SECTION SIZE (AS NOT SPECIFIED, 10% CONSIDERED) (AH)	14,0
UNCORRECTED SIZE (AH)	153,8
DESIGN FACTOR	120%
AGING FACTOR	1,3
REQUIRED CELL SIZE (AH)	230,7
SELECTED BATTERY (AH)	231

Table 74. 044-DC-102 cell sizing calculation.

4.2.6. CAPACITOR BANK

The power factor (PF) is the ratio between the active power (W) and the apparent power (VA), and this is determined by the type of loads connected to the installation. Excessive reactive energy means a risk for electrical installations, due to the appearance of harmonics, for which it is required to compensate it through capacitor banks.

For the design of the capacitor bank, first of all, we will carry out a study of the loads connected to the 044-HT6-101 panel, the procedure will be as follows:

1. Load study and calculation, without capacitor bank. (Table 81)
2. Compensation calculation: two methods are used.
3. Load study and calculation, with capacitor bank. (Table 82)

In order to fulfill with the project requirements, it is assumed the followings statements:

- Powers in the loads, continuous, intermittent and reserve will be multiplied by a factor.
- It's a condition of design a power factor improvement up to 0.98.
- 20% spare for future margin.

4.2.6.1. Compensation calculation

A) Fixed compensation for each transformer

The required power consumed by a transformer is Q_{tr} , and is calculated as follows:

$$Q_{tr} = U_{cc} \cdot \left(\frac{S}{S_n} \right)^2 \cdot S_n$$

Where:

- S_n is the transformer rated power (kVA).
- U_{cc} is the impedance of transformer in % according to requirements.
- S is the transformer load (kVA), based on the load flow calculation results.

The calculation results for each transformer are indicated on the following Table 75:

Fixed compensation for each transformer				
ID	Sn	Ucc (%)	Transformer Total Load (kVA)	Qtr (kVar)
044-TR-102 A	2500	8,5	2023,44	139,21
044-TR-102 B				
044-TR-103 A	2500	8,5	1941,08	128,11
044-TR-103 B				
044-TR-104 A	2500	8,5	2128,77	154,08
044-TR-104 B				
044-TR-105 A	1600	6,25	1025,02	41,04
044-TR-105 B				
Total Qtr				462,43

Table 75. Transformers compensation load calculation.

B) Load consumption compensation

The vectorial diagram shows the relation between reactive power factor, $\cos \varphi$ target.

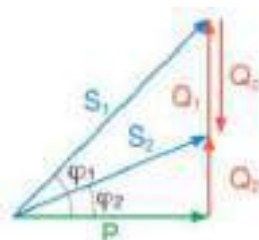


Figure 4. Vectorial diagram of the power factor. Source: IEEE Std.141

The following equations will be used to compute the power factor improvement:

$$Q_c = 1.2 \cdot P \cdot (\tan(\arccos \varphi_1) - \tan(\arccos \varphi_2))$$

Where,

- Q_c is the required capacity of power capacitor [kVAr].
- P is the electrical power consumption [kW].
- 1.2 for 20% future spare.
- $\cos \varphi_1$ is the cosine value corresponding to initial power factor.
- $\cos \varphi_2$ is the cosine value corresponding to desired power factor.

As already mentioned, the desired power factor for the system is 0.98. The real power factor is calculated as $\cos \varphi_1 = \frac{P_{KW}}{S_{KVA}}$ of HT6-101 switchboard. The total compensation will be the addition of the load and transformers' compensations. As there will be two capacitors' banks, the compensation is divided by two. The results are summarized in Table 76:

Total compensation calculation	
Desired cos fi	0,98
Real cos fi	0,85417
Desired fi in radians	0,200
Real fi in radians	0,547
Total Q_c (kVar)	4018,093
Total $Q_c + Q_{tr}$ (kVAr)	4480,523
Required Capacity rating per equipment (kVAr)	2240,262

Table 76. Total compensation calculation for capacitors banks.

C) Compensation calculation applying IEEE-141

Another method for the calculation of the load consumption compensation is by applying the IEEE Std. 141. By using the following Table 77, we will calculate the reactive power that we need to achieve a power factor of 0.98. The calculation is as follows, first on the horizontal axis we locate the power factor we want to achieve, and in the same way on the vertical axis we locate the power factor of our system. As we already know from previous calculations: $\cos \varphi_1$ (corresponding to before compensation) = 0.85417 and $\cos \varphi_2$ (corresponding to after compensation) = 0.98.

Desired power factor in percent																					
Original power factor	0.80	0.81	0.82	0.83	0.84	0.85	0.86	0.87	0.88	0.89	0.90	0.91	0.92	0.93	0.94	0.95	0.96	0.97	0.98	0.99	1.0
0.50	0.982	1.008	1.034	1.060	1.086	1.112	1.138	1.165	1.192	1.220	1.248	1.276	1.306	1.337	1.369	1.403	1.440	1.481	1.529	1.589	1.732
0.52	0.893	0.919	0.945	0.971	0.997	1.023	1.050	1.076	1.103	1.131	1.159	1.187	1.217	1.248	1.280	1.314	1.351	1.392	1.440	1.500	1.643
0.54	0.809	0.835	0.861	0.887	0.913	0.939	0.966	0.992	1.019	1.047	1.075	1.103	1.133	1.164	1.196	1.230	1.267	1.308	1.356	1.416	1.559
0.56	0.730	0.756	0.782	0.808	0.834	0.860	0.887	0.913	0.940	0.968	0.996	1.024	1.054	1.085	1.117	1.151	1.188	1.229	1.277	1.337	1.480
0.58	0.655	0.681	0.707	0.733	0.759	0.785	0.812	0.838	0.865	0.893	0.921	0.949	0.979	1.010	1.042	1.076	1.113	1.154	1.202	1.262	1.405
0.60	0.583	0.609	0.635	0.661	0.687	0.713	0.740	0.766	0.793	0.821	0.849	0.877	0.907	0.938	0.970	1.004	1.041	1.082	1.130	1.190	1.333
0.62	0.516	0.542	0.568	0.594	0.620	0.646	0.673	0.699	0.726	0.754	0.782	0.810	0.840	0.871	0.903	0.937	0.974	1.015	1.063	1.123	1.266
0.64	0.451	0.474	0.500	0.525	0.551	0.581	0.608	0.634	0.661	0.689	0.717	0.745	0.775	0.806	0.838	0.872	0.909	0.950	0.998	1.068	1.201
0.66	0.388	0.414	0.440	0.466	0.492	0.518	0.545	0.571	0.598	0.626	0.654	0.682	0.712	0.743	0.775	0.809	0.846	0.887	0.935	0.995	1.128
0.68	0.328	0.354	0.380	0.406	0.432	0.458	0.485	0.511	0.538	0.566	0.594	0.622	0.652	0.683	0.715	0.749	0.786	0.827	0.875	0.935	1.078
0.70	0.270	0.296	0.322	0.348	0.374	0.400	0.427	0.453	0.480	0.508	0.536	0.564	0.594	0.625	0.657	0.691	0.728	0.769	0.817	0.877	1.020
0.72	0.214	0.240	0.266	0.292	0.318	0.344	0.371	0.397	0.424	0.452	0.480	0.508	0.538	0.569	0.601	0.635	0.672	0.713	0.761	0.821	0.964
0.74	0.159	0.185	0.211	0.237	0.263	0.289	0.316	0.342	0.369	0.397	0.425	0.453	0.483	0.514	0.546	0.580	0.617	0.658	0.706	0.766	0.909
0.76	0.105	0.131	0.157	0.183	0.209	0.235	0.262	0.288	0.315	0.343	0.371	0.399	0.429	0.460	0.492	0.526	0.563	0.604	0.652	0.712	0.855
0.78	0.052	0.078	0.104	0.130	0.156	0.182	0.209	0.235	0.262	0.290	0.318	0.346	0.376	0.407	0.439	0.473	0.510	0.551	0.599	0.659	0.802
0.80	0.000	0.026	0.052	0.078	0.104	0.130	0.157	0.183	0.210	0.238	0.266	0.294	0.324	0.355	0.387	0.421	0.458	0.499	0.547	0.609	0.750
0.82		0.000	0.026	0.052	0.078	0.105	0.131	0.158	0.186	0.214	0.242	0.272	0.303	0.335	0.369	0.406	0.447	0.493	0.555	0.698	
0.84			0.000	0.026	0.053	0.079	0.106	0.134	0.162	0.190	0.220	0.251	0.283	0.317	0.354	0.395	0.443	0.503	0.646		
0.86						0.000	0.026	0.053	0.081	0.109	0.137	0.167	0.198	0.230	0.264	0.301	0.342	0.390	0.450	0.593	
0.88							0.000	0.028	0.056	0.084	0.114	0.145	0.177	0.211	0.248	0.289	0.337	0.397	0.540		
0.90								0.000	0.028	0.058	0.089	0.121	0.155	0.192	0.233	0.281	0.341	0.404			
0.92									0.000	0.031	0.063	0.097	0.134	0.175	0.223	0.283	0.346				
0.94										0.000	0.034	0.071	0.112	0.160	0.220	0.283					
0.96											0.000	0.041	0.089	0.149	0.212						
0.98												0.000	0.050	0.203							

Table 77. Power factor improvement KVar. Source: IEEE Std.141.

Once the data is located, we will proceed to carry out the following operation.

$$Q_c = 1.2 \cdot P \cdot F$$

Where:

- Qc is the required capacity of power capacitor [kVar]
- 1.2 for 20% future spare.
- P is the electrical power consumption [kW], according to the load flow calculations without capacitor banks.
- F is the factor obtained in table desired power factor in percent.

In our case, our power factor value is between 0.86 and 0.88, therefore, to reach a value closer to reality, we will interpolate for a value of 0.8684.

0.86	0.390
0.85417	0.4054
0.88	0.337

Table 78. Interpolation of the power factor improvement.

In this case, the final required capacity will be:

$$Q_c = 9904.07 \cdot 1.2 \cdot 0.4054 = 4015.49 \text{ kVar}$$

The total compensation will be the addition of both load and transformers' compensations. Results are summarized in Table 79. The final capacity of the capacitor banks that will be used is 2400 kVar.

Total Compensation	
Total Qc (kVar)	4015,49
Total Qc+Qtr (kVAr)	4477,92
Required Capacity rating per equipment (kVAr)	2238,96

Table 79. Required capacity rating for capacitors banks.

4.2.6.2. Nominal characteristics calculation

A) Overvoltage

The system voltage variation is $\pm 6\%$. Therefore, as a 6% series reactor is used, the total over voltage will be 12%. Capacitor bank shall be designed for 112% of the rated system voltage.

Capacitor bank impedance:

$$X_C = \frac{V_r^2}{Q_C} = \frac{(6.6)^2}{2240.26 \cdot 0.001} = 19.85 \Omega$$

Where,

- Q_C is the capacitor size in MVar.
- V_r is the capacitor's voltage in kV.

The total impedance $X_{C_{new}}$ including 6% impedance of series reactor is:

$$X_{C_{new}} = \frac{X_C}{1 - 0.06} = \frac{19.85}{1 - 0.06} = 21.12 \Omega$$

Finally, the capacitor bank $Q_{C_{new}}$ capacity with a 12% over voltage will be:

$$Q_{C_{new}} = \frac{(1.12 \cdot V_r)^2}{X_{C_{new}}} = \frac{(1.12 \cdot 6.6)^2}{21.12} = 2641.57 \text{ kVAr} \quad \text{at 112\% of system voltage}$$

B) Reactive power steps

Table 80 below determines the reactive power to be supplied by the 044-CB-101A and 044-CB-101B capacitor bank per step. The capacitor bank (voltage 6.6kV $\pm 6\%$ and 2400 kVAr per bar) will have 4 steps, each step with 25% capacity). As a result, 1st, 2st, 3st and 4st step will be 600k kVAr.

STEP	% CAPACITY	KVAR
1	25	600
2	25	600
3	25	600
4	25	600
TOTAL	100	2400

Table 80. Reactive Power Steps for 044-CB-101A and 044-CB-101B

4.2.6.3. Filter reactor design

The reduction of the dominant harmonics depends on the degree of tuning of the filter. The connection of a capacitor bank will produce a resonance close to the harmonics of greater amplitude, for example 5th, for which the amplification of harmonic voltages and currents could be inadmissible. A series reactor is included. These are filters tuned at a frequency lower than the lowest order harmonic (5th) with amplitude significantly in the network. The network with characteristic harmonics of order 5, 7, 11, 13 ... the chosen frequency is between 75% and 90% of the frequency of the harmonic of order 5. The typical tuning values for the 50 Hz network correspond to the frequency of 189 Hz and 215 Hz. This will avoid the risk of resonance as well as absorb a 5th harmonic, even if it is in a reduced percentage. The inductive reactance X_{LH} of the reactor is calculated. H is the 3.78 order harmonic, which is a 189 Hz frequency.

$$X_{LH} = \frac{X_C}{H^2} = \frac{19.85}{3.78^2} = 1.3894 \, \Omega$$

The rms current through the reactor is the rms sum of all the harmonic currents that will pass through it. This includes not only the harmonic to which it is tuned, but also that portion of the other harmonics that will be absorbed in the filter. I_1 is the current that passes through the reactor and $I_{3.78}$ is the absorbed current by the filter.

$$I_1 = \frac{V_{L-N}}{X_C - X_{LH}} = \frac{\frac{6.996 \cdot 1000}{\sqrt{3}}}{19.8528 - 1.3894} = 208.53 \, A$$

$$I_{3.78} = \frac{1}{H} \frac{kW_{Load}}{\sqrt{3} V_L} = \frac{1}{3.78} \cdot \frac{9904.07}{\sqrt{3} \cdot 6.996} = 226.83 \, A \quad \text{of } 3.78^{th} \text{ harmonic}$$

$$I_{rms} = \sqrt{I_1^2 + I_{3.78}^2} = \sqrt{208.53^2 + 226.83^2} = 308.124 \, A$$

The characteristic reactance X_n and effective filter size Q_{Filter} are:

$$X_n = \sqrt{X_{LH} \cdot X_C} = \sqrt{1.3894 \cdot 19.8528} = 5.252 \, \Omega$$

$$Q_{Filter} = \frac{V^2}{X_C - X_{LH}} = \frac{6.996^2}{19.8528 - 1.3894} = 2.4 \, MVar$$

The voltage in the capacitor will be:

$$V_C = \frac{H^2}{H^2 - 1} V_{bus} = \frac{3.78^2}{3.78^2 - 1} \cdot 6900 = 7522.47 \, V$$

The rated voltage of the capacitor bank will be provided by the manufacturer, and it should be great that the voltage in capacitor calculated.

 							ELECTRICAL LOAD CALCULATIONS																							
PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPech” (J-18)						SWITCHBOARD 044-HT6-101 WITHOUT CAPACITOR BANK																							
CLIENT:	INDIAN OIL CORPORATION LIMITED																													
ITEM	LOAD DESCRIPTION	LOAD TYPE	LOAD SERVICE	SCHEME TYPE	FED FROM	BUSBAR	RATED VOLTAGE (V)	N° PH	LOAD DUTY	SIMULTANEITY FACTOR	ABSORBED MECHANIC POWER (KW)	MOTOR RATED POWER (KW)	LOAD FACTOR	EFFICIENCY at rated load	EFFICIENCY at operating load	POWER FACTOR at rated load	POWER FACTOR at operating load	RATED CONSUMED ELECTRICAL LOAD		OPERATING CONUMED ELECTRICAL LOAD										
A	B	C	D	E	F	G	H	I	J	K	L	M	N=L/M	O	P	Q	R	S=M/O	T=S/Q	U=L/P	V	KVA								
1803-PM-101 A	HOT FRESH FEED PUMPS	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS A	6600	3PH	C	100	197,9	225	0,880	0,942	0,938	0,890	0,890	238,85	268,37	210,98	108,09	237,06								
1803-PM-101 B	HOT FRESH FEED PUMPS	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS B	6600	3PH	S	10	197,9	225	0,880	0,942	0,938	0,890	0,890	238,85	268,37	210,98	108,09	237,06								
1803-PM-202 A	LCO PUMPAROUND PUMP	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS A	6600	3PH	C	100	244,0	290	0,841	0,936	0,933	0,840	0,817	309,83	368,84	261,53	184,45	320,04								
1803-PM-202 B	LCO PUMPAROUND PUMP	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS B	6600	3PH	C	100	244,0	290	0,841	0,936	0,933	0,840	0,817	309,83	368,84	261,53	184,45	320,04								
1803-PM-202 C	LCO PUMPAROUND PUMP	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS B	6600	3PH	S	10	244,0	290	0,841	0,936	0,933	0,840	0,817	309,83	368,84	261,53	184,45	320,04								
1803-PM-204 A	HCO PUMPAROUND PUMP	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS A	6600	3PH	C	100	169,0	210	0,805	0,930	0,928	0,830	0,806	225,81	272,06	182,19	133,80	226,04								
1803-PM-204 B	HCO PUMPAROUND PUMP	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS A	6600	3PH	C	100	169,0	210	0,805	0,930	0,928	0,830	0,806	225,81	272,06	182,19	133,80	226,04								
1803-PM-204 C	HCO PUMPAROUND PUMP	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS B	6600	3PH	S	10	169,0	210	0,805	0,930	0,928	0,830	0,806	225,81	272,06	182,19	133,80	226,04								
1803-PM-205 A	MAIN FRACTIONATOR BOTTOM PUMP	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS A	6600	3PH	S	10	482,0	550	0,876	0,952	0,955	0,850	0,845	577,73	679,68	504,71	319,41	597,29								
1803-PM-205 B	MAIN FRACTIONATOR BOTTOM PUMP	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS B	6600	3PH	C	100	482,0	550	0,876	0,952	0,955	0,850	0,845	577,73	679,68	504,71	319,41	597,29								
1803-PM-213 A	DEETHANIZER STRIPPER CHARGE PUMP	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS A	6600	3PH	S	10	232,6	250	0,930	0,930	0,926	0,830	0,808	268,82	323,88	251,08	182,82	310,59								
1803-PM-213 B	DEETHANIZER STRIPPER CHARGE PUMP	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS B	6600	3PH	C	100	232,6	250	0,930	0,930	0,926	0,830	0,808	268,82	323,88	251,08	182,82	310,59								
1803-PM-214 A	GASOLINE RECYCLE PUMP	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS A	6600	3PH	S	10	146,54	170	0,862	0,925	0,919	0,880	0,862	183,78	208,85	159,46	93,77	184,98								
1803-PM-214 B	GASOLINE RECYCLE PUMP	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS B	6600	3PH	C	100	146,54	170	0,862	0,925	0,919	0,880	0,862	183,78	208,85	159,46	93,77	184,98								
1803-PM-222 A	LEAN AMINE PUMP	MOTOR (DOL)	Normal	2/M1	044-HT6-101	BUS A	6600	3PH	C	100	241,3	275	0,877	0,938	0,936	0,880	0,868	293,18	333,16	257,69	147,42	296,88								
1803-PM-222 B	LEAN AMINE PUMP	MOTOR (DOL)	Normal	2/M1	044-HT6-101	BUS B	6600	3PH	S	10	241,3	275	0,877	0,938	0,936	0,880	0,868	293,18	333,16	257,69	147,42	296,88								
1803-X-107-K-001A	WGS OXIDATION BLOWER PUMP	MOTOR (DOL)	Normal	-	044-HT6-101	BUS A	6600	3PH	C	100	147,0	200	0,735	0,930	0,930	0,830	0,830	215,05	259,10	158,06	106,22	190,44								
1803-X-107-K-001B	WGS OXIDATION BLOWER PUMP	MOTOR (DOL)	Normal	-	044-HT6-101	BUS B	6600	3PH	C	100	147,0	200	0,735	0,930	0,930	0,830	0,830	215,05	259,10	158,06	106,22	190,44								
1803-X-107-K-001C	WGS OXIDATION BLOWER PUMP	MOTOR (DOL)	Normal	-	044-HT6-101	BUS A	6600	3PH	S	10	147,0	200	0,735	0,930	0,930	0,830	0,830	215,05	259,10	158,06	106,22	190,44								
DOWNSTREAM LOADS																														
044-HT6-102 A	044-HT6-102 INCOMER 1 (6,6 KV EMERGENCY PANEL)	CONTROLLED-FEEDER	Normal	-	044-HT6-101	BUS A	6600	3PH	C	100	462,03	462,03	1	1	1	0,89	0,89	462,03	519,14	462,03	236,71	519,14								
044-HT6-102 B	044-HT6-102 INCOMER 2 (6,6 KV EMERGENCY PANEL)	CONTROLLED-FEEDER	Normal	-	044-HT6-101	BUS B	6600	3PH	S	10	462,03	462,03	1	1	1	0,89	0,89	462,03	519,14	462,03	236,71	519,14								
044-TR-102A	DISTRIBUTION TRANSFORMER 6.6 / 0.433 kV (044-PMCC-101)	CONTROLLED-FEEDER	Normal	-	044-HT6-101	BUS A	6600	3PH	C	100	1577,37	2144	0,736	0,98	0,98	0,875	0,875	2187,76	2500,29	1609,56	890,54	1839,49								
044-TR-102B	DISTRIBUTION TRANSFORMER 6.6 / 0.433 kV (044-PMCC-101)	CONTROLLED-FEEDER	Normal	-	044-HT6-101	BUS B	6600	3PH	S	10	1577,37	2144	0,736	0,98	0,98	0,875	0,875	2187,76	2500,29	1609,56	890,54	1839,49								
044-TR-103A	DISTRIBUTION TRANSFORMER 6.6 / 0.433 kV (044-PMCC-102)	CONTROLLED-FEEDER	Normal	-	044-HT6-101	BUS A	6600	3PH	C	100	1527,45	2144	0,712	0,98	0,98	0,88	0,88	2187,76	2486,09	1558,63	841,26	1771,17								
044-TR-103B	DISTRIBUTION TRANSFORMER 6.6 / 0.433 kV (044-PMCC-102)	CONTROLLED-FEEDER	Normal	-	044-HT6-101	BUS B	6600	3PH	S	10	1521,81	2144	0,710	0,98	0,98	0,88	0,88	2187,76	2486,09	1552,87	838,15	1764,62								
044-TR-104A	DISTRIBUTION TRANSFORMER 6.6 / 0.433 kV (044-PMCC-103)	CONTROLLED-FEEDER	Normal	-	044-HT6-101	BUS A	6600	3PH	C	100	1659,47	2144	0,774	0,98	0,98	0,875	0,875	2187,76	2500,29	1693,34	936,89	1935,24								
044-TR-104B	DISTRIBUTION TRANSFORMER 6.6 / 0.433 kV (044-PMCC-103)	CONTROLLED-FEEDER	Normal	-	044-HT6-101	BUS B	6600	3PH	S	10	1659,47	2144	0,774	0,98	0,98	0,875	0,875	2187,76	2500,29	1693,34	936,89	1935,24								
																			TOTAL CONTINUOUS LOAD				a	7523,05	4605,86	8821,01				
																			TOTAL INTERMITTENT LOAD				b	0,00	0,00	0,00				
																			INTERMITTENT LOAD CONSIDERED =				c=b*30%				0,00	0,00	0,00	
																			INTERMITTENT LOAD * SIMULTANEITY FACTOR											
																			TOTAL NORMAL RUNNING LOAD				d=a+c	7523,05	4605,86	8821,01				
																			TOTAL STANDBY LOAD				e	7303,50	4178,28	8414,22				
																			STANDBY LOAD CONSIDERED =				f=e*10%				730,35	417,83	841,42	
																			STANDBY LOAD * SIMALTANEITY LOAD											
																			TOTAL PEAK LOAD				g=a+c+f	8253,40	5023,68	9662,43				
																			TOTAL LOAD WITH FUTURE 20% LOAD				h=120%*g	9904,08	6028,42	11594,91				

Table 81. 044-HT6-101 load calculation without capacitor bank.

 							ELECTRICAL LOAD CALCULATIONS																
PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LaPech” (J-18)						SWITCHBOARD 044-HT6-101 WITH CAPACITOR BANK																
CLIENT:	INDIAN OIL CORPORATION LIMITED																						
ITEM	LOAD DESCRIPTION	LOAD TYPE	LOAD SERVICE	SCHEME TYPE	FED FROM	BUSBAR	RATED VOLTAGE (V)	N° PH	LOAD DUTY	SIMULTANEITY FACTOR	ABSORBED MECHANIC POWER (KW)	MOTOR RATED POWER (KW)	LOAD FACTOR	EFFICIENCY at rated load	EFFICIENCY at operating load	POWER FACTOR at rated load	POWER FACTOR at operating load	RATED CONSUMED ELECTRICAL LOAD		OPERATING CONUMED ELECTRICAL LOAD			
A	B	C	D	E	F	G	H	I	J	K	L	M	N=L/M	O	P	Q	R	S=M/O	T=S/Q	U=L/P	V	W=U/R	
1803-PM-101 A	HOT FRESH FEED PUMPS	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS A	6600	3PH	C	100	197,9	225	0,880	0,942	0,938	0,890	0,890	238,85	268,37	210,98	108,09	237,06	
1803-PM-101 B	HOT FRESH FEED PUMPS	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS B	6600	3PH	S	10	197,9	225	0,880	0,942	0,938	0,890	0,890	238,85	268,37	210,98	108,09	237,06	
1803-PM-202 A	LCO PUMPAROUND PUMP	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS A	6600	3PH	C	100	244,0	290	0,841	0,936	0,933	0,840	0,817	309,83	368,84	261,53	184,45	320,04	
1803-PM-202 B	LCO PUMPAROUND PUMP	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS B	6600	3PH	C	100	244,0	290	0,841	0,936	0,933	0,840	0,817	309,83	368,84	261,53	184,45	320,04	
1803-PM-202 C	LCO PUMPAROUND PUMP	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS B	6600	3PH	S	10	244,0	290	0,841	0,936	0,933	0,840	0,817	309,83	368,84	261,53	184,45	320,04	
1803-PM-204 A	HCO PUMPAROUND PUMP	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS A	6600	3PH	C	100	169,0	210	0,805	0,930	0,928	0,830	0,806	225,81	272,06	182,19	133,80	226,04	
1803-PM-204 B	HCO PUMPAROUND PUMP	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS A	6600	3PH	C	100	169,0	210	0,805	0,930	0,928	0,830	0,806	225,81	272,06	182,19	133,80	226,04	
1803-PM-204 C	HCO PUMPAROUND PUMP	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS B	6600	3PH	S	10	169,0	210	0,805	0,930	0,928	0,830	0,806	225,81	272,06	182,19	133,80	226,04	
1803-PM-205 A	MAIN FRACTIONATOR BOTTOM PUMP	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS A	6600	3PH	S	10	482,0	550	0,876	0,952	0,955	0,850	0,845	577,73	679,68	504,71	319,41	597,29	
1803-PM-205 B	MAIN FRACTIONATOR BOTTOM PUMP	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS B	6600	3PH	C	100	482,0	550	0,876	0,952	0,955	0,850	0,845	577,73	679,68	504,71	319,41	597,29	
1803-PM-213 A	DEETHANIZER STRIPPER CHARGE PUMP	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS A	6600	3PH	S	10	232,6	250	0,930	0,930	0,926	0,830	0,808	268,82	323,88	251,08	182,82	310,59	
1803-PM-213 B	DEETHANIZER STRIPPER CHARGE PUMP	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS B	6600	3PH	C	100	232,6	250	0,930	0,930	0,926	0,830	0,808	268,82	323,88	251,08	182,82	310,59	
1803-PM-214 A	GASOLINE RECYCLE PUMP	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS A	6600	3PH	S	10	146,54	170	0,862	0,925	0,919	0,880	0,862	183,78	208,85	159,46	93,77	184,98	
1803-PM-214 B	GASOLINE RECYCLE PUMP	MOTOR (DOL)	Normal	3/M20	044-HT6-101	BUS B	6600	3PH	C	100	146,54	170	0,862	0,925	0,919	0,880	0,862	183,78	208,85	159,46	93,77	184,98	
1803-PM-222 A	LEAN AMINE PUMP	MOTOR (DOL)	Normal	2/M1	044-HT6-101	BUS A	6600	3PH	C	100	241,3	275	0,877	0,938	0,936	0,880	0,868	293,18	333,16	257,69	147,42	296,88	
1803-PM-222 B	LEAN AMINE PUMP	MOTOR (DOL)	Normal	2/M1	044-HT6-101	BUS B	6600	3PH	S	10	241,3	275	0,877	0,938	0,936	0,880	0,868	293,18	333,16	257,69	147,42	296,88	
1803-X-107-K-001A	WGS OXIDATION BLOWER PUMP	MOTOR (DOL)	Normal	-	044-HT6-101	BUS A	6600	3PH	C	100	147,0	200	0,735	0,930	0,930	0,830	0,830	215,05	259,10	158,06	106,22	190,44	
1803-X-107-K-001B	WGS OXIDATION BLOWER PUMP	MOTOR (DOL)	Normal	-	044-HT6-101	BUS B	6600	3PH	C	100	147,0	200	0,735	0,930	0,930	0,830	0,830	215,05	259,10	158,06	106,22	190,44	
1803-X-107-K-001C	WGS OXIDATION BLOWER PUMP	MOTOR (DOL)	Normal	-	044-HT6-101	BUS A	6600	3PH	S	10	147,0	200	0,735	0,930	0,930	0,830	0,830	215,05	259,10	158,06	106,22	190,44	
DOWNSTREAM LOADS																							
044-HT6-102 A	044-HT6-102 INCOMER 1 (6,6 KV EMERGENCY PANEL)	CONTROLLED-FEEDER	Normal	-	044-HT6-101	BUS A	6600	3PH	C	100	462,03	462,03	1	1	1	0,89	0,89	462,03	519,14	462,03	236,71	519,14	
044-HT6-102 B	044-HT6-102 INCOMER 2 (6,6 KV EMERGENCY PANEL)	CONTROLLED-FEEDER	Normal	-	044-HT6-101	BUS B	6600	3PH	S	10	462,03	462,03	1	1	1	0,89	0,89	462,03	519,14	462,03	236,71	519,14	
044-TR-102A	TRANSFORMER 6.6 / 0.433 kV (044-PMCC-101) DISTRIBUTION	CONTROLLED-FEEDER	Normal	-	044-HT6-101	BUS A	6600	3PH	C	100	1577,37	2144	0,736	0,98	0,98	0,875	0,875	2187,76	2500,29	1609,56	890,54	1839,49	
044-TR-102B	TRANSFORMER 6.6 / 0.433 kV (044-PMCC-101) DISTRIBUTION	CONTROLLED-FEEDER	Normal	-	044-HT6-101	BUS B	6600	3PH	S	10	1577,37	2144	0,736	0,98	0,98	0,875	0,875	2187,76	2500,29	1609,56	890,54	1839,49	
044-TR-103A	TRANSFORMER 6.6 / 0.433 kV (044-PMCC-102) DISTRIBUTION	CONTROLLED-FEEDER	Normal	-	044-HT6-101	BUS A	6600	3PH	C	100	1527,45	2144	0,712	0,98	0,98	0,88	0,88	2187,76	2486,09	1558,63	841,26	1771,17	
044-TR-103B	TRANSFORMER 6.6 / 0.433 kV (044-PMCC-102) DISTRIBUTION	CONTROLLED-FEEDER	Normal	-	044-HT6-101	BUS B	6600	3PH	S	10	1521,81	2144	0,710	0,98	0,98	0,88	0,88	2187,76	2486,09	1552,87	838,15	1764,62	
044-TR-104A	TRANSFORMER 6.6 / 0.433 kV (044-PMCC-103) DISTRIBUTION	CONTROLLED-FEEDER	Normal	-	044-HT6-101	BUS A	6600	3PH	C	100	1659,47	2144	0,774	0,98	0,98	0,875	0,875	2187,76	2500,29	1693,34	936,89	1935,24	
044-TR-104B	TRANSFORMER 6.6 / 0.433 kV (044-PMCC-103) DISTRIBUTION	CONTROLLED-FEEDER	Normal	-	044-HT6-101	BUS B	6600	3PH	S	10	1659,47	2144	0,774	0,98	0,98	0,875	0,875	2187,76	2500,29	1693,34	936,89	1935,24	
044-CB-101A	HV CAPACITOR BANK	CAPACITOR	Normal	-	044-HT6-101	BUS A	6600	3PH	C	100	-2400	-2400	1	1	1	0	0	0,00	2400,00	0,00	-2400,00	2400,00	
044-CB-101B	HV CAPACITOR BANK	CAPACITOR	Normal	-	044-HT6-101	BUS B	6600	3PH	C	100	-2400	-2400	1	1	1	0	0	0,00	2400,00	0,00	-2400,00	2400,00	
																		TOTAL CONTINUOUS LOAD		a	7523,05	-194,14	7525,55
																		TOTAL INTERMITTENT LOAD		b	0,00	0,00	0,00
																		INTERMITTENT LOAD CONSIDERED = INTERMITTENT LOAD * SIMULTANEITY FACTOR		c=b*30%	0,00	0,00	0,00
																		TOTAL NORMAL RUNNING LOAD		d=a+c	7523,05	-194,14	7525,55
																		TOTAL STANDBY LOAD		e	7303,50	4178,28	8414,22
																		STANDBY LOAD CONSIDERED = STANDBY LOAD * SIMALTANEITY LOAD		f=e*10%	730,35	417,83	841,42
																		TOTAL PEAK LOAD		g=a+c+f	8253,40	223,68	8366,97
																		TOTAL LOAD WITH FUTURE 20% LOAD		h=120%*g	9904,08	268,42	10040,37

Table 82. 044-HT6-101 load calculation with capacitor bank.

4.3. MOTOR STARTING STUDY

The calculations in this study have also been performed using the power system simulation software ETAP, detailed simulation results are added in the annexes. During starting or reacceleration of motors, either singly or in a group, the maximum permissible voltage drops, shall be according to the following Table 83. Transient voltage deviations occurring at switchgear bus bars during motor or group motor starting/reacceleration shall be such as to maintain a voltage on all other consumers of at least 85%, but not more than 110% of rated equipment voltage. The above-mentioned voltage deviations shall have no consequence on plant operations. Static motor starting is the method of calculation. The motor is represented by its locked-rotor impedance during the acceleration period, and it is assumed that the starting motor can always be started.

S. No.	System Element	Operating Condition	Maximum permissible Voltage drop
A	At the bus bars of the worst affected switchboard.	Start-up of the large motor with other loads on the bus or reacceleration of a group of HV motors.	15%
B	At the bus bars of the worst affected MV switchboard (PCC/ PMCC/ MCC).	Start-up of large MV motor with other loads on the bus, or reacceleration of a group of MV motors.	10%
C	Cables between HV switchboard & motor.	Motor start-up or reacceleration.	5%
D	Cables between MV switchboard (PCC/ PMCC/ MCC) and motor.	Motor start-up or reacceleration.	15%

Table 83. Maximum permissible voltage conditions drop for motor starting.

The ETAP results obtained are summarized in Table 84. For the calculation, the highest motor of each switchgear has been selected. The results are in accordance with the required specifications.

BUS		HIGHEST MOTOR		MAXIMUM VOLTAGE DROP (% NOMINAL)		
ITEM	NOMINAL VOLTAGE	ITEM	MOTOR RATING	At bus		At motor terminal
				t=0,0-	t=0,1+	t=0,1+
044-HT6-101	6,6kV	1803-PM-205	480 W	104,1%	103,8%	103,8%
044-HT6-102	6,6kV	1803-PM-609	275 W	99,5%	99,4%	103,9%
044-PMCC-101	415V	1803-PM-206	150 W	102,1%	101,60%	94,3%
044-PMCC-102	415V	1803-PM-219	160 W	102,4%	102,0%	94,2%
044-PMCC-103	415V	1803-PM-209	132 W	96,2%	95,7%	89,2%
044-EPMCC-101	415V	1803-PM-610	160 W	104,5%	104,0%	95,0%

Table 84. ETAP results for maximum voltage drop for highest rated motors.

4.4. SHORT CIRCUIT STUDY

The object of this study is to determine the magnitude of the prospective currents flowing throughout the power system at various time intervals after a fault occurs. The information will be used to select switchgear ratings. The short circuit study consists of ETAP simulations. The main reason for performing this study is to verify of the adequacy of new –or existing- interrupting equipment, and to determine of the effects of the fault currents on various system components such as cables, lines, busways, transformers during the time the fault persists. The “Method C” is used for calculation of the ratio X/R for peak current. The voltage factor “C”, given in the following Table 85 on IEC 60909 standard, is used for calculation for maximum and minimum short circuit currents. Simulations are made for the three cases explained previously:

- Case 1: Normal operation with minimum short circuit level and voltage factor Cmin. ETAP results are indicated in Table 87.
- Case 2: Contingency operation with maximum short circuit level and voltage factor Cmax. ETAP results are indicated in Table 88
- Case 3: Emergency operation with minimum short circuit level and voltage factor Cmin. ETAP results are indicated in Table 86.

Nominal Voltage Un (V)	Voltage C factor according to IEC 60909-0	
	Maximum short-circuit currents Cmax	Minimum short-circuit currents Cmin
Low voltage 100V to 1000V	1,05	0,95
Medium voltage >1kV to 35kV	1,1	1

Table 85. C factor for short circuit study. Source: IEC 60909

The simulation obtains short circuit currents for three different situations: three phase faults, line-to-ground faults and line-to-line faults.

EMERGENCY: Calculated Short Circuit Current / Minimum Short-Circuit Level													
Bus identification		Nominal Voltage (kV)	3-Phase Fault (kA)			Line-to-Ground Fault (kA)			Line-to-Line Fault (kA)			MAX Ik/ I'k	MAX Ipeak
			I'k	Ip	Ik	I'k	Ip	Ik	I'k	Ip	Ik		
044-HT11-101	-	11	27,924	62,150	27,201	24,907	55,434	24,907	24,182	53,820	24,182	27,924	62,150
044-HT6-102	-	6,6	5,093	12,181	4,476	0,326	0,781	0,326	4,410	10,547	4,410	5,093	12,181
044-EPMC-101	-	0,415	27,817	65,378	22,752	29,948	70,387	29,948	23,979	56,357	23,979	29,948	70,387
044-MLDB-102	Bus A	0,415	1,456	2,124	1,450	0,914	1,333	0,914	1,261	1,840	1,261	1,456	2,124
	Bus B	0,415	1,456	2,124	1,450	0,914	1,333	0,914	1,261	1,840	1,261	1,456	2,124
044-ELDB-101	Bus A	0,415	3,155	5,181	3,100	3,328	5,464	3,328	2,733	4,488	2,733	3,328	5,464
	Bus B	0,415	3,155	5,181	3,100	3,328	5,464	3,328	2,733	4,488	2,733	3,328	5,464
044-LDB-106	-	0,415	0,322	0,465	0,322	0,249	0,359	0,249	0,279	0,403	0,279	0,322	0,465
044-LDB-107	-	0,415	0,558	0,804	0,558	0,409	0,590	0,409	0,483	0,697	0,483	0,558	0,804
044-LDB-108	-	0,415	0,558	0,804	0,558	0,409	0,590	0,409	0,483	0,697	0,483	0,558	0,804
044-LDB-116	-	0,415	0,242	0,349	0,242	0,191	0,275	0,191	0,210	0,303	0,210	0,242	0,349
044-LDB-117	-	0,415	0,242	0,349	0,242	0,191	0,275	0,191	0,210	0,303	0,210	0,242	0,349
044-ELDB-101	-	0,415	0,724	1,045	0,724	0,626	0,903	0,626	0,627	0,905	0,627	0,724	1,045
044-ELDB-102	-	0,415	0,269	0,388	0,269	0,227	0,328	0,227	0,233	0,336	0,233	0,269	0,388
044-ELDB-103	-	0,415	0,416	0,601	0,417	0,354	0,511	0,354	0,361	0,520	0,361	0,417	0,601
044-ELDB-104	-	0,415	0,292	0,421	0,292	0,247	0,356	0,247	0,253	0,365	0,253	0,292	0,421
044-ELDB-105	-	0,415	0,371	0,535	0,371	0,315	0,455	0,315	0,322	0,464	0,322	0,371	0,535
044-ELDB-106	-	0,415	0,510	0,735	0,510	0,435	0,628	0,435	0,441	0,637	0,441	0,510	0,735
044-ELDB-107	-	0,415	0,095	0,138	0,095	0,080	0,115	0,080	0,083	0,119	0,083	0,095	0,138
044-ELDB-108	-	0,415	0,165	0,237	0,165	0,139	0,200	0,139	0,143	0,206	0,143	0,165	0,237
044-ELDB-109	-	0,415	0,319	0,460	0,319	0,270	0,390	0,270	0,276	0,399	0,276	0,319	0,460
044-ELDB-110	-	0,415	0,217	0,313	0,217	0,183	0,264	0,183	0,188	0,271	0,188	0,217	0,313
044-ELDB-111	-	0,415	0,107	0,155	0,107	0,090	0,130	0,090	0,093	0,134	0,093	0,107	0,155
044-ELDB-112	-	0,415	0,217	0,313	0,217	0,183	0,264	0,183	0,188	0,271	0,188	0,217	0,313
044-ELDB-113	-	0,415	0,217	0,313	0,217	0,183	0,264	0,183	0,188	0,271	0,188	0,217	0,313
044-ELDB-114	-	0,415	0,165	0,237	0,165	0,139	0,200	0,139	0,143	0,206	0,143	0,165	0,237
044-ELDB-115	-	0,415	0,111	0,160	0,111	0,093	0,134	0,093	0,096	0,139	0,096	0,111	0,160

Table 86. Emergency operation: short circuit ETAP results.

NORMAL: Calculated Short Circuit Current / Minimum Short-Circuit Level													
Bus identification		Nominal Voltage (kV)	3-Phase Fault (kA)			Line-to-Ground Fault (kA)			Line-to-Line Fault (kA)			MAX Ik/ I''k	MAX Ipeak
			I''k	Ip	Ik	I''k	Ip	Ik	I''k	Ip	Ik		
044-HT33-101	Bus A	33	35,961	82,398	34,803	34,150	78,249	34,150	31,114	71,292	31,114	35,961	82,398
	Bus B	33	35,889	82,265	34,803	34,104	78,174	34,104	31,048	71,168	31,048	35,889	82,265
044-HT11-101	-	11	27,576	61,437	27,201	24,722	55,078	24,722	23,882	53,206	23,882	27,576	61,437
044-HT6-101	Bus A	6	20,107	50,453	17,162	0,420	1,054	0,420	17,252	43,291	17,252	20,107	50,453
	Bus B	6,6	19,572	49,435	17,162	0,420	1,061	0,420	16,773	42,363	16,773	19,572	49,435
044-HT6-102	-	6,6	20,897	52,233	17,849	0,439	1,098	0,439	17,932	44,822	17,932	20,897	52,233
AU-V REVAMP UNIT	Bus A	6,6	10,459	26,264	8,821	0,315	0,790	0,315	9,057	22,744	9,057	10,459	26,264
	Bus B	6,6	10,445	26,232	8,808	0,315	0,790	0,315	9,045	22,716	9,045	10,445	26,232
VDU UNIT	Bus A	6,6	10,341	25,903	8,635	0,315	0,788	0,315	8,955	33,432	8,955	10,341	33,432
	Bus B	6,6	11,194	28,118	9,485	0,329	0,826	0,329	9,693	24,350	9,693	11,194	28,118
044-PMCC-101	Bus A	0,415	44,923	108,147	35,581	42,960	103,421	42,960	37,813	91,032	37,813	44,923	108,147
	Bus B	0,415	45,114	108,467	35,581	42,966	103,303	42,966	37,822	90,937	37,822	45,114	108,467
044-PMCC-102	Bus A	0,415	44,208	106,938	35,630	42,400	102,566	42,400	37,072	89,678	37,072	44,208	106,938
	Bus B	0,415	44,921	108,456	35,630	42,769	103,260	42,769	37,563	90,692	37,563	44,921	108,456
044-PMCC-103	Bus A	0,415	51,239	124,725	42,291	50,345	122,549	50,345	43,711	106,402	43,711	51,239	124,725
	Bus B	0,415	43,413	105,656	35,661	42,441	103,290	42,441	37,126	90,354	37,126	43,413	105,656
044-EPMCC-101	-	0,415	36,244	86,751	31,264	35,968	86,090	35,968	31,243	74,781	31,243	36,244	86,751
044-MCC-101	Bus A	0,415	40,450	82,617	32,591	34,460	70,383	34,460	34,122	69,693	34,122	40,450	82,617
	Bus B	0,415	40,586	82,919	32,591	34,464	70,411	34,464	34,120	69,709	34,120	40,586	82,919
044-MCC-102	Bus A	0,415	39,937	81,384	32,591	34,243	69,781	34,243	33,778	68,834	33,778	39,937	81,384
	Bus B	0,415	40,334	82,252	32,591	34,347	70,042	34,347	33,937	69,206	33,937	40,334	82,252
044-MCC-103	Bus A	0,415	39,440	80,344	32,484	33,645	68,540	33,645	33,193	67,619	33,193	39,440	80,344
	Bus B	0,415	40,126	81,521	32,484	33,918	68,909	33,918	33,657	68,377	33,657	40,126	81,521
044-MCC-104	Bus A	0,415	40,335	82,385	32,591	34,410	70,283	34,410	34,041	69,529	34,041	40,335	82,385
	Bus B	0,415	40,479	82,562	32,591	34,420	70,204	34,420	34,054	69,457	34,054	40,479	82,562
044-MCC-105	Bus A	0,415	39,393	80,205	32,484	33,637	68,486	33,637	33,181	67,558	33,181	39,393	80,205
	Bus B	0,415	39,949	81,041	32,484	33,861	68,691	33,861	33,569	68,098	33,569	39,949	81,041
044-MCC-106	Bus A	0,415	39,386	80,254	32,484	33,638	68,542	33,638	33,181	67,612	33,181	39,386	80,254
	Bus B	0,415	39,554	80,069	32,484	33,702	68,223	33,702	33,319	67,448	33,319	39,554	80,069
044-MCC-107	Bus A	0,415	44,819	89,634	37,856	38,140	76,276	38,140	38,271	76,540	38,271	44,819	89,634
	Bus B	0,415	38,754	79,297	32,511	33,625	68,801	33,625	33,172	67,876	33,172	38,754	79,297
044-ASB-101	Bus A	0,415	39,222	67,874	34,521	29,416	50,904	29,416	33,690	58,301	33,690	39,222	67,874
	Bus B	0,415	34,713	61,862	30,170	26,963	48,051	26,963	29,832	53,164	29,832	34,713	61,862
044-ASB-102	Bus A	0,415	40,391	73,209	35,317	31,589	57,255	31,589	34,684	62,865	34,684	40,391	73,209
	Bus B	0,415	35,576	66,313	30,706	28,654	53,424	28,654	30,562	56,981	30,562	35,576	66,313
044-MLDB-101	Bus A	0,415	5,662	9,415	5,549	6,008	9,990	6,008	4,898	8,144	4,898	6,008	9,990
	Bus B	0,415	5,651	9,427	5,525	6,000	10,000	6,000	4,880	8,155	4,880	6,000	10,000
044-MLDB-102	Bus A	0,415	1,793	2,596	1,787	1,021	1,479	1,021	1,552	2,248	1,552	1,793	2,596
	Bus B	0,415	1,428	2,083	1,424	0,901	1,314	0,901	1,237	1,804	1,237	1,428	2,083
044-EMLDB-101	Bus A	0,415	3,030	4,936	2,997	3,152	5,134	3,152	2,623	4,273	2,623	3,152	5,134
	Bus B	0,415	3,030	4,936	2,997	3,152	5,134	3,152	2,623	4,273	2,623	3,152	5,134
044-LDB-101	-	0,415	0,780	1,126	0,781	0,664	0,958	0,664	0,676	0,975	0,676	0,781	1,126
044-LDB-102	-	0,415	0,435	0,627	0,435	0,367	0,529	0,367	0,377	0,543	0,377	0,435	0,627
044-LDB-103	-	0,415	0,208	0,300	0,208	0,175	0,252	0,175	0,180	0,260	0,180	0,208	0,300
044-LDB-104	-	0,415	0,300	0,432	0,300	0,252	0,363	0,252	0,259	0,374	0,259	0,300	0,432
044-LDB-105	-	0,415	0,602	0,869	0,602	0,510	0,736	0,510	0,522	0,752	0,522	0,602	0,869
044-LDB-106	-	0,415	0,332	0,480	0,332	0,255	0,368	0,255	0,288	0,415	0,288	0,332	0,480
044-LDB-107	-	0,415	0,554	0,799	0,532	0,407	0,587	0,407	0,480	0,692	0,480	0,554	0,799
044-LDB-108	-	0,415	0,591	0,853	0,591	0,426	0,614	0,426	0,512	0,739	0,512	0,591	0,853
044-LDB-109	-	0,415	0,517	0,746	0,517	0,437	0,630	0,437	0,448	0,646	0,448	0,517	0,746
044-LDB-110	-	0,415	0,351	0,506	0,351	0,296	0,426	0,296	0,304	0,438	0,304	0,351	0,506
044-LDB-111	-	0,415	0,340	0,490	0,340	0,286	0,413	0,286	0,294	0,425	0,294	0,340	0,490
044-LDB-112	-	0,415	0,351	0,506	0,351	0,296	0,426	0,296	0,304	0,438	0,304	0,351	0,506
044-LDB-113	-	0,415	0,221	0,319	0,221	0,186	0,268	0,186	0,192	0,277	0,192	0,221	0,319
044-LDB-114	-	0,415	0,266	0,383	0,266	0,223	0,322	0,223	0,230	0,332	0,230	0,266	0,383
044-LDB-115	-	0,415	0,437	0,630	0,437	0,369	0,532	0,369	0,378	0,546	0,378	0,437	0,630
044-LDB-116	-	0,415	0,248	0,357	0,248	0,194	0,280	0,194	0,215	0,310	0,215	0,248	0,357
044-LDB-117	-	0,415	0,242	0,349	0,242	0,190	0,275	0,190	0,209	0,302	0,209	0,242	0,349
044-PDB-101	-	0,415	0,780	1,125	0,780	0,664	0,957	0,664	0,676	0,974	0,676	0,780	1,125
044-PDB-102	-	0,415	0,535	0,772	0,536	0,453	0,653	0,453	0,464	0,669	0,464	0,536	0,772
044-PDB-103	-	0,415	0,384	0,554	0,384	0,324	0,467	0,324	0,333	0,480	0,333	0,384	0,554
044-PDB-104	-	0,415	0,329	0,474	0,329	0,277	0,399	0,277	0,285	0,410	0,285	0,329	0,474
044-PDB-105	-	0,415	1,015	1,465	1,015	0,870	1,254	0,870	0,880	1,269	0,880	1,015	1,465
044-ELDB-101	-	0,415	0,718	1,036	0,718	0,621	0,895	0,621	0,622	0,897	0,622	0,718	1,036
044-ELDB-102	-	0,415	0,268	0,386	0,261	0,226	0,327	0,226	0,232	0,335	0,232	0,261	0,386
044-ELDB-103	-	0,415	0,415	0,598	0,415	0,353	0,509	0,353	0,359	0,518	0,359	0,415	0,598
044-ELDB-104	-	0,415	0,291	0,419	0,291	0,246	0,355	0,246	0,252	0,363	0,252	0,291	0,419
044-ELDB-105	-	0,415	0,370	0,533	0,370	0,314	0,453	0,314	0,320	0,462	0,320	0,370	0,533
044-ELDB-106	-	0,415	0,507	0,731	0,507	0,433	0,625	0,433	0,439	0,633	0,439	0,507	0,731
044-ELDB-107	-	0,415	0,095	0,137	0,095	0,080	0,115	0,080	0,082	0,119	0,082	0,095	0,137
044-ELDB-108	-	0,415	0,164	0,237	0,164	0,138	0,199	0,138	0,142	0,205	0,142	0,164	0,237
044-ELDB-109	-	0,415	0,318	0,459	0,318	0,269	0,388	0,269	0,275	0,397	0,275	0,318	0,459
044-ELDB-110	-	0,415	0,217	0,313	0,217	0,183	0,264	0,183	0,188	0,271	0,188	0,217	0,313

CONTINGENCY: Calculated Short Circuit Current / Minimum Short-Circuit Level													
Bus identification		Nominal Voltage (kV)	3-Phase Fault (kA)			Line-to-Ground Fault (kA)			Line-to-Line Fault (kA)			MAX Ik/ I''k	MAX Ipeak
			I''k	Ip	Ik	I''k	Ip	Ik	I''k	Ip	Ik		
044-HT33-101	Bus A	33	36,757	84,310	34,803	34,616	79,399	34,616	31,789	72,915	31,789	36,757	84,310
	Bus B	33	36,757	84,310	34,803	34,616	79,399	34,616	31,789	72,915	31,789	36,757	84,310
044-HT11-101	-	11	27,576	61,437	27,201	24,722	55,078	24,722	23,882	53,206	23,882	27,576	61,437
044-HT6-101	Bus A	6	22,252	54,988	17,162	0,420	1,038	0,420	18,980	46,902	18,980	22,252	54,988
	Bus B	6,6	22,252	54,988	17,162	0,420	1,038	0,420	18,980	46,902	18,980	22,252	54,988
044-HT6-102	-	6,6	23,108	56,868	17,849	0,439	1,081	0,439	19,712	48,512	19,712	23,108	56,868
AU-V REVAMP UNIT	Bus A	6,6	12,093	30,300	8,821	0,315	0,789	0,315	10,472	26,239	10,472	12,093	30,300
	Bus B	6,6	12,093	30,300	8,821	0,315	0,789	0,315	10,472	26,239	10,472	12,093	30,300
VDU UNIT	Bus A	6,6	12,045	30,112	8,635	0,315	0,787	0,315	10,431	26,077	10,431	12,045	30,112
	Bus B	6,6	12,045	30,112	8,635	0,315	0,787	0,315	10,431	26,077	10,431	12,045	30,112
044-PMCC-101	Bus A	0,415	54,171	125,151	35,323	47,698	110,196	47,698	44,519	102,850	44,519	54,171	125,151
	Bus B	0,415	54,171	125,151	35,323	47,698	110,196	47,698	44,519	102,850	44,519	54,171	125,151
044-PMCC-102	Bus A	0,415	53,235	123,815	35,374	46,989	109,287	46,989	43,474	101,113	43,474	53,235	123,815
	Bus B	0,415	53,235	123,815	35,374	46,989	109,287	46,989	43,474	101,113	43,474	53,235	123,815
044-PMCC-103	Bus A	0,415	58,771	138,807	41,962	54,787	129,399	54,787	49,745	117,491	49,745	58,771	138,807
	Bus B	0,415	58,771	138,807	41,962	54,787	129,399	54,787	49,745	117,491	49,745	58,771	138,807
044-EPMCC-101	-	0,415	36,428	87,059	31,068	36,077	86,221	36,077	31,385	75,007	31,385	36,428	87,059
044-MCC-101	Bus A	0,415	47,984	93,939	32,377	37,359	73,139	37,359	39,621	77,566	39,621	47,984	93,939
	Bus B	0,415	47,984	93,939	32,377	37,359	73,139	37,359	39,621	77,566	39,621	47,984	93,939
044-MCC-102	Bus A	0,415	47,096	91,843	32,377	37,029	72,210	37,029	39,020	76,093	39,020	47,096	91,843
	Bus B	0,415	47,096	91,843	32,377	37,029	72,210	37,029	39,020	76,093	39,020	47,096	91,843
044-MCC-103	Bus A	0,415	46,612	90,943	32,273	36,365	70,951	36,365	38,314	74,753	38,314	46,612	90,943
	Bus B	0,415	46,612	90,943	32,273	36,365	70,951	36,365	38,314	74,753	38,314	46,612	90,943
044-MCC-104	Bus A	0,415	47,726	93,288	32,377	37,267	72,844	37,267	39,453	77,116	39,453	47,726	93,288
	Bus B	0,415	47,726	93,288	32,377	37,267	72,844	37,267	39,453	77,116	39,453	47,726	93,288
044-MCC-105	Bus A	0,415	46,354	90,264	32,273	36,302	70,690	36,302	38,204	74,394	38,204	46,354	90,264
	Bus B	0,415	46,354	90,264	32,273	36,302	70,690	36,302	38,204	74,394	38,204	46,354	90,264
044-MCC-106	Bus A	0,415	45,894	89,257	32,273	36,146	70,299	36,146	37,925	73,758	37,925	45,894	89,257
	Bus B	0,415	45,894	89,257	32,273	36,146	70,299	36,146	37,925	73,758	37,925	45,894	89,257
044-MCC-107	Bus A	0,415	50,412	97,503	37,597	40,422	78,182	40,422	42,745	82,673	42,745	50,412	97,503
	Bus B	0,415	50,412	97,503	37,597	40,422	78,182	40,422	42,745	82,673	42,745	50,412	97,503
044-ASB-101	Bus A	0,415	42,735	71,734	34,314	30,412	51,049	30,412	36,571	61,388	36,571	42,735	71,734
	Bus B	0,415	42,735	71,734	34,314	30,412	51,049	30,412	36,571	61,388	36,571	42,735	71,734
044-ASB-102	Bus A	0,415	44,272	77,657	35,096	32,839	57,603	32,839	37,867	66,422	37,867	44,272	77,657
	Bus B	0,415	44,272	77,657	35,096	32,839	57,603	32,839	37,867	66,422	37,867	44,272	77,657
044-MLDB-101	Bus A	0,415	5,785	9,567	5,597	6,098	10,083	6,098	5,002	8,272	5,002	6,098	10,083
	Bus B	0,415	5,785	9,567	5,597	6,098	10,083	6,098	5,002	8,272	5,002	6,098	10,083
044-MLDB-102	Bus A	0,415	1,472	2,146	1,469	0,918	1,337	0,918	1,275	1,859	1,275	1,472	2,146
	Bus B	0,415	1,472	2,146	1,469	0,918	1,337	0,918	1,275	1,859	1,275	1,472	2,146
044-EMLDB-101	Bus A	0,415	3,251	5,310	3,219	3,398	5,549	3,398	2,816	4,598	2,816	3,398	5,549
	Bus B	0,415	3,251	5,310	3,219	3,398	5,549	3,398	2,816	4,598	2,816	3,398	5,549
044-LDB-101	-	0,415	0,780	1,126	0,781	0,664	0,958	0,664	0,676	0,975	0,676	0,781	1,126
044-LDB-102	-	0,415	0,435	0,627	0,435	0,367	0,529	0,367	0,377	0,543	0,377	0,435	0,627
044-LDB-103	-	0,415	0,208	0,300	0,208	0,175	0,252	0,175	0,180	0,260	0,180	0,208	0,300
044-LDB-104	-	0,415	0,300	0,432	0,300	0,252	0,363	0,252	0,259	0,374	0,259	0,300	0,432
044-LDB-105	-	0,415	0,602	0,869	0,603	0,510	0,736	0,510	0,522	0,753	0,522	0,603	0,869
044-LDB-106	-	0,415	0,323	0,466	0,323	0,249	0,360	0,249	0,280	0,403	0,280	0,323	0,466
044-LDB-107	-	0,415	0,559	0,806	0,559	0,409	0,591	0,409	0,484	0,699	0,484	0,559	0,806
044-LDB-108	-	0,415	0,559	0,806	0,559	0,409	0,591	0,409	0,484	0,699	0,484	0,559	0,806
044-LDB-109	-	0,415	0,517	0,746	0,517	0,437	0,630	0,437	0,448	0,646	0,448	0,517	0,746
044-LDB-110	-	0,415	0,351	0,506	0,351	0,296	0,426	0,296	0,304	0,439	0,304	0,351	0,506
044-LDB-111	-	0,415	0,340	0,491	0,340	0,286	0,413	0,286	0,295	0,425	0,295	0,340	0,491
044-LDB-112	-	0,415	0,351	0,506	0,351	0,296	0,426	0,296	0,304	0,439	0,304	0,351	0,506
044-LDB-113	-	0,415	0,221	0,319	0,222	0,186	0,268	0,186	0,192	0,277	0,192	0,222	0,319
044-LDB-114	-	0,415	0,266	0,383	0,266	0,223	0,322	0,223	0,230	0,332	0,230	0,266	0,383
044-LDB-115	-	0,415	0,437	0,630	0,437	0,369	0,532	0,369	0,378	0,546	0,378	0,437	0,630
044-LDB-116	-	0,415	0,243	0,350	0,243	0,191	0,275	0,191	0,210	0,303	0,210	0,243	0,350
044-LDB-117	-	0,415	0,243	0,350	0,243	0,191	0,275	0,191	0,210	0,303	0,210	0,243	0,350
044-PDB-101	-	0,415	0,780	1,126	0,781	0,664	0,958	0,664	0,676	0,975	0,676	0,781	1,126
044-PDB-102	-	0,415	0,535	0,772	0,536	0,453	0,653	0,453	0,464	0,669	0,464	0,536	0,772
044-PDB-103	-	0,415	0,384	0,554	0,384	0,324	0,467	0,324	0,333	0,480	0,333	0,384	0,554
044-PDB-104	-	0,415	0,329	0,474	0,329	0,277	0,399	0,277	0,285	0,410	0,285	0,329	0,474
044-PDB-105	-	0,415	1,016	1,466	1,016	0,870	1,255	0,870	0,880	1,270	0,880	1,016	1,466
044-ELDB-101	-	0,415	0,727	1,048	0,727	0,627	0,904	0,627	0,629	0,908	0,629	0,727	1,048
044-ELDB-102	-	0,415	0,269	0,388	0,269	0,227	0,328	0,227	0,233	0,336	0,233	0,269	0,388
044-ELDB-103	-	0,415	0,417	0,602	0,417	0,355	0,512	0,355	0,361	0,521	0,361	0,417	0,602
044-ELDB-104	-	0,415	0,292	0,421	0,292	0,247	0,356	0,247	0,253	0,365	0,253	0,292	0,421
044-ELDB-105	-	0,415	0,372	0,536	0,372	0,315	0,455	0,315	0,322	0,464	0,322	0,372	0,536
044-ELDB-106	-	0,415	0,511	0,737	0,511	0,436	0,629	0,436	0,442	0,638	0,442	0,511	0,737
044-ELDB-107	-	0,415	0,095	0,138	0,095	0,080	0,115	0,080	0,083	0,119	0,083	0,095	0,138
044-ELDB-108	-	0,415	0,165	0,238	0,165	0,139	0,200	0,139	0,143	0,206	0,143	0,165	0,238
044-ELDB-109	-	0,415	0,319	0,461	0,320	0,270	0,390	0,270	0,277	0,399	0,277	0,320	0,461
044-ELDB-110	-	0,415	0,217	0,314	0,217	0,183	0,264	0,183	0,188	0,272	0,188	0,217	0,3

The simulation results indicate the following fault currents:

- **Initial symmetrical current (I''_k):** The r.m.s. value of the AC symmetrical component of an available short-circuit current, applicable at the instant of short circuit if the impedance remains at zero-time value (definition according to IEC 60909-0, section 4.2.).
- **Rated short-time withstand current (I_k):** The r.m.s. value of the current which the switchgear and controlgear can carry in the closed position during a specified short time under prescribed conditions of use and behavior (definition according to IEC 62271-1, section 4.5.).
- **Rated peak withstand current (I_p):** The peak current associated with the first major loop of the rated short-time withstand current which switchgear and controlgear can carry in the closed position under prescribed conditions of use and behavior. The rated peak withstand current shall correspond to the rated frequency. For a rated frequency of 50 Hz and below it is equal to 2.5 times the rated short-time withstand current (definition according to IEC 62271-1, section 4.6) for high voltage switchgear. For low voltage switchgear, the value of peak current shall be obtained by multiplying the short-circuit current by factor n . Standard values for the factor n and the corresponding power factor are given in Table 89, according to IEC 61439-1.

$$I_{peak} = n \cdot I''_K$$

Standard values for the factor n according IEC 61439-1		
RMS value of short-circuit current kA	$\cos \varphi$	n
$I \leq 5$	0,7	1,5
$5 < I \leq 10$	0,5	1,7
$10 < I \leq 20$	0,3	2
$20 < I \leq 50$	0,25	2,1
$50 < I$	0,2	2,2

Table 89. Factor n standard values. Source: IEC 61439-1

Once the different short-circuit currents have been obtained for the three types of faults, it is checked that they do not exceed the maximum admissible currents specified during design. For this purpose, the maximum current values (I''_k and I_{peak}) of the three cases (normal, contingency and emergency) are taken and it is checked that their available reserve margin is sufficient.

The final calculation and results are indicated in the following tables (Table 90 and Table 91):

Rated Short-Circuit Capability: High Voltage Switchgears								
HIGH VOLTAGE SWITCHGEAR TAGS	Nominal Voltage (V)	ETAP results		Design requirements		n factor (IEC 62271-1, section 4.6)	Available reserve margin	
		I''_k max (kA)	I_{PEAK} max (kA)	I''_k max (kA)	I_{PEAK} max (kA)		Rated short-time withstand current (%)	Rated peak withstand current (%)
044-HT33-101	33000	36,8	84,3	40	100	2,5	8	16
044-HT11-101	11000	27,9	62,1	40	100	2,5	30	38
042-HT6-101	6600	22,3	55,0	40	100	2,5	44	45
042-HT6-102	6600	20,9	52,2	40	100	2,5	48	48

Table 90. Rated short circuit capability for HV switchgears.

Rated Short-Circuit Capability: Medium Voltage Switchgears/ Switchboards								
MEDIUM VOLTAGE SWITCHGEAR TAGS	Nominal Voltage (V)	ETAP results		Design requirements		n factor (IEC 61439-1, table 7)	Available reserve margin (%)	
		I''k max (kA)	I _{PEAK} max (kA)	I''k max (kA)	I _{PEAK} max (kA)		Rated short-time withstand current (%)	Rated peak withstand current (%)
044-PMCC-101	415	54,171	125,151	65	143	2,2	17	12
044-PMCC-102	415	53,235	123,815	65	143	2,2	18	13
044-PMCC-103	415	58,771	138,807	65	143	2,2	10	3
044-EPMCC-101	415	36,428	87,059	65	143	2,2	44	39
044-MCC-101	415	47,984	93,939	65	137	2,1	26	31
044-MCC-102	415	47,096	91,843	65	137	2,1	28	33
044-MCC-103	415	46,612	90,943	65	137	2,1	28	33
044-MCC-104	415	47,726	93,288	65	137	2,1	27	32
044-MCC-105	415	46,354	90,264	65	137	2,1	29	34
044-MCC-106	415	45,894	89,257	65	137	2,1	29	35
044-MCC-107	415	50,412	97,503	65	143	2,2	22	32
044-ASB-101	415	42,735	71,734	50	105	2,1	15	32
044-ASB-102	415	44,272	77,657	50	105	2,1	11	26
044-MLDB-101	415	6,098	10,083	10	17	1,7	39	41
044-MLDB-102	415	1,793	2,596	10	15	1,5	82	83
044-EMLDB-101	415	3,398	5,549	10	15	1,5	66	63
044-ELDB-101	415	0,727	1,048	10	15	1,5	93	93
044-ELDB-102	415	0,621	0,388	10	15	1,5	94	97
044-ELDB-103	415	0,417	0,602	10	15	1,5	96	96
044-ELDB-104	415	0,292	0,421	10	15	1,5	97	97
044-ELDB-105	415	0,372	0,536	10	15	1,5	96	96
044-ELDB-106	415	0,511	0,737	10	15	1,5	95	95
044-ELDB-107	415	0,095	0,138	10	15	1,5	99	99
044-ELDB-108	415	0,165	0,238	10	15	1,5	98	98
044-ELDB-109	415	0,320	0,461	10	15	1,5	97	97
044-ELDB-110	415	0,217	0,314	10	15	1,5	98	98
044-ELDB-111	415	0,107	0,155	10	15	1,5	99	99
044-ELDB-112	415	0,217	0,314	10	15	1,5	98	98
044-ELDB-113	415	0,217	0,314	10	15	1,5	98	98
044-ELDB-114	415	0,165	0,238	10	15	1,5	98	98
044-ELDB-115	415	0,237	0,160	10	15	1,5	98	99
044-LDB-101	415	0,781	1,126	10	15	1,5	92	92
044-LDB-102	415	0,435	0,627	10	15	1,5	96	96
044-LDB-103	415	0,208	0,300	10	15	1,5	98	98
044-LDB-104	415	0,300	0,432	10	15	1,5	97	97
044-LDB-105	415	0,603	0,869	10	15	1,5	94	94
044-LDB-106	415	0,332	0,480	10	15	1,5	97	97
044-LDB-107	415	0,559	0,806	10	15	1,5	94	95
044-LDB-108	415	0,591	0,853	10	15	1,5	94	94
044-LDB-109	415	0,517	0,746	10	15	1,5	95	95
044-LDB-110	415	0,351	0,506	10	15	1,5	96	97
044-LDB-111	415	0,340	0,491	10	15	1,5	97	97
044-LDB-112	415	0,351	0,506	10	15	1,5	96	97
044-LDB-113	415	0,222	0,319	10	15	1,5	98	98
044-LDB-114	415	0,266	0,383	10	15	1,5	97	97
044-LDB-115	415	0,437	0,630	10	15	1,5	96	96
044-LDB-116	415	0,248	0,357	10	15	1,5	98	98
044-LDB-117	415	0,243	0,350	10	15	1,5	98	98
044-PDB-101	415	0,781	1,126	10	15	1,5	92	92
044-PDB-102	415	0,536	0,772	10	15	1,5	95	95
044-PDB-103	415	0,384	0,554	10	15	1,5	96	96
044-PDB-104	415	0,329	0,474	10	15	1,5	97	97
044-PDB-105	415	1,016	1,466	10	15	1,5	90	90

Table 91. Rated short circuit capability for MV switchgears.

4.5. HARMONIC STUDY

In modern power systems, the introduction of solid-state devices for power supplies, variable speed motor control systems, and all types of electronic equipment have increased the distortion of the sinusoidal wave to the point where they threaten the safe operation of the power system. The purpose of harmonic analysis is to examine and reduce the voltage and current harmonic distortion throughout the electrical system. In the study we will plot frequency scanners, distortion spectrums and distortion waveforms, to examine the magnitudes and phase angles of bus driving point impedance over a frequency range specified. The system's frequency and voltage requirements are indicated in Table 92. The study is developed for normal operation case study. The harmonic results are obtained by using the power system simulation software ETAP.

	11kV System	6.6kV System	415V Motor System	415V Emergency System
Rated voltage	11 kV (+6%; -9%)	6.6 kV $\pm$ 6%	415 V $\pm$ 6%	415 V $\pm$ 6%
Rated Frequency	50 Hz $\pm$ 3%	50 Hz $\pm$ 3%	50 Hz $\pm$ 3%	50 Hz $\pm$ 3%
Phases	3	3	3	3
Rated Short-time	40 kA - 1 second	40 kA for 1 second	65 kA for 1 second	65 kA for 1 second
Peak Withstand Current	100 kA	100 kA	143 kA	137 kA

Table 92. Frequency and voltage requirements.

As mentioned above, the main harmonic sources are power electronic equipment. For this analysis battery chargers, AC UPS and VFD have been considered as the main electrical equipment that might cause distortion to the system. Therefore, harmonic current spectrum contribution for each device must be indicated. Values correspond to line-side contribution without any filter installed online-side terminals. The following tables indicate the current spectrum for VDF, AC UPS and battery chargers.

Harmonic Order	Magnitud (%)
H5	20.00
H7	14.30
H11	9.10
H13	7.70
H17	5.90
H19	5.30
H23	4.30
H25	4.00
H29	3.40
H31	3.20
H35	2.80
H37	2.70
H41	2.40
H43	2.30
H47	2.10
H49	2.00

Table 93. Current spectrum from ETAP library 'Typical-IEEE - 6 Pulse1'.

Harmonic Order	Magnitud (%)
H3	0.35
H5	2.31
H7	0.35
H9	0.05
H11	0.95
H13	0.39
H15	0.02

Table 94. Current spectrum from ETAP library 'RFCC UPS 6P'

Harmonic Order	Magnitud (%)
H2	0.16
H3	0.59
H4	0.12
H5	25.52
H6	0.10
H7	6.08
H8	0.03
H9	0.09
H10	0.00
H11	4.57
H12	0.03
H13	4.20
H14	0.03
H15	0.06
H17	1.80
H19	1.37
H23	0.75
H25	0.56
H29	0.49
H31	0.54

Table 95. Current spectrum from ETAP library 'Rockwell - 6 pulse VFD'.

For motor variable frequency drives (VFD) the current spectrum was taken from ETAP library 'Rockwell - 6 pulse VFD'. Regarding the battery chargers, the current spectrum was also taken from an ETAP library: 'Typical-IEEE - 6 Pulse1'.

The standard that must be followed is IEEE-519-2014 (Recommended Practice and Requirements for Harmonic Control in Electric Power Systems), which defines maximum values of distortion for voltage and current.

According to this standard, for voltage levels below 69kV, the voltage total harmonic distortion (VTHD) should be:

- Less than 5% for bus voltage at PCC of $V \leq 1.0$ kV.

- Less than 8% for bus voltage at PCC of $1 \text{ kV} < V \leq 69 \text{ kV}$,

PCC is the point of common coupling, a point on a public power supply system, electrically nearest to a particular load, to which other loads are connected. PCC is a point located upstream of the considered installation.

Most relevant summary results from ETAP calculations of the equipment's THD are shown in Table 96.

Switchboard	Volts (V)	IEEE-519	RMS (%)	THD (%)
BUS A 044-HT33-101	33000	5	99,91	0,02
BUS B 044-HT33-101	33000	5	99,91	0,02
BUS A 44-HT6-101	6600	5	103,88	0,13
BUS B 044-HT6-101	6600	5	103,52	0,28
044-HT6-102	6600	5	99,36	0,13
044-EPMCC-101	415	8	104,89	0,24
BUS A 044-MCC-101	415	8	103,46	0,95
BUS A 044-MCC-102	415	8	103,4	1,02
BUS A 044-MCC-103	415	8	103,55	0,84
BUS A 044-MCC-104	415	8	103,43	0,95
BUS A 044-MCC-105	415	8	103,66	0,77
BUS A 044-MCC-106	415	8	103,55	0,78
BUS A 044-MCC-107	415	8	98,55	0,15
BUS B 044-MCC-101	415	8	102,93	0,87
BUS B 044-MCC-102	415	8	102,88	0,93
BUS B 044-MCC-103	415	8	103,03	0,76
BUS B 044-MCC-104	415	8	102,92	0,87
BUS B 044-MCC-105	415	8	103,15	0,71
BUS B 044-MCC-106	415	8	103,2	0,71
BUS B 044-MCC-107	415	8	102,96	0,23
BUS A 044-PMCC-101	415	8	103,64	0,95
BUS A 044-PMCC-102	415	8	103,81	0,78
BUS A 044-PMCC-103	415	8	98,71	0,15
BUS B 044-PMCC-101	415	8	103,13	0,87
BUS B 044-PMCC-102	415	8	103,3	0,71
BUS B 044-PMCC-103	415	8	103,09	0,23

Table 96. Voltage total harmonic distortion ETAP results.

4.6. ETAP SIMULATION FINAL DESIGN

This section contains the detailed connectivity of all the equipment and motors that has been designed in ETAP software:

- Normal operation from Figure 5 to Figure 13.
- Contingency operation from Figure 14 to Figure 22.
- Emergency operation from to Figure 23 to Figure 26.

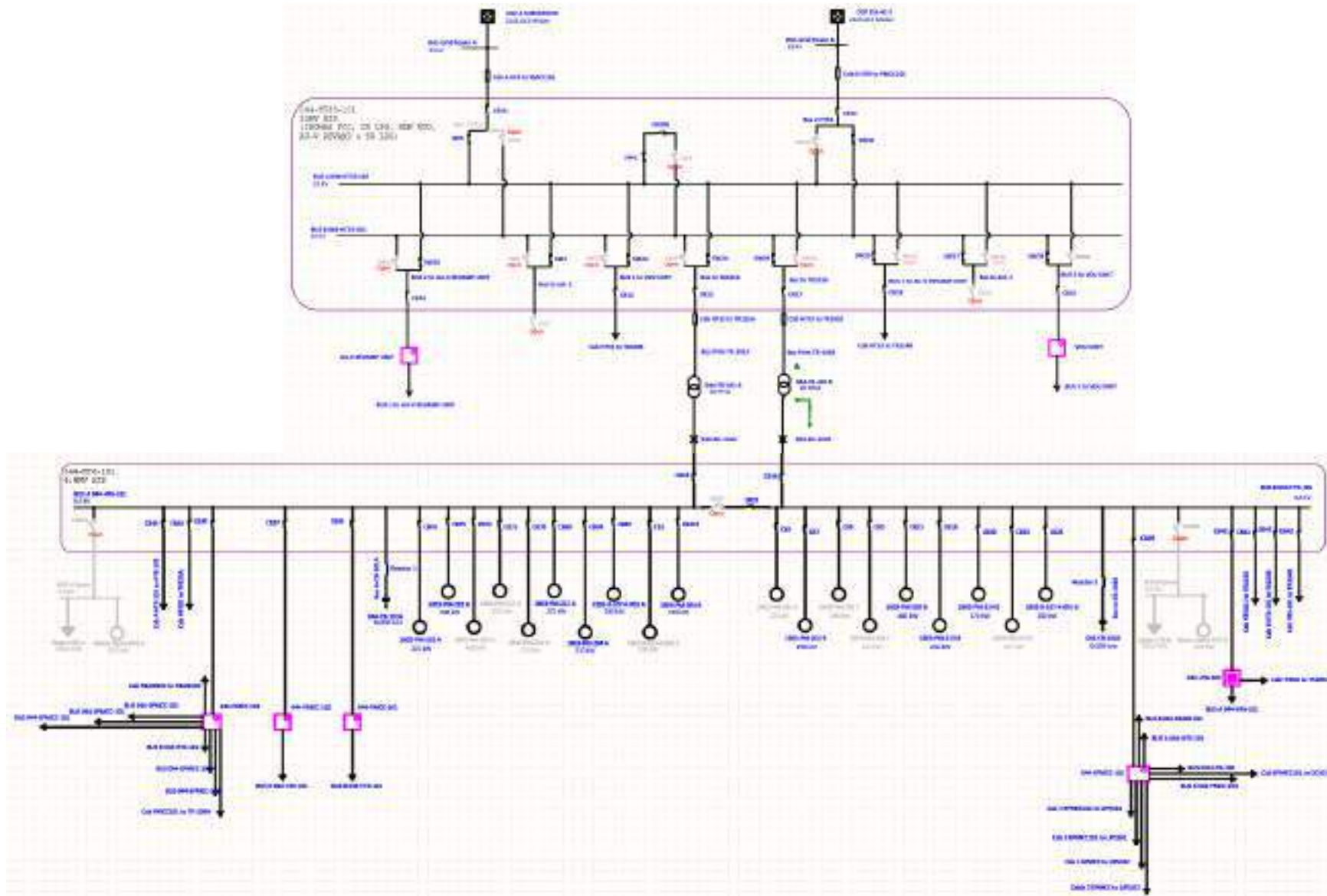


Figure 5. Normal operation: 044-HT33-101 and 044-HT6-101.

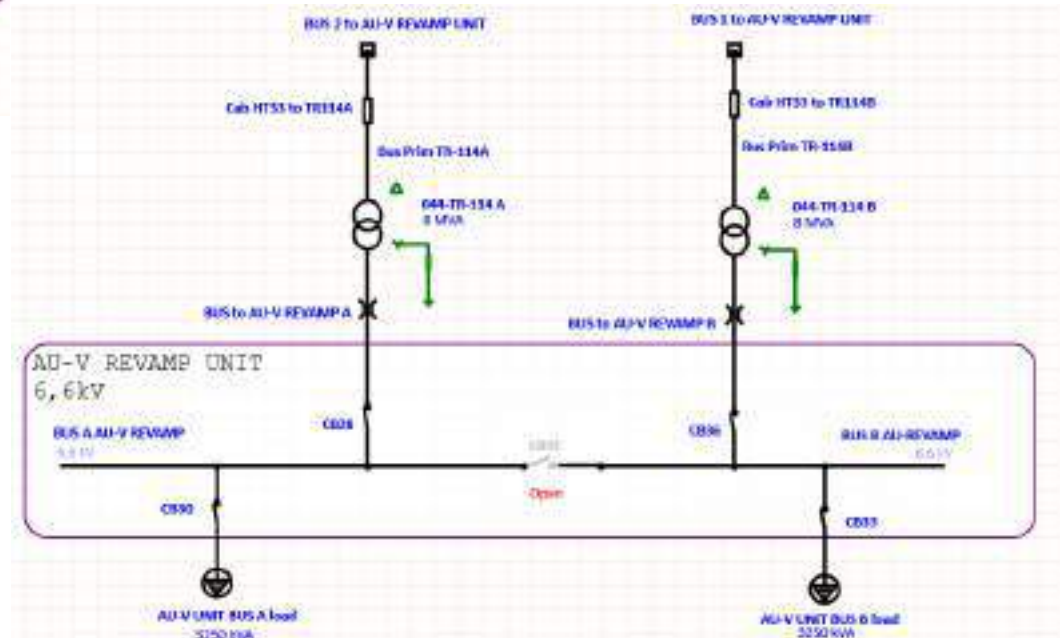
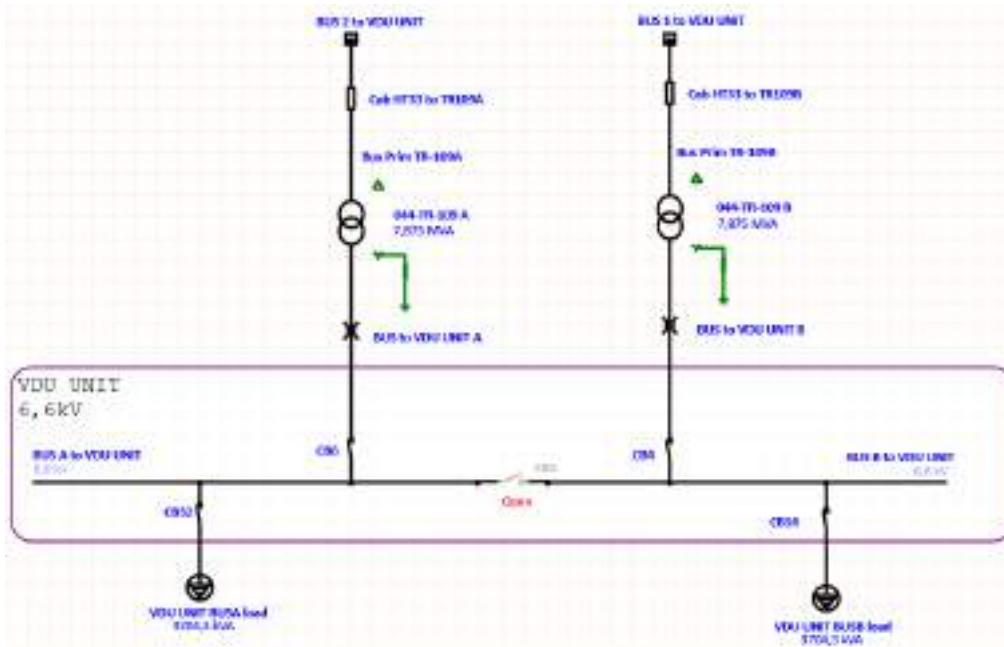


Figure 6. Normal operation: VDU and AU-V REVAMP units

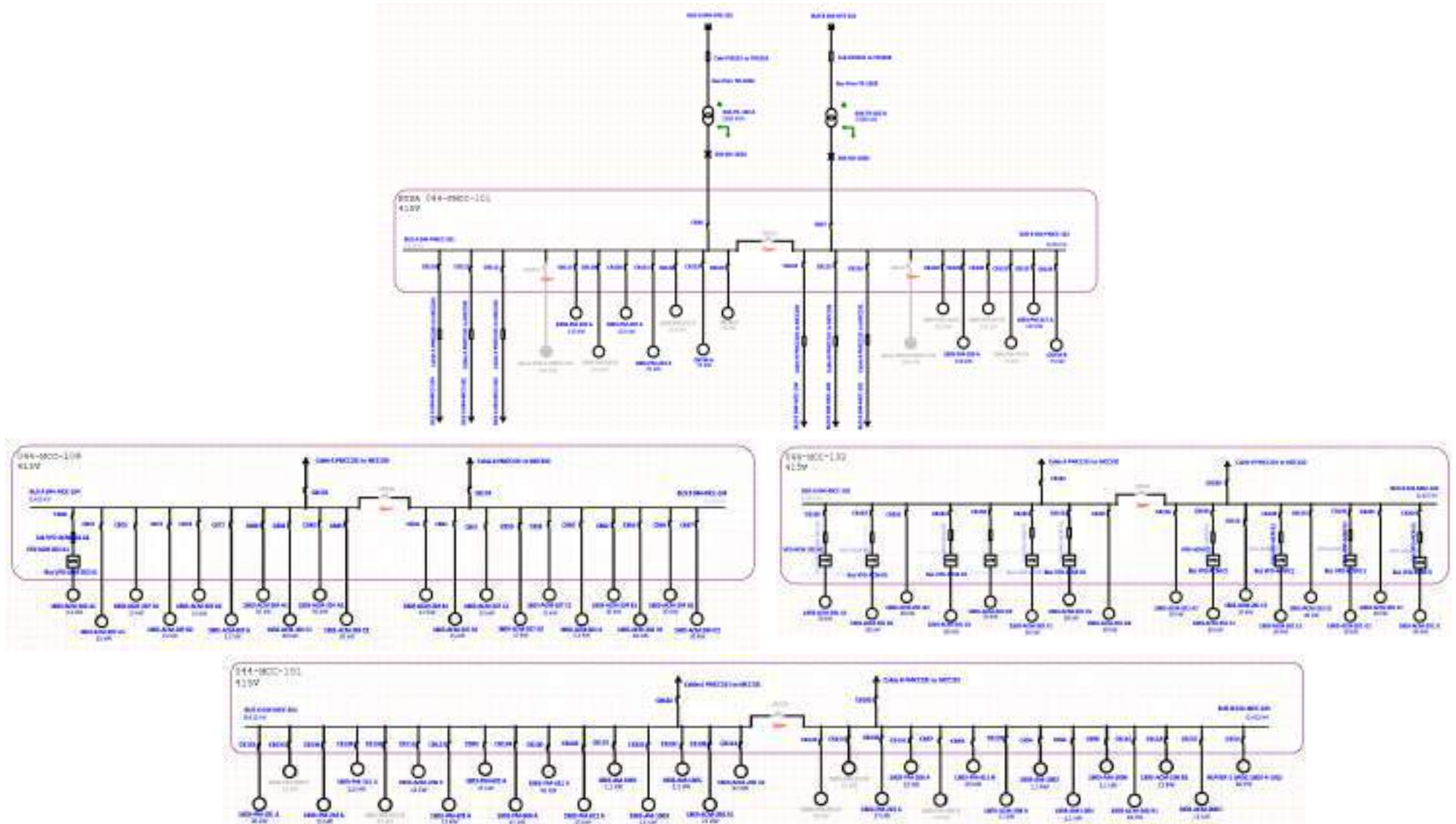


Figure 7. Normal operation: 044-PMCC-101, 044-MCC-101, 044-MCC-102 and 044-MCC-104.

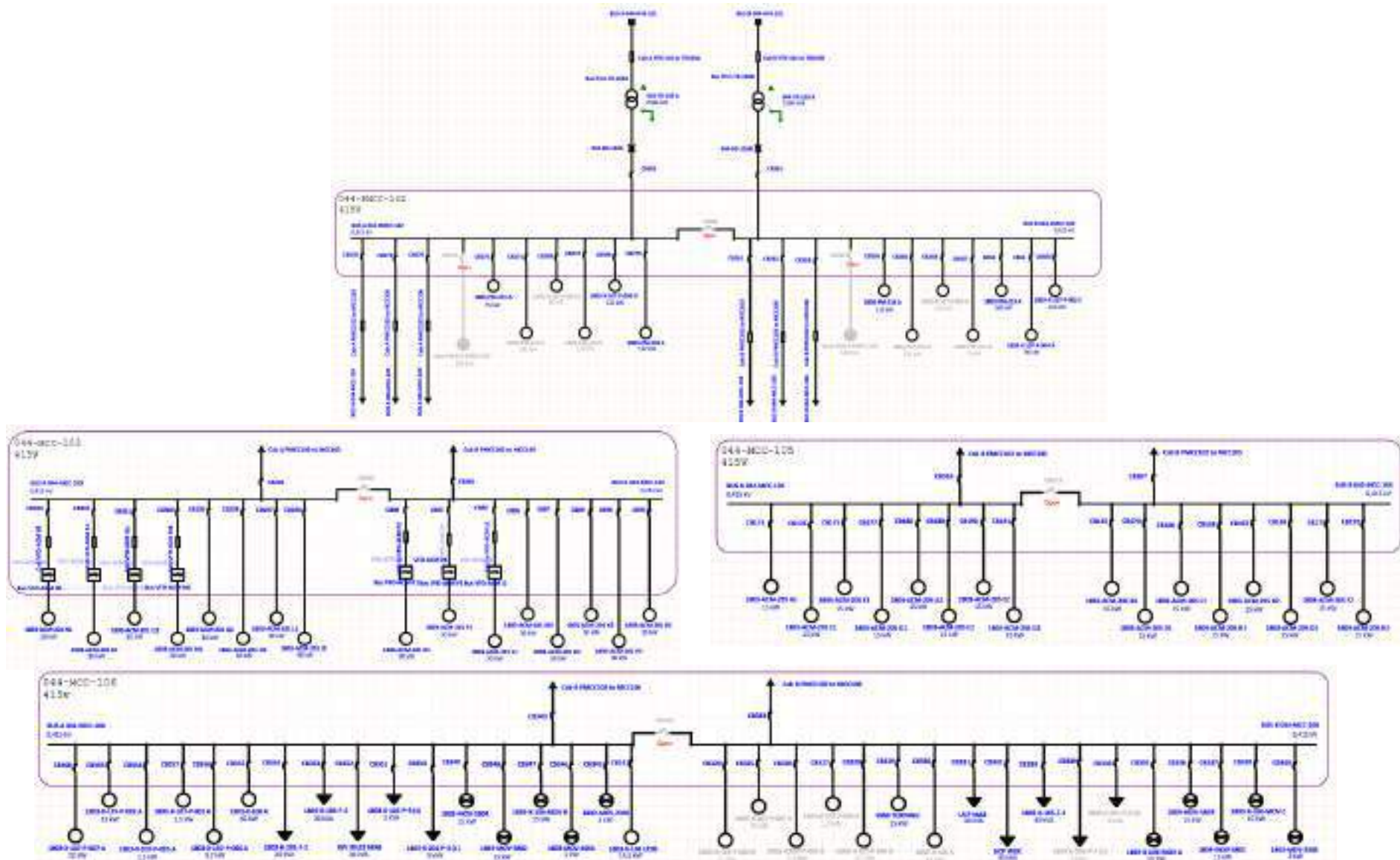


Figure 8. Normal operation: 044-PMCC-102, 044-MCC-103, 044-MCC-105 and 044-MCC-106.

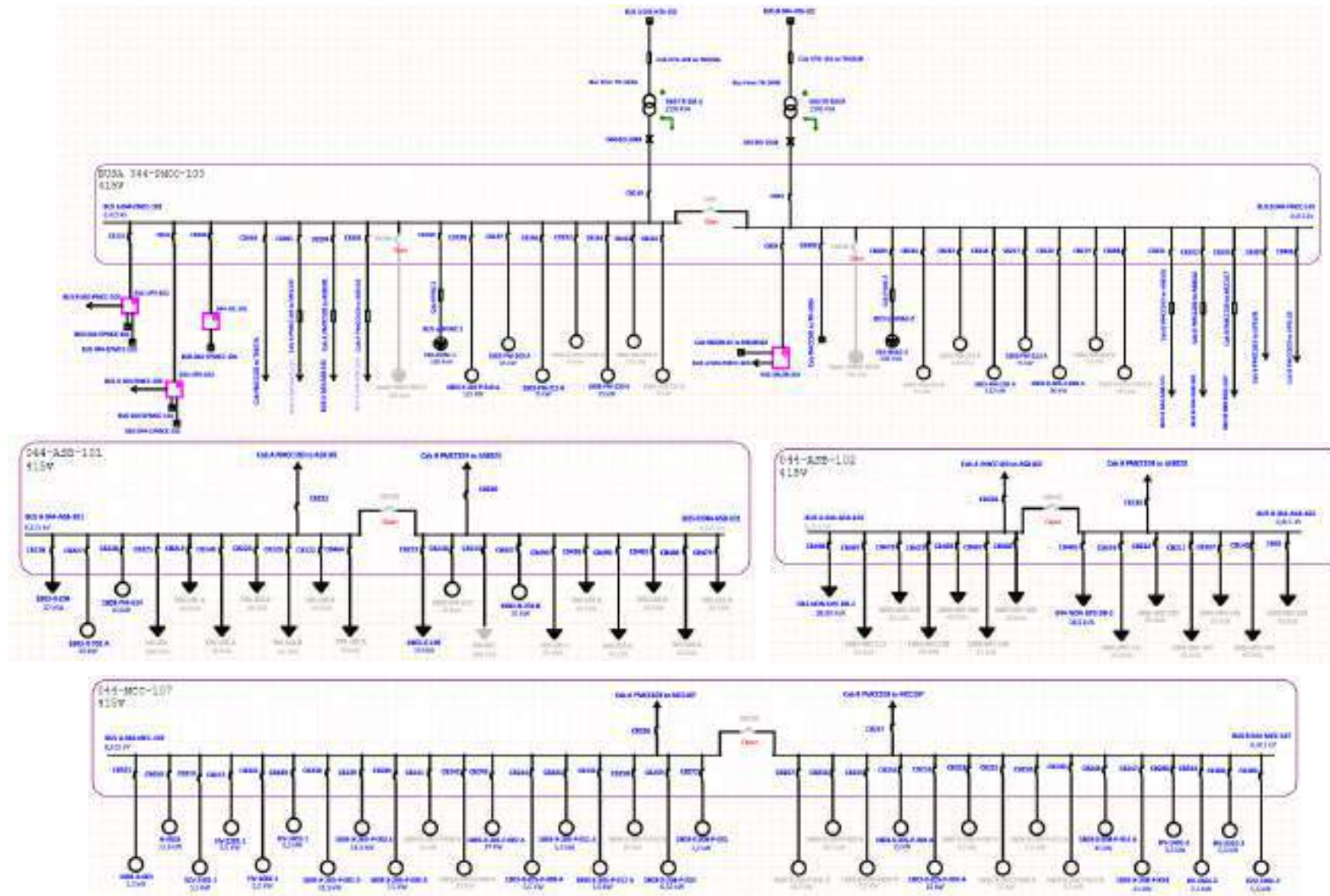


Figure 9. Normal operation: 044-PMCC-103, 044-ASB-101, 044-ASB-102 and 044-MCC-107.

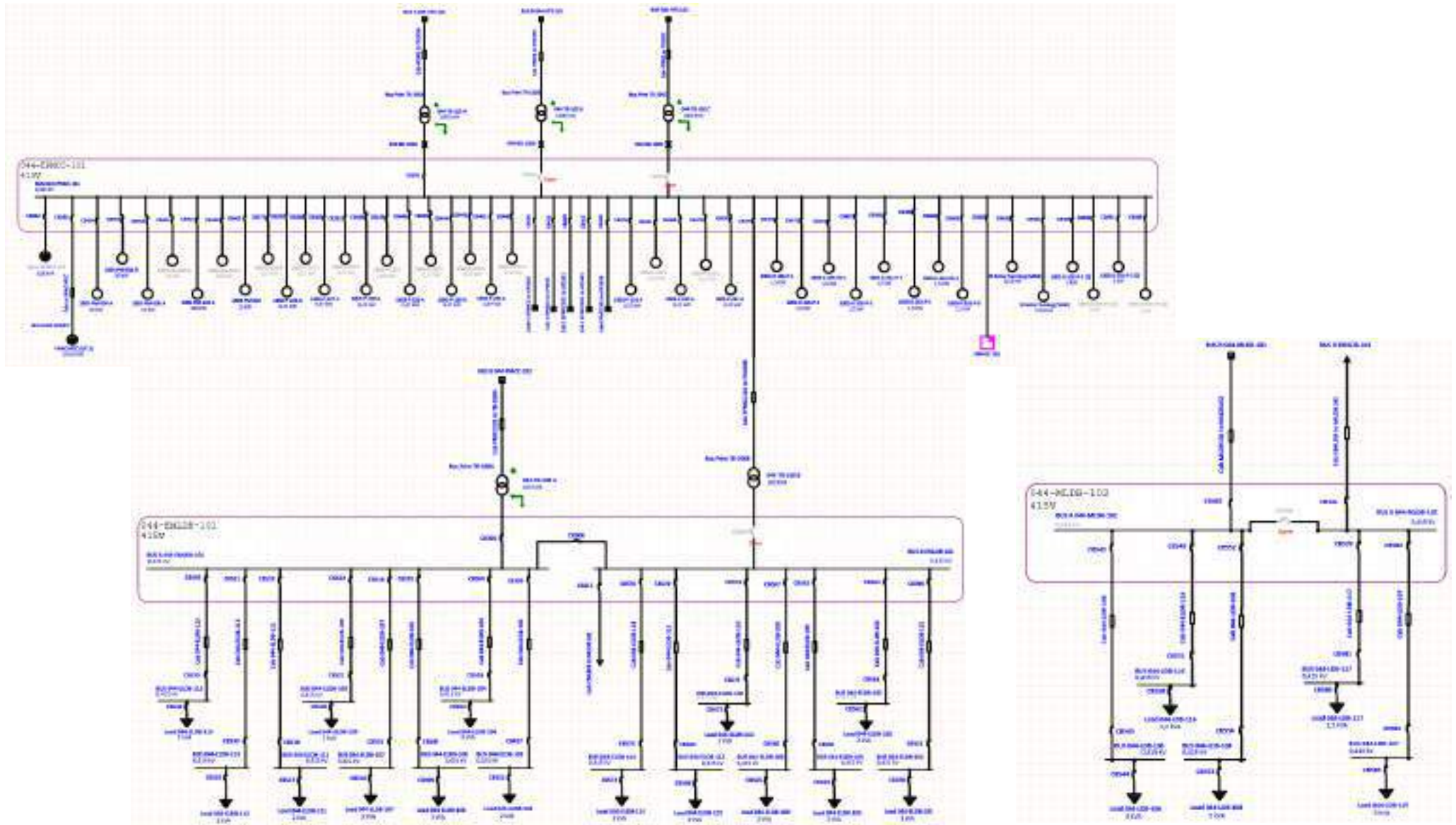


Figure 10. Normal operation: 044-EPMCC-101, 044-EMLDB-101and 044-MLDB-102

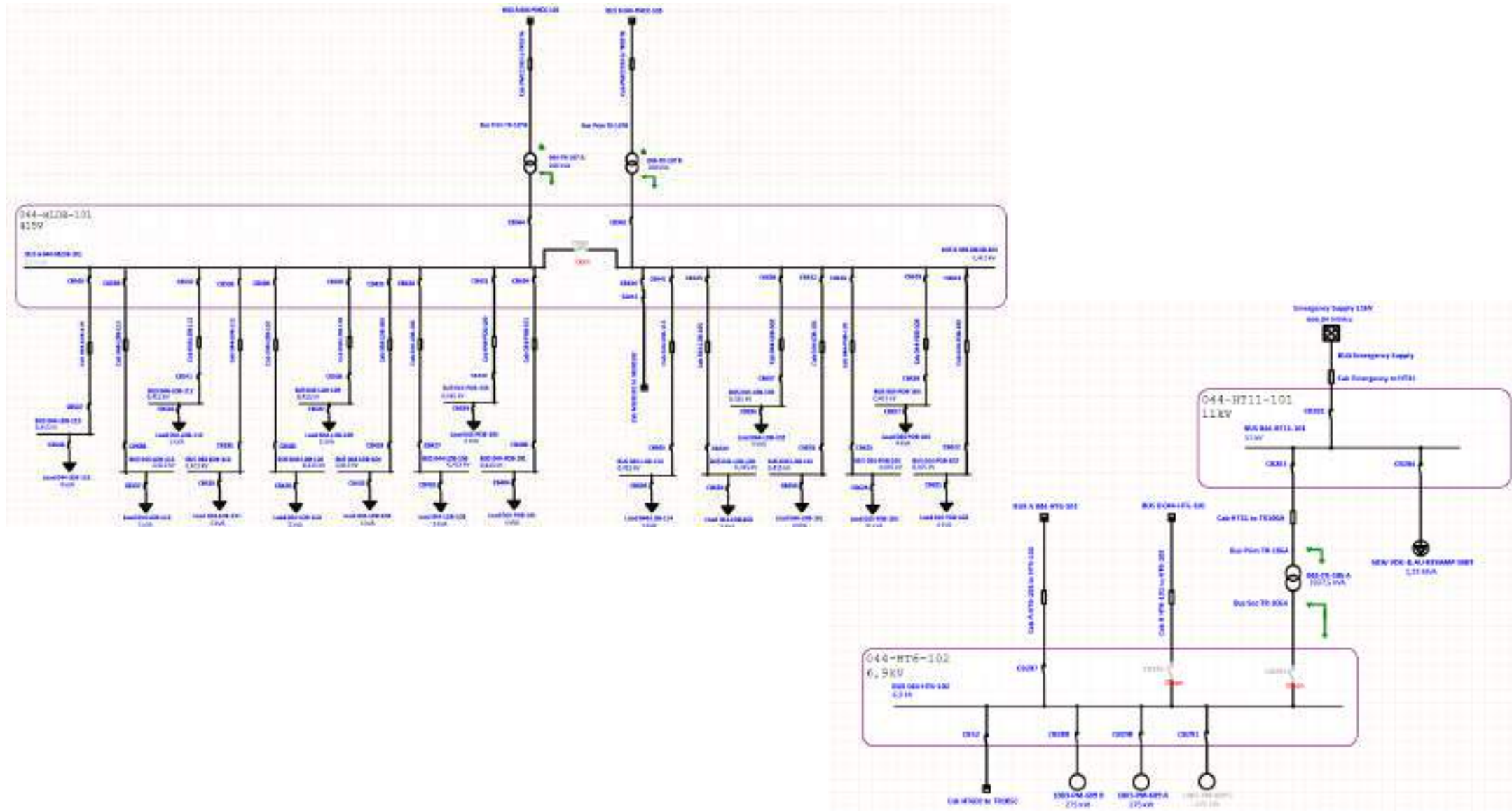


Figure 11. Normal operation: 044-MLDB-101, 044-HT6-102, 044-HT11-101 and 044-HT6-102.

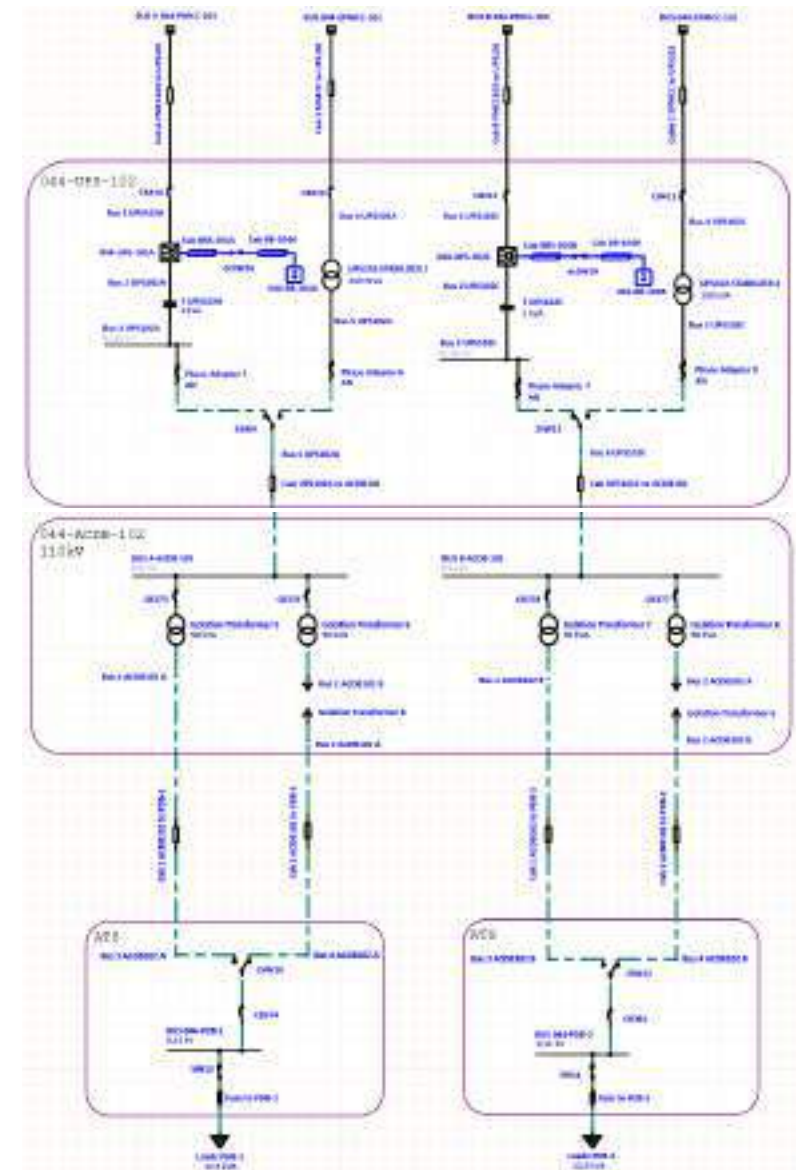
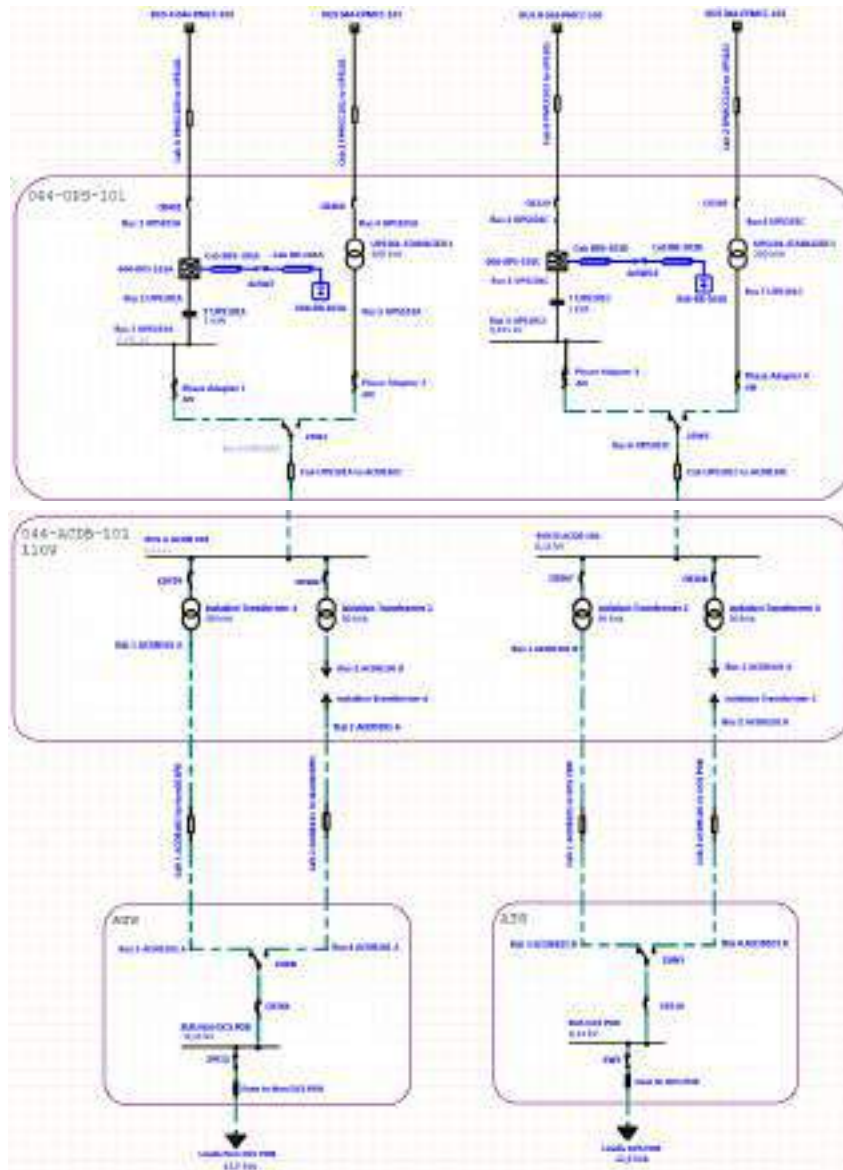


Figure 12. Normal operation: 044-UPS-101 and 044-UPS-102.

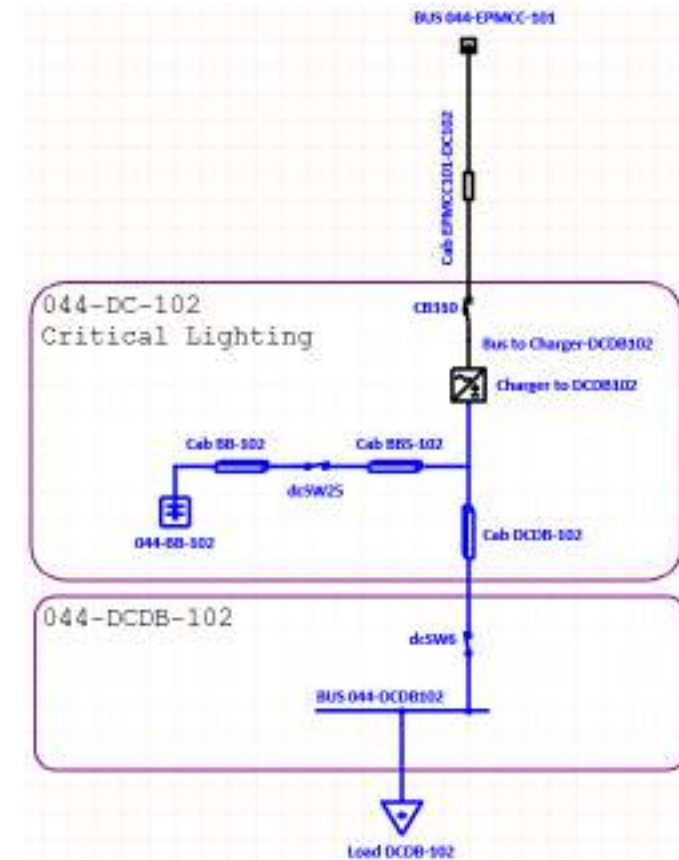
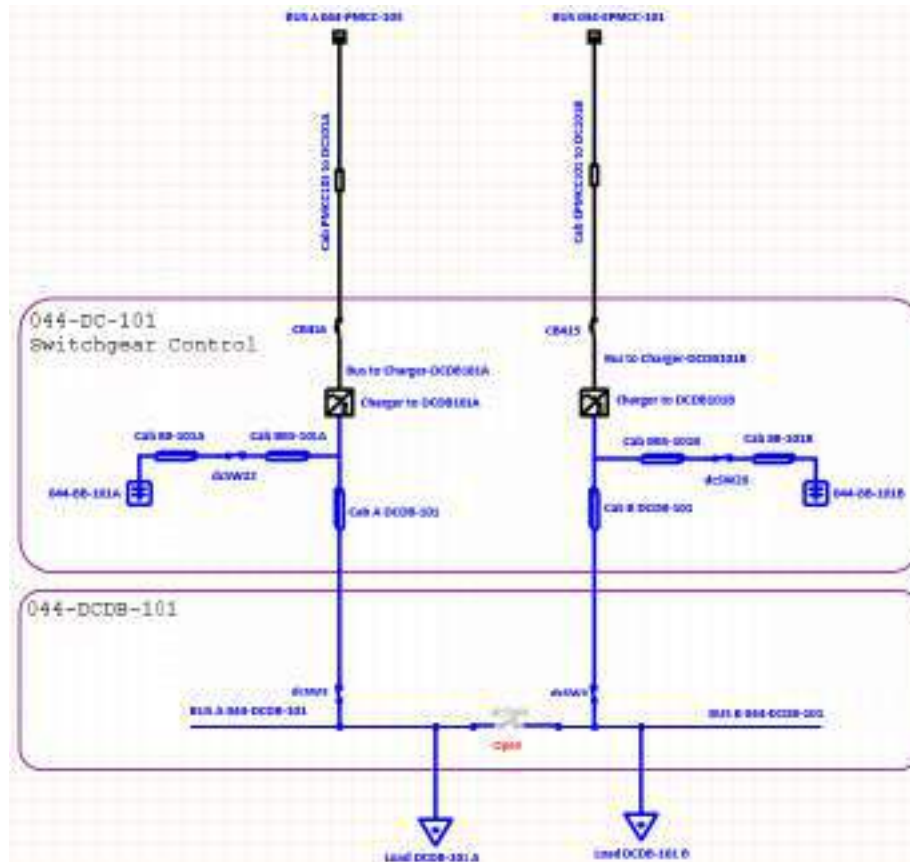


Figure 13. Normal operation: 044-DC-101 and 044-DC-102.

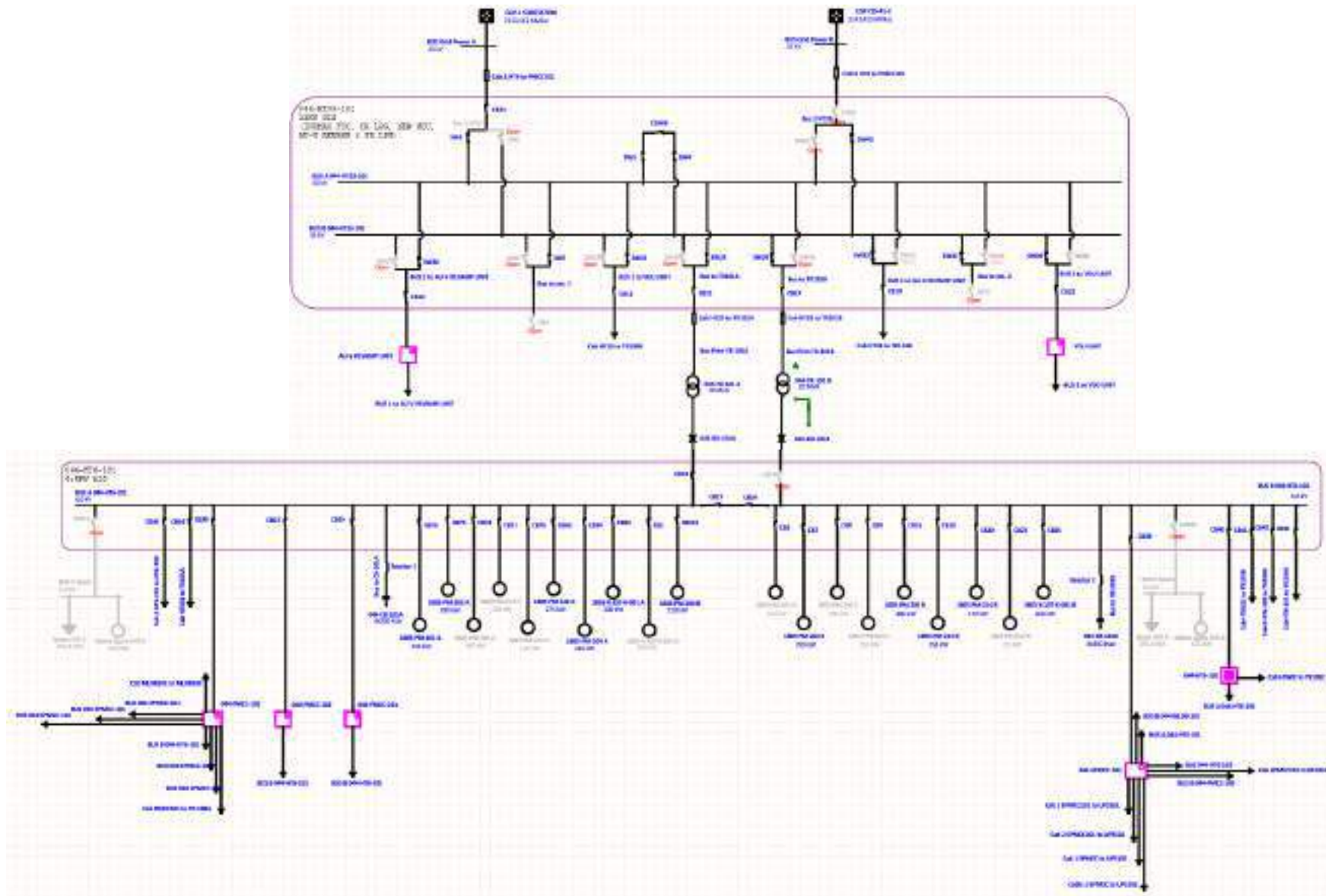


Figure 14. Contingency operation: 044-HT33-101 and 044-HT6-101.

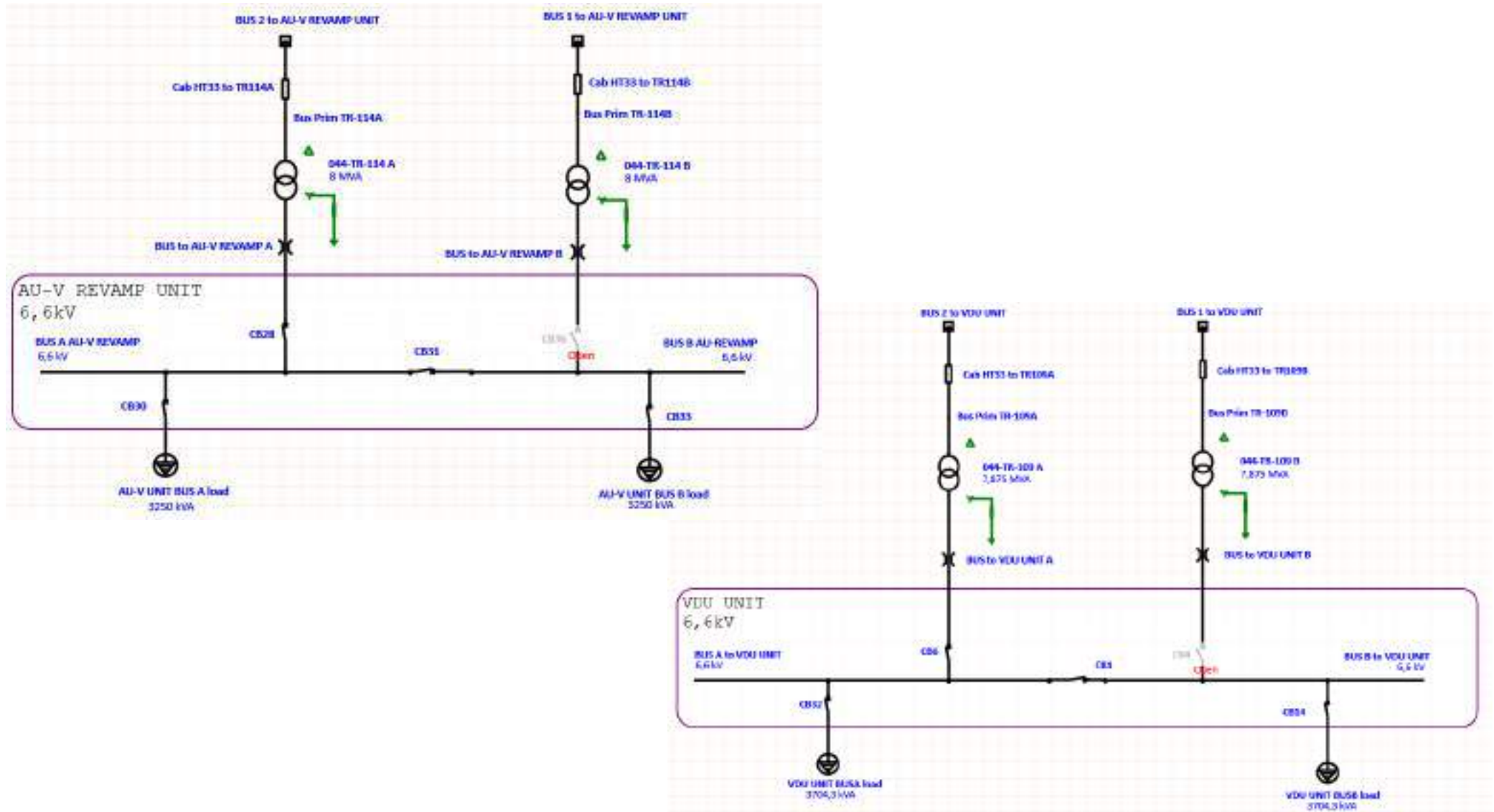


Figure 15. Contingency operation: AU-V REVAMP unit and VDU unit.

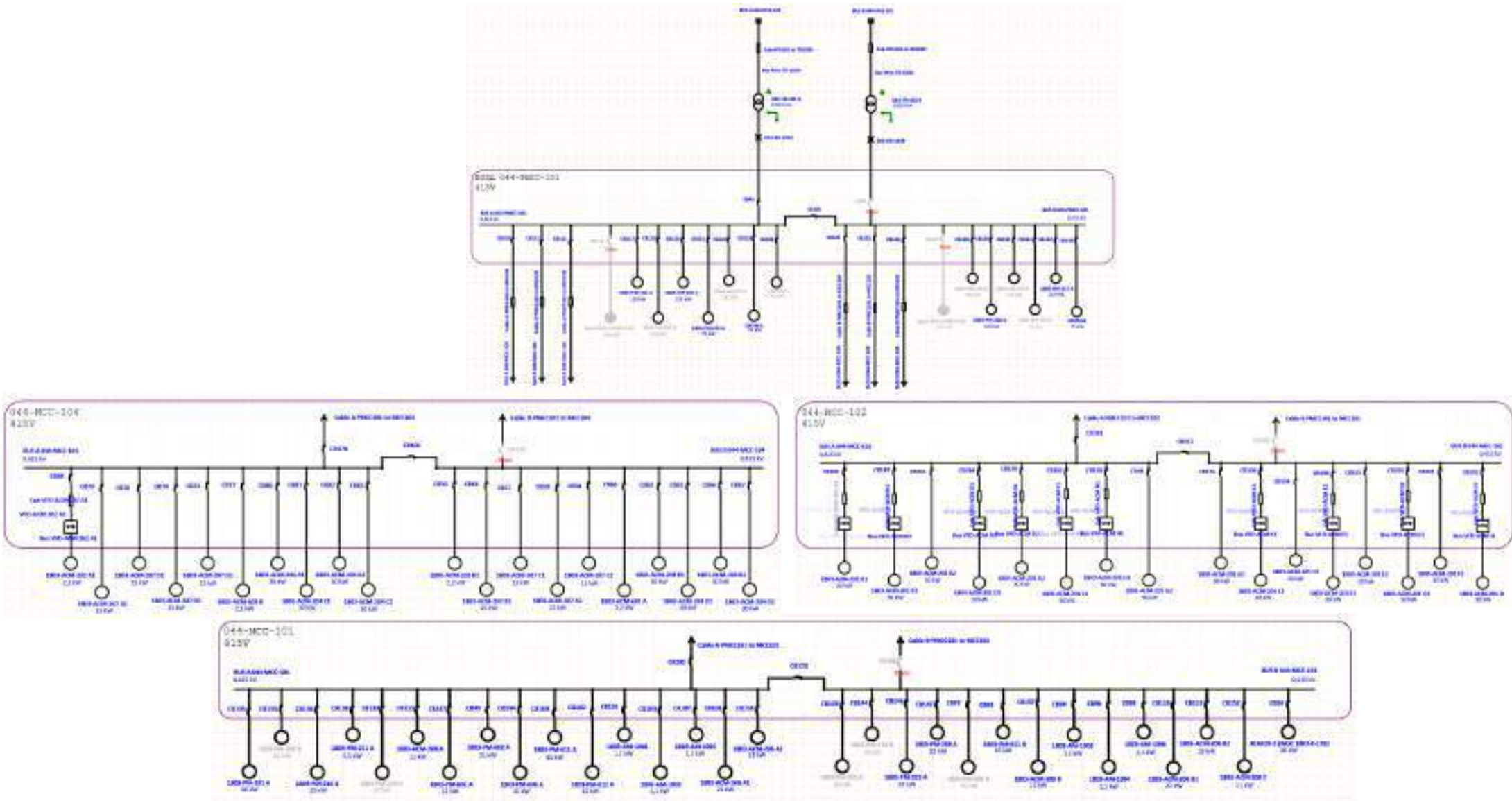
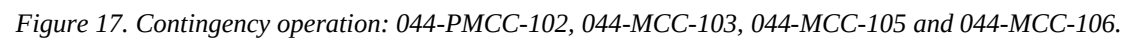


Figure 16. Contingency operation: 044-PMCC-101, 044-MCC-101, 044-MCC-102 and 044-MCC-104.



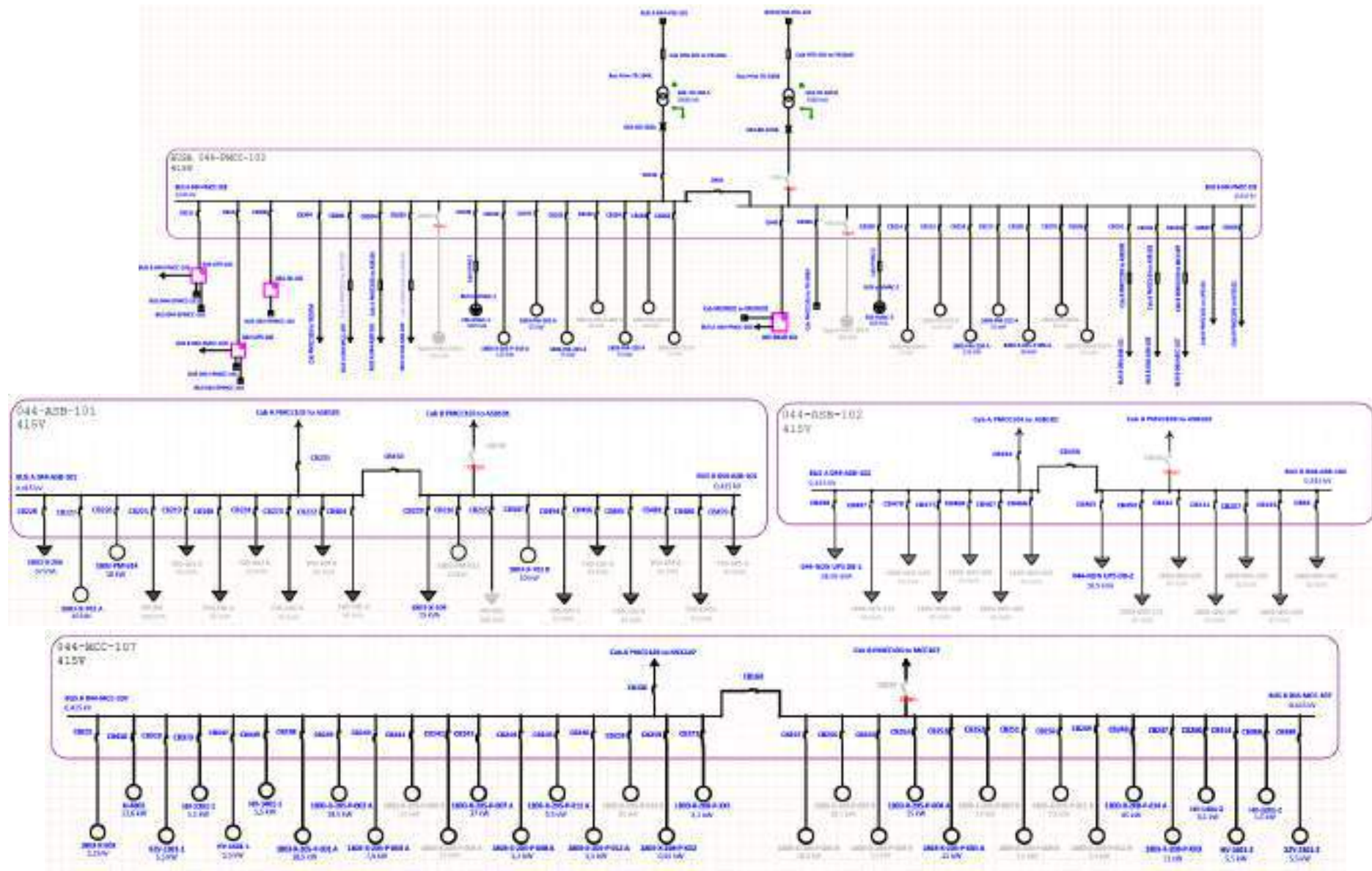


Figure 18. Contingency operation: 044-PMCC-103, 044-ASB-101, 044-ASB-102 and 044-MCC-107.

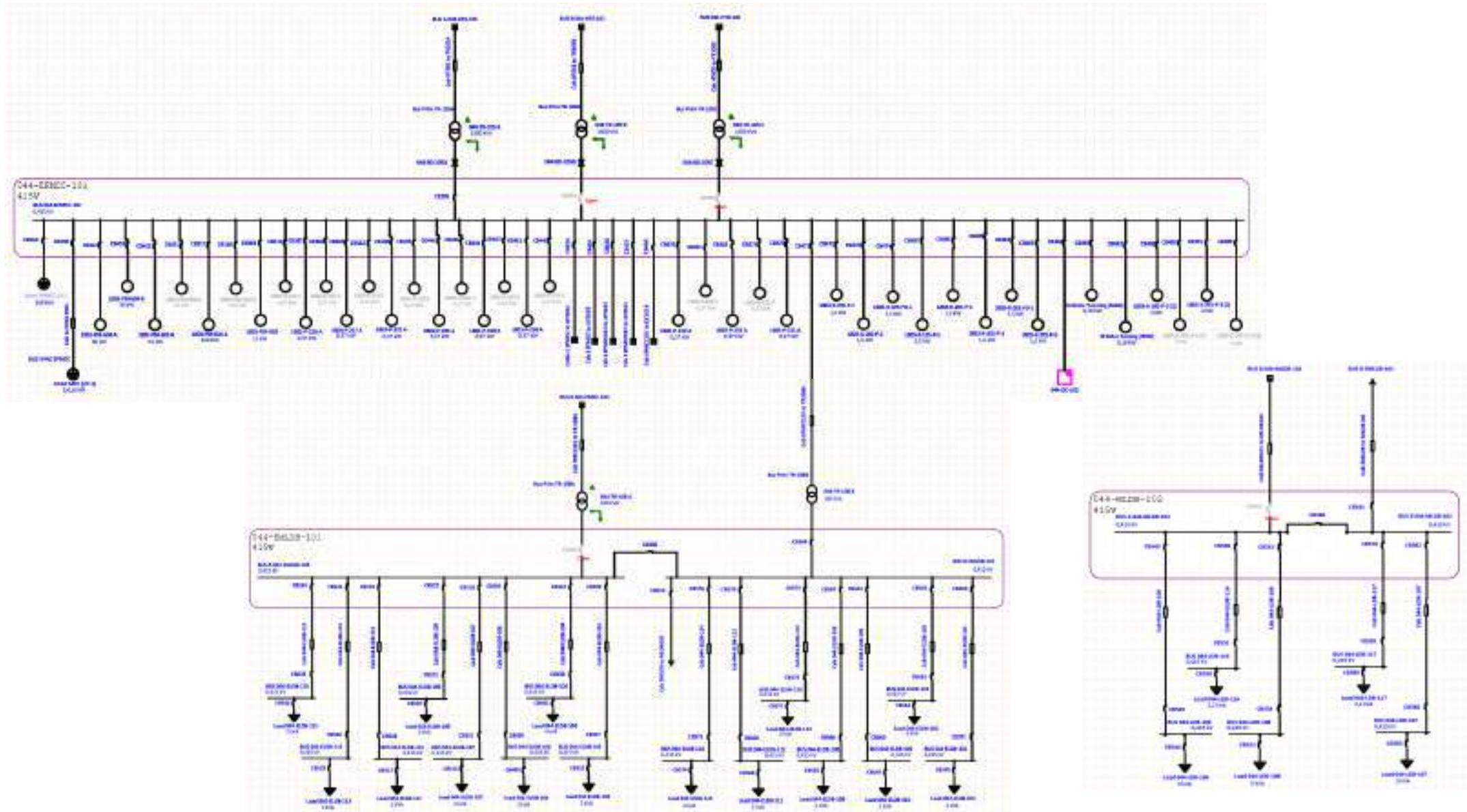


Figure 19. Contingency operation: 044-EPMCC-101, 044-EMLDB-101 and 044-MLDB-102.

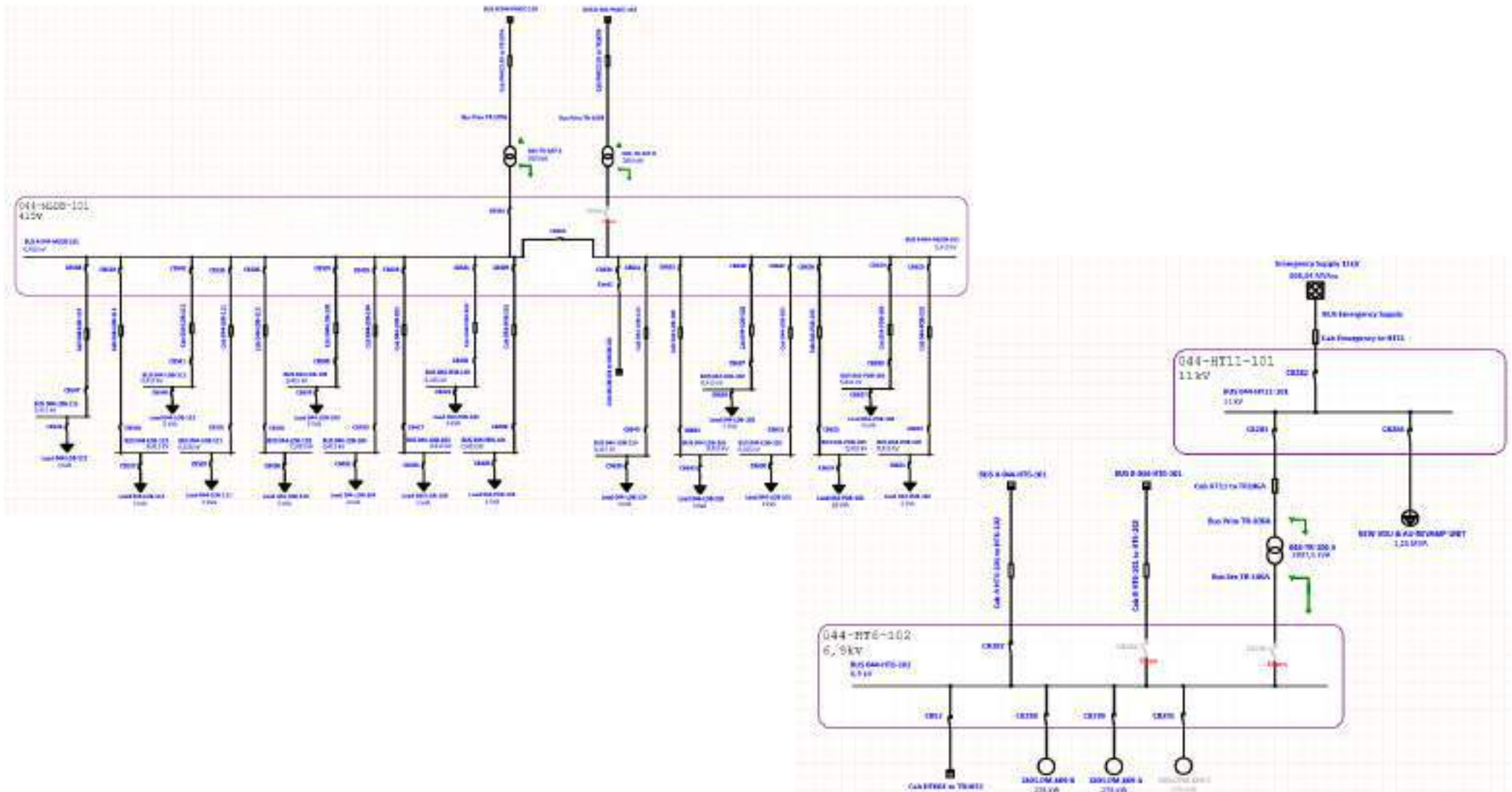


Figure 20. Contingency operation: 044-MLDB-101, 044-HT11-101 and 044-HT6-102.

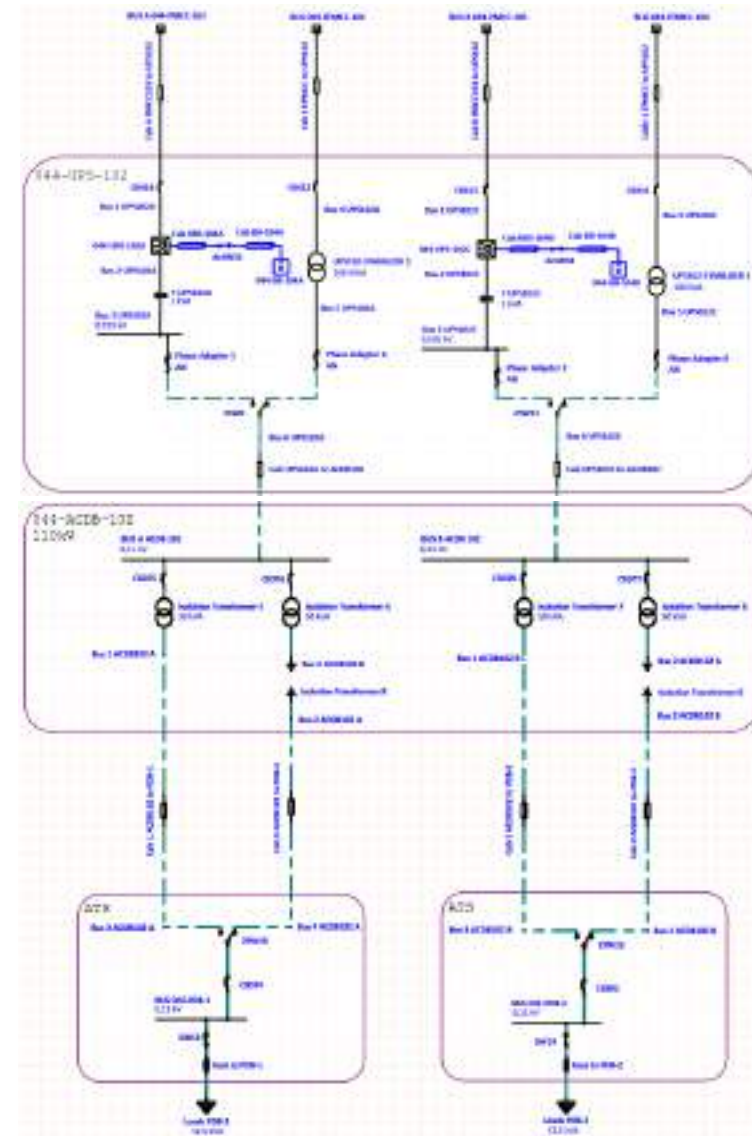
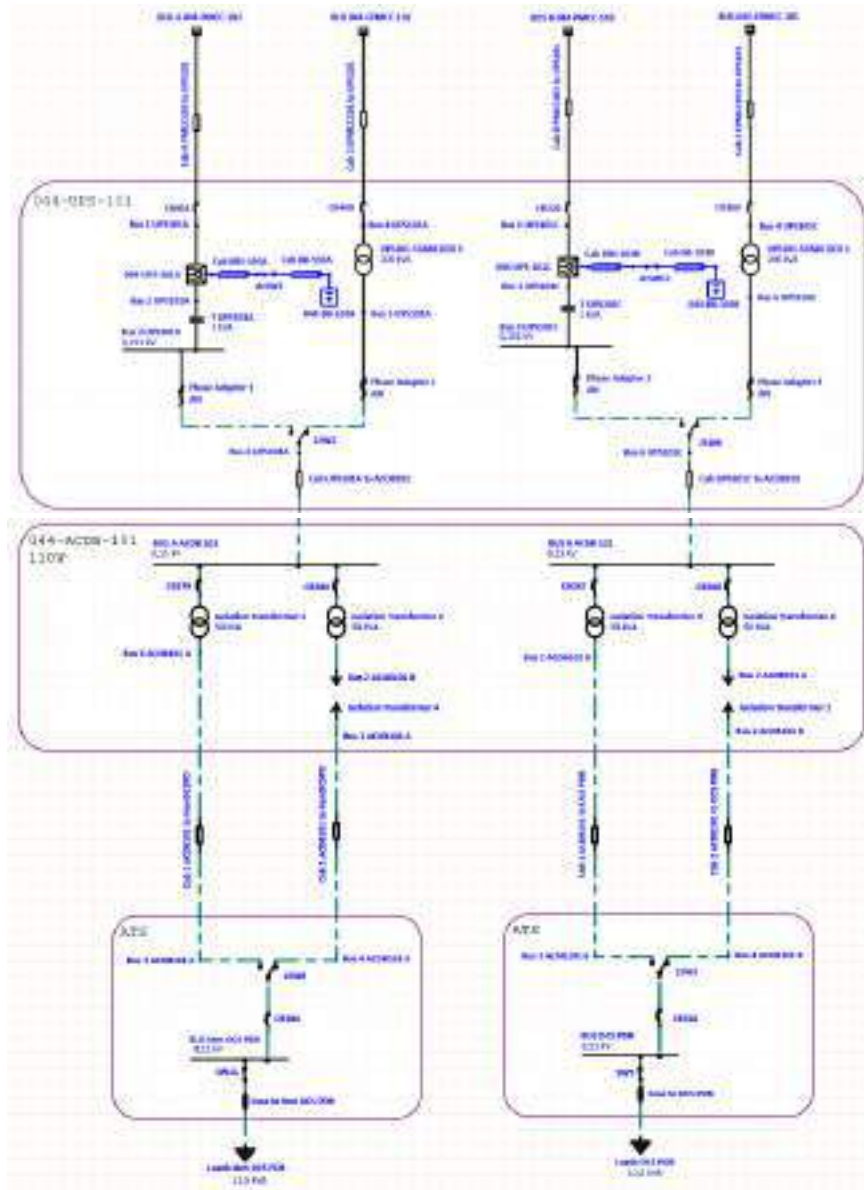


Figure 21. Contingency operation: 044-UPS-101 and 044-UPS-102.

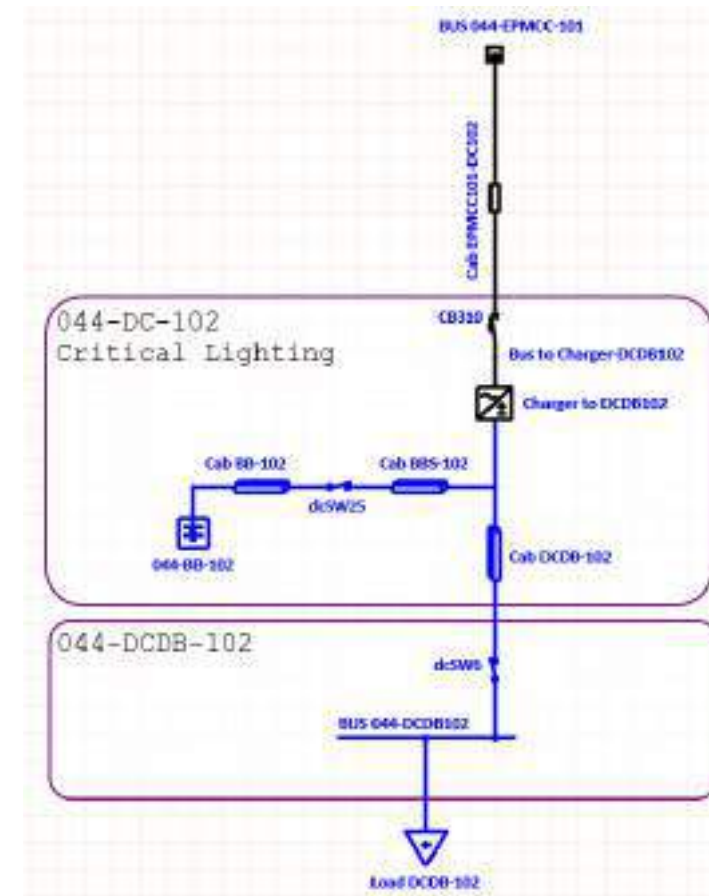
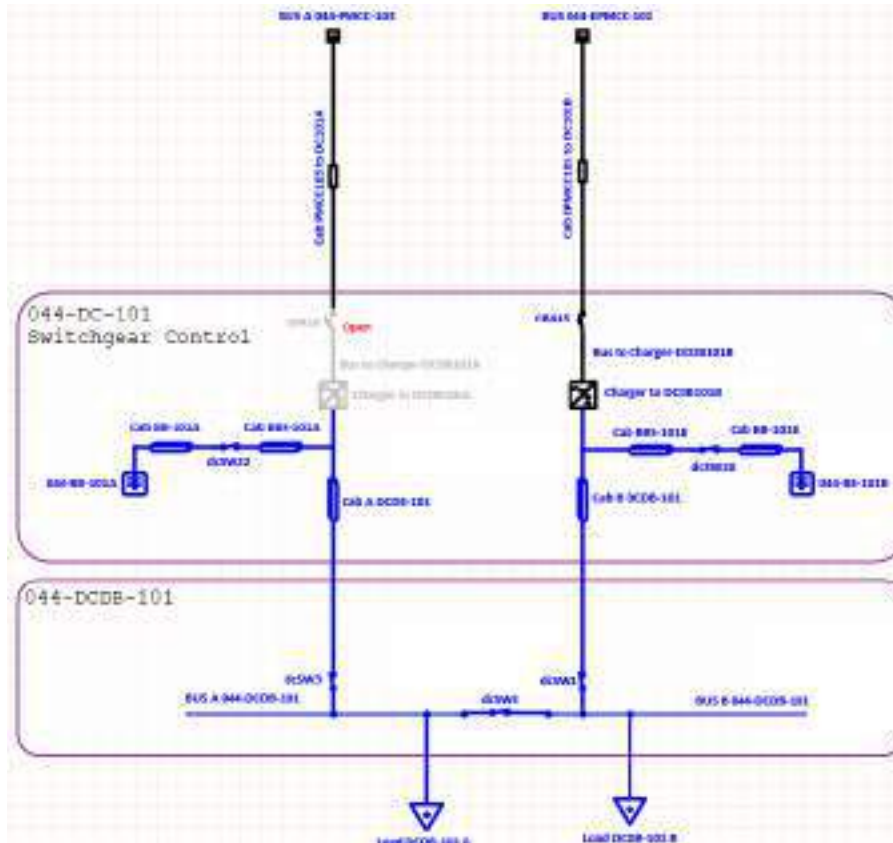


Figure 22. Contingency operation: 044-DC-101 and 044-DC-102.

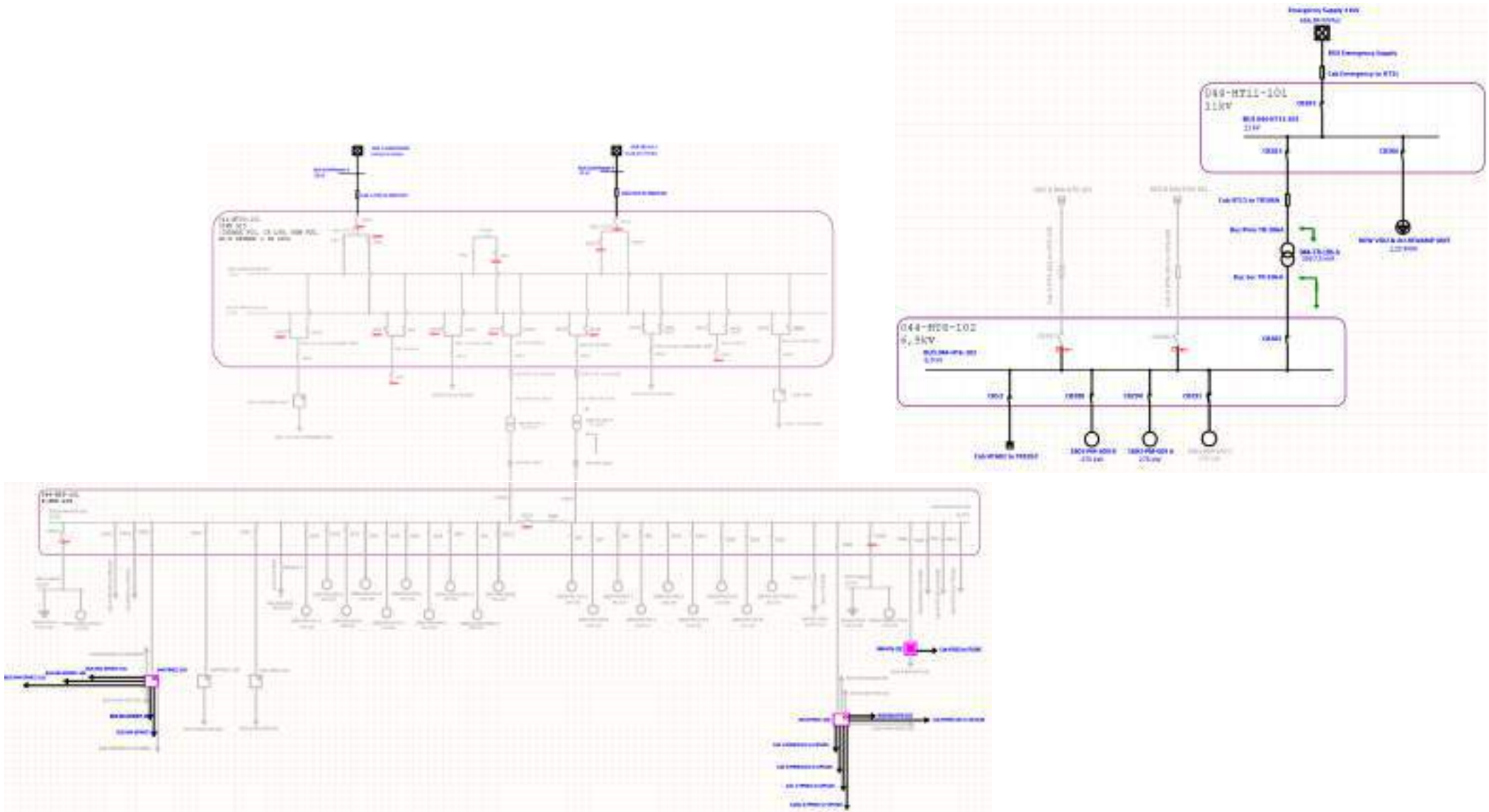


Figure 23. Emergency operation: 044-HT33-101, 044-HT6-101, 044-HT6-102 and 044-HT11-101.

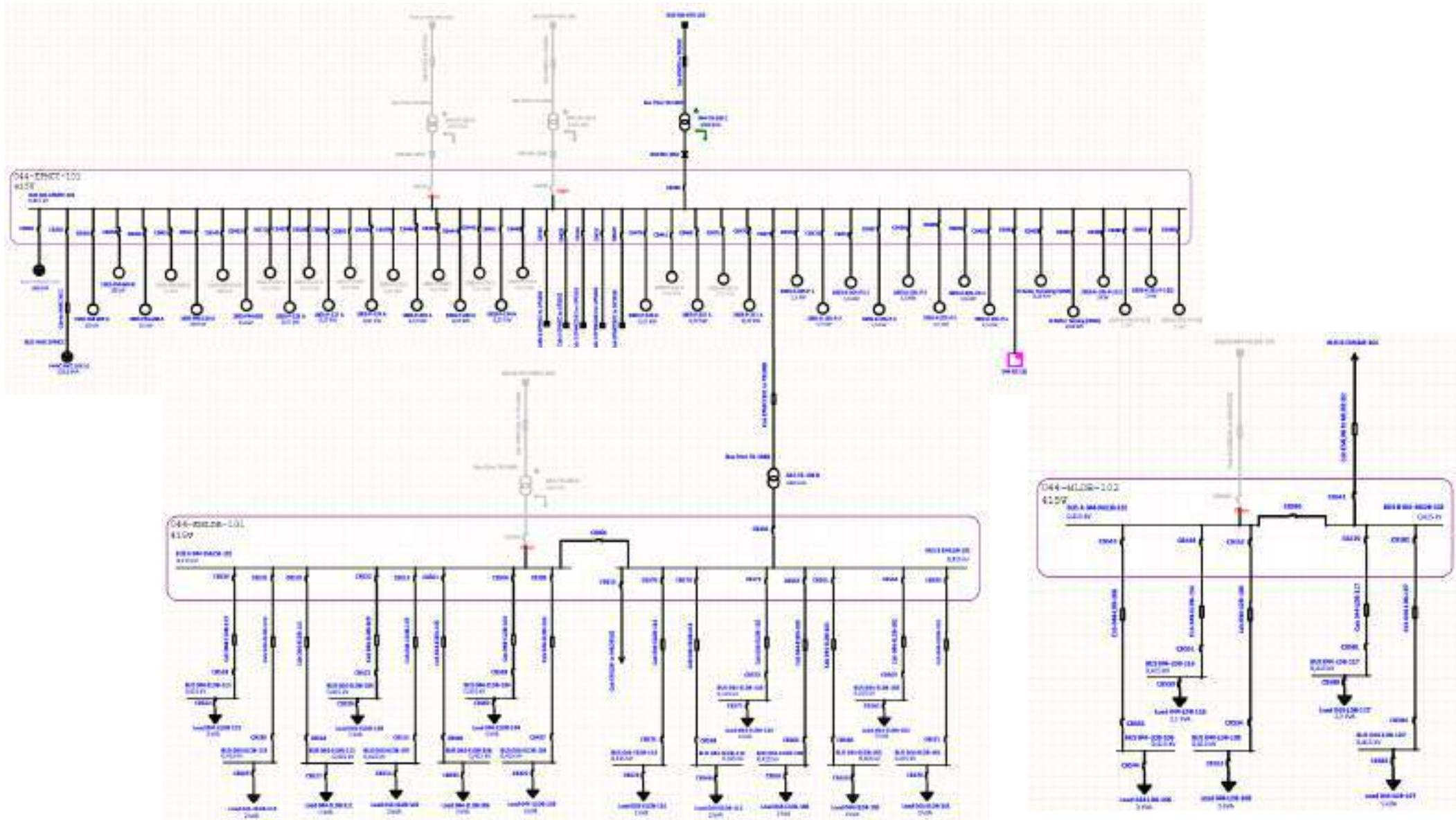


Figure 24. Emergency operation: 044-EPMCC-101, 044-EMLDB-101 and 044-MLDB-102.

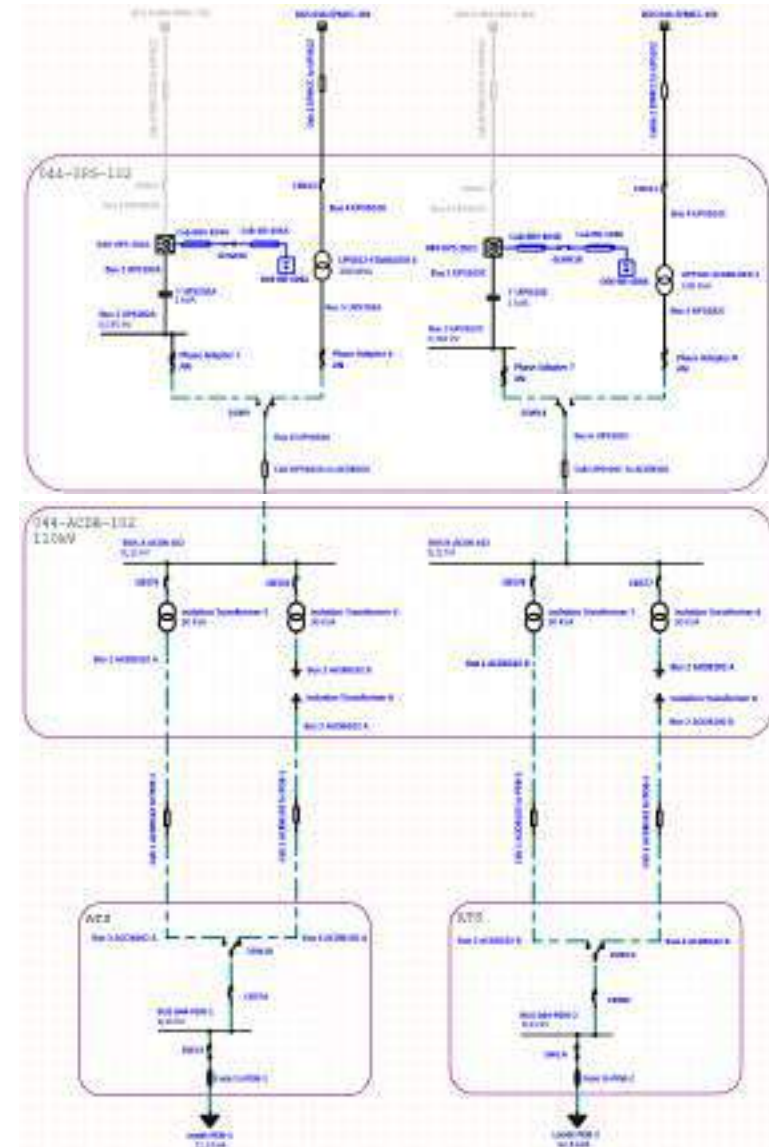
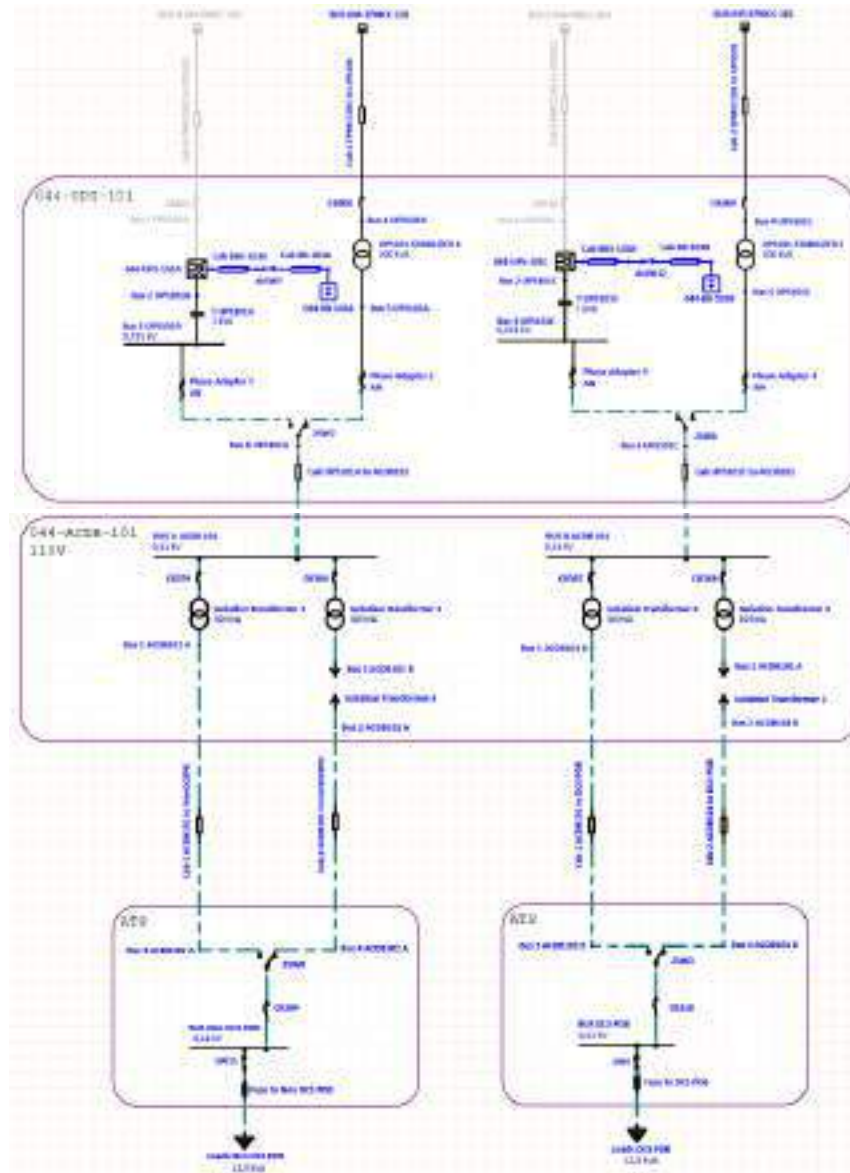


Figure 25. Emergency operation: 044-UPS-101 and 044-UPS-102.

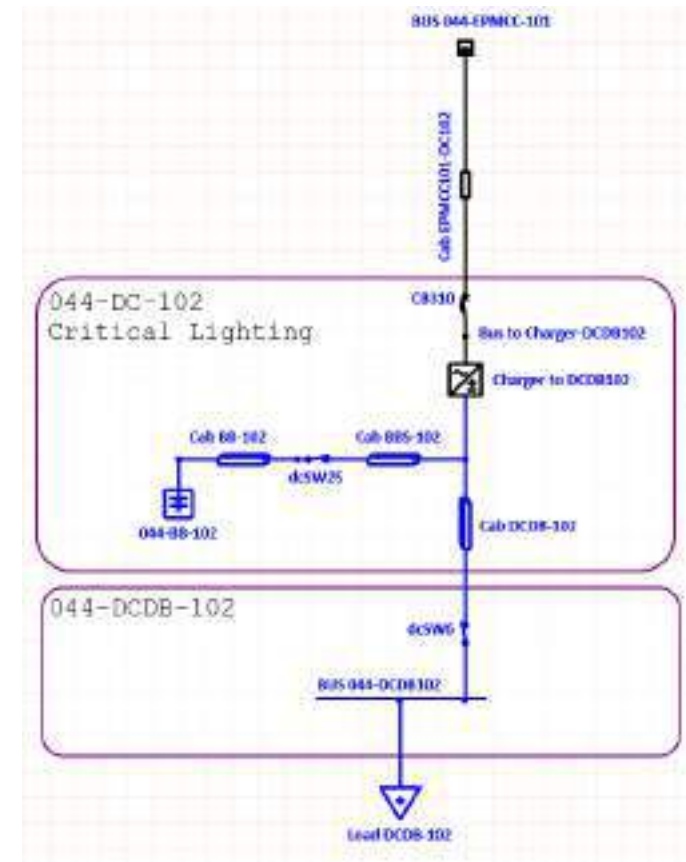
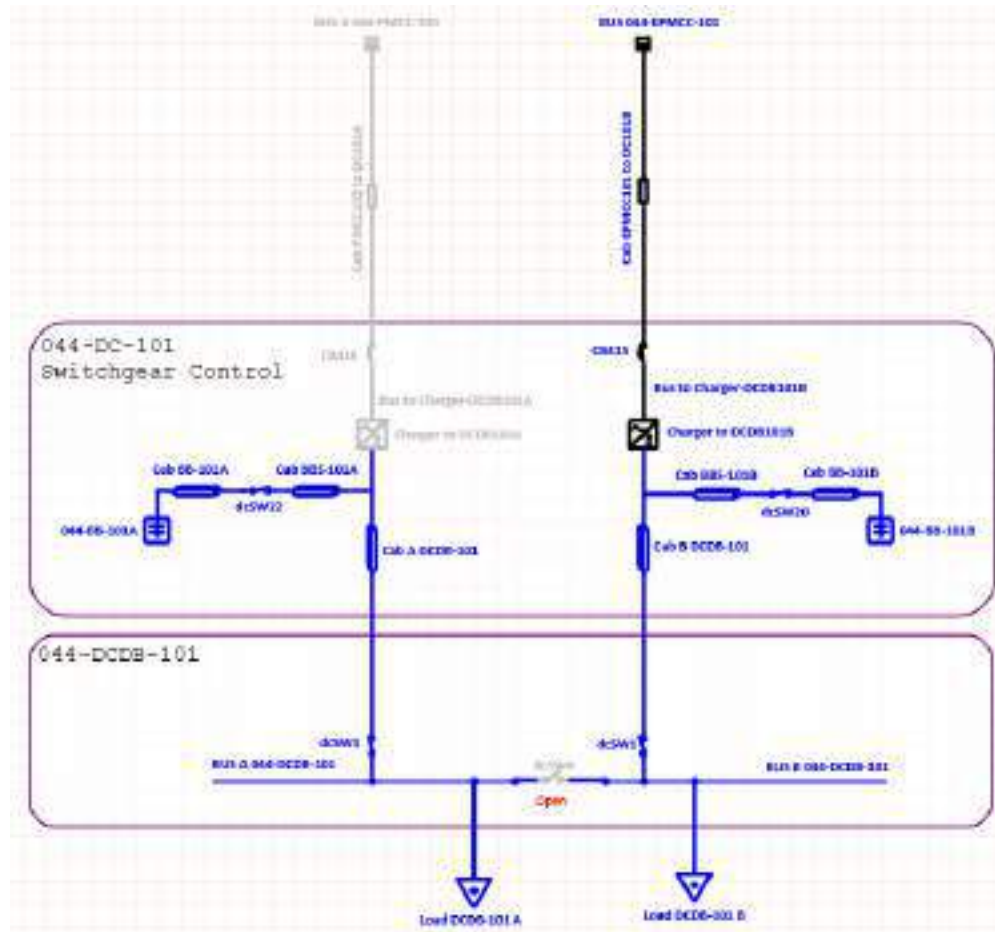


Figure 26. Emergency operation: 044-DC-101 and 044-DC-102.

Chapter 5. Cabling system

4.1. DESIGN CRITERIA

HV cables shall be with stranded aluminum conductor, dry cured XLPE insulated, insulation screened, extruded PVC inner sheathed, armored and extruded FRLS PVC outer sheathed. HV cables shall be provided with both conductor and insulation screening. MV cables shall be with stranded aluminum or copper conductor, XLPE insulated, extruded PVC inner sheathed, armored and extruded FRLS PVC outer sheathed. A minimum of 10% spare core shall be provided. All incoming cables to switchgear, UPS, DC system, DBs, etc. shall be sized to maximum anticipated load including 20% future growth. Cables to capacitor bank shall be sized for 135% of rated capacitor current. Feeders and sub-feeders shall be sized for the demand based on the operating kVA required for normal design throughput of the unit except that feeders to transformers shall be sized to suit transformer rating. Cable tags are to be provided at both ends and points (entry) where cable is exposed.

The power and control cables shall have the following minimum cross-sectional areas:

A.	Medium voltage power cable	25 mm ² - Aluminium
		2.5 mm ² to 16 mm ² - Copper
B.	Control cables	2.5 mm ² – stranded Copper and shielded
C.	Lighting	2.5 mm ² – stranded Copper

Table 97. Cables' minimum cross-sectional areas.

For lighting inside the building minimum 1.5mm² copper conductor, PVC insulated wire shall be used in conduit system, with proper color coding. Cables from UPS to ACDB and UPS to Battery shall be only copper irrespective of the cable size.

Separate control cables shall be used for each of the following:

- CT secondary circuit.
- PT secondary circuits.
- Interlocking circuits.
- DC signals between instrumentation and electrical equipment.
- AC signals between instrumentation and electrical equipment.
- Switchboard to each local control station.

The following voltage drop criteria must be applied, depending on the equipment.

- Bus duct or cable between transformer secondary and HV Switchboard or MV switchboard:
0.5%.

- Cable between MV switchboard and MCC or auxiliary switchboard (near MV Switchboard): 0.5%.
- Higher voltage drop may be permitted between PCC / PMCC and remote mounted MCC / Auxiliary Switchboard, subject to overall voltage drop up to motor (from PCC / PMCC) is limited within 5.5%.
- Cable between MV switchboard and MCC or auxiliary switchboard (remote from MV switchboard): 2 to 2.5%.
- Higher voltage drop may be permitted between PCC / PMCC and remote mounted MCC / Auxiliary Switchboard, subject to overall voltage drop up to motor (from PCC / PMCC) is limited within 5.5%.
- Cable between HV Switchboard and HV Motor: 3%
- Cable between MV switchboard and motor: 5.5%
- Cable between MCC (situated near MV switchboard) and motors: 5%
- Cable between MCC (situated remote from MV switchboard) and motors: 3%
- Cable between auxiliary Switchboard & Lighting Panel: 1 to 1.5%. (In case of difficulty in achieving specified voltage drop in cable up to lighting panel, total voltage drop of 5% from auxiliary switchboard up to lighting points may be permitted)
- Circuit between lighting panels and lighting points: 4% (In case of difficulty in achieving specified voltage drop in cable up to lighting panel, total voltage drop of 5% from auxiliary switchboard up to lighting points may be permitted)
- DC Supply Circuit (Electrical Controls): 5%
- DC Supply Circuit (Instrumentation): 5%
- UPS Supply Circuit (Instrumentation): 5%

The maximum voltage drop at various buses during start-up of large motor and motor reacceleration conditions shall be within the limits stated below:

S. No.	System Element	Operating Condition	Maximum permissible voltage drop
A.	At the bus bars of the worst affected Switchboard	Start-up of the large HV motor with other loads on the bus or reacceleration of a group of HV motors	15%
B.	At the bus bars of the worst affected MV Switchboard (PCC/PMCC/MCC)	Start-up of large MV motor with other loads on the bus, or reacceleration of a group of MV motors	10%
C.	Cables between HV Switchboard & Motor	Motor start-up or reacceleration	5%
D.	Cables between MV Switchboard (PCC/PMCC/MCC) and Motor	Motor start-up or reacceleration	15%

Table 98. Maximum voltage drop for cables.

Table 99 indicates the main characteristics for all the substation cables that must be designed.

Description	High Voltage	415 Volts
Loads located beyond 1 km	3 core cable	-
Loads located up to 1000m	3 core cable	1 Core / 3 Core cable / 3 ½ Core cable / 4 Core cable
Loads beyond 1000 A rating	Bus duct / 1 core cable	Bus duct / 1 core cable
Recommended limiting size of multi- core cable (mm2)	300	300
Short-circuit withstand time (seconds)	3 sec (33kV incoming & O/G feeder) 1 sec (Incomer from transformer) 1 sec (Incomer from other switchboard / plant feeder) 1 sec (Transformer feeder) 0.25 sec (Motor feeder)	1 sec (Plant feeder / incomer from another switchboard) 0.25 sec (outgoing breaker fed motor feeder)
Insulation voltage grade	Unearthed	Earthed
Type of cable insulation	XLPE - FRLS	XLPE – FRLS
Fire survival (Resistant) cable	NA	Yes
Conductor	Aluminum	Copper up to 16 mm2 and above 16 mm2 Aluminum
No. of cores for motor cables	3	3.5 / 3
Power and Control cables	Armored	Armored

Table 99. Cables description and characteristics.

Cables from UPS to ACDB/DCDB, UPS to Battery and from ACDB/DCDB to downstream distribution systems shall be only copper irrespective of the cable size. Copper earth strip (suitable for earth fault current) shall be provided for cables of voltage grade 33kV and above. Wherever cable sizes are calculated as per rating and short circuit levels, one run in addition for the designed runs shall be considered for the radial feeders between substations (long distance cables) in order to cater for full load during outage of single run cable to avoid unit shutdowns during fault.

4.2. DERATING FACTORS CALCULATION

To account for specific operating conditions that may reduce the cable's performance, a derating factor is applied, so the calculated cable size is adjusted to ensure that the cable can safely carry the expected current without exceeding its thermal limits.

For the calculation of all the derating factors for the correction factors, standard IS 3961 parts 6 and 7 have been used. Four correction conditions have been considered. The total factor has been calculated as follows:

$$K = K_t \cdot K_r \cdot K_g \cdot K_d$$

Where,

- K is the total derating factor.

- K_t is the ground or air temperature correction factor.
- K_r is the correction factor for variation in thermal resistivity.
- K_g is the reduction factor for group of conductors.
- K_d is the reduction factor for depth of laying.

Medium voltage and high voltage cables will be placed as buried cables or on the cable cellar through a cable ladder. All the correction factors for these cases have been calculated.

A) MV buried cables.

The ambient temperature for buried cables is $T=27.5^\circ\text{C}$. According to IS 3961 part 6 table 8, the temperature factor is $K_t=1.02$. Regarding the depth conditions, cables will be buried 1200mm, according to IS 3961 part 6 tables 10 and 11, K_d will be 0.95. As per a thermal resistivity report provided by the client, the thermal resistivity (Km/W) average will be 0.63km/W and considering that, as per IS 3961 part 6 table 17, factors starting from 1 Km/W, several cases must be split:

- For Cu conductors (size $\leq 16 \text{ mm}^2$), thermal resistivity factor should be 1.06.
- For Al conductors, worst case and minimum value should be considered. Therefore 1.07 should be considered.

For simplification, the resistivity factor to be considered will be $K_r=1.06$, which is the most restrictive. For the grouping factor, the most restrictive condition has also been considered. This is for multi-core cables laid directly in the ground in horizontal conditions. For a 150mm separation and 10 circuits aggrupation, K_g will be 0.54, according to IS 3961 part 6 table 22.

The results for the derating factor for MV buried cables are summarized in Table 100.

Derating factor for MV buried cables	
Kt para 27,5°C	1,02
Depth of laying rating factor	0,95
Factor Thermal resistivity	1,06
Group rating factor	0,54
Overall de rating factor	0,5547

Table 100. Derating factor calculation for MV buried cables.

B) MV cables in cable cellar.

The ambient temperature for MV cable cellar cables is $T=47^\circ\text{C}$. According to IS 3961 part 6 table 7, the temperature factor is $K_t=0.92$. As the cable will be in the cable ladder, there is not resistivity and burring factors. Regarding the aggrupation factors, two cases have been considered, single core and multi core cables:

- According to IS 3961 part 6 table 27, for three-phase single core circuits K_g will be 0.86, this is the most restrictive condition.
- According to IS 3961 part 6 table 26, for multi-core cables circuits in ladder supports K_g will be 0.7, this is also the most restrictive condition.

The results for the derating factor for MV cable cellar cables are summarized in the Table 101.

Derating factor for MV cable cellar	
Kt para 47°C	0,92
Depth of laying rating factor	1
Factor Thermal resistivity	1
Group rating for single core	0,86
Group rating for multi core	0,7
Overall derating factor for single core	0,7912
Overall derating factor for multi core	0,6440

Table 101. Derating factor calculation for MV cable cellar.

C) HV buried cables.

This calculation will be for multi core buried cables laid directly in the ground for 3.3kV, 6.6kV and 11kV HV cables. The ambient temperature for buried cables is $T=27.5^{\circ}\text{C}$. According to IS 3961 part 7 table 14, the temperature factor is $K_t=1.02$. Regarding the depth conditions, cables will be buried 1500mm maximum, according to IS 3961 part 7 table 16, K_d will be 0.94 which is the most restrictive factor. As per a thermal resistivity report provided by the client, the thermal resistivity (Km/W) average will be 0.63km/W . Therefore, according to IS 3961 part 7 table 23 and a maximum cable section of 400 mm^2 , the resistivity factor will be $K_t=1.09$. The aggrupation factor will be for four multi core cables separated 200mm and directly buried horizontally in the ground. According to IS 3961 part 7 table 28, the group factor will be $K_g=0.72$. The results for the derating factor for these HV buried cables are summarized in Table 102.

Derating factor for HV buried cables	
Kt para 27,5°C	1,02
Depth of laying rating factor	0,94
Factor Thermal resistivity	1,09
Group rating factor	0,72
Overall derating factor	0,7525

Table 102. Derating factor calculation for HV buried cables.

D) HV cables in cable cellar.

The ambient temperature for MH cable cellar cables is $T=47^{\circ}\text{C}$. According to IS 3961 part 7 table 13, the temperature factor is $K_t=0.92$. As the cable will be in the cable ladder, there is not resistivity and burring factors. Regarding the aggrupation factors, two cases have been considered, single core and multi core cables:

- According to IS 3961 part 7 table 33, for two three-phase single core circuits K_g will be 0.97, this is the most restrictive condition.
- According to IS 3961 part 7 table 32, for two multi-core cables circuits in ladder supports K_g will be 0.86, this is also the most restrictive condition.

The results for the derating factor for MH cable cellar cables are summarized in the Table 103.

Derating factor for HV cable cellar	
Kt para 47°C	0,92
Depth of laying rating factor	1
Factor Thermal resistivity	1
Group rating for single core	0,97
Group rating for multi core	0,86
Overall derating factor for single core	0,8924
Overall derating factor for multi core	0,7912

Table 103. Derating factor calculation for HV cable cellar.

E) 33kV HV cables.

These cables, which will be laid horizontally in a tray in unventilated formed trench, have different derating factors conditions. The ambient temperature for 33kV cables is T=40°C. According to IS 3961 part 7 table 15, the temperature factor is Kt=0.91. Regarding the depth conditions, cables will be buried 1500mm maximum, according to IS 3961 part 7 table 17, Kd will be 0.96 which is the most restrictive factor. Group and resistivity factors have been provided by the vendor. The results for the derating factor for 33kV HH cables are summarized in the Table 104.

Derating factor for HV 33kV	
Kt para 40°C	0,91
Depth of laying rating factor	0,96
Factor Thermal resistivity	1
Group rating	0,81
Overall derating factor	0,7076

Table 104. Derating factor calculation for HV 33kV.

4.3. CABLES SIZING CALCULATION

The cable sizing calculation shall verify the following criteria: current carrying capacity, maximum voltage drop and maximum short circuit current.

The current carrying capacity will be verified according to current rates tables of IS 3961 part 6 tables 1, 2, 3 and 4 for MV cables and IS 3961 part 7 tables 2, 4, 6, 8, 10 and 12 for HV cables. The selected cables shall verify the following conditions:

$$I = \frac{S}{U \cdot \sqrt{3}}$$

$$I < I_r \text{ with } I_r = K \cdot I_{ad}$$

Where,

- I is the full load current.

- S is the apparent electrical power.
- U is the voltage between phases.
- Ir is the cable's real current carrying capacities related to site condition.
- Iad is the cable's nominal current carrying capacities, according to IS 3961 tables.
- K is the total derating factor.

The maximum voltage drops in various sections of the electrical system under steady state conditions at full load, shall be within the limits stated as the design criteria already explained.

Voltage drop shall be calculated by the following formula:

$$\Delta V = \sqrt{3} \cdot I \cdot L \cdot (R \cdot \cos \gamma + X \cdot \sin \gamma)$$

Where,

- I is the full load current (A).
- L is the cable length (km).
- R is the cable resistance corrected for temperature (Ω/km).
- X is the cable reactance (Ω/km).
- ΔV is the voltage drop (V).

Cables shall withstand any short-circuit or overload at circuit breaker terminals without damage, keeping in mind the operation time of protection devices. The short circuit assessment shall take account of the fault clearance time of the primary protective device. When a feeder is made with two or more cables in parallel, each cable alone shall be able of supporting the short-circuit effect without any damage when this occurs on one of the cables.

In case of outgoings or branches with short-circuit limiting elements, this limitation can be considered to calculate the cable short-circuit withstand current.

The minimum conductor cross-sectional area of cables to withstand the thermal effects associated with a worst-case short circuit current is determined by the adiabatic temperature rise equation (according to IEC 60949):

$$S = \frac{I_K \cdot \sqrt{t_K}}{K}$$

Where:

- I_K is the short circuit current value, in Amperes.
- t_K is the duration of short circuit current, in seconds (tripping protection time), according to electrical basis of design.

- K is the constant depending on conductor material (143 for copper conductors, 94 for aluminum, XLPE insulated) and the temperatures at the beginning (operating temperature (90°C), and at the end of the short circuit (temperature limit for XLPE is 250°C.).)

HV cables selection and calculation has been summarized in the following tables (Table 105, Table 106 and Table 107).

33kV cables calculation			
Cable sizing calculation		Incoming Cable	Outgoing Cables
Rating	S [kVA]	35000	16000
Nominal Voltage	Vn [kV]	33 (UE)	33 (UE)
From	-	Existing 33 KV GIS Switchgear	New 33 KV GIS Switchgear
To	-	New 33 KV GIS Switchgear	16 MVA Power Transformer
Length	L [m]	1100	25
Resistance	R [Ohm/km]	0,06	0,13
Reactance	X [Ohm/km]	0,108	0,108
Cos θ	-	0,86	0,86
Sin θ	-	0,51	0,51
SHORT CIRCUIT CALCULATION			
Fault Current	I-fault (kA)	40	40
Fault withstand time	t (sec)	1	1
Constant K for Al	-	94	94
Minimum cross section of conductor	$S = I\text{-fault} * \sqrt{t/0.094} \text{ [mm}^2\text{]}$	425,53	425,53
VOLTAGE DROP CALCULATION			
Full load current	$I_f = S/(\sqrt{3} * V_n) \text{ [A]}$	612,359	279,936
Derating Factor	-	0,708	0,708
Total load current	$I_{full} = I_f / \text{Derating factor} \text{ [A]}$	865,38	395,60
Current (Considering Duct) .	I duct [A]	424	317
No. of Runs calculated	-	2,04	1,25
No. of Runs considered	-	2,00	2,00
Final no. of runs	-	3,00	3,00
Voltage Drop	$V = I_f * L * (R * \cos \theta + X * \sin \theta) / (N * 1000) \text{ [V]}$	35,940	0,584
% of Voltage Drop	V [%]	0,109	0,002
Selected cable Size	S	3Cx(3Cx(1x630mm²))	3Cx(3X300mm²)

Table 105. 33kV cables calculation.

11kV cables calculation			
Cable sizing calculation		Incoming Cable	Outgoing Cables
Rating	S [kVA]	6870	4000
Nominal Voltage	Vn [kV]	11	11
From	-	Existing 11 KV GIS Switchgear	New 11 KV Switchgear
To	-	New 11 KV Switchgear	3,15 MVA Transformer
Length	L [m]	1160	100
Resistance	R [Ohm/km]	0,102	0,161
Reactance	X [Ohm/km]	0,0849	0,09
Cos θ	-	0,86	0,86
Sin θ	-	0,51	0,51
SHORT CIRCUIT CALCULATION			
Fault Current	I-fault (kA)	40	40
Fault withstand time	t (sec)	1	1
Constant K for Al	-	94	94
Minimum cross section of conductor	$S = I\text{-fault} * \sqrt{t/0.094} \text{ [mm}^2\text{]}$	425,53	425,53
VOLTAGE DROP CALCULATION			
Full load current	$I_f = S/(\sqrt{3} * V_n) \text{ [A]}$	360,592	209,952
Derating Factor	-	0,8924	0,8924
Total load current	$I_{full} = I_f / \text{Derating factor} \text{ [A]}$	404,07	235,27
Current (Considering Duct) .	I duct [A]	401	680
No. of Runs calculated	-	1,01	0,35
No. of Runs considered	-	1,00	1,00
Final no. of runs	-	1,00	1,00
Voltage Drop	$V = I_f * L * (R * \cos \theta + X * \sin \theta) / (N * 1000) \text{ [V]}$	54,814	3,871
% of Voltage Drop	V [%]	0,498	0,035
Selected cable size	S [mm²]	1Cx(3Cx(1x500mm²))	1Cx(3Cx(1X500mm²))

Table 106. 11kV cables calculation.

6.6 kV cables calculation				
Cable sizing calculation		Lowest Rating Motor	Highest Rating Motor	Highest Transformer
Rating	P [kW]	185	450	2245
Rating	S [kVA]	215	523	2500
Nominal Voltage	Vn [kV]	6.6 (UE)	6.6 (UE)	6.6 (UE)
From	-	6.6 KV Switchgear	6.6 KV Switchgear	6.6 KV Switchgear
To	-	Debutanizer Feed Pump Motor	Cooling water supply booster pump Motor	Heat Pump Compressor Motor
Length	L [m]	320	235	100
Resistance	R [Ohm/km]	0,16	0,16	0,0801
Reactance	X [Ohm/km]	0,085	0,085	0,0806
Starting cos θ	-	0,51	0,9	0,91
Starting sin θ	-	0,86	0,44	0,41
Cos θ	-	0,86	0,9	0,91
Sin θ	-	0,51	0,44	0,41
SHORT CIRCUIT CALCULATION				
Fault Current	I-fault (kA)	40	40	40
Fault withstand time	t (sec)	0,25	0,25	1
Constant K for Al	-	94	94	94
Minimum cross section of conductor	S=I-fault * √ t/0.094 [mm²]	212,77	212,77	425,53
VOLTAGE DROP CALCULATION				
Full load current	If = S/(√3 * Vn) [A]	18,818	45,774	218,710
Derating Factor	-	0,7525	0,7525	0,8924
Total load current	I _{full} = If / Derating factor [A]	31,26	76,04	306,35
Current (Considering Duct) .	I _{duct} [A]	278	278	647
No. of Runs calculated	-	0,11	0,27	0,47
No. of Runs considered	-	1,00	1,00	1,00
Final no. of runs	-	1,00	1,00	1,00
Starting Voltage Drop	V=5*If*L*(R*cos θ+X*sin θ)/(N*1000) [V]	41,428	35,602	24,552
% of Starting Voltage Drop	V [%]	0,628	0,539	0,372
Voltage Drop	V=If*L*(R*cos θ+X*sin θ)/(N*1000) [V]	9,692	7,120	4,910
% of Voltage Drop	V [%]	0,147	0,108	0,074
Selected cable size	S [mm²]	1Cx(3x240mm²)	1Cx(3x240mm²)	1Cx(3Cx(1X500mm²))

Table 107. 6.6kV cables calculation.

For lower voltage cables (415V), the cable calculation for each load has also been carried out. The same ampacity, short circuit and voltage drop criteria (for total load and starting load) has also been applied. In this case, the short circuit calculation is made thought the energy ampacity calculation, which is calculated as follows:

$$E_{SC} = I_{SC}^2 \cdot 10^6 \cdot t_{SC} \cdot 10^{-3}$$

Where,

- t_{SC} is the expected duration of the short circuit or time it takes for the protective device to open (milliseconds).
- E_{SC} is the expected energy released during the short circuit.
- I_{SC} is the expected short circuit current (kA).

In the case of motors with a power rating from 55kW to 160kW, the energy ampacity power of their cables was estimated according to the breaker installed for each motor. In this case, two different models of circuit breakers have been used, as it is indicated in the Table 108.

	Breaker 1	Breaker 2
Catalog brand	ABB	GE
Model	MCCB T2	SPECTRA SE
Short circuit level	80	80
Voltage level	415	415
Standard applied	IEC	NEC

Table 108. Circuit breaker description for motors.

The expected energy realized for the cable calculation will be as the following Table 109 indicates, which will be selected depending on the breaker rating. This value is chosen according to the rated current of the load.

NEC Spectra SE		IEC MCCB T2	
Circuit breaker rating	Expected energy released	Circuit breaker rating	Expected energy released
1200	2	200	0,35
1000	3	160	0,35
900	4	125	0,35
800	5	100	0,35
700	6	80	0,35
600	7	63	0,21
500	8	50	0,21
450	9	40	0,21
400	10	32	0,19
350	11	25	0,19
300	12	20	0,17
250	13	16	0,16
225	14	12,5	0,15
200	15	10	0,09
175	16	8	0,05
150	17	6,3	0,04
125	18	5	0,035
110	19	4	0,03
100	20	3,2	0,015
90	21	2,5	0,003
80	22	2	0,0015
70	23	1,6	0,0009
60	24	1	0,00025
50	25		
40	26		
30	27		
25	28		
20	29		
15	30		
7	31		
3	32		

Table 109. Circuit breaker's expected energy released.

The following tables represent all the calculations and detailed MV cable sizing calculations:

- Short circuit and ampacity calculations from Table 110 to Table 120.
- Voltage drop verification from Table 121 to Table 126.

Finally, a complete list with all the cables of the substation with their characteristics and description are indicated in tables from Table 127 to Table 143.

PROJECT:		EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LuPech" (J-18)						ELECTRICAL CABLE CALCULATIONS: SHORT CIRCUIT AND AMPACITY											
CLIENT:		INDIAN OIL CORPORATION LIMITED																	
LOAD DESCRIPTION			CABLE DESCRIPTION					SHORT CIRCUIT CALCULATION					AMPACITY CALCULATION						
Associated load	Description	From equipment	Cable lenght (m)	Connexion	Installation	Type	Selected cable size	Fault current (kA)	Fault withstand time (msec)	Constant K	Energy ampacity	Minimum cross section of conductor	N° of conductors per phase	Security factor	Derrating factor (Kt)	Cable Ampacity (A)	Nominal current (A)	Cable derrated ampacity (A)	Final cable current (A)
1803-PM-101 A	Power cable for HOT FRESH FEED PUMPS	044-HT6-101	178,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x240mm2)	40	250	93	400	215,05	1	1,25	0,752	278	23,48	209,06	29,35
1803-PM-101 B	Power cable for HOT FRESH FEED PUMPS	044-HT6-101	178,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x240mm2)	40	250	93	400	215,05	1	1,25	0,752	278	23,48	209,06	29,35
1803-PM-202 A	Power cable for LCO PUMPAROUND PUMP	044-HT6-101	273	3PH	Duct bank	MULTIPOLAR	1Cx(3x240mm2)	40	250	93	400	215,05	1	1,25	0,752	278	32,27	209,06	40,34
1803-PM-202 B	Power cable for LCO PUMPAROUND PUMP	044-HT6-101	273	3PH	Duct bank	MULTIPOLAR	1Cx(3x240mm2)	40	250	93	400	215,05	1	1,25	0,752	278	32,27	209,06	40,34
1803-PM-202 C	Power cable for LCO PUMPAROUND PUMP	044-HT6-101	273	3PH	Duct bank	MULTIPOLAR	1Cx(3x240mm2)	40	250	93	400	215,05	1	1,25	0,752	278	32,27	209,06	40,34
1803-PM-204 A	Power cable for HCO PUMPAROUND PUMP	044-HT6-101	330,75	3PH	Duct bank	MULTIPOLAR	1Cx(3x240mm2)	40	250	93	400	215,05	1	1,25	0,752	278	23,8	209,06	29,75
1803-PM-204 B	Power cable for HCO PUMPAROUND PUMP	044-HT6-101	330,75	3PH	Duct bank	MULTIPOLAR	1Cx(3x240mm2)	40	250	93	400	215,05	1	1,25	0,752	278	23,8	209,06	29,75
1803-PM-204 C	Power cable for HCO PUMPAROUND PUMP	044-HT6-101	330,75	3PH	Duct bank	MULTIPOLAR	1Cx(3x240mm2)	40	250	93	400	215,05	1	1,25	0,752	278	23,8	209,06	29,75
1803-PM-205 A	Power cable for MAIN FRACTIONATOR BOTTOM PUMP	044-HT6-101	246,75	3PH	Duct bank	MULTIPOLAR	1Cx(3x240mm2)	40	250	93	400	215,05	1	1,25	0,752	278	59,46	209,06	74,33
1803-PM-205 B	Power cable for MAIN FRACTIONATOR BOTTOM PUMP	044-HT6-101	246,75	3PH	Duct bank	MULTIPOLAR	1Cx(3x240mm2)	40	250	93	400	215,05	1	1,25	0,752	278	59,46	209,06	74,33
1803-PM-213 A	Power cable for DEETHANIZER STRIPPER CHARGE PUMP	044-HT6-101	194,25	3PH	Duct bank	MULTIPOLAR	1Cx(3x240mm2)	40	250	93	400	215,05	1	1,25	0,752	278	28,33	209,06	35,41
1803-PM-213 B	Power cable for DEETHANIZER STRIPPER CHARGE PUMP	044-HT6-101	194,25	3PH	Duct bank	MULTIPOLAR	1Cx(3x240mm2)	40	250	93	400	215,05	1	1,25	0,752	278	28,33	209,06	35,41
1803-PM-214 A	Power cable for GASOLINE RECYCLE PUMP	044-HT6-101	336	3PH	Duct bank	MULTIPOLAR	1Cx(3x240mm2)	40	250	93	400	215,05	1	1,25	0,752	278	18,27	209,06	22,84
1803-PM-214 B	Power cable for GASOLINE RECYCLE PUMP	044-HT6-101	336	3PH	Duct bank	MULTIPOLAR	1Cx(3x240mm2)	40	250	93	400	215,05	1	1,25	0,752	278	18,27	209,06	22,84
1803-PM-222 A	Power cable for LEAN AMINE PUMP	044-HT6-101	126	3PH	Duct bank	MULTIPOLAR	1Cx(3x240mm2)	40	250	93	400	215,05	1	1,25	0,752	278	29,14	209,06	36,43
1803-PM-222 B	Power cable for LEAN AMINE PUMP	044-HT6-101	126	3PH	Duct bank	MULTIPOLAR	1Cx(3x240mm2)	40	250	93	400	215,05	1	1,25	0,752	278	29,14	209,06	36,43
1803-X-107-K-001A	Power cable for WGS OXIDATION BLOWER PUMP	044-HT6-101	84	3PH	Duct bank	MULTIPOLAR	1Cx(3x240mm2)	40	250	93	400	215,05	1	1,25	0,752	278	22,67	209,06	28,34
1803-X-107-K-001B	Power cable for WGS OXIDATION BLOWER PUMP	044-HT6-101	84	3PH	Duct bank	MULTIPOLAR	1Cx(3x240mm2)	40	250	93	400	215,05	1	1,25	0,752	278	22,67	209,06	28,34
1803-X-107-K-001C	Power cable for WGS OXIDATION BLOWER PUMP	044-HT6-101	84	3PH	Duct bank	MULTIPOLAR	1Cx(3x240mm2)	40	250	93	400	215,05	1	1,25	0,752	278	22,67	209,06	28,34
044-HT6-102 A	Power cable for 044-HT6-102 INCOMER 1 (6,6 KV EMERGENCY PANEL)	044-HT6-101	38,85	3PH	Tray	MONOPOLAR	1Cx(3Cx(1x500mm2))	40	1000	93	1600	430,11	1	1,25	0,8924	647	45,41	577,38	56,76
044-HT6-102 B	Power cable for 044-HT6-102 INCOMER 2 (6,6 KV EMERGENCY PANEL)	044-HT6-101	38,85	3PH	Tray	MONOPOLAR	1Cx(3Cx(1x500mm2))	40	1000	93	1600	430,11	1	1,25	0,8924	647	45,51	577,38	56,89
044-TR-102A	Power cable for DISTRIBUTION TRANSFORMER 6.6 / 0.433 kV (044-PMCC-101)	044-HT6-101	47,25	3PH	Tray	MONOPOLAR	1Cx(3Cx(1x500mm2))	40	1000	93	1600	430,11	1	1,25	0,8924	647	218,72	577,38	273,40
044-TR-102B	Power cable for DISTRIBUTION TRANSFORMER 6.6 / 0.433 kV (044-PMCC-101)	044-HT6-101	47,25	3PH	Tray	MONOPOLAR	1Cx(3Cx(1x500mm2))	40	1000	93	1600	430,11	1	1,25	0,8924	647	218,72	577,38	273,40
044-TR-103A	Power cable for DISTRIBUTION TRANSFORMER 6.6 / 0.433 kV (044-PMCC-102)	044-HT6-101	23,1	3PH	Tray	MONOPOLAR	1Cx(3Cx(1x500mm2))	40	1000	93	1600	430,11	1	1,25	0,8924	647	218,72	577,38	273,40
044-TR-103B	Power cable for DISTRIBUTION TRANSFORMER 6.6 / 0.433 kV (044-PMCC-102)	044-HT6-101	23,1	3PH	Tray	MONOPOLAR	1Cx(3Cx(1x500mm2))	40	1000	93	1600	430,11	1	1,25	0,8924	647	218,72	577,38	273,40
044-TR-104A	Power cable for DISTRIBUTION TRANSFORMER 6.6 / 0.433 kV (044-PMCC-103)	044-HT6-101	23,1	3PH	Tray	MONOPOLAR	1Cx(3Cx(1x500mm2))	40	1000	93	1600	430,11	1	1,25	0,8924	647	218,72	577,38	273,40
044-TR-104B	Power cable for DISTRIBUTION TRANSFORMER 6.6 / 0.433 kV (044-PMCC-103)	044-HT6-101	23,1	3PH	Tray	MONOPOLAR	1Cx(3Cx(1x500mm2))	40	1000	93	1600	430,11	1	1,25	0,8924	647	218,72	577,38	273,40
044-TR-105A	Power cable for DISTRIBUTION TRANSFORMER 6.6 / 0.433 kV (044-EPMCC-101)	044-HT6-101	31,5	3PH	Tray	MONOPOLAR	1Cx(3Cx(1x500mm2))	40	1000	93	1600	430,11	1	1,25	0,8924	647	174,95	577,38	218,69
044-TR-105B	Power cable for DISTRIBUTION TRANSFORMER 6.6 / 0.433 kV (044-EPMCC-101)	044-HT6-101	31,5	3PH	Tray	MONOPOLAR	1Cx(3Cx(1x500mm2))	40	1000	93	1600	430,11	1	1,25	0,8924	647	174,95	577,38	218,69
044-CB-101A	Power cable for HV CAPACITOR BANK	044-HT6-101	10,5	3PH	Tray	MONOPOLAR	1Cx(3Cx(1x500mm2))	40	1000	93	1600	430,11	1	1,35	0,8924	647	209,95	577,38	283,43
044-CB-101B	Power cable for HV CAPACITOR BANK	044-HT6-101	10,5	3PH	Tray	MONOPOLAR	1Cx(3Cx(1x500mm2))	40	1000	93	1600	430,11	1	1,35	0,8924	647	209,95	577,38	283,43
1803-PM-609 A	Power cable for HP BOILER FEED WATER PUMP	044-HT6-102	220	3PH	Duct bank	MULTIPOLAR	1Cx(3x240mm2)	40	250	93	400	215,05	1	1,25	0,752	278	29,14	209,06	36,43
1803-PM-609 B	Power cable for HP BOILER FEED WATER PUMP	044-HT6-102	220	3PH	Duct bank	MULTIPOLAR	1Cx(3x240mm2)	40	250	93	400	215,05	1	1,25	0,752	278	29,14	209,06	36,43
1803-PM-609 C	Power cable for HP BOILER FEED WATER PUMP	044-HT6-102	220	3PH	Duct bank	MULTIPOLAR	1Cx(3x240mm2)	40	250	93	400	215,05	1	1,25	0,752	278	29,14	209,06	36,43
044-TR-105 C	Power cable for EMERGENCY DISTRIBUTION TRANSFORMER 6.6 / 0.433 kV (044-EPMCC-101)	044-HT6-102	40	3PH	Tray	MONOPOLAR	1Cx(3Cx(1x500mm2))	40	1000	93	1600	430,11	1	1,25	0,8924	647	174,06	577,38	217,58
044-MCC-101 A	Power cable for 044-MCC-101 INCOMER 1	044-PMCC-101	29	3PH+N	Tray	MULTIPOLAR	3Cx(4x185mm2)	65	1000	93	6	26,34	3	1	0,644	329	497,99	211,88	166,00
044-MCC-101 B	Power cable for 044-MCC-101 INCOMER 2	044-PMCC-101	29	3PH+N	Tray	MULTIPOLAR	3Cx(4x185mm2)	65	1000	93	6	26,34	3	1	0,644	329	497,99	211,88	166,00
044-MCC-102 A	Power cable for 044-MCC-102 INCOMER 1	044-PMCC-101	23	3PH+N	Tray	MULTIPOLAR	3Cx(4x185mm2)	65	1000	93	5	24,04	3	1	0,644	329	629,99	211,88	210,00
044-MCC-102 B	Power cable for 044-MCC-102 INCOMER 2	044-PMCC-101	23	3PH+N	Tray	MULTIPOLAR	3Cx(4x185mm2)	65	1000	93	5	24,04	3	1	0,644	329	629,99	211,88	210,00
044-MCC-104 A	Power cable for 044-MCC-104 INCOMER 1	044-PMCC-101	23	3PH+N	Tray	MULTIPOLAR	3Cx(4x185mm2)	65	1000	93	5	24,04	3	1	0,644	329	629,99	211,88	210,00
044-MCC-104 B	Power cable for 044-MCC-104 INCOMER 2	044-PMCC-101	23	3PH+N	Tray	MULTIPOLAR	3Cx(4x185mm2)	65	1000	93	5	24,04	3	1	0,644	329	629,99	211,88	210,00

Table 110. MV Cables calculations: short circuit and ampacity (part 1).

PROJECT:		EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPech” (J-18)						ELECTRICAL CABLE CALCULATIONS: SHORT CIRCUIT AND AMPACITY											
CLIENT:		INDIAN OIL CORPORATION LIMITED																	
LOAD DESCRIPTION			CABLE DESCRIPTION					SHORT CIRCUIT CALCULATION					AMPACITY CALCULATION						
Associated load	Description	From equipment	Cable length (m)	Connexion	Installation	Type	Selected cable size	Fault current (kA)	Fault withstand time (msec)	Constant K	Energy ampacity	Minimum cross section of conductor	N° of conductors per phase	Security factor	Derrating factor (Ki)	Cable Ampacity (A)	Nominal current (A)	Cable derated ampacity (A)	Final cable current (A)
1803-PM-102 A	Power cable for COLD FRESH FEED PUMP	044-PMCC-101	10,5	3PH	Duct bank	MULTIPOLAR	2Cx(3x120mm2)	65	250	93	2	15,21	2	1	0,5546	187	184,41	103,71	92,21
1803-PM-102 B	Power cable for COLD FRESH FEED PUMPS	044-PMCC-101	10,5	3PH	Duct bank	MULTIPOLAR	2Cx(3x120mm2)	65	250	93	2	15,21	2	1	0,5546	187	184,41	103,71	92,21
1803-PM-206 A	Power cable for CLO PRODUCT PUMP	044-PMCC-101	312	3PH	Duct bank	MULTIPOLAR	2Cx(3x185mm2)	65	250	93	11	35,66	2	1	0,5546	238	253,82	131,99	126,91
1803-PM-206 B	Power cable for CLO PRODUCT PUMP	044-PMCC-101	312	3PH	Duct bank	MULTIPOLAR	2Cx(3x185mm2)	65	250	93	11	35,66	2	1	0,5546	238	253,82	131,99	126,91
1803-PM-207 A	Power cable for FRACTIONATOR REFLUX PUMP	044-PMCC-101	190	3PH	Duct bank	MULTIPOLAR	2Cx(3x150mm2)	65	250	93	12	37,25	2	1	0,5546	209	222,89	115,91	111,45
1803-PM-207 B	Power cable for FRACTIONATOR REFLUX PUMP	044-PMCC-101	190	3PH	Duct bank	MULTIPOLAR	2Cx(3x150mm2)	65	250	93	12	37,25	2	1	0,5546	209	222,89	115,91	111,45
1803-PM-217 A	Power cable for PRIMARY ABSORBER BOTTOM PUMP	044-PMCC-101	190	3PH	Duct bank	MULTIPOLAR	2Cx(3x150mm2)	65	250	93	12	37,25	2	1	0,5546	209	222,89	115,91	111,45
1803-PM-217 B	Power cable for PRIMARY ABSORBER BOTTOM PUMP	044-PMCC-101	190	3PH	Duct bank	MULTIPOLAR	2Cx(3x150mm2)	65	250	93	12	37,25	2	1	0,5546	209	222,89	115,91	111,45
1803-PM-224 A	Power cable for HCN PUMPAROUND PUMP	044-PMCC-101	10,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x240mm2)	65	250	93	1,9	14,82	1	1	0,5546	276	132,14	153,07	132,14
1803-PM-224 B	Power cable for HCN PUMPAROUND PUMP	044-PMCC-101	10,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x240mm2)	65	250	93	1,9	14,82	1	1	0,5546	276	132,14	153,07	132,14
OXTM-A	Power cable for OXIDATION TANK MIXER MOTORS A (1803-X-107)	044-PMCC-101	10,5	3PH	Tray	MULTIPOLAR	1Cx(3x120mm2)	65	250	93	1,6	13,60	1	1	0,644	249	124,42	160,36	124,42
OXTM-B	Power cable for OXIDATION TANK MIXER MOTORS B (1803-X-107)	044-PMCC-101	10,5	3PH	Tray	MULTIPOLAR	1Cx(3x120mm2)	65	250	93	1,6	13,60	1	1	0,644	249	124,42	160,36	124,42
OXTM-C	Power cable for OXIDATION TANK MIXER MOTORS C (1803-X-107)	044-PMCC-101	10,5	3PH	Tray	MULTIPOLAR	1Cx(3x120mm2)	65	250	93	1,6	13,60	1	1	0,644	249	124,42	160,36	124,42
044-MCC-103 A	Power cable for 044-MCC-103 INCOMER 1	044-PMCC-102	21	3PH+N	Tray	MULTIPOLAR	3Cx(4x185mm2)	65	1000	93	5	24,04	3	1	0,644	329	629,99	211,88	210,00
044-MCC-103 B	Power cable for 044-MCC-103 INCOMER 2	044-PMCC-102	21	3PH+N	Tray	MULTIPOLAR	3Cx(4x185mm2)	65	1000	93	5	24,04	3	1	0,644	329	629,99	211,88	210,00
044-MCC-105 A	Power cable for 044-MCC-105 INCOMER 1	044-PMCC-102	21	3PH+N	Tray	MULTIPOLAR	3Cx(4x185mm2)	65	1000	93	5	24,04	3	1	0,644	329	629,99	211,88	210,00
044-MCC-105 B	Power cable for 044-MCC-105 INCOMER 2	044-PMCC-102	21	3PH+N	Tray	MULTIPOLAR	3Cx(4x185mm2)	65	1000	93	5	24,04	3	1	0,644	329	629,99	211,88	210,00
044-MCC-106 A	Power cable for 044-MCC-106 INCOMER 1	044-PMCC-102	21	3PH+N	Tray	MULTIPOLAR	3Cx(4x185mm2)	65	1000	93	5	24,04	3	1	0,644	329	629,99	211,88	210,00
044-MCC-106 B	Power cable for 044-MCC-106 INCOMER 2	044-PMCC-102	21	3PH+N	Tray	MULTIPOLAR	3Cx(4x185mm2)	65	1000	93	5	24,04	3	1	0,644	329	629,99	211,88	210,00
1803-PM-215 A	Power cable for PRIMARY ABSORBER INTERCOOLER-I PUMP	044-PMCC-102	10,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x185mm2)	65	250	93	0,35	6,36	1	1	0,5546	238	126,41	131,99	126,41
1803-PM-215 B	Power cable for PRIMARY ABSORBER INTERCOOLER-I PUMP	044-PMCC-102	10,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x185mm2)	65	250	93	0,35	6,36	1	1	0,5546	238	126,41	131,99	126,41
1803-PM-216 A	Power cable for PRIMARY ABSORBER INTERCOOLER-II PUMPS	044-PMCC-102	10,5	3PH	Duct bank	MULTIPOLAR	2Cx(3x120mm2)	65	250	93	2	15,21	2	1	0,5546	187	186,14	103,71	93,07
1803-PM-216 B	Power cable for PRIMARY ABSORBER INTERCOOLER-II PUMPS	044-PMCC-102	10,5	3PH	Duct bank	MULTIPOLAR	2Cx(3x120mm2)	65	250	93	2	15,21	2	1	0,5546	187	186,14	103,71	93,07
1803-PM-218 A	Power cable for DEBUTANIZER REFLUX PUMP	044-PMCC-102	10,5	3PH	Duct bank	MULTIPOLAR	2Cx(3x150mm2)	65	250	93	12	37,25	2	1	0,5546	209	222,89	115,91	111,45
1803-PM-218 B	Power cable for DEBUTANIZER REFLUX PUMP	044-PMCC-102	10,5	3PH	Duct bank	MULTIPOLAR	2Cx(3x150mm2)	65	250	93	12	37,25	2	1	0,5546	209	222,89	115,91	111,45
1803-PM-219 A	Power cable for LPG PRODUCT PUMP	044-PMCC-102	10,5	3PH	Duct bank	MULTIPOLAR	2Cx(3x185mm2)	65	250	93	11	35,66	2	1	0,5546	238	260,89	131,99	130,45
1803-PM-219 B	Power cable for LPG PRODUCT PUMP	044-PMCC-102	10,5	3PH	Duct bank	MULTIPOLAR	2Cx(3x185mm2)	65	250	93	11	35,66	2	1	0,5546	238	260,89	131,99	130,45
1803-X-107-P003A	Power cable for SPRAY TOWER RECIRCULATION PUMP (WET GAS SCRUBBER PACKAGE)	044-PMCC-102	10,5	3PH	Duct bank	MULTIPOLAR	2Cx(3x150mm2)	65	250	93	12	37,25	2	1	0,5546	209	218,97	115,91	109,49
1803-X-107-P003B	Power cable for SPRAY TOWER RECIRCULATION PUMP (WET GAS SCRUBBER PACKAGE)	044-PMCC-102	10,5	3PH	Duct bank	MULTIPOLAR	2Cx(3x150mm2)	65	250	93	12	37,25	2	1	0,5546	209	218,97	115,91	109,49
1803-X-107-P003C	Power cable for SPRAY TOWER RECIRCULATION PUMP (WET GAS SCRUBBER PACKAGE)	044-PMCC-102	10,5	3PH	Duct bank	MULTIPOLAR	2Cx(3x150mm2)	65	250	93	12	37,25	2	1	0,5546	209	218,97	115,91	109,49
1803-X-107-P004A	Power cable for FILTERING MODULES RECIRCULATION PUMP (WET GAS SCRUBBER PACKAGE)	044-PMCC-102	10,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x240mm2)	65	250	93	1,9	14,82	1	1	0,5546	276	149,3	153,07	149,30
1803-X-107-P004B	Power cable for FILTERING MODULES RECIRCULATION PUMP (WET GAS SCRUBBER PACKAGE)	044-PMCC-102	10,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x240mm2)	65	250	93	1,9	14,82	1	1	0,5546	276	149,3	153,07	149,30
044-TR-107 A	Power cable for MAIN LIGHTING TRANSFORMER 0,415 / 0,433 kV (044-MLDB-101)	044-PMCC-103	21	3PH+N	Tray	MULTIPOLAR	1Cx(4x300mm2)	65	1000	93	11	35,66	1	1	0,644	452	278,24	291,09	278,24
044-TR-107 B	Power cable for MAIN LIGHTING TRANSFORMER 0,415 / 0,433 kV (044-MLDB-101)	044-PMCC-103	21	3PH+N	Tray	MULTIPOLAR	1Cx(4x300mm2)	65	1000	93	11	35,66	1	1	0,644	452	278,24	291,09	278,24
044-ASB-101 A	Power cable for 044-ASB-101 (WELDINGSOCKETS) INCOMER 1	044-PMCC-103	21	3PH+N	Tray	MULTIPOLAR	2Cx(4x120mm2)	65	1000	93	10	34,00	2	1	0,644	249	292,97	160,36	146,49
044-ASB-101 B	Power cable for 044-ASB-101 (WELDINGSOCKETS) INCOMER 2	044-PMCC-103	21	3PH+N	Tray	MULTIPOLAR	2Cx(4x120mm2)	65	1000	93	10	34,00	2	1	0,644	249	292,97	160,36	146,49
044-ASB-102 A	Power cable for 044-ASB-102 (WELDINGSOCKETS) INCOMER 1	044-PMCC-103	21	3PH+N	Tray	MULTIPOLAR	2Cx(4x150mm2)	65	1000	93	9	32,26	2	1	0,644	284	325,98	182,90	162,99
044-ASB-102 B	Power cable for 044-ASB-102 (WELDINGSOCKETS) INCOMER 2	044-PMCC-103	21	3PH+N	Tray	MULTIPOLAR	2Cx(4x150mm2)	65	1000	93	9	32,26	2	1	0,644	284	325,98	182,90	162,99
ESS-044-HVAC-1	Power cable for ESS-044 HVAC MCC INCOMER 1	044-PMCC-103	21	3PH+N	Tray	MULTIPOLAR	3Cx(4x240mm2)	65	1000	93	4	21,51	3	1	0,644	392	709,8	252,45	236,60
ESS-044-HVAC-2	Power cable for ESS-044 HVAC MCC INCOMER 2	044-PMCC-103	21	3PH+N	Tray	MULTIPOLAR	3Cx(4x240mm2)	65	1000	93	4	21,51	3	1	0,644	392	709,8	252,45	236,60
044-MCC-107 A	Power cable for 044-MCC-107 INCOMER 1	044-PMCC-103	21	3PH+N	Tray	MULTIPOLAR	3Cx(4x185mm2)	65	1000	93	5	24,04	3	1	0,644	329	629,99	211,88	210,00

Table 111. MV Cables calculations: short circuit and ampacity (part 2).

PROJECT:		EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LaPeck" (J-18)						ELECTRICAL CABLE CALCULATIONS: SHORT CIRCUIT AND AMPACITY											
CLIENT:		INDIAN OIL CORPORATION LIMITED																	
LOAD DESCRIPTION		CABLE DESCRIPTION						SHORT CIRCUIT CALCULATION						AMPACITY CALCULATION					
Associated load	Description	From equipment	Cable lenght (m)	Connexion	Installation	Type	Selected cable size	Fault current (kA)	Fault withstand time (msec)	Constant K	Energy ampacity	Minimum cross section of conductor	N° of conductors per phase	Security factor	Derrating factor (Kt)	Cable Ampacity (A)	Nominal current (A)	Cable derrated ampacity (A)	Final cable current (A)
044-MCC-107 B	Power cable for 044-MCC-107 INCOMER 2	044-PMCC-103	21	3PH+N	Tray	MULTIPOLAR	3Cx(4x185mm2)	65	1000	93	5	24,04	3	1	0,644	329	629,99	211,88	210,00
ESS-044-HVAC-1	Power cable for ESS-044 HVAC MCC INCOMER 1	044-PMCC-103	100	3PH+N	Tray	MULTIPOLAR	3Cx(4x240mm2)	65	1000	93	4	21,51	3	1	0,644	392	709,8	252,45	236,60
ESS-044-HVAC-2	Power cable for ESS-044 HVAC MCC INCOMER 2	044-PMCC-103	100	3PH+N	Tray	MULTIPOLAR	3Cx(4x240mm2)	65	1000	93	4	21,51	3	1	0,644	392	709,8	252,45	236,60
044-UPS-101 A	Power cable for 044-UPS 101 NOM. POWER 80 kVA (DCS/ESD) INCOMER 1 - CHARGER	044-PMCC-103	172	3PH+N	Duct bank	MULTIPOLAR	2Cx(4x120mm2)	65	1000	93	14	40,23	2	1	0,5546	187	166,94	103,71	83,47
044-UPS-101 C	Power cable for 044-UPS 101 NOM. POWER 80 kVA (DCS/ESD) INCOMER 3 - CHARGER	044-PMCC-103	172	3PH+N	Duct bank	MULTIPOLAR	2Cx(4x120mm2)	65	1000	93	14	40,23	2	1	0,5546	187	166,94	103,71	83,47
044-UPS-102 A	Power cable for 044-UPS 102 NOM. POWER 15 kVA (TELECOM, CCTV, PAGING & FDAS SYSTEM) INCOMER 1 - CHARGER	044-PMCC-103	172	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x70mm2)	65	1000	93	26	54,83	1	1	0,5546	137	31,3	75,98	31,30
044-UPS-102 C	Power cable for 044-UPS 102 NOM. POWER 15 kVA (TELECOM, CCTV, PAGING & FDAS SYSTEM) INCOMER 3 - CHARGER	044-PMCC-103	172	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x70mm2)	65	1000	93	26	54,83	1	1	0,5546	137	31,3	75,98	31,30
044-DC-101 A	Power cable for 044-DC 101 NOM. POWER 30 kVA (SWITCHGEAR CONTROL) INCOMER 1	044-PMCC-103	31,5	3PH+N	Tray	MULTIPOLAR	1Cx(4x70mm2)	65	1000	93	0,21	4,93	1	1	0,644	175	41,74	112,70	41,74
044-TR-108 A	Power cable for EMERGENCY LIGHTING TRANSFORMER 415/ 433 V (044-EMLDB-101)	044-PMCC-103	31,5	3PH+N	Tray	MULTIPOLAR	1Cx(4x185mm2)	65	1000	93	0,35	6,36	1	1	0,644	329	139,12	211,88	139,12
1803-PM-203 A	Power cable for LCO PRODUCT PUMP	044-PMCC-103	10,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x120mm2)	65	250	93	0,35	6,36	1	1	0,5546	187	94,37	103,71	94,37
1803-PM-203 B	Power cable for LCO PRODUCT PUMP	044-PMCC-103	10,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x120mm2)	65	250	93	0,35	6,36	1	1	0,5546	187	94,37	103,71	94,37
1803-PM-212 A	Power cable for COMPRESSOR INTERSTAGE LIQUID PUMP	044-PMCC-103	10,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x185mm2)	65	250	93	0,35	6,36	1	1	0,5546	238	126,41	131,99	126,41
1803-PM-212 B	Power cable for COMPRESSOR INTERSTAGE LIQUID PUMP	044-PMCC-103	10,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x185mm2)	65	250	93	0,35	6,36	1	1	0,5546	238	126,41	131,99	126,41
1803-PM-220 A	Power cable for LEAN OIL PUMP	044-PMCC-103	10,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x185mm2)	65	250	93	0,35	6,36	1	1	0,5546	238	126,41	131,99	126,41
1803-PM-220 B	Power cable for LEAN OIL PUMP	044-PMCC-103	10,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x185mm2)	65	250	93	0,35	6,36	1	1	0,5546	238	126,41	131,99	126,41
1803-PM-209 A	Power cable for DISTILLATE DRUM LIQUID PUMP	044-PMCC-103	10,5	3PH	Duct bank	MULTIPOLAR	2Cx(3x150mm2)	65	250	93	12	37,25	2	1	0,5546	209	218,11	115,91	109,06
1803-PM-209 B	Power cable for DISTILLATE DRUM LIQUID PUMP	044-PMCC-103	10,5	3PH	Duct bank	MULTIPOLAR	2Cx(3x150mm2)	65	250	93	12	37,25	2	1	0,5546	209	218,11	115,91	109,06
1803-PM-225 A	Power cable for RICH AMINE PUMP	044-PMCC-103	10,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x240mm2)	65	250	93	1,9	14,82	1	1	0,5546	276	132,14	153,07	132,14
1803-PM-225 B	Power cable for RICH AMINE PUMP	044-PMCC-103	10,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x240mm2)	65	250	93	1,9	14,82	1	1	0,5546	276	132,14	153,07	132,14
1803-X-205-P-006A	Power cable for REGENERATED CAUSTIC PUMPS (CR LPG TREATMENT PACKAGE)	044-PMCC-103	10,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x240mm2)	65	250	93	1,9	14,82	1	1	0,5546	276	149,5	153,07	149,50
1803-X-205-P-006B	Power cable for REGENERATED CAUSTIC PUMPS (CR LPG TREATMENT PACKAGE)	044-PMCC-103	10,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x240mm2)	65	250	93	1,9	14,82	1	1	0,5546	276	149,5	153,07	149,50
1803-X-205-P-010A	Power cable for LPG BOOSTER PUMPS (CR LPG TREATMENT PACKAGE)	044-PMCC-103	10,5	3PH	Duct bank	MULTIPOLAR	2Cx(3x150mm2)	65	250	93	12	37,25	2	1	0,5546	209	215,69	115,91	107,85
1803-X-205-P-010B	Power cable for LPG BOOSTER PUMPS (CR LPG TREATMENT PACKAGE)	044-PMCC-103	10,5	3PH	Duct bank	MULTIPOLAR	2Cx(3x150mm2)	65	250	93	12	37,25	2	1	0,5546	209	215,69	115,91	107,85
1803-PM-603	Power cable for HEAVY HC CLOSED BLOWDOWN DRUM PUMP	044-EPMCC-101	315	3PH	Duct bank	MULTIPOLAR	1Cx(3x16mm2)	65	250	142	0,19	3,07	1	1	0,5546	79	24,2	43,81	24,20
1803-PM-604 A	Power cable for FLARE KOD PUMP	044-EPMCC-101	320,25	3PH	Duct bank	MULTIPOLAR	1Cx(3x95mm2)	65	250	93	0,35	6,36	1	1	0,5546	164	54,01	90,95	54,01
1803-PM-604 B	Power cable for FLARE KOD PUMP	044-EPMCC-101	320,25	3PH	Duct bank	MULTIPOLAR	1Cx(3x95mm2)	65	250	93	0,35	6,36	1	1	0,5546	164	54,01	90,95	54,01
1803-P-226 A	Power cable for CORROSION INHIBITOR INJECTION PUMP MOTOR (1803-X-202)	044-EPMCC-101	231	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,00025	0,11	1	1	0,5546	29	0,59	16,08	0,59
1803-P-227 A	Power cable for CORROSION INHIBITOR INJECTION PUMP MOTOR (1803-X-202)	044-EPMCC-101	231	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,00025	0,11	1	1	0,5546	29	0,59	16,08	0,59
1803-P-228 A	Power cable for CORROSION INHIBITOR INJECTION PUMP MOTOR (1803-X-202)	044-EPMCC-101	231	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,00025	0,11	1	1	0,5546	29	0,59	16,08	0,59
1803-P-226 S	Power cable for CORROSION INHIBITOR INJECTION PUMP MOTOR (1803-X-202, SPARE IN WAREHOUSE)	044-EPMCC-101	231	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,00025	0,11	1	1	0,5546	29	0,59	16,08	0,59
1803-P-227 S	Power cable for CORROSION INHIBITOR INJECTION PUMP MOTOR (1803-X-202, SPARE IN WAREHOUSE)	044-EPMCC-101	231	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,00025	0,11	1	1	0,5546	29	0,59	16,08	0,59
1803-P-228 S	Power cable for CORROSION INHIBITOR INJECTION PUMP MOTOR (1803-X-202, SPARE IN WAREHOUSE)	044-EPMCC-101	231	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,00025	0,11	1	1	0,5546	29	0,59	16,08	0,59
1803-P-229 A	Power cable for AMMONIUM POLYSULPHIDE DOSING PUMP MOTOR (1803-X-203)	044-EPMCC-101	231	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,00025	0,11	1	1	0,5546	29	0,59	16,08	0,59
1803-P-229 S	Power cable for AMMONIUM POLYSULPHIDE DOSING PUMP MOTOR (1803-X-203, SPARE IN WAREHOUSE)	044-EPMCC-101	231	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,00025	0,11	1	1	0,5546	29	0,59	16,08	0,59
1803-P-230 A	Power cable for ANTIFOAM INJECTION PUMP MOTOR (1803-X-204)	044-EPMCC-101	231	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,00025	0,11	1	1	0,5546	29	0,59	16,08	0,59
1803-P-230 S	Power cable for ANTIFOAM INJECTION PUMP MOTOR (1803-X-204, SPARE IN WAREHOUSE)	044-EPMCC-101	231	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,00025	0,11	1	1	0,5546	29	0,59	16,08	0,59
1803-P-231 A	Power cable for PHOSPHATE INJECTION PUMP MOTOR (1803-X-601)	044-EPMCC-101	231	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,00025	0,11	1	1	0,5546	29	0,59	16,08	0,59
1803-P-231 S	Power cable for PHOSPHATE INJECTION PUMP MOTOR (1803-X-601, SPARE IN WAREHOUSE)	044-EPMCC-101	231	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,00025	0,11	1	1	0,5546	29	0,59	16,08	0,59
1803-P-232 A	Power cable for PHOSPHATE INJECTION PUMP MOTOR (1803-X-601)	044-EPMCC-101	231	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,00025	0,11	1	1	0,5546	29	0,59	16,08	0,59
1803-P-232 S	Power cable for PHOSPHATE INJECTION PUMP MOTOR (1803-X-601, SPARE IN WAREHOUSE)	044-EPMCC-101	231	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,00025	0,11	1	1	0,5546	29	0,59	16,08	0,59
1803-P-233 A	Power cable for NEUTRALISING AMINE INJECTION PUMP MOTOR (1803-X-604)	044-EPMCC-101	231	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,00025	0,11	1	1	0,5546	29	0,59	16,08	0,59

Table 112. MV Cables calculations: short circuit and ampacity (part 3).

PROJECT:		EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LuPeb" (J-18)						ELECTRICAL CABLE CALCULATIONS: SHORT CIRCUIT AND AMPACITY											
CLIENT:		INDIAN OIL CORPORATION LIMITED																	
		LOAD DESCRIPTION		CABLE DESCRIPTION				SHORT CIRCUIT CALCULATION						AMPACITY CALCULATION					
Associated load	Description	From equipment	Cable length (m)	Connexion	Installation	Type	Selected cable size	Fault current (kA)	Fault withstand time (msec)	Constant K	Energy ampacity	Minimum cross section of conductor	N° of conductors per phase	Security factor	Derrating factor (Kt)	Cable Ampacity (A)	Nominal current (A)	Cable derrated ampacity (A)	Final cable current (A)
1803-P-233 S	Power cable for NEUTRALISING AMINE INJECTION PUMP MOTOR (1803-X-604. SPARE IN WAREHOUSE)	044-EPGCC-101	231	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,00025	0,11	1	1	0,5546	29	0,59	16,08	0,59
1803-P-234 A	Power cable for OXYGEN SCAVENGER DOSING PUMP MOTOR (1803-X-605. SPARE IN WAREHOUSE)	044-EPGCC-101	231	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,00025	0,11	1	1	0,5546	29	0,59	16,08	0,59
1803-P-234 S	Power cable for OXYGEN SCAVENGER DOSING PUMP MOTOR (1803-X-605. SPARE IN WAREHOUSE)	044-EPGCC-101	231	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,00025	0,11	1	1	0,5546	29	0,59	16,08	0,59
1803-X-105-P-2	Power cable for COOLING OIL PUMP MOTOR (MAIN AIR BLOWER 1803-K-101)	044-EPGCC-101	178,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,015	0,86	1	1	0,5546	29	2,41	16,08	2,41
1803-X-105-P-1	Power cable for AUXILIARY LUBE OIL PUMP MOTOR (MAIN AIR BLOWER 1803-K-101)	044-EPGCC-101	178,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,015	0,86	1	1	0,5546	29	2,41	16,08	2,41
1803-X-105-FD-1	Power cable for OIL MIST FAN MOTOR (MAIN AIR BLOWER 1803-K-101)	044-EPGCC-101	178,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,015	0,86	1	1	0,5546	29	2,41	16,08	2,41
1803-X-105-P-5	Power cable for JACKING OIL PUMP MOTOR (MAIN AIR BLOWER 1803-K-101)	044-EPGCC-101	178,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,015	0,86	1	1	0,5546	29	2,41	16,08	2,41
ST ROTOR TURNING GEAR MOTOR (MAIN AIR BLOWER 1803-K-101)	Power cable for ST ROTOR TURNING GEAR MOTOR (MAIN AIR BLOWER 1803-K-101)	044-EPGCC-101	178,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,00025	0,11	1	1	0,5546	29	0,29	16,08	0,29
1803-K-201-P-2	Power cable for COOLING OIL PUMP MOTOR (WET GAS COMPRESSOR 1803-K-201)	044-EPGCC-101	252	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,015	0,86	1	1	0,5546	29	2,41	16,08	2,41
1803-K-201-P-1	Power cable for AUXILIARY LUBE OIL PUMP MOTOR (WET GAS COMPRESSOR 1803-K-201)	044-EPGCC-101	252	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,015	0,86	1	1	0,5546	29	2,41	16,08	2,41
1803-K-201-FD-1	Power cable for OIL MIST FAN MOTOR (WET GAS COMPRESSOR 1803-K-201)	044-EPGCC-101	252	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,015	0,86	1	1	0,5546	29	2,41	16,08	2,41
1803-K-201-P-5	Power cable for JACKING OIL PUMP MOTOR (WET GAS COMPRESSOR 1803-K-201)	044-EPGCC-101	252	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,015	0,86	1	1	0,5546	29	2,41	16,08	2,41
ST ROTOR TURNING GEAR MOTOR (WET GAS COMPRESSOR 1803-K-201)	Power cable for ST ROTOR TURNING GEAR MOTOR (WET GAS COMPRESSOR 1803-K-201)	044-EPGCC-101	252	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,00025	0,11	1	1	0,5546	29	0,29	16,08	0,29
1803-K-201-P-3	Power cable for CONTROL OIL PUMP 1 (WGC 1803-K-201)	044-EPGCC-101	252	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,04	1,41	1	1	0,5546	29	4,83	16,08	4,83
1803-K-201-P-4	Power cable for CONTROL OIL PUMP 2 (WGC 1803-K-201)	044-EPGCC-101	252	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,04	1,41	1	1	0,5546	29	4,83	16,08	4,83
1803-K-105-P-3	Power cable for CONTROL OIL PUMP 1(MAB 1803-K-101)	044-EPGCC-101	252	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,04	1,41	1	1	0,5546	29	4,83	16,08	4,83
1803-K-105-P-4	Power cable for CONTROL OIL PUMP 2(MAB 1803-K-101)	044-EPGCC-101	252	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,04	1,41	1	1	0,5546	29	4,83	16,08	4,83
CR-HVAC-1	Power cable for CONTROL ROOM HVAC MCC INCOMER 1	044-EPGCC-101	231	3PH+N	BANDEJA	MULTIPOLAR	2Cx(4x240mm2)	65	1000	93	12	37,25	2	1	0,644	392	220,83	252,45	110,42
044-DC-102	Power cable for 044-DC 102 NOM. POWER 10 kVA (CRITICAL LIGHTING) CHARGER INCOMER	044-EPGCC-101	31,5	3PH+N	BANDEJA	MULTIPOLAR	1Cx(4x25mm2)	65	1000	93	0,19	4,69	1	1	0,644	93	23,71	59,89	23,71
044-DC-101B	Power cable for 044-DC 101 NOM. POWER 30 kVA (SWITCHGEAR CONTROL) INCOMER 2 - CHARGER	044-EPGCC-101	31,5	3PH+N	BANDEJA	MULTIPOLAR	1Cx(4x95mm2)	65	1000	93	0,35	6,36	1	1	0,644	216	71,14	139,10	71,14
044-UPS-101B	Power cable for 044-UPS 101 (INSTR LOAD DCS /ESD) INCOMER 2 - BYPASS TRANSFORMER	044-EPGCC-101	172	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x185mm2)	65	1000	93	1,6	13,60	1	1	0,5546	238	126,47	131,99	126,47
044-UPS-101D	Power cable for 044-UPS 101 (INSTR LOAD DCS /ESD) INCOMER 4 - BYPASS TRANSFORMER	044-EPGCC-101	172	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x185mm2)	65	1000	93	1,6	13,60	1	1	0,5546	238	126,47	131,99	126,47
044-UPS-102B	Power cable for 044-UPS 102 (TELECOM, CCTV, PAGING & FDAS SYSTEM) INCOMER 2 - BYPASS TRANSFORMER	044-EPGCC-101	172	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x35mm2)	65	1000	93	0,19	4,69	1	1	0,5546	94	23,71	52,13	23,71
044-UPS-102D	Power cable for 044-UPS 102 (TELECOM, CCTV, PAGING & FDAS SYSTEM) INCOMER 4 - BYPASS TRANSFORMER	044-EPGCC-101	172	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x35mm2)	65	1000	93	0,19	4,69	1	1	0,5546	94	23,71	52,13	23,71
044-TR-108B	Power cable for EMERGENCY LIGHTING TRANSFORMER 0.415 /0.433 kV (044-EMLDDB-101)	044-EPGCC-101	31,5	3PH+N	Tray	MULTIPOLAR	1Cx(4x185mm2)	65	1000	93	0,35	6,36	1	1	0,644	329	139,12	211,88	139,12
1803-PM-608 A	Power cable for FLUSHING OIL DRUM PUMP	044-EPGCC-101	10,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x95mm2)	65	250	93	0,35	6,36	1	1	0,5546	164	88,72	90,95	88,72
1803-PM-608 B	Power cable for FLUSHING OIL DRUM PUMP	044-EPGCC-101	10,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x95mm2)	65	250	93	0,35	6,36	1	1	0,5546	164	88,72	90,95	88,72
1803-PM-610 A	Power cable for FIRE WATER BOOSTER PUMP	044-EPGCC-101	10,5	3PH	Duct bank	MULTIPOLAR	2Cx(3x185mm2)	65	250	93	11	35,66	2	1	0,5546	238	260,34	131,99	130,17
1803-PM-610 B	Power cable for FIRE WATER BOOSTER PUMP	044-EPGCC-101	10,5	3PH	Duct bank	MULTIPOLAR	2Cx(3x185mm2)	65	250	93	11	35,66	2	1	0,5546	238	260,34	131,99	130,17
1803-PM-201 A	Power cable for HCN PRODUCT PUMP	044-MCC-101	273	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,35	6,36	1	1	0,5546	112	54,01	62,12	54,01
1803-PM-201 B	Power cable for HCN PRODUCT PUMP	044-MCC-101	273	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,35	6,36	1	1	0,5546	112	54,01	62,12	54,01
1803-PM-208 A	Power cable for REFLUX DRUM SOUR WATER PUMP	044-MCC-101	178,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x25mm2)	65	250	93	0,21	4,93	1	1	0,5546	79	36,84	43,81	36,84
1803-PM-208 B	Power cable for REFLUX DRUM SOUR WATER PUMP	044-MCC-101	178,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x25mm2)	65	250	93	0,21	4,93	1	1	0,5546	79	36,84	43,81	36,84
1803-PM-210 A	Power cable for DISTILLATE DRUM SOUR WATER PUMP	044-MCC-101	199,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x16mm2)	65	250	142	0,21	3,23	1	1	0,5546	79	26,87	43,81	26,87
1803-PM-210 B	Power cable for DISTILLATE DRUM SOUR WATER PUMP	044-MCC-101	199,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x16mm2)	65	250	142	0,21	3,23	1	1	0,5546	79	26,87	43,81	26,87
1803-PM-211 A	Power cable for COMPRESSOR SUCTION KO DRUM PUMP	044-MCC-101	183,75	3PH	Duct bank	MULTIPOLAR	1Cx(3x6mm2)	65	250	142	0,16	2,82	1	1	0,5546	47	10,99	26,07	10,99
1803-PM-211 S	Power cable for COMPRESSOR SUCTION KO DRUM PUMP (SPARE IN WAREHOUSE)	044-MCC-101	183,75	3PH	Duct bank	MULTIPOLAR	1Cx(3x6mm2)	65	250	142	0,16	2,82	1	1	0,5546	47	10,99	26,07	10,99
1803-PM-223 A	Power cable for SOUR WATER PUMP	044-MCC-101	157,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,35	6,36	1	1	0,5546	112	61,83	62,12	61,83
1803-PM-223 B	Power cable for SOUR WATER PUMP	044-MCC-101	157,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,35	6,36	1	1	0,5546	112	61,83	62,12	61,83
1803-PM-601 A	Power cable for CLOSED BLOWDOWN DRUM PUMP	044-MCC-101	273	3PH	Duct bank	MULTIPOLAR	1Cx(3x16mm2)	65	250	142	0,19	3,07	1	1	0,5546	79	24,2	43,81	24,20
1803-PM-601 S	Power cable for CLOSED BLOWDOWN DRUM PUMP (SPARE IN WAREHOUSE)	044-MCC-101	273	3PH	Duct bank	MULTIPOLAR	1Cx(3x16mm2)	65	250	142	0,19	3,07	1	1	0,5546	79	24,2	43,81	24,20

Table 113. MV Cables calculations: short circuit and ampacity (part 4).

PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LaPech” (J-18)							ELECTRICAL CABLE CALCULATIONS: SHORT CIRCUIT AND AMPACITY											
CLIENT:	INDIAN OIL CORPORATION LIMITED																		
LOAD DESCRIPTION			CABLE DESCRIPTION					SHORT CIRCUIT CALCULATION					AMPACITY CALCULATION						
Associated load	Description	From equipment	Cable lenght (m)	Connexion	Installation	Type	Selected cable size	Fault current (kA)	Fault withstand time (msec)	Constant K	Energy ampacity	Minimum cross section of conductor	N° of conductors per phase	Security factor	Derrating factor (Kt)	Cable Ampacity (A)	Nominal current (A)	Cable derrated ampacity (A)	Final cable current (A)
1803-PM-602 A	Power cable for AMINE DRAIN DRUM PUMP	044-MCC-101	283,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x10mm2)	65	250	142	0,19	3,07	1	1	0,5546	62	17,74	34,39	17,74
1803-PM-602 S	Power cable for AMINE DRAIN DRUM PUMP (SPARE IN WAREHOUSE)	044-MCC-101	283,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x10mm2)	65	250	142	0,19	3,07	1	1	0,5546	62	17,74	34,39	17,74
1803-PM-606 A	Power cable for SUSPECT CONDENSATE PUMP	044-MCC-101	126	3PH	Duct bank	MULTIPOLAR	1Cx(3x10mm2)	65	250	142	0,21	3,23	1	1	0,5546	62	26,87	34,39	26,87
1803-PM-606 B	Power cable for SUSPECT CONDENSATE PUMP	044-MCC-101	126	3PH	Duct bank	MULTIPOLAR	1Cx(3x10mm2)	65	250	142	0,21	3,23	1	1	0,5546	62	26,87	34,39	26,87
1803-PM-611 A	Power cable for CONTAMINATED RAIN WATER SEWER PUMP	044-MCC-101	84	3PH	Duct bank	MULTIPOLAR	1Cx(3x95mm2)	65	250	93	0,35	6,36	1	1	0,5546	164	70,98	90,95	70,98
1803-PM-611 B	Power cable for CONTAMINATED RAIN WATER SEWER PUMP	044-MCC-101	84	3PH	Duct bank	MULTIPOLAR	1Cx(3x95mm2)	65	250	93	0,35	6,36	1	1	0,5546	164	70,98	90,95	70,98
1803-PM-612 A	Power cable for OILY WATER SEWER PUMP	044-MCC-101	84	3PH	Duct bank	MULTIPOLAR	1Cx(3x6mm2)	65	250	142	0,19	3,07	1	1	0,5546	47	24,2	26,07	24,20
1803-PM-612 S	Power cable for OILY WATER SEWER PUMP (SPARE IN WAREHOUSE)	044-MCC-101	84	3PH	Duct bank	MULTIPOLAR	1Cx(3x6mm2)	65	250	142	0,19	3,07	1	1	0,5546	47	24,2	26,07	24,20
UNIT CONTROL PANEL NON UPS (MAB 1803-K-101)	Power cable for UNIT CONTROL PANEL NON UPS (MAIN AIR BLOWER 1803-K-101)	044-MCC-106	6,3	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x50mm2)	65	250	93	0,21	4,93	1	1	0,5546	112	48,16	62,12	48,16
IGV (INLET GUIDE VANE MAIN AIR BLOWER 1803-K-101)	Power cable for IGV (INLET GUIDE VANE MAIN AIR BLOWER 1803-K-101)	044-MCC-106	6,3	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x50mm2)	65	250	93	0,21	4,93	1	1	0,5546	112	48,16	62,12	48,16
1803-X-105-F-1	Power cable for HEATER-1 (MAIN AIR BLOWER 1803-K-101)	044-MCC-106	6,3	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x50mm2)	65	250	93	0,21	4,93	1	1	0,5546	112	48,16	62,12	48,16
1803-X-105-F-2	Power cable for UNIT CONTROL PANEL NON UPS (WET GAS COMPRESSOR 1803-K-102)	044-MCC-106	6,3	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x50mm2)	65	250	93	0,21	4,93	1	1	0,5546	112	48,16	62,12	48,16
UNIT CONTROL PANEL NON UPS (WET GAS COMPRESSOR 1803-K-102)	Power cable for HEATER-1 (WET GAS COMPRESSOR 1803-K-102)	044-MCC-106	6,3	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x50mm2)	65	250	93	0,21	4,93	1	1	0,5546	112	48,16	62,12	48,16
1803-K-201-F-1	Power cable for HEATER-2 (WET GAS COMPRESSOR 1803-K-102)	044-MCC-101	6,3	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x50mm2)	65	250	93	0,21	4,93	1	1	0,5546	112	48,16	62,12	48,16
1803-K-105-P-3	Power cable for CONTROL OIL PUMPI FOR MAB	044-MCC-106	6,3	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,04	1,41	1	1	0,5546	29	4,82	16,08	4,82
1803-K-105-P-4	Power cable for CONTROL OIL PUMPI FOR MAB	044-MCC-106	6,3	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,04	1,41	1	1	0,5546	29	4,82	16,08	4,82
1803-K-201-P-3	Power cable for CONTROL OIL PUMPI FOR WGC	044-MCC-106	6,3	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,04	1,41	1	1	0,5546	29	4,82	16,08	4,82
1803-K-201-P-4	Power cable for CONTROL OIL PUMPI FOR WGC	044-MCC-106	6,3	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,04	1,41	1	1	0,5546	29	4,82	16,08	4,82
MAB TURNING GEAR MOTOR	Power cable for MAIN AIR BLOWER TURNING GEAR MOTOR	044-MCC-106	6,3	3PH	Duct bank	MULTIPOLAR	1Cx(3x16mm2)	65	250	142	0,19	3,07	1	1	0,5546	79	24,08	43,81	24,08
1803-ACM-201 A1	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-1	044-MCC-102	162,75	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,35	6,36	1	1	0,5546	112	50,41	62,12	50,41
1803-ACM-201 A2	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-2	044-MCC-102	162,75	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,35	6,36	1	1	0,5546	112	50,41	62,12	50,41
1803-ACM-201 B1	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-3	044-MCC-102	162,75	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,35	6,36	1	1	0,5546	112	50,41	62,12	50,41
1803-ACM-201 C1	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-4	044-MCC-102	162,75	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,35	6,36	1	1	0,5546	112	50,41	62,12	50,41
1803-ACM-201 B2	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-5	044-MCC-102	155,4	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,35	6,36	1	1	0,5546	112	50,41	62,12	50,41
1803-ACM-201 C2	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-6	044-MCC-102	155,4	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,35	6,36	1	1	0,5546	112	50,41	62,12	50,41
1803-ACM-201 D1	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-7	044-MCC-102	110,25	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,35	6,36	1	1	0,5546	112	50,41	62,12	50,41
1803-ACM-201 E1	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-8	044-MCC-102	110,25	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,35	6,36	1	1	0,5546	112	50,41	62,12	50,41
1803-ACM-201 D2	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-9	044-MCC-102	117,6	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,35	6,36	1	1	0,5546	112	50,41	62,12	50,41
1803-ACM-201 E2	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-10	044-MCC-102	117,6	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,35	6,36	1	1	0,5546	112	50,41	62,12	50,41
1803-ACM-201 F1	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-11	044-MCC-102	126	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,35	6,36	1	1	0,5546	112	50,41	62,12	50,41
1803-ACM-201 G1	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-12	044-MCC-102	126	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,35	6,36	1	1	0,5546	112	50,41	62,12	50,41
1803-AM-1001	Power cable for CORROSION INHIBITOR DRUM AGITATOR MOTOR	044-MCC-101	231	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,003	0,39	1	1	0,5546	29	1,77	16,08	1,77
1803-AM-1002	Power cable for AMMONIUM POLYSULPHIDE DRUM AGITATOR MOTOR	044-MCC-101	210	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,003	0,39	1	1	0,5546	29	1,77	16,08	1,77
1803-AM-1003	Power cable for ANTIFOAM DRUM AGITATOR MOTOR	044-MCC-101	126	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,003	0,39	1	1	0,5546	29	1,77	16,08	1,77
1803-AM-1004	Power cable for PHOSPHATE DRUM AGITATOR MOTOR	044-MCC-101	231	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,003	0,39	1	1	0,5546	29	1,77	16,08	1,77
1803-AM-1005	Power cable for NEUTRALISING AMINE DRUM AGITATOR MOTOR	044-MCC-101	220,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,003	0,39	1	1	0,5546	29	1,77	16,08	1,77
1803-AM-1006	Power cable for OXYGEN SCAVENGER DRUM AGITATOR MOTOR	044-MCC-101	220,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,003	0,39	1	1	0,5546	29	1,77	16,08	1,77
1803-ACM-201 H1	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-13	044-MCC-102	147	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,35	6,36	1	1	0,5546	112	50,41	62,12	50,41
1803-ACM-201 F2	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-14	044-MCC-102	147	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,35	6,36	1	1	0,5546	112	50,41	62,12	50,41
1803-ACM-201 G2	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-15	044-MCC-102	154,35	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,35	6,36	1	1	0,5546	112	50,41	62,12	50,41
1803-ACM-201 J1	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-16	044-MCC-102	154,35	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,35	6,36	1	1	0,5546	112	50,41	62,12	50,41

Table 114. MV Cables calculations: short circuit and ampacity (part 5).

PROJECT:	EPCC-2 PACKAGE (INDM RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LaPech” (J-18)							ELECTRICAL CABLE CALCULATIONS: SHORT CIRCUIT AND AMPACITY											
CLIENT:	INDIAN OIL CORPORATION LIMITED																		
LOAD DESCRIPTION		CABLE DESCRIPTION						SHORT CIRCUIT CALCULATION					AMPACITY CALCULATION						
Associated load	Description	From equipment	Cable lenght (m)	Connexion	Installation	Type	Selected cable size	Fault current (kA)	Fault withstand time (msec)	Constant K	Energy ampacity	Minimum cross section of conductor	N° of conductors per phase	Security factor	Derrating factor (Kt)	Cable Ampacity (A)	Nominal current (A)	Cable derrated ampacity (A)	Final cable current (A)
1803-ACM-201 K1	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-17	044-MCC-103	159,6	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,35	6,36	1	1	0,5546	112	50,41	62,12	50,41
1803-ACM-201 H2	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-18	044-MCC-103	159,6	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,35	6,36	1	1	0,5546	112	50,41	62,12	50,41
1803-ACM-201 J2	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-19	044-MCC-103	168	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,35	6,36	1	1	0,5546	112	50,41	62,12	50,41
1803-ACM-201 L1	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-20	044-MCC-103	168	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,35	6,36	1	1	0,5546	112	50,41	62,12	50,41
1803-ACM-201 M1	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-21	044-MCC-103	178,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x70mm2)	65	250	93	0,35	6,36	1	1	0,5546	137	50,41	75,98	50,41
1803-ACM-201 K2	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-22	044-MCC-103	178,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x70mm2)	65	250	93	0,35	6,36	1	1	0,5546	137	50,41	75,98	50,41
1803-ACM-201 L2	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-23	044-MCC-103	186,9	3PH	Duct bank	MULTIPOLAR	1Cx(3x70mm2)	65	250	93	0,35	6,36	1	1	0,5546	137	50,41	75,98	50,41
1803-ACM-201 M2	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-24	044-MCC-103	186,9	3PH	Duct bank	MULTIPOLAR	1Cx(3x70mm2)	65	250	93	0,35	6,36	1	1	0,5546	137	50,41	75,98	50,41
1803-ACM-201 N1	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-25	044-MCC-103	194,25	3PH	Duct bank	MULTIPOLAR	1Cx(3x70mm2)	65	250	93	0,35	6,36	1	1	0,5546	137	50,41	75,98	50,41
1803-ACM-201 P1	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-26	044-MCC-103	194,25	3PH	Duct bank	MULTIPOLAR	1Cx(3x70mm2)	65	250	93	0,35	6,36	1	1	0,5546	137	50,41	75,98	50,41
1803-ACM-201 N2	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-27	044-MCC-103	201,6	3PH	Duct bank	MULTIPOLAR	1Cx(3x70mm2)	65	250	93	0,35	6,36	1	1	0,5546	137	50,41	75,98	50,41
1803-ACM-201 P2	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-28	044-MCC-103	201,6	3PH	Duct bank	MULTIPOLAR	1Cx(3x70mm2)	65	250	93	0,35	6,36	1	1	0,5546	137	50,41	75,98	50,41
1803-ACM-201 Q1	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-29	044-MCC-103	210	3PH	Duct bank	MULTIPOLAR	1Cx(3x70mm2)	65	250	93	0,35	6,36	1	1	0,5546	137	50,41	75,98	50,41
1803-ACM-201 R1	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-30	044-MCC-103	210	3PH	Duct bank	MULTIPOLAR	1Cx(3x70mm2)	65	250	93	0,35	6,36	1	1	0,5546	137	50,41	75,98	50,41
1803-ACM-201 Q2	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-31	044-MCC-103	217,35	3PH	Duct bank	MULTIPOLAR	1Cx(3x70mm2)	65	250	93	0,35	6,36	1	1	0,5546	137	50,41	75,98	50,41
1803-ACM-201 R2	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-32	044-MCC-103	217,35	3PH	Duct bank	MULTIPOLAR	1Cx(3x70mm2)	65	250	93	0,35	6,36	1	1	0,5546	137	50,41	75,98	50,41
1803-ACM-202 A1	Power cable for LCO PUMPAROUND AIR COOLER FAN-1	044-MCC-104	224,7	3PH	Duct bank	MULTIPOLAR	1Cx(3x6mm2)	65	250	142	0,04	1,41	1	1	0,5546	47	4,05	26,07	4,05
1803-ACM-202 B1	Power cable for LCO PUMPAROUND AIR COOLER FAN-2	044-MCC-104	224,7	3PH	Duct bank	MULTIPOLAR	1Cx(3x6mm2)	65	250	142	0,04	1,41	1	1	0,5546	47	4,05	26,07	4,05
1803-ACM-204 A1	Power cable for COMPRESSOR INTERSTAGE AIR CONDENSER FAN-1	044-MCC-104	224,7	3PH	Duct bank	MULTIPOLAR	1Cx(3x95mm2)	65	250	93	0,35	6,36	1	1	0,5546	164	50,41	90,95	50,41
1803-ACM-204 B1	Power cable for COMPRESSOR INTERSTAGE AIR CONDENSER FAN-2	044-MCC-104	215,25	3PH	Duct bank	MULTIPOLAR	1Cx(3x95mm2)	65	250	93	0,35	6,36	1	1	0,5546	164	50,41	90,95	50,41
1803-ACM-204 C1	Power cable for COMPRESSOR INTERSTAGE AIR CONDENSER FAN-3	044-MCC-104	215,25	3PH	Duct bank	MULTIPOLAR	1Cx(3x95mm2)	65	250	93	0,35	6,36	1	1	0,5546	164	50,41	90,95	50,41
1803-ACM-204 D1	Power cable for COMPRESSOR INTERSTAGE AIR CONDENSER FAN-4	044-MCC-104	220,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x95mm2)	65	250	93	0,35	6,36	1	1	0,5546	164	50,41	90,95	50,41
1803-ACM-204 A2	Power cable for COMPRESSOR INTERSTAGE AIR CONDENSER FAN-5	044-MCC-104	220,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x95mm2)	65	250	93	0,35	6,36	1	1	0,5546	164	50,41	90,95	50,41
1803-ACM-204 B2	Power cable for COMPRESSOR INTERSTAGE AIR CONDENSER FAN-6	044-MCC-104	226,8	3PH	Duct bank	MULTIPOLAR	1Cx(3x95mm2)	65	250	93	0,35	6,36	1	1	0,5546	164	50,41	90,95	50,41
1803-ACM-204 C2	Power cable for COMPRESSOR INTERSTAGE AIR CONDENSER FAN-7	044-MCC-104	226,8	3PH	Duct bank	MULTIPOLAR	1Cx(3x95mm2)	65	250	93	0,35	6,36	1	1	0,5546	164	50,41	90,95	50,41
1803-ACM-204 D2	Power cable for COMPRESSOR INTERSTAGE AIR CONDENSER FAN-8	044-MCC-104	226,8	3PH	Duct bank	MULTIPOLAR	1Cx(3x95mm2)	65	250	93	0,35	6,36	1	1	0,5546	164	50,41	90,95	50,41
1803-ACM-207 A1	Power cable for DEBUTANIZER OVERHEAD AIR CONDENSER FAN-1	044-MCC-104	371,7	3PH	Duct bank	MULTIPOLAR	1Cx(3x95mm2)	65	250	93	0,21	4,93	1	1	0,5546	164	25,73	90,95	25,73
1803-ACM-205 A1	Power cable for HIGH PRESSURE AIR CONDENSER FAN-1	044-MCC-105	262,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,21	4,93	1	1	0,5546	112	25,73	62,12	25,73
1803-ACM-205 B1	Power cable for HIGH PRESSURE AIR CONDENSER FAN-2	044-MCC-105	262,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,21	4,93	1	1	0,5546	112	25,73	62,12	25,73
1803-ACM-205 C1	Power cable for HIGH PRESSURE AIR CONDENSER FAN-3	044-MCC-105	268,8	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,21	4,93	1	1	0,5546	112	25,73	62,12	25,73
1803-ACM-205 D1	Power cable for HIGH PRESSURE AIR CONDENSER FAN-4	044-MCC-105	268,8	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,21	4,93	1	1	0,5546	112	25,73	62,12	25,73
1803-ACM-205 E1	Power cable for HIGH PRESSURE AIR CONDENSER FAN-5	044-MCC-105	275,1	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,21	4,93	1	1	0,5546	112	25,73	62,12	25,73
1803-ACM-205 F1	Power cable for HIGH PRESSURE AIR CONDENSER FAN-6	044-MCC-105	275,1	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,21	4,93	1	1	0,5546	112	25,73	62,12	25,73
1803-ACM-205 G1	Power cable for HIGH PRESSURE AIR CONDENSER FAN-7	044-MCC-105	281,4	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,21	4,93	1	1	0,5546	112	25,73	62,12	25,73
1803-ACM-205 H1	Power cable for HIGH PRESSURE AIR CONDENSER FAN-8	044-MCC-105	281,4	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,21	4,93	1	1	0,5546	112	25,73	62,12	25,73
1803-ACM-205 A2	Power cable for HIGH PRESSURE AIR CONDENSER FAN-9	044-MCC-105	288,75	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,21	4,93	1	1	0,5546	112	25,73	62,12	25,73
1803-ACM-205 B2	Power cable for HIGH PRESSURE AIR CONDENSER FAN-10	044-MCC-105	288,75	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,21	4,93	1	1	0,5546	112	25,73	62,12	25,73
1803-ACM-205 C2	Power cable for HIGH PRESSURE AIR CONDENSER FAN-11	044-MCC-105	288,75	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,21	4,93	1	1	0,5546	112	25,73	62,12	25,73
1803-ACM-205 D2	Power cable for HIGH PRESSURE AIR CONDENSER FAN-12	044-MCC-105	296,1	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,21	4,93	1	1	0,5546	112	25,73	62,12	25,73
1803-ACM-205 E2	Power cable for HIGH PRESSURE AIR CONDENSER FAN-13	044-MCC-105	296,1	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,21	4,93	1	1	0,5546	112	25,73	62,12	25,73
1803-ACM-205 F2	Power cable for HIGH PRESSURE AIR CONDENSER FAN-14	044-MCC-105	302,4	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,21	4,93	1	1	0,5546	112	25,73	62,12	25,73

Table 115. MV Cables calculations: short circuit and ampacity (part 6).

PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPech” (J-18)							ELECTRICAL CABLE CALCULATIONS: SHORT CIRCUIT AND AMPACITY											
CLIENT:	INDIAN OIL CORPORATION LIMITED																		
LOAD DESCRIPTION			CABLE DESCRIPTION					SHORT CIRCUIT CALCULATION					AMPACITY CALCULATION						
Associated load	Description	From equipment	Cable lenght (m)	Connexion	Installation	Type	Selected cable size	Fault current (kA)	Fault withstand time (msec)	Constant K	Energy ampacity	Minimum cross section of conductor	N° of conductors per phase	Security factor	Derrating factor (Kt)	Cable Ampacity (A)	Nominal current (A)	Cable derrated ampacity (A)	Final cable current (A)
1803-ACM-205 G2	Power cable for HIGH PRESSURE AIR CONDENSER	044-MCC-105	302,4	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,21	4,93	1	1	0,5546	112	25,73	62,12	25,73
1803-ACM-205 H2	Power cable for HIGH PRESSURE AIR CONDENSER	044-MCC-105	315	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,21	4,93	1	1	0,5546	112	25,73	62,12	25,73
1803-ACM-207 B1	Power cable for DEBUTANIZER OVERHEAD AI	044-MCC-104	357	3PH	Duct bank	MULTIPOLAR	1Cx(3x95mm2)	65	250	93	0,21	4,93	1	1	0,5546	164	25,73	90,95	25,73
1803-MOV-2305	Power cable for WASTE HEAT BOILER INLET WHB-	044-MCC-106	84	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	1000	142	0,04	1,41	1	1	0,5546	29	4,39	16,08	4,39
1803-MOV -2306	Power cable for WASTE HEAT BOILER OUTLET WHB-	044-MCC-106	84	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	1000	142	0,04	1,41	1	1	0,5546	29	4,39	16,08	4,39
1803-MOV -4001	Power cable for HC VAP RCTR OVRHD TO	044-MCC-106	84	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	1000	142	0,04	1,41	1	1	0,5546	29	4,39	16,08	4,39
1803-MOV -5801	Power cable for WGC 1ST STAGE COMPRESSOR	044-MCC-106	84	3PH	Duct bank	MULTIPOLAR	1Cx(3x16mm2)	65	1000	142	0,19	3,07	1	1	0,5546	79	21,97	43,81	21,97
1803-MOV -5802	Power cable for WGC 1ST STAGE COMPRESSOR	044-MCC-106	84	3PH	Duct bank	MULTIPOLAR	1Cx(3x16mm2)	65	1000	142	0,19	3,07	1	1	0,5546	79	21,97	43,81	21,97
1803-MOV -5803	Power cable for WGC 2ND STAGE COMPRESSOR	044-MCC-106	84	3PH	Duct bank	MULTIPOLAR	1Cx(3x16mm2)	65	1000	142	0,19	3,07	1	1	0,5546	79	21,97	43,81	21,97
1803-MOV -5804	Power cable for WGC 2ND STAGE COMPRESSOR	044-MCC-106	84	3PH	Duct bank	MULTIPOLAR	1Cx(3x16mm2)	65	1000	142	0,19	3,07	1	1	0,5546	79	21,97	43,81	21,97
1803-X-106 A	Power cable for PURGE AIR FAN (WASTE HEAT	044-MCC-106	168	3PH	Duct bank	MULTIPOLAR	1Cx(3x95mm2)	65	1000	93	0,35	6,36	1	1	0,5546	164	72,23	90,95	72,23
1803-X-106 B	Power cable for PURGE AIR FAN (WASTE HEAT	044-MCC-106	168	3PH	Duct bank	MULTIPOLAR	1Cx(3x95mm2)	65	1000	93	0,35	6,36	1	1	0,5546	164	72,23	90,95	72,23
1803-X-106 LRSB	Power cable for SOOT BLOWER POWER PANEL	044-MCC-106	173,25	3PH	Duct bank	MULTIPOLAR	1Cx(3x25mm2)	65	250	93	0,19	4,69	1	1	0,5546	79	23,28	43,81	23,28
1803-X-106 MOV A	Power cable for MOTORISED MAIN STEAM STOP VALVE (MSSV) WASTE HEAT BOILER	044-MCC-106	173,25	3PH	Duct bank	MULTIPOLAR	1Cx(3x25mm2)	65	250	93	0,19	4,69	1	1	0,5546	79	24,08	43,81	24,08
1803-X-106 MOV B	Power cable for MOTORISED BY-PASS VALVE FOR MSSV (WASTE HEAT BOILER)	044-MCC-106	173,25	3PH	Duct bank	MULTIPOLAR	1Cx(3x25mm2)	65	250	93	0,19	4,69	1	1	0,5546	79	24,08	43,81	24,08
1803-X-106 MOV C	Power cable for MOTORISED START UP VENT VALVE (WASTE HEAT BOILER)	044-MCC-106	173,25	3PH	Duct bank	MULTIPOLAR	1Cx(3x25mm2)	65	250	93	0,19	4,69	1	1	0,5546	79	24,08	43,81	24,08
1803-X-107-P001A	Power cable for CAUSTIC BOOSTER PUMP (WET GAS SCRUBBER PACKAGE)	044-MCC-106	84	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,015	0,86	1	1	0,5546	29	2,49	16,08	2,49
1803-X-107-P001B	Power cable for CAUSTIC BOOSTER PUMP (WET GAS SCRUBBER PACKAGE)	044-MCC-106	84	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,015	0,86	1	1	0,5546	29	2,49	16,08	2,49
1803-X-107-P002A	Power cable for MAKE-UP WATER BOOSTER PUMP (WET GAS SCRUBBER PACKAGE)	044-MCC-106	84	3PH	Duct bank	MULTIPOLAR	1Cx(3x25mm2)	65	250	93	0,21	4,93	1	1	0,5546	79	36,5	43,81	36,50
1803-X-107-P002B	Power cable for MAKE-UP WATER BOOSTER PUMP (WET GAS SCRUBBER PACKAGE)	044-MCC-106	84	3PH	Duct bank	MULTIPOLAR	1Cx(3x25mm2)	65	250	93	0,21	4,93	1	1	0,5546	79	36,5	43,81	36,50
1803-X-107-P005A	Power cable for COAGULANT METERING PUMP (WET GAS SCRUBBER PACKAGE)	044-MCC-106	84	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,015	0,86	1	1	0,5546	29	2,49	16,08	2,49
1803-X-107-P005B	Power cable for COAGULANT METERING PUMP (WET GAS SCRUBBER PACKAGE)	044-MCC-106	84	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,015	0,86	1	1	0,5546	29	2,49	16,08	2,49
1803-X-107-P007A	Power cable for EFFLUENT FILTER SUPPLY PUMP (WET GAS SCRUBBER PACKAGE)	044-MCC-106	84	3PH	Duct bank	MULTIPOLAR	1Cx(3x25mm2)	65	250	93	0,21	4,93	1	1	0,5546	79	36,5	43,81	36,50
1803-X-107-P007B	Power cable for EFFLUENT FILTER SUPPLY PUMP (WET GAS SCRUBBER PACKAGE)	044-MCC-106	84	3PH	Duct bank	MULTIPOLAR	1Cx(3x25mm2)	65	250	93	0,21	4,93	1	1	0,5546	79	36,5	43,81	36,50
1803-X-107-P006A	Power cable for FILTRATE PUMP (WET GAS SCRUBBER PACKAGE)	044-MCC-106	84	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,05	1,57	1	1	0,5546	29	6,14	16,08	6,14
1803-X-107-P006B	Power cable for FILTRATE PUMP (WET GAS SCRUBBER PACKAGE)	044-MCC-106	84	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,05	1,57	1	1	0,5546	29	6,14	16,08	6,14
1803-X-205-P-001A	Power cable for AMINE TRANSFER PUMP (CR LPG TREATMENT PACKAGE)	044-MCC-107	367,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,21	4,93	1	1	0,5546	112	32,92	62,12	32,92
1803-X-205-P-001B	Power cable for AMINE TRANSFER PUMP (CR LPG TREATMENT PACKAGE)	044-MCC-107	367,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,21	4,93	1	1	0,5546	112	32,92	62,12	32,92
1803-X-205-P-002A	Power cable for AMINE TRANSFER PUMP (CR LPG TREATMENT PACKAGE)	044-MCC-107	367,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,21	4,93	1	1	0,5546	112	32,92	62,12	32,92
1803-X-205-P-002B	Power cable for AMINE TRANSFER PUMP (CR LPG TREATMENT PACKAGE)	044-MCC-107	367,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,21	4,93	1	1	0,5546	112	32,92	62,12	32,92
1803-X-205-P-003A	Power cable for SO2 TOWER RECYCLE PUMP (CR LPG TREATMENT PACKAGE)	044-MCC-107	367,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x16mm2)	65	250	142	0,17	2,90	1	1	0,5546	79	15,08	43,81	15,08
1803-X-205-P-003B	Power cable for SO2 TOWER RECYCLE PUMP (CR LPG TREATMENT PACKAGE)	044-MCC-107	367,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x16mm2)	65	250	142	0,17	2,90	1	1	0,5546	79	15,08	43,81	15,08
1803-X-205-P-004A	Power cable for CAUSTIC TRANSFER PUMP (CR LPG TREATMENT PACKAGE)	044-MCC-107	367,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,21	4,93	1	1	0,5546	112	26,87	62,12	26,87
1803-X-205-P-004B	Power cable for CAUSTIC TRANSFER PUMP (CR LPG TREATMENT PACKAGE)	044-MCC-107	367,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,21	4,93	1	1	0,5546	112	26,87	62,12	26,87
1803-X-205-P-005A	Power cable for SOLVENT RECYCLE PUMP (CR LPG TREATMENT PACKAGE)	044-MCC-107	367,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,21	4,93	1	1	0,5546	112	28,09	62,12	28,09
1803-X-205-P-005B	Power cable for SOLVENT RECYCLE PUMP (CR LPG TREATMENT PACKAGE)	044-MCC-107	367,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,21	4,93	1	1	0,5546	112	28,09	62,12	28,09
1803-X-205-P-007A	Power cable for SOLVENT RECYCLE PUMP (CR LPG TREATMENT PACKAGE)	044-MCC-107	367,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x150mm2)	65	250	93	0,35	6,36	1	1	0,5546	209	60,08	115,91	60,08
1803-X-205-P-007B	Power cable for SOLVENT RECYCLE PUMP (CR LPG TREATMENT PACKAGE)	044-MCC-107	367,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x150mm2)	65	250	93	0,35	6,36	1	1	0,5546	209	60,08	115,91	60,08
1803-X-205-P-008A	Power cable for SOLVENT / DSO PUMP (CR LPG TREATMENT PACKAGE)	044-MCC-107	367,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x16mm2)	65	250	142	0,17	2,90	1	1	0,5546	79	13,77	43,81	13,77
1803-X-205-P-008B	Power cable for SOLVENT / DSO PUMP (CR LPG TREATMENT PACKAGE)	044-MCC-107	367,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x16mm2)	65	250	142	0,17	2,90	1	1	0,5546	79	13,77	43,81	13,77
1803-X-205-P-011A	Power cable for BRINE RECYCLE PUMP (CR LPG TREATMENT PACKAGE)	044-MCC-107	367,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x16mm2)	65	250	142	0,17	2,90	1	1	0,5546	79	13,77	43,81	13,77

Table 116. MV Cables calculations: short circuit and ampacity (part 7).

PROJECT:		EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LuPech" (J-18)						ELECTRICAL CABLE CALCULATIONS: SHORT CIRCUIT AND AMPACITY											
CLIENT:		INDIAN OIL CORPORATION LIMITED																	
LOAD DESCRIPTION		CABLE DESCRIPTION						SHORT CIRCUIT CALCULATION						AMPACITY CALCULATION					
Associated load	Description	From equipment	Cable lenght (m)	Connexion	Installation	Type	Selected cable size	Fault current (kA)	Fault withstand time (msec)	Constant K	Energy ampacity	Minimum cross section of conductor	N° of conductors per phase	Security factor	Derrating factor (Kt)	Cable Ampacity (A)	Nominal current (A)	Cable derrated ampacity (A)	Final cable current (A)
1803-X-205-P-011B	Power cable for BRINE RECYCLE PUMP (CR LPG TREATMENT PACKAGE)	044-MCC-107	367,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x16mm2)	65	250	142	0,17	2,90	1	1	0,5546	79	13,77	43,81	13,77
1803-X-205-P-012A	Power cable for SPENT CAUSTIC FEED PUMP (CR LPG TREATMENT PACKAGE)	044-MCC-107	367,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x16mm2)	65	250	142	0,16	2,82	1	1	0,5546	79	10,99	43,81	10,99
1803-X-205-P-012B	Power cable for SPENT CAUSTIC FEED PUMP (CR LPG TREATMENT PACKAGE)	044-MCC-107	367,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x16mm2)	65	250	142	0,16	2,82	1	1	0,5546	79	10,99	43,81	10,99
1803-X-205-P-014A	Power cable for PROCESS WATER PUMP (CR LPG TREATMENT PACKAGE)	044-MCC-107	367,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x185mm2)	65	250	93	0,35	6,36	1	1	0,5546	238	72,23	131,99	72,23
1803-X-205-P-014B	Power cable for PROCESS WATER PUMP (CR LPG TREATMENT PACKAGE)	044-MCC-107	367,5	3PH	Duct bank	MULTIPOLAR	1Cx(3x185mm2)	65	250	93	0,35	6,36	1	1	0,5546	238	72,23	131,99	72,23
1803-X-108-P-XX1	Power cable for TRAVEL MOTOR (1803-X-108 PACKAGE)	044-MCC-107	150	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,035	1,32	1	1	0,5546	29	3,53	16,08	3,53
1803-X-108-P-XX2	Power cable for TRAVEL MOTOR (1803-X-108 PACKAGE)	044-MCC-107	150	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,0009	0,21	1	1	0,5546	29	0,88	16,08	0,88
1803-X-108-P-XX3	Power cable for VCM MOTOR (1803-X-108 PACKAGE)	044-MCC-107	150	3PH	Duct bank	MULTIPOLAR	1Cx(3x10mm2)	65	250	142	0,19	3,07	1	1	0,5546	62	17,66	34,39	17,66
1803-ACM-206 A1	Power cable for GASOLINE RECYCLE AIR COOLER FAN-1	044-MCC-101	350,7	3PH	Duct bank	MULTIPOLAR	1Cx(3x95mm2)	65	250	93	0,21	4,93	1	1	0,5546	164	37,29	90,95	37,29
1803-ACM-206 B1	Power cable for GASOLINE RECYCLE AIR COOLER FAN-2	044-MCC-101	350,7	3PH	Duct bank	MULTIPOLAR	1Cx(3x95mm2)	65	250	93	0,21	4,93	1	1	0,5546	164	37,29	90,95	37,29
1803-ACM-206 A2	Power cable for GASOLINE RECYCLE AIR COOLER FAN-3	044-MCC-101	357	3PH	Duct bank	MULTIPOLAR	1Cx(3x95mm2)	65	250	93	0,21	4,93	1	1	0,5546	164	37,29	90,95	37,29
1803-ACM-206 B2	Power cable for GASOLINE RECYCLE AIR COOLER FAN-4	044-MCC-101	357	3PH	Duct bank	MULTIPOLAR	1Cx(3x95mm2)	65	250	93	0,21	4,93	1	1	0,5546	164	37,29	90,95	37,29
1803-ACM-207 C1	Power cable for DEBUTANIZER OVERHEAD AIR CONDENSER FAN-3	044-MCC-104	378	3PH	Duct bank	MULTIPOLAR	1Cx(3x70mm2)	65	250	93	0,21	4,93	1	1	0,5546	137	25,73	75,98	25,73
1803-ACM-207 D1	Power cable for DEBUTANIZER OVERHEAD AIR CONDENSER FAN-4	044-MCC-104	378	3PH	Duct bank	MULTIPOLAR	1Cx(3x70mm2)	65	250	93	0,21	4,93	1	1	0,5546	137	25,73	75,98	25,73
1803-ACM-207 A2	Power cable for DEBUTANIZER OVERHEAD AIR CONDENSER FAN-5	044-MCC-104	384,3	3PH	Duct bank	MULTIPOLAR	1Cx(3x70mm2)	65	250	93	0,21	4,93	1	1	0,5546	137	25,73	75,98	25,73
1803-ACM-207 B2	Power cable for DEBUTANIZER OVERHEAD AIR CONDENSER FAN-6	044-MCC-104	384,3	3PH	Duct bank	MULTIPOLAR	1Cx(3x70mm2)	65	250	93	0,21	4,93	1	1	0,5546	137	25,73	75,98	25,73
1803-ACM-207 C2	Power cable for DEBUTANIZER OVERHEAD AIR CONDENSER FAN-7	044-MCC-104	393,75	3PH	Duct bank	MULTIPOLAR	1Cx(3x70mm2)	65	250	93	0,21	4,93	1	1	0,5546	137	25,73	75,98	25,73
1803-ACM-207 D2	Power cable for DEBUTANIZER OVERHEAD AIR CONDENSER FAN-8	044-MCC-104	393,75	3PH	Duct bank	MULTIPOLAR	1Cx(3x70mm2)	65	250	93	0,21	4,93	1	1	0,5546	137	25,73	75,98	25,73
1803-ACM-208 A	Power cable for LCO PRODUCT AIR COOLER FAN-1	044-MCC-101	399	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,19	4,69	1	1	0,5546	112	19,02	62,12	19,02
1803-ACM-208 B	Power cable for LCO PRODUCT AIR COOLER FAN-2	044-MCC-101	399	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,19	4,69	1	1	0,5546	112	19,02	62,12	19,02
1803-ACM-208 C	Power cable for LCO PRODUCT AIR COOLER FAN-3	044-MCC-101	399	3PH	Duct bank	MULTIPOLAR	1Cx(3x50mm2)	65	250	93	0,19	4,69	1	1	0,5546	112	19,02	62,12	19,02
1803-ACM-601 A	Power cable for CONDENSATE FLASH DRUM AIR COOLER FAN-1	044-MCC-104	141,75	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,04	1,41	1	1	0,5546	29	4,05	16,08	4,05
1803-ACM-601 B	Power cable for CONDENSATE FLASH DRUM AIR COOLER FAN-2	044-MCC-104	141,75	3PH	Duct bank	MULTIPOLAR	1Cx(3x2,5mm2)	65	250	142	0,04	1,41	1	1	0,5546	29	4,05	16,08	4,05
HV-1401-1	Power cable for HPCU for Regenerated catalyst slide valve motor 1	044-MCC-107	6,3	3PH	Duct bank	MULTIPOLAR	1Cx(3x4mm2)	65	250	142	0,15	2,73	1	1	0,5546	38	8,05	21,07	8,05
HV-1401-2	Power cable for HPCU for Regenerated catalyst slide valve motor 2	044-MCC-107	6,3	3PH	Duct bank	MULTIPOLAR	1Cx(3x4mm2)	65	250	142	0,15	2,73	1	1	0,5546	38	8,05	21,07	8,05
HV-1601-1	Power cable for HPCU for Spent catalyst valve slide motor 1	044-MCC-107	6,3	3PH	Duct bank	MULTIPOLAR	1Cx(3x4mm2)	65	250	142	0,15	2,73	1	1	0,5546	38	8,05	21,07	8,05
HV-1601-2	Power cable for HPCU for Spent catalyst valve slide motor 2	044-MCC-107	6,3	3PH	Duct bank	MULTIPOLAR	1Cx(3x4mm2)	65	250	142	0,15	2,73	1	1	0,5546	38	8,05	21,07	8,05
HV-2201-1	Power cable for HPCU for Double disc flue gas slide valve motor 1	044-MCC-107	6,3	3PH	Duct bank	MULTIPOLAR	1Cx(3x4mm2)	65	250	142	0,15	2,73	1	1	0,5546	38	8,05	21,07	8,05
HV-2201-2	Power cable for HPCU for Double disc flue gas slide valve motor 2	044-MCC-107	6,3	3PH	Duct bank	MULTIPOLAR	1Cx(3x4mm2)	65	250	142	0,15	2,73	1	1	0,5546	38	8,05	21,07	8,05
XZV-2301-1	Power cable for HPCU for Flue gas diverter valve motor 1	044-MCC-107	6,3	3PH	Duct bank	MULTIPOLAR	1Cx(3x4mm2)	65	250	142	0,15	2,73	1	1	0,5546	38	8,05	21,07	8,05
XZV-2301-2	Power cable for HPCU for Flue gas diverter valve motor 2	044-MCC-107	6,3	3PH	Duct bank	MULTIPOLAR	1Cx(3x4mm2)	65	250	142	0,15	2,73	1	1	0,5546	38	8,05	21,07	8,05
H-4001	Power cable for CCV Overhead line automatic isolation valve actuator	044-MCC-107	6,3	3PH	Duct bank	MULTIPOLAR	1Cx(3x6mm2)	65	250	142	0,19	3,07	1	1	0,5546	47	19,92	26,07	19,92
1803-X-109	Power cable for 1806-X-109 EOT Crane (for Main Air Blower)	044-ASB-101	126	3PH	Duct bank	MULTIPOLAR	1Cx(3x16mm2)	65	1000	142	0,19	3,07	1	1	0,5546	79	20,87	43,81	20,87
1803-X-206	Power cable for 1806-X-206 EOT Crane (for Wet Gas Compressor)	044-ASB-101	126	3PH	Duct bank	MULTIPOLAR	1Cx(3x25mm2)	65	1000	142	0,35	4,17	1	1	0,5546	102	51,47	56,57	51,47
HB-001-01	Power cable for Hydro Blasting RFCC Unit 1	044-ASB-101	220,5	3PH+N	Duct bank	MULTIPOLAR	3Cx(4x240mm2)	65	1000	93	7	28,45	3	1	0,5546	276	400,67	153,07	133,56
HB-002-01	Power cable for Hydro Blasting RFCC Unit 2	044-ASB-101	462	3PH+N	Duct bank	MULTIPOLAR	4Cx(4x240mm2)	65	1000	93	7	28,45	4	1	0,5546	276	400,67	153,07	100,17
TRS-101A	Power cable for 100A Socket at Transformer Area 1 (044-TR-101A)	044-ASB-101	52,5	3PH+N	Tray	MULTIPOLAR	1Cx(4x35mm2)	65	1000	93	0,35	6,36	1	1	0,644	114	62,6	73,42	62,60
TRS-101B	Power cable for 100A Socket at Transformer Area 2 (044-TR-106A)	044-ASB-101	47,25	3PH+N	Tray	MULTIPOLAR	1Cx(4x35mm2)	65	1000	93	0,35	6,36	1	1	0,644	114	62,6	73,42	62,60
TRS-106A	Power cable for 100A Socket at Transformer Area 3 (044-TR-102A)	044-ASB-101	68,25	3PH+N	Tray	MULTIPOLAR	1Cx(4x35mm2)	65	1000	93	0,35	6,36	1	1	0,644	114	62,6	73,42	62,60
TRS-102A	Power cable for 100A Socket at Transformer Area 4 (044-TR-103A)	044-ASB-101	44,1	3PH+N	Tray	MULTIPOLAR	1Cx(4x35mm2)	65	1000	93	0,35	6,36	1	1	0,644	114	62,6	73,42	62,60
TRS-102B	Power cable for 100A Socket at Transformer Area 5 (044-TR-104A)	044-ASB-101	44,1	3PH+N	Tray	MULTIPOLAR	1Cx(4x35mm2)	65	1000	93	0,35	6,36	1	1	0,644	114	62,6	73,42	62,60

Table 117. MV Cables calculations: short circuit and ampacity (part 8).

PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPech” (J-18)							ELECTRICAL CABLE CALCULATIONS: SHORT CIRCUIT AND AMPACITY											
CLIENT:	INDIAN OIL CORPORATION LIMITED																		
LOAD DESCRIPTION			CABLE DESCRIPTION					SHORT CIRCUIT CALCULATION					AMPACITY CALCULATION						
Associated load	Description	From equipment	Cable lenght (m)	Connexion	Installation	Type	Selected cable size	Fault current (kA)	Fault withstand time (msec)	Constant K	Energy ampacity	Minimum cross section of conductor	N° of conductors per phase	Security factor	Derrating factor (Ki)	Cable Ampacity (A)	Nominal current (A)	Cable derrated ampacity (A)	Final cable current (A)
TRS-103A	Power cable for 100A Socket at Transformer Area 6 (044-TR-105A)	044-ASB-101	52,5	3PH+N	Tray	MULTIPOLAR	1Cx(4x35mm2)	65	1000	93	0,35	6,36	1	1	0,644	114	62,6	73,42	62,60
TRS-103B	Power cable for 100A Socket at Transformer Area 7 (044-TR-101B)	044-ASB-101	42	3PH+N	Tray	MULTIPOLAR	1Cx(4x35mm2)	65	1000	93	0,35	6,36	1	1	0,644	114	62,6	73,42	62,60
TRS-104A	Power cable for 100A Socket at Transformer Area 8 (044-TR-105B)	044-ASB-101	52,5	3PH+N	Tray	MULTIPOLAR	1Cx(4x35mm2)	65	1000	93	0,35	6,36	1	1	0,644	114	62,6	73,42	62,60
TRS-104B	Power cable for 100A Socket at Transformer Area 9 (044-TR-102B)	044-ASB-101	68,25	3PH+N	Tray	MULTIPOLAR	1Cx(4x35mm2)	65	1000	93	0,35	6,36	1	1	0,644	114	62,6	73,42	62,60
TRS-105A	Power cable for 100A Socket at Transformer Area 10 (044-TR-103B)	044-ASB-101	44,1	3PH+N	Tray	MULTIPOLAR	1Cx(4x35mm2)	65	1000	93	0,35	6,36	1	1	0,644	114	62,6	73,42	62,60
TRS-105B	Power cable for 100A Socket at Transformer Area 11 (044-TR-104B)	044-ASB-101	44,1	3PH+N	Tray	MULTIPOLAR	1Cx(4x35mm2)	65	1000	93	0,35	6,36	1	1	0,644	114	62,6	73,42	62,60
TRS-105C	Power cable for 100A Socket at Transformer Area 12 (044-TR-105C)	044-ASB-101	47,25	3PH+N	Tray	MULTIPOLAR	1Cx(4x35mm2)	65	1000	93	0,35	6,36	1	1	0,644	114	62,6	73,42	62,60
1803-X-702	Power cable for SUBSTATION LIFT	044-ASB-101	126	3PH+N	Tray	MULTIPOLAR	1Cx(4x4mm2)	65	1000	142	0,17	2,90	1	1	0,644	42	13,91	27,05	13,91
1803-X-702	Power cable for SUBSTATION LIFT MOTOR	044-ASB-101	126	3PH+N	Tray	MULTIPOLAR	1Cx(4x4mm2)	65	1000	142	0,17	2,90	1	1	0,644	42	13,91	27,05	13,91
1803-PM-614	Power cable for DRAIN PUMP 1	044-ASB-101	6,3	3PH	Duct bank	MULTIPOLAR	1Cx(3x4mm2)	65	1000	142	0,17	2,90	1	1	0,5546	38	13,91	21,07	13,91
1803-PM-613	Power cable for DRAIN PUMP 2	044-ASB-101	6,3	3PH	Duct bank	MULTIPOLAR	1Cx(3x4mm2)	65	1000	142	0,17	2,90	1	1	0,5546	38	13,91	21,07	13,91
1803-WO-101	Power cable for Welding Socket at SS-044 ground floor (max. 2 socket per feeder, 63 A, 4 pin)	044-ASB-102	57,75	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x35mm2)	65	1000	142	0,35	4,17	1	1	0,5546	122	62,6	67,66	62,60
1803-WO-102	Power cable for Welding Socket at second floor (max. 2 socket per feeder, 63 A, 4 pin)	044-ASB-102	73,5	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x35mm2)	65	1000	142	0,35	4,17	1	1	0,5546	122	62,6	67,66	62,60
1803-WO-103	Power cable for Welding Socket at RFCC CRR (max. 2 socket per feeder, 63 A, 4 pin)	044-ASB-102	162,75	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x35mm2)	65	1000	142	0,35	4,17	1	1	0,5546	122	62,6	67,66	62,60
1803-WO-104	Power cable for Welding Socket at laydown area (max. 2 socket per feeder, 63 A, 4 pin)	044-ASB-102	318,15	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x50mm2)	65	1000	142	0,35	4,17	1	1	0,5546	144	62,6	79,86	62,60
1803-WO-105	Power cable for Welding Socket at deluge house (max. 2 socket per feeder, 63 A, 4 pin)	044-ASB-102	428,4	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x95mm2)	65	1000	142	0,35	4,17	1	1	0,5546	212	62,6	117,58	62,60
1803-WO-106	Power cable for Welding Socket at CR LPG treater unit (max. 2 socket per feeder, 63 A, 4 pin)	044-ASB-102	330,75	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x50mm2)	65	1000	142	0,35	4,17	1	1	0,5546	144	62,6	79,86	62,60
1803-WO-107	Power cable for Welding Socket at recirculation pumps (max. 2 socket per feeder, 63 A, 4 pin)	044-ASB-102	202,65	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x35mm2)	65	1000	142	0,35	4,17	1	1	0,5546	122	62,6	67,66	62,60
1803-WO-108	Power cable for Welding Socket at Deethenizer and debutanizer area (max. 2 socket per feeder, 63 A, 4 pin)	044-ASB-102	428,4	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x95mm2)	65	1000	142	0,35	4,17	1	1	0,5546	212	62,6	117,58	62,60
1803-WO-109	Power cable for Welding Socket AT Reactor & Regenerator area (max. 2 socket per feeder, 63 A, 4 pin)	044-ASB-102	393,75	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x70mm2)	65	1000	142	0,35	4,17	1	1	0,5546	177	62,6	98,16	62,60
1803-WO-110	Power cable for Welding Socket Wet Gas Scrubber area (max. 2 socket per feeder, 63 A, 4 pin)	044-ASB-102	225,75	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x35mm2)	65	1000	142	0,35	4,17	1	1	0,5546	122	62,6	67,66	62,60
1803-WO-111	Power cable for Welding Socket Flue Gas Waste Heat Boiler area (max. 2 socket per feeder, 63 A, 4 pin)	044-ASB-102	244,65	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x35mm2)	65	1000	142	0,35	4,17	1	1	0,5546	122	62,6	67,66	62,60
1803-WO-112	Power cable for Welding Socket at Recirculation Pumps (max. 2 socket per feeder, 63 A, 4 pin)	044-ASB-102	168	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x35mm2)	65	1000	142	0,35	4,17	1	1	0,5546	122	62,6	67,66	62,60
044-NON-UPS PDB-1	Power cable for NON UPS DB-1 (CONTROL)	044-ASB-102	105	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x50mm2)	65	1000	93	0,35	6,36	1	1	0,5546	112	54,18	62,12	54,18
044-NON-UPS PDB-2	Power cable for NON UPS DB-2 (CONTROL)	044-ASB-102	105	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x50mm2)	65	1000	93	0,35	6,36	1	1	0,5546	112	54,18	62,12	54,18
044-MLDB-102 A	Power cable for SECURITY GATE BUILDING INCOMER 1	044-MLDB-101	1260	3PH+N	Duct bank	MULTIPOLAR	3Cx(4x120mm2)	65	1000	93	0,35	6,36	3	1	0,5546	187	73,22	103,71	24,41
044-MLDB-102 B	Power cable for SECURITY GATE BUILDING INCOMER 2	044-EMLDB-101	1260	3PH+N	Duct bank	MULTIPOLAR	3Cx(4x120mm2)	65	1000	93	0,35	6,36	3	1	0,5546	187	73,22	103,71	24,41
044-ELDB-101	Power cable for Indoor ELDB in SS-044 third floor	044-EMLDB-101	42	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x2,5mm2)	65	1000	142	0,03	1,22	1	1	0,5546	29	2,93	16,08	2,93
044-ELDB-102	Power cable for Outdoor ELDB at Laydown area	044-EMLDB-101	126	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x2,5mm2)	65	1000	142	0,03	1,22	1	1	0,5546	29	2,93	16,08	2,93
044-ELDB-103	Power cable for Indoor ELDB IN CRR-	044-EMLDB-101	78,75	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x2,5mm2)	65	1000	142	0,05	1,57	1	1	0,5546	29	5,86	16,08	5,86
044-ELDB-104	Power cable for Indoor ELDB in SS-044 ground	044-EMLDB-101	115,5	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x2,5mm2)	65	1000	142	0,03	1,22	1	1	0,5546	29	2,93	16,08	2,93
044-ELDB-105	Power cable for Indoor ELDB in SS-044 first floor	044-EMLDB-101	89,25	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x2,5mm2)	65	1000	142	0,03	1,22	1	1	0,5546	29	2,93	16,08	2,93
044-ELDB-106	Power cable for Indoor ELDB in SS-044 second	044-EMLDB-101	63	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x2,5mm2)	65	1000	142	0,03	1,22	1	1	0,5546	29	2,93	16,08	2,93
044-ELDB-107	Power cable for Outdoor ELDB at Deluge house	044-EMLDB-101	367,5	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x2,5mm2)	65	1000	142	0,03	1,22	1	1	0,5546	29	2,93	16,08	2,93
044-ELDB-108	Power cable for Outdoor ELDB at LPG treater unit	044-EMLDB-101	210	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x2,5mm2)	65	1000	142	0,03	1,22	1	1	0,5546	29	2,93	16,08	2,93
044-ELDB-109	Power cable for Outdoor ELDB at recirculation	044-EMLDB-101	105	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x2,5mm2)	65	1000	142	0,03	1,22	1	1	0,5546	29	2,93	16,08	2,93
044-ELDB-110	Power cable for Outdoor ELDB at Deethenizer and Debutanizer area	044-EMLDB-101	157,5	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x2,5mm2)	65	1000	142	0,03	1,22	1	1	0,5546	29	2,93	16,08	2,93
044-ELDB-111	Power cable for Outdoor ELDB at reactor & regenerator area	044-EMLDB-101	325,5	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x2,5mm2)	65	1000	142	0,03	1,22	1	1	0,5546	29	2,93	16,08	2,93
044-ELDB-112	Power cable for Outdoor ELDB at Wet Gas	044-EMLDB-101	157,5	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x2,5mm2)	65	1000	142	0,03	1,22	1	1	0,5546	29	2,93	16,08	2,93
044-ELDB-113	Power cable for Outdoor ELDB at flue gas WH	044-EMLDB-101	157,5	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x2,5mm2)	65	1000	142	0,03	1,22	1	1	0,5546	29	2,93	16,08	2,93
044-ELDB-114	Power cable for Outdoor ELDB street light at piperack (West)	044-EMLDB-101	420	3PH+N	Duct bank	MULTIPOLAR	2Cx(4x2,5mm2)	65	1000	142	0,03	1,22	2	1	0,5546	29	2,93	16,08	1,47

Table 118. MV Cables calculations: short circuit and ampacity (part 9).

PROJECT:		EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LaPech” (J-18)						ELECTRICAL CABLE CALCULATIONS: SHORT CIRCUIT AND AMPACITY											
CLIENT:		INDIAN OIL CORPORATION LIMITED																	
LOAD DESCRIPTION			CABLE DESCRIPTION					SHORT CIRCUIT CALCULATION					AMPACITY CALCULATION						
Associated load	Description	From equipment	Cable length (m)	Connexion	Installation	Type	Selected cable size	Fault current (kA)	Fault withstand time (msec)	Constant K	Energy ampacity	Minimum cross section of conductor	N° of conductors per phase	Security factor	Derrating factor (Kt)	Cable Ampacity (A)	Nominal current (A)	Cable derrated ampacity (A)	Final cable current (A)
044-ELDB-115	Power cable for Outdoor ELDB street light at piperack (East)	044-EMLDB-101	315	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x2,5mm2)	65	1000	142	0,03	1,22	1	1	0,5546	29	2,93	16,08	2,93
044-LDB-101	Power cable for Indoor LDB in SS-044 third floor	044-MLDB-101	42	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x2,5mm2)	65	1000	142	0,04	1,41	1	1	0,5546	29	4,39	16,08	4,39
044-LDB-104	Power cable for Indoor LDB in SS-044 ground floor	044-MLDB-101	115,5	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x2,5mm2)	65	1000	142	0,04	1,41	1	1	0,5546	29	4,39	16,08	4,39
044-LDB-105	Power cable for Indoor LDB in SS-044 first floor	044-MLDB-101	89,25	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x4mm2)	65	1000	142	0,17	2,90	1	1	0,5546	38	13,91	21,07	13,91
044-LDB-106	Power cable for Indoor LDB in SS-044 second floor	044-MLDB-101	63	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x2,5mm2)	65	1000	142	0,04	1,41	1	1	0,5546	29	4,39	16,08	4,39
044-LDB-103	Power cable for Indoor LDB in CRR-	044-MLDB-101	168	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x2,5mm2)	65	1000	142	0,04	1,41	1	1	0,5546	29	4,39	16,08	4,39
044-LDB-102	Power cable for Outdoor LDB at Laydown area	044-MLDB-101	126	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x4mm2)	65	1000	142	0,09	2,11	1	1	0,5546	38	7,32	21,07	7,32
044-LDB-107	Power cable for Outdoor LDB at Deluge house	044-MLDB-101	367,5	3PH+N	Duct bank	MULTIPOLAR	2Cx(4x4mm2)	65	1000	142	0,09	2,11	2	1	0,5546	38	7,32	21,07	3,66
044-LDB-108	Power cable for Outdoor LDB at LPG treater	044-MLDB-101	210	3PH+N	Duct bank	MULTIPOLAR	2Cx(4x4mm2)	65	1000	142	0,17	2,90	2	1	0,5546	38	13,91	21,07	6,96
044-LDB-109	Power cable for Outdoor LDB at recirculation pumps	044-MLDB-101	105	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x4mm2)	65	1000	142	0,09	2,11	1	1	0,5546	38	7,32	21,07	7,32
044-LDB-110	Power cable for Outdoor LDB at Deethenizer and Debutanizer area	044-MLDB-101	157,5	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x4mm2)	65	1000	142	0,09	2,11	1	1	0,5546	38	7,32	21,07	7,32
044-LDB-111	Power cable for Outdoor LDB at reactor & regenerator area	044-MLDB-101	325,5	3PH+N	Duct bank	MULTIPOLAR	2Cx(4x4mm2)	65	1000	142	0,09	2,11	2	1	0,5546	38	7,32	21,07	3,66
044-LDB-112	Power cable for Outdoor LDB at Wet Gas Scrubber area	044-MLDB-101	157,5	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x4mm2)	65	1000	142	0,09	2,11	1	1	0,5546	38	7,32	21,07	7,32
044-LDB-113	Power cable for Outdoor LDB at flue gas WH Boiler area	044-MLDB-101	157,5	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x2,5mm2)	65	1000	142	0,09	2,11	1	1	0,5546	29	7,32	16,08	7,32
044-LDB-114	Power cable for Outdoor LDB street light at piperack (West)	044-MLDB-101	420	3PH+N	Duct bank	MULTIPOLAR	2Cx(4x4mm2)	65	1000	142	0,05	1,57	2	1	0,5546	38	5,86	21,07	2,93
044-LDB-115	Power cable for Outdoor LDB street light at piperack (East)	044-MLDB-101	315	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x10mm2)	65	1000	142	0,17	2,90	1	1	0,5546	62	13,91	34,39	13,91
044-PDB-101	Power cable for Indoor PDB in SS-044 third floor	044-MLDB-101	42	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x2,5mm2)	65	1000	142	0,05	1,57	1	1	0,5546	29	5,86	16,08	5,86
044-PDB-102	Power cable for Indoor PDB in SS-044 second floor	044-MLDB-101	63	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x2,5mm2)	65	1000	142	0,05	1,57	1	1	0,5546	29	5,86	16,08	5,86
044-PDB-103	Power cable for Indoor PDB in SS-044 first floor	044-MLDB-101	89,25	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x2,5mm2)	65	1000	142	0,05	1,57	1	1	0,5546	29	5,86	16,08	5,86
044-PDB-104	Power cable for Indoor PDB in SS-044 ground floor	044-MLDB-101	105	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x2,5mm2)	65	1000	142	0,05	1,57	1	1	0,5546	29	5,86	16,08	5,86
044-PDB-105	Power cable for Indoor PDB IN CRR-	044-MLDB-101	105	3PH+N	Duct bank	MULTIPOLAR	1Cx(4x10mm2)	65	1000	142	0,21	3,23	1	1	0,5546	62	29,29	34,39	29,29
044-ACDB-101	Power cable for Uninterruptible Power Supply System (UPS for DCS/ECS System) Distribution Panel	044-UPS-101	10,5	3PH+N	Tray	MONOPOLAR	2Cx(4Cx(1x500mm2))	40	1000	93	1600	430,11	2	1	0,7912	685	699,82	541,97	349,91
044-ACDB-102	Power cable for Uninterruptible Power Supply System (UPS for Telec, CCTV, PAGA & FDAS) Distribution Panel	044-UPS-101	10,5	3PH+N	Tray	MONOPOLAR	1Cx(4Cx(1x500mm2))	40	1000	93	1600	430,11	1	1	0,7912	685	218,69	541,97	218,69
044-Non DCS PDB	Power cable for distributed control system Distribution Panel	044-UPS-101	52,5	3PH+N	Tray	MONOPOLAR	1Cx(4Cx(1x500mm2))	40	1000	93	1600	430,11	1	1	0,7912	685	131,22	541,97	131,22
044-DCS PDB	Power cable for distributed control system Distribution Panel	044-UPS-101	52,5	3PH+N	Tray	MONOPOLAR	4Cx(4Cx(1x500mm2))	40	1000	93	1600	430,11	4	1	0,7912	685	568,6	541,97	142,15
044-PDB-1	Power cable for NON UPS PDB-1	044-UPS-101	52,5	3PH+N	Tray	MONOPOLAR	1Cx(4Cx(1x500mm2))	40	1000	93	1600	430,11	1	1	0,7912	685	131,22	541,97	131,22
044-PDB-2	Power cable for NON UPS PDB-2	044-UPS-101	52,5	3PH+N	Tray	MONOPOLAR	1Cx(4Cx(1x500mm2))	40	1000	93	1600	430,11	1	1	0,7912	685	87,48	541,97	87,48
1803-BB-101	Power cable for battery bank 044-DC-101	044-UPS-101	21	DC	Tray	MONOPOLAR	2Cx(2Cx(1x400mm2))	40	1000	142	1600	281,69	2	1	0,7912	940	722,49	743,73	361,25
1803-BB-102	Power cable for battery bank 044-DC-102	044-UPS-101	21	DC	Tray	MONOPOLAR	2Cx(2Cx(1x400mm2))	40	1000	142	1600	281,69	2	1	0,7912	940	137,8	743,73	68,90
1803-BB-103	Power cable for battery bank 044-UPS-101	044-UPS-101	21	DC	Tray	MONOPOLAR	2Cx(2Cx(1x400mm2))	40	1000	142	1600	281,69	2	1	0,7912	940	254,8	743,73	127,40
1803-BB-104	Power cable for battery bank 044-UPS-102	044-UPS-101	21	DC	Tray	MONOPOLAR	2Cx(2Cx(1x400mm2))	40	1000	142	1600	281,69	2	1	0,7912	940	68,9	743,73	34,45

Table 119. MV Cables calculations: short circuit and ampacity (part 10).

PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPech” (J-18)								ELECTRICAL CABLE CALCULATIONS: VOLTAGE DROP VERIFICATION									
CLIENT:	INDIAN OIL CORPORATION LIMITED																	
LOAD DESCRIPTION					CABLE DESCRIPTION				VOLTAGE DROP CALCULATION				STARTING VOLTAGE DROP CALCULATION					
Associated load	Operating voltage (kV)	Power factor (Cos 0)	Starting Power factor (Cos 0st)	Nominal current (A)	Nº of conductors per phase	Cable lenght (m)	Resistance Rc (Ohm/km)	Reactance Xc (Ohm/km)	Total load current (A)	AV Voltage drop calculated	% Voltage drop calculated	% Voltage drop required	Starting factor	Starting current (A)	Total starting current (A)	AVStarting Voltage drop	% Starting Voltage drop	
1803-PM-101 A	6,6	0,89	0,23	23,48	1	178,5	0,163	0,085	26,228	1,491	0,023	3	5	117,4	129,14	4,800	0,073	
1803-PM-101 B	6,6	0,89	0,23	23,48	1	178,5	0,163	0,085	26,228	1,491	0,023	3,00	5	117,4	129,14	4,800	0,073	
1803-PM-202 A	6,6	0,84	0,2	32,27	1	273	0,163	0,085	36,046	3,120	0,047	3,00	5	161,35	177,485	9,725	0,147	
1803-PM-202 B	6,6	0,84	0,2	32,27	1	273	0,163	0,085	36,046	3,120	0,047	3,00	5	161,35	177,485	9,725	0,147	
1803-PM-202 C	6,6	0,84	0,2	32,27	1	273	0,163	0,085	36,046	3,120	0,047	3,00	5	161,35	177,485	9,725	0,147	
1803-PM-204 A	6,6	0,83	0,23	23,8	1	330,75	0,163	0,085	26,585	2,783	0,042	3,00	5	119	130,9	9,015	0,137	
1803-PM-204 B	6,6	0,83	0,23	23,8	1	330,75	0,163	0,085	26,585	2,783	0,042	3,00	5	119	130,9	9,015	0,137	
1803-PM-204 C	6,6	0,83	0,23	23,8	1	330,75	0,163	0,085	26,585	2,783	0,042	3,00	5	119	130,9	9,015	0,137	
1803-PM-205 A	6,6	0,85	0,7	59,46	1	246,75	0,163	0,085	66,418	5,204	0,079	3,00	5	297,3	327,03	24,432	0,370	
1803-PM-205 B	6,6	0,85	0,3	59,46	1	246,75	0,163	0,085	66,418	5,204	0,079	3,00	5	297,3	327,03	18,168	0,275	
1803-PM-213 A	6,6	0,83	0,23	28,33	1	194,25	0,163	0,085	31,645	1,945	0,029	3,00	5	141,65	155,815	6,302	0,095	
1803-PM-213 B	6,6	0,83	0,23	28,33	1	194,25	0,163	0,085	31,645	1,945	0,029	3,00	5	141,65	155,815	6,302	0,095	
1803-PM-214 A	6,6	0,88	0,17	18,27	1	336	0,163	0,085	20,408	2,183	0,033	3,00	5	91,35	100,485	6,519	0,099	
1803-PM-214 B	6,6	0,88	0,17	18,27	1	336	0,163	0,085	20,408	2,183	0,033	3,00	5	91,35	100,485	6,519	0,099	
1803-PM-222 A	6,6	0,88	0,17	29,14	1	126	0,163	0,085	32,550	1,306	0,020	3,00	5	145,7	160,27	3,899	0,059	
1803-PM-222 B	6,6	0,88	0,17	29,14	1	126	0,163	0,085	32,550	1,306	0,020	3,00	5	145,7	160,27	3,899	0,059	
1803-X-107-K-001A	6,6	0,83	0,3	22,67	1	84	0,163	0,085	25,323	0,673	0,010	3,00	5	113,35	124,685	2,358	0,036	
1803-X-107-K-001B	6,6	0,83	0,3	22,67	1	84	0,163	0,085	25,323	0,673	0,010	3,00	5	113,35	124,685	2,358	0,036	
1803-X-107-K-001C	6,6	0,83	0,3	22,67	1	84	0,163	0,085	25,323	0,673	0,010	3,00	5	113,35	124,685	2,358	0,036	
044-HT6-102 A	6,6	0,89	0,3	45,41	1	38,85	0,0801	0,089	50,724	0,382	0,006	0,50	5	227,05	249,755	1,831	0,028	
044-HT6-102 B	6,6	0,89	0,3	45,51	1	38,85	0,0801	0,089	50,836	0,383	0,006	0,50	5	227,55	250,305	1,835	0,028	
044-TR-102A	6,6	0,88	0,3	218,72	1	47,25	0,0801	0,089	244,315	2,255	0,034	0,50	5	1093,6	1202,96	10,724	0,162	
044-TR-102B	6,6	0,88	0,3	218,72	1	47,25	0,0801	0,089	244,315	2,255	0,034	0,50	5	1093,6	1202,96	10,724	0,162	
044-TR-103A	6,6	0,88	0,3	218,72	1	23,1	0,0801	0,089	244,315	1,102	0,017	0,50	5	1093,6	1202,96	5,243	0,079	
044-TR-103B	6,6	0,88	0,3	218,72	1	23,1	0,0801	0,089	244,315	1,102	0,017	0,50	5	1093,6	1202,96	5,243	0,079	
044-TR-104A	6,6	0,88	0,3	218,72	1	23,1	0,0801	0,089	244,315	1,102	0,017	0,50	5	1093,6	1202,96	5,243	0,079	
044-TR-104B	6,6	0,88	0,3	218,72	1	23,1	0,0801	0,089	244,315	1,102	0,017	0,50	5	1093,6	1202,96	5,243	0,079	
044-TR-105A	6,6	0,88	0,3	174,95	1	31,5	0,0801	0,089	195,423	1,202	0,018	0,50	5	874,75	962,225	5,719	0,087	
044-TR-105B	6,6	0,88	0,3	174,95	1	31,5	0,0801	0,089	195,423	1,202	0,018	0,50	5	874,75	962,225	5,719	0,087	
044-CB-101A	6,6	0	0	209,95	1	10,5	0,0801	0,089	234,519	0,380	0,006	0,50	5	1049,75	1154,725	1,869	0,028	
044-CB-101B	6,6	0	0	209,95	1	10,5	0,0801	0,089	234,519	0,380	0,006	0,50	5	1049,75	1154,725	1,869	0,028	
1803-PM-609 A	6,6	0,88	0,17	29,14	1	220	0,163	0,085	32,550	2,280	0,035	3,00	5	145,7	160,27	6,808	0,103	
1803-PM-609 B	6,6	0,88	0,17	29,14	1	220	0,163	0,085	32,550	2,280	0,035	3,00	5	145,7	160,27	6,808	0,103	
1803-PM-609 C	6,6	0,88	0,17	29,14	1	220	0,163	0,085	32,550	2,280	0,035	3,00	5	145,7	160,27	6,808	0,103	
044-TR-105 C	6,6	0,88	0,3	174,06	1	40	0,0801	0,089	194,429	1,519	0,023	0,50	5	870,3	957,33	7,225	0,109	
044-MCC-101 A	0,415	0,88	0,3	497,99	3	29	0,21	0,072	185,422	2,040	0,491	0,50	6	2987,94	1095,578	7,247	1,746	
044-MCC-101 B	0,415	0,88	0,3	497,99	3	29	0,21	0,072	185,422	2,040	0,491	0,50	6	2987,94	1095,578	7,247	1,746	
044-MCC-102 A	0,415	0,88	0,3	629,99	3	23	0,21	0,072	234,571	2,046	0,493	0,50	6	3779,94	1385,978	7,271	1,752	
044-MCC-102 B	0,415	0,88	0,3	629,99	3	23	0,21	0,072	234,571	2,046	0,493	0,50	6	3779,94	1385,978	7,271	1,752	
044-MCC-104 A	0,415	0,88	0,3	629,99	3	23	0,21	0,072	234,571	2,046	0,493	0,50	6	3779,94	1385,978	7,271	1,752	
044-MCC-104 B	0,415	0,88	0,3	629,99	3	23	0,21	0,072	234,571	2,046	0,493	0,50	6	3779,94	1385,978	7,271	1,752	
1803-PM-102 A	0,415	0,88	0,25	184,41	2	10,5	0,324	0,0713	102,995	0,597	0,144	5,50	6	1106,46	608,553	1,661	0,400	
1803-PM-102 B	0,415	0,88	0,25	184,41	2	10,5	0,324	0,0713	102,995	0,597	0,144	5,50	6	1106,46	608,553	1,661	0,400	
1803-PM-206 A	0,415	0,86	0,33	253,82	2	312	0,21	0,072	141,761	16,650	4,012	5,50	6	1522,92	837,606	62,133	14,972	
1803-PM-206 B	0,415	0,86	0,33	253,82	2	312	0,21	0,072	141,761	16,650	4,012	5,50	6	1522,92	837,606	62,133	14,972	
1803-PM-207 A	0,415	0,87	0,32	222,89	2	190	0,264	0,0718	124,486	10,860	2,617	5,50	6	1337,34	735,537	36,915	8,895	
1803-PM-207 B	0,415	0,87	0,32	222,89	2	190	0,264	0,0718	124,486	10,860	2,617	5,50	6	1337,34	735,537	36,915	8,895	
1803-PM-217 A	0,415	0,87	0,32	222,89	2	190	0,264	0,0718	124,486	10,860	2,617	5,50	6	1337,34	735,537	36,915	8,895	
1803-PM-217 B	0,415	0,87	0,32	222,89	2	190	0,264	0,0718	124,486	10,860	2,617	5,50	6	1337,34	735,537	36,915	8,895	
1803-PM-224 A	0,415	0,84	0,32	132,14	1	10,5	0,16	0,0713	147,603	0,465	0,112	5,50	6	792,84	872,124	1,883	0,454	
1803-PM-224 B	0,415	0,84	0,32	132,14	1	10,5	0,16	0,0713	147,603	0,465	0,112	5,50	6	792,84	872,124	1,883	0,454	
OXTM-A	0,415	0,88	0,3	124,42	1	10,5	0,324	0,0713	138,980	0,806	0,194	0,50	5	622,1	684,31	2,056	0,495	
OXTM-B	0,415	0,88	0,3	124,42	1	10,5	0,324	0,0713	138,980	0,806	0,194	0,50	5	622,1	684,31	2,056	0,495	
OXTM-C	0,415	0,88	0,3	124,42	1	10,5	0,324	0,0713	138,980	0,806	0,194	0,50	5	622,1	684,31	2,056	0,495	
044-MCC-103 A	0,415	0,88	0,3	629,99	3	21	0,21	0,072	234,571	1,869	0,450	0,50	6	3779,94	1385,978	6,638	1,600	

Table 120. MV Cables calculations: short circuit and ampacity (part 11).

PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPech” (J-18)								ELECTRICAL CABLE CALCULATIONS: VOLTAGE DROP VERIFICATION									
CLIENT:	INDIAN OIL CORPORATION LIMITED																	
	LOAD DESCRIPTION				CABLE DESCRIPTION				VOLTAGE DROP CALCULATION				STARTING VOLTAGE DROP CALCULATION					
Associated load	Operating voltage (kV)	Power factor (Cos θ)	Starting Power factor (Cos θst)	Nominal current (A)	N° of conductors per phase	Cable lenght (m)	Resistance Rc (Ohm/km)	Reactance Xc (Ohm/km)	Total load current (A)	AV Voltage drop calculated	% Voltage drop calculated	% Voltage drop required	Starting factor	Starting current (A)	Total starting current (A)	AVStarting Voltage drop	% Starting Voltage drop	
044-MCC-103 B	0,415	0,88	0,3	629,99	3	21	0,21	0,072	234,571	1,869	0,450	0,5	6	3779,94	1385,978	6,638	1,600	
044-MCC-105 A	0,415	0,88	0,3	629,99	3	21	0,21	0,072	234,571	1,869	0,450	0,50	6	3779,94	1385,978	6,638	1,600	
044-MCC-105 B	0,415	0,88	0,3	629,99	3	21	0,21	0,072	234,571	1,869	0,450	0,50	6	3779,94	1385,978	6,638	1,600	
044-MCC-106 A	0,415	0,88	0,3	629,99	3	21	0,21	0,072	234,571	1,869	0,450	0,50	6	3779,94	1385,978	6,638	1,600	
044-MCC-106 B	0,415	0,88	0,3	629,99	3	21	0,21	0,072	234,571	1,869	0,450	0,50	6	3779,94	1385,978	6,638	1,600	
1803-PM-215 A	0,415	0,88	0,35	126,41	1	10,5	0,21	0,072	141,203	0,562	0,136	5,50	6	758,46	834,306	2,139	0,515	
1803-PM-215 B	0,415	0,88	0,35	126,41	1	10,5	0,21	0,072	141,203	0,562	0,136	5,50	6	758,46	834,306	2,139	0,515	
1803-PM-216 A	0,415	0,87	0,28	186,14	2	10,5	0,324	0,0713	103,961	0,599	0,144	5,50	6	1116,84	614,262	1,778	0,428	
1803-PM-216 B	0,415	0,87	0,28	186,14	2	10,5	0,324	0,0713	103,961	0,599	0,144	5,50	6	1116,84	614,262	1,778	0,428	
1803-PM-218 A	0,415	0,87	0,32	222,89	2	10,5	0,264	0,0718	124,486	0,600	0,145	5,50	6	1337,34	735,537	2,040	0,492	
1803-PM-218 B	0,415	0,87	0,32	222,89	2	10,5	0,264	0,0718	124,486	0,600	0,145	5,50	6	1337,34	735,537	2,040	0,492	
1803-PM-219 A	0,415	0,9	0,25	260,89	2	10,5	0,21	0,072	145,710	0,584	0,141	5,50	6	1565,34	860,937	1,914	0,461	
1803-PM-219 B	0,415	0,9	0,25	260,89	2	10,5	0,21	0,072	145,710	0,584	0,141	5,50	6	1565,34	860,937	1,914	0,461	
1803-X-107-P003A	0,415	0,88	0,3	218,97	2	10,5	0,264	0,0718	122,297	0,593	0,143	5,50	5	1094,85	602,1675	1,617	0,390	
1803-X-107-P003B	0,415	0,88	0,3	218,97	2	10,5	0,264	0,0718	122,297	0,593	0,143	5,50	5	1094,85	602,1675	1,617	0,390	
1803-X-107-P003C	0,415	0,88	0,3	218,97	2	10,5	0,264	0,0718	122,297	0,593	0,143	5,50	5	1094,85	602,1675	1,617	0,390	
1803-X-107-P004A	0,415	0,88	0,3	149,3	1	10,5	0,16	0,0713	166,771	0,530	0,128	5,50	5	746,5	821,15	1,733	0,417	
1803-X-107-P004B	0,415	0,88	0,3	149,3	1	10,5	0,16	0,0713	166,771	0,530	0,128	5,50	5	746,5	821,15	1,733	0,417	
044-TR-107 A	0,415	1	0,3	278,24	1	21	0,128	0,0703	310,800	1,447	0,349	0,50	6	1669,44	1836,384	7,044	1,697	
044-TR-107 B	0,415	1	0,3	278,24	1	21	0,128	0,0703	310,800	1,447	0,349	0,50	6	1669,44	1836,384	7,044	1,697	
044-ASB-101 A	0,415	0,88	0,3	292,97	2	21	0,324	0,0713	163,627	1,898	0,457	0,50	6	1757,82	966,801	5,810	1,400	
044-ASB-101 B	0,415	0,88	0,3	292,97	2	21	0,324	0,0713	163,627	1,898	0,457	0,50	6	1757,82	966,801	5,810	1,400	
044-ASB-102 A	0,415	0,88	0,3	325,98	2	21	0,264	0,0718	182,063	1,764	0,425	0,50	6	1955,88	1075,734	5,779	1,393	
044-ASB-102 B	0,415	0,88	0,3	325,98	2	21	0,264	0,0718	182,063	1,764	0,425	0,50	6	1955,88	1075,734	5,779	1,393	
ESS-044-HVAC-1	0,415	0,9	0,3	709,8	3	21	0,16	0,0713	264,287	1,683	0,406	0,50	6	4258,8	1561,56	6,590	1,588	
ESS-044-HVAC-2	0,415	0,9	0,3	709,8	3	21	0,16	0,0713	264,287	1,683	0,406	0,50	6	4258,8	1561,56	6,590	1,588	
044-MCC-107 A	0,415	0,88	0,3	629,99	3	21	0,21	0,072	234,571	1,869	0,450	0,50	6	3779,94	1385,978	6,638	1,600	
044-MCC-107 B	0,415	0,88	0,3	629,99	3	21	0,21	0,072	234,571	1,869	0,450	0,50	6	3779,94	1385,978	6,638	1,600	
ESS-044-HVAC-1	0,415	0,9	0,3	709,8	3	100	0,16	0,0713	264,287	8,014	1,931	2,50	6	4258,8	1561,56	31,379	7,561	
ESS-044-HVAC-2	0,415	0,9	0,3	709,8	3	100	0,16	0,0713	264,287	8,014	1,931	2,50	6	4258,8	1561,56	31,379	7,561	
044-UPS-101 A	0,415	1	0,3	166,94	2	172	0,324	0,0713	93,238	9,000	2,169	2,50	6	1001,64	550,902	27,115	6,534	
044-UPS-101 C	0,415	1	0,3	166,94	2	172	0,324	0,0713	93,238	9,000	2,169	2,50	6	1001,64	550,902	27,115	6,534	
044-UPS-102 A	0,415	1	0,3	31,3	1	172	0,568	0,0742	34,963	5,916	1,426	2,50	6	187,8	206,58	14,843	3,577	
044-UPS-102 C	0,415	1	0,3	31,3	1	172	0,568	0,0742	34,963	5,916	1,426	2,50	6	187,8	206,58	14,843	3,577	
044-DC-101 A	0,415	1	0,3	41,74	1	31,5	0,568	0,0742	46,624	1,445	0,348	0,50	6	250,44	275,484	3,625	0,874	
044-TR-108 A	0,415	1	0,3	139,12	1	31,5	0,21	0,072	155,400	1,780	0,429	0,50	6	834,72	918,192	6,597	1,590	
1803-PM-203 A	0,415	0,87	0,35	94,37	1	10,5	0,324	0,0713	105,413	0,608	0,146	5,50	6	566,22	622,842	2,041	0,492	
1803-PM-203 B	0,415	0,87	0,35	94,37	1	10,5	0,324	0,0713	105,413	0,608	0,146	5,50	6	566,22	622,842	2,041	0,492	
1803-PM-212 A	0,415	0,88	0,35	126,41	1	10,5	0,21	0,072	141,203	0,562	0,136	5,50	6	758,46	834,306	2,139	0,515	
1803-PM-212 B	0,415	0,88	0,35	126,41	1	10,5	0,21	0,072	141,203	0,562	0,136	5,50	6	758,46	834,306	2,139	0,515	
1803-PM-220 A	0,415	0,88	0,35	126,41	1	10,5	0,21	0,072	141,203	0,562	0,136	5,50	6	758,46	834,306	2,139	0,515	
1803-PM-220 B	0,415	0,88	0,35	126,41	1	10,5	0,21	0,072	141,203	0,562	0,136	5,50	6	758,46	834,306	2,139	0,515	
1803-PM-209 A	0,415	0,89	0,25	218,11	2	10,5	0,264	0,0718	121,817	0,593	0,143	5,50	6	1308,66	719,763	1,774	0,427	
1803-PM-209 B	0,415	0,89	0,25	218,11	2	10,5	0,264	0,0718	121,817	0,593	0,143	5,50	6	1308,66	719,763	1,774	0,427	
1803-PM-225 A	0,415	0,84	0,32	132,14	1	10,5	0,16	0,0713	147,603	0,465	0,112	5,50	6	792,84	872,124	1,883	0,454	
1803-PM-225 B	0,415	0,84	0,3	132,14	1	10,5	0,16	0,0713	147,603	0,465	0,112	5,50	6	792,84	872,124	1,840	0,443	
1803-X-205-P-006A	0,415	0,89	0,35	149,5	1	10,5	0,16	0,0713	166,995	0,531	0,128	5,50	6	897	986,7	2,203	0,531	
1803-X-205-P-006B	0,415	0,89	0,35	149,5	1	10,5	0,16	0,0713	166,995	0,531	0,128	5,50	6	897	986,7	2,203	0,531	
1803-X-205-P-010A	0,415	0,9	0,27	215,69	2	10,5	0,264	0,0718	120,465	0,589	0,142	5,50	6	1294,14	711,777	1,818	0,438	
1803-X-205-P-010B	0,415	0,9	0,27	215,69	2	10,5	0,264	0,0718	120,465	0,589	0,142	5,50	6	1294,14	711,777	1,818	0,438	
1803-PM-603	0,415	0,88	0,3	24,2	1	315	1,47	0,0767	27,032	19,616	4,727	5,50	6	145,2	159,72	44,806	10,797	
1803-PM-604 A	0,415	0,84	0,44	54,01	1	320,25	0,41	0,0725	60,330	12,842	3,094	5,50	6	324,06	356,466	48,543	11,697	
1803-PM-604 B	0,415	0,84	0,44	54,01	1	320,25	0,41	0,0725	60,330	12,842	3,094	5,50	6	324,06	356,466	48,543	11,697	
1803-P-226 A	0,415	0,9	0,3	0,59	1	231	9,45	0,0942	0,659	2,253	0,543	5,50	6	3,54	3,894	4,557	1,098	
1803-P-227 A	0,415	0,9	0,3	0,59	1	231	9,45	0,0942	0,659	2,253	0,543	5,50	6	3,54	3,894	4,557	1,098	

Table 121. MV Cables calculations: voltage drop verification (part 1).

PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LuPech" (J-18)								ELECTRICAL CABLE CALCULATIONS: VOLTAGE DROP VERIFICATION									
CLIENT:	INDIAN OIL CORPORATION LIMITED																	
LOAD DESCRIPTION					CABLE DESCRIPTION				VOLTAGE DROP CALCULATION					STARTING VOLTAGE DROP CALCULATION				
Associated load	Operating voltage (kV)	Power factor (Cos θ)	Starting Power factor (Cos θst)	Nominal current (A)	N° of conductors per phase	Cable lenght (m)	Resistance Rc (Ohm/km)	Reactance Xc (Ohm/km)	Total load current (A)	AV Voltage drop calculated	% Voltage drop calculated	% Voltage drop required	Starting factor	Starting current (A)	Total starting current (A)	AVStarting Voltage drop	% Starting Voltage drop	
1803-P-228 A	0,415	0,9	0,3	0,59	1	231	9,45	0,0942	0,659	2,253	0,543	5,5	6	3,54	3,894	4,557	1,098	
1803-P-226 S	0,415	0,9	0,3	0,59	1	231	9,45	0,0942	0,659	2,253	0,543	5,50	6	3,54	3,894	4,557	1,098	
1803-P-227 S	0,415	0,9	0,3	0,59	1	231	9,45	0,0942	0,659	2,253	0,543	5,50	6	3,54	3,894	4,557	1,098	
1803-P-228 S	0,415	0,9	0,3	0,59	1	231	9,45	0,0942	0,659	2,253	0,543	5,50	6	3,54	3,894	4,557	1,098	
1803-P-229 A	0,415	0,9	0,3	0,59	1	231	9,45	0,0942	0,659	2,253	0,543	5,50	6	3,54	3,894	4,557	1,098	
1803-P-229 S	0,415	0,9	0,3	0,59	1	231	9,45	0,0942	0,659	2,253	0,543	5,50	6	3,54	3,894	4,557	1,098	
1803-P-230 A	0,415	0,9	0,3	0,59	1	231	9,45	0,0942	0,659	2,253	0,543	5,50	6	3,54	3,894	4,557	1,098	
1803-P-230 S	0,415	0,9	0,3	0,59	1	231	9,45	0,0942	0,659	2,253	0,543	5,50	6	3,54	3,894	4,557	1,098	
1803-P-231 A	0,415	0,9	0,3	0,59	1	231	9,45	0,0942	0,659	2,253	0,543	5,50	6	3,54	3,894	4,557	1,098	
1803-P-231 S	0,415	0,9	0,3	0,59	1	231	9,45	0,0942	0,659	2,253	0,543	5,50	6	3,54	3,894	4,557	1,098	
1803-P-232 A	0,415	0,9	0,3	0,59	1	231	9,45	0,0942	0,659	2,253	0,543	5,50	6	3,54	3,894	4,557	1,098	
1803-P-232 S	0,415	0,9	0,3	0,59	1	231	9,45	0,0942	0,659	2,253	0,543	5,50	6	3,54	3,894	4,557	1,098	
1803-P-233 A	0,415	0,9	0,3	0,59	1	231	9,45	0,0942	0,659	2,253	0,543	5,50	6	3,54	3,894	4,557	1,098	
1803-P-233 S	0,415	0,9	0,3	0,59	1	231	9,45	0,0942	0,659	2,253	0,543	5,50	6	3,54	3,894	4,557	1,098	
1803-P-234 A	0,415	0,9	0,3	0,59	1	231	9,45	0,0942	0,659	2,253	0,543	5,50	6	3,54	3,894	4,557	1,098	
1803-P-234 S	0,415	0,9	0,3	0,59	1	231	9,45	0,0942	0,659	2,253	0,543	5,50	6	3,54	3,894	4,557	1,098	
1803-X-105-P-2	0,415	0,9	0,3	2,41	1	178,5	9,45	0,0942	2,692	7,113	1,714	5,50	6	14,46	15,906	14,384	3,466	
1803-X-105-P-1	0,415	0,9	0,3	2,41	1	178,5	9,45	0,0942	2,692	7,113	1,714	5,50	6	14,46	15,906	14,384	3,466	
1803-X-105-FD-1	0,415	0,9	0,3	2,41	1	178,5	9,45	0,0942	2,692	7,113	1,714	5,50	6	14,46	15,906	14,384	3,466	
1803-X-105-P-5	0,415	0,9	0,3	2,41	1	178,5	9,45	0,0942	2,692	7,113	1,714	5,50	6	14,46	15,906	14,384	3,466	
ST ROTOR TURNING GEAR MOTOR (MAIN AIR BLOWER 1803-K-101)	0,415	0,9	0,3	0,29	1	178,5	9,45	0,0942	0,324	0,856	0,206	5,50	6	1,74	1,914	1,731	0,417	
1803-K-201-P-2	0,415	0,9	0,3	2,41	1	252	9,45	0,0942	2,692	10,042	2,420	5,50	6	14,46	15,906	20,306	4,893	
1803-K-201-P-1	0,415	0,9	0,3	2,41	1	252	9,45	0,0942	2,692	10,042	2,420	5,50	6	14,46	15,906	20,306	4,893	
1803-K-201-FD-1	0,415	0,9	0,3	2,41	1	252	9,45	0,0942	2,692	10,042	2,420	5,50	6	14,46	15,906	20,306	4,893	
1803-K-201-P-5	0,415	0,9	0,3	2,41	1	252	9,45	0,0942	2,692	10,042	2,420	5,50	6	14,46	15,906	20,306	4,893	
ST ROTOR TURNING GEAR MOTOR (WET GAS COMPRESSOR 1803-K-201)	0,415	0,9	0,3	0,29	1	252	9,45	0,0942	0,324	1,208	0,291	5,50	6	1,74	1,914	2,443	0,589	
1803-K-201-P-3	0,415	0,9	0,3	4,83	1	252	9,45	0,0942	5,395	20,125	4,849	5,50	6	28,98	31,878	40,697	9,806	
1803-K-201-P-4	0,415	0,9	0,3	4,83	1	252	9,45	0,0942	5,395	20,125	4,849	5,50	6	28,98	31,878	40,697	9,806	
1803-K-105-P-3	0,415	0,9	0,3	4,83	1	252	9,45	0,0942	5,395	20,125	4,849	5,50	6	28,98	31,878	40,697	9,806	
1803-K-105-P-4	0,415	0,9	0,3	4,83	1	252	9,45	0,0942	5,395	20,125	4,849	5,50	6	28,98	31,878	40,697	9,806	
CR-HVAC-1	0,415	0,9	0,3	220,83	2	231	0,16	0,0713	123,336	8,640	2,082	2,50	6	1324,98	728,739	33,827	8,151	
044-DC-102	0,415	0,88	0,3	23,71	1	31,5	1,539	0,0808	26,485	2,012	0,485	0,50	6	142,26	156,486	4,600	1,108	
044-DC-101B	0,415	0,88	0,3	71,14	1	31,5	0,41	0,0725	79,465	1,714	0,413	0,50	6	426,84	469,524	4,923	1,186	
044-UPS-101B	0,415	0,88	0,3	126,47	1	172	0,21	0,072	141,270	9,217	2,221	2,50	6	758,82	834,702	32,746	7,890	
044-UPS-101D	0,415	0,88	0,3	126,47	1	172	0,21	0,072	141,270	9,217	2,221	2,50	6	758,82	834,702	32,746	7,890	
044-UPS-102B	0,415	0,88	0,3	23,71	1	172	1,113	0,0787	26,485	8,023	1,933	2,50	6	142,26	156,486	19,066	4,594	
044-UPS-102D	0,415	0,88	0,3	23,71	1	172	1,113	0,0787	26,485	8,023	1,933	2,50	6	142,26	156,486	19,066	4,594	
044-TR-108B	0,415	0,88	0,3	139,12	1	31,5	0,21	0,072	155,400	1,857	0,447	0,50	6	834,72	918,192	6,597	1,590	
1803-PM-608 A	0,415	0,88	0,3	88,72	1	10,5	0,41	0,0725	99,102	0,712	0,172	5,50	6	532,32	585,552	2,046	0,493	
1803-PM-608 B	0,415	0,88	0,3	88,72	1	10,5	0,41	0,0725	99,102	0,712	0,172	5,50	6	532,32	585,552	2,046	0,493	
1803-PM-610 A	0,415	0,9	0,2	260,34	2	10,5	0,21	0,072	145,403	0,583	0,140	5,50	6	1562,04	859,122	1,758	0,424	
1803-PM-610 B	0,415	0,9	0,2	260,34	2	10,5	0,21	0,072	145,403	0,583	0,140	5,50	6	1562,04	859,122	1,758	0,424	
1803-PM-201 A	0,415	0,84	0,3	54,01	1	273	0,822	0,078	60,330	20,905	5,037	5,50	6	324,06	356,466	54,107	13,038	
1803-PM-201 B	0,415	0,84	0,3	54,01	1	273	0,822	0,078	60,330	20,905	5,037	5,50	6	324,06	356,466	54,107	13,038	
1803-PM-208 A	0,415	0,91	0,45	36,84	1	178,5	1,539	0,0808	41,151	18,244	4,396	5,50	6	221,04	243,144	57,485	13,852	
1803-PM-208 B	0,415	0,91	0,45	36,84	1	178,5	1,539	0,0808	41,151	18,244	4,396	5,50	6	221,04	243,144	57,485	13,852	
1803-PM-210 A	0,415	0,86	0,42	26,87	1	199,5	1,47	0,0767	30,014	13,517	3,257	5,50	6	161,22	177,342	42,099	10,144	
1803-PM-210 B	0,415	0,86	0,42	26,87	1	199,5	1,47	0,0767	30,014	13,517	3,257	5,50	6	161,22	177,342	42,099	10,144	
1803-PM-211 A	0,415	0,8	0,5	10,99	1	183,75	3,93	0,0839	12,276	12,480	3,007	5,50	6	65,94	72,534	47,039	11,335	
1803-PM-211 S	0,415	0,8	0,5	10,99	1	183,75	3,93	0,0839	12,276	12,480	3,007	5,50	6	65,94	72,534	47,039	11,335	
1803-PM-223 A	0,415	0,9	0,45	61,83	1	157,5	0,822	0,078	69,065	14,579	3,513	5,50	6	370,98	408,078	48,933	11,791	
1803-PM-223 B	0,415	0,9	0,45	61,83	1	157,5	0,822	0,078	69,065	14,579	3,513	5,50	6	370,98	408,078	48,933	11,791	
1803-PM-601 A	0,415	0,88	0,3	24,2	1	273	1,47	0,0767	27,032	17,000	4,097	5,50	6	145,2	159,72	38,832	9,357	
1803-PM-601 S	0,415	0,88	0,3	24,2	1	273	1,47	0,0767	27,032	17,000	4,097	5,50	6	145,2	159,72	38,832	9,357	
1803-PM-602 A	0,415	0,88	0,3	17,74	1	283,5	2,33	0,0804	19,816	20,323	4,897	5,50	6	106,44	117,084	44,597	10,746	

Table 122. MV Cables calculations: voltage drop verification (part 2).

PROJECT:		EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LaPeeh” (J-18)							ELECTRICAL CABLE CALCULATIONS: VOLTAGE DROP VERIFICATION									
CLIENT:		INDIAN OIL CORPORATION LIMITED																
LOAD DESCRIPTION					CABLE DESCRIPTION				VOLTAGE DROP CALCULATION					STARTING VOLTAGE DROP CALCULATION				
Associated load	Operating voltage (kV)	Power factor (Cos θ)	Starting Power factor (Cos θst)	Nominal current (A)	N° of conductors per phase	Cable lenght (m)	Resistance Rc (Ohm/km)	Reactance Xc (Ohm/km)	Total current (A)	AV Voltage drop calculated	% Voltage drop calculated	% Voltage drop required	Starting factor	Starting current (A)	Total starting current (A)	AVStarting Voltage drop	% Starting Voltage drop	
1803-PM-602 S	0,415	0,88	0,3	17,74	1	283,5	2,33	0,0804	19,816	20,323	4,897	5,5	6	106,44	117,084	44,597	10,746	
1803-PM-606 A	0,415	0,86	0,42	26,87	1	126	2,33	0,0804	30,014	13,394	3,228	5,50	6	161,22	177,342	40,699	9,807	
1803-PM-606 B	0,415	0,86	0,42	26,87	1	126	2,33	0,0804	30,014	13,394	3,228	5,50	6	161,22	177,342	40,699	9,807	
1803-PM-611 A	0,415	0,9	0,3	70,98	1	84	0,41	0,0725	79,286	4,621	1,114	5,50	6	425,88	468,468	13,097	3,156	
1803-PM-611 B	0,415	0,9	0,3	70,98	1	84	0,41	0,0725	79,286	4,621	1,114	5,50	6	425,88	468,468	13,097	3,156	
1803-PM-612 A	0,415	0,88	0,3	24,2	1	84	3,93	0,0839	27,032	13,758	3,315	5,50	6	145,2	159,72	29,257	7,050	
1803-PM-612 S	0,415	0,88	0,3	24,2	1	84	3,93	0,0839	27,032	13,758	3,315	5,50	6	145,2	159,72	29,257	7,050	
UNIT CONTROL PANEL NON UPS (MAIN AIR BLOWER 1803-K-101)	0,415	0,9	0,7	48,16	1	6,3	0,822	0,078	53,796	0,454	0,109	5,50	6	288,96	317,856	2,189	0,527	
IGV (INLET GUIDE VANE MAIN AIR BLOWER 1803-K-101)	0,415	0,9	0,7	48,16	1	6,3	0,822	0,078	53,796	0,454	0,109	5,50	6	288,96	317,856	2,189	0,527	
1803-X-105-F-1	0,415	0,9	0,7	48,16	1	6,3	0,822	0,078	53,796	0,454	0,109	5,50	6	288,96	317,856	2,189	0,527	
1803-X-105-F-2	0,415	0,9	0,7	48,16	1	6,3	0,822	0,078	53,796	0,454	0,109	5,50	6	288,96	317,856	2,189	0,527	
UNIT CONTROL PANEL NON UPS (WET GAS COMPRESSOR 1803-K-102)	0,415	0,9	0,7	48,16	1	6,3	0,822	0,078	53,796	0,454	0,109	5,50	6	288,96	317,856	2,189	0,527	
1803-K-201-F-1	0,415	0,9	0,7	48,16	1	6,3	0,822	0,078	53,796	0,454	0,109	5,50	6	288,96	317,856	2,189	0,527	
1803-K-105-P-3	0,415	0,9	0,7	4,82	1	6,3	9,45	0,0942	5,384	0,502	0,121	5,50	6	28,92	31,812	2,320	0,559	
1803-K-105-P-4	0,415	0,9	0,7	4,82	1	6,3	9,45	0,0942	5,384	0,502	0,121	5,50	6	28,92	31,812	2,320	0,559	
1803-K-201-P-3	0,415	0,9	0,7	4,82	1	6,3	9,45	0,0942	5,384	0,502	0,121	5,50	6	28,92	31,812	2,320	0,559	
1803-K-201-P-4	0,415	0,9	0,7	4,82	1	6,3	9,45	0,0942	5,384	0,502	0,121	5,50	6	28,92	31,812	2,320	0,559	
MAIN AIR BLOWER TURNING GEAR MOTOR	0,415	0,9	0,7	24,08	1	6,3	1,47	0,0767	26,898	0,398	0,096	5,50	6	144,48	158,928	1,879	0,453	
1803-ACM-201 A1	0,415	0,9	0,7	50,41	1	162,75	0,822	0,078	56,309	12,283	2,960	5,50	6	302,46	332,706	59,189	14,262	
1803-ACM-201 A2	0,415	0,9	0,7	50,41	1	162,75	0,822	0,078	56,309	12,283	2,960	5,50	6	302,46	332,706	59,189	14,262	
1803-ACM-201 B1	0,415	0,9	0,7	50,41	1	162,75	0,822	0,078	56,309	12,283	2,960	5,50	6	302,46	332,706	59,189	14,262	
1803-ACM-201 C1	0,415	0,9	0,7	50,41	1	162,75	0,822	0,078	56,309	12,283	2,960	5,50	6	302,46	332,706	59,189	14,262	
1803-ACM-201 B2	0,415	0,9	0,7	50,41	1	155,4	0,822	0,078	56,309	11,728	2,826	5,50	6	302,46	332,706	56,516	13,618	
1803-ACM-201 C2	0,415	0,9	0,7	50,41	1	155,4	0,822	0,078	56,309	11,728	2,826	5,50	6	302,46	332,706	56,516	13,618	
1803-ACM-201 D1	0,415	0,9	0,7	50,41	1	110,25	0,822	0,078	56,309	8,320	2,005	5,50	6	302,46	332,706	40,096	9,662	
1803-ACM-201 E1	0,415	0,9	0,7	50,41	1	110,25	0,822	0,078	56,309	8,320	2,005	5,50	6	302,46	332,706	40,096	9,662	
1803-ACM-201 D2	0,415	0,9	0,7	50,41	1	117,6	0,822	0,078	56,309	8,875	2,139	5,50	6	302,46	332,706	42,769	10,306	
1803-ACM-201 E2	0,415	0,9	0,7	50,41	1	117,6	0,822	0,078	56,309	8,875	2,139	5,50	6	302,46	332,706	42,769	10,306	
1803-ACM-201 F1	0,415	0,9	0,7	50,41	1	126	0,822	0,078	56,309	9,509	2,291	5,50	6	302,46	332,706	45,824	11,042	
1803-ACM-201 G1	0,415	0,9	0,7	50,41	1	126	0,822	0,078	56,309	9,509	2,291	5,50	6	302,46	332,706	45,824	11,042	
1803-AM-1001	0,415	0,9	0,7	1,77	1	231	9,45	0,0942	1,977	6,760	1,629	5,50	6	10,62	11,682	31,233	7,526	
1803-AM-1002	0,415	0,9	0,7	1,77	1	210	9,45	0,0942	1,977	6,146	1,481	5,50	6	10,62	11,682	28,394	6,842	
1803-AM-1003	0,415	0,9	0,7	1,77	1	126	9,45	0,0942	1,977	3,687	0,889	5,50	6	10,62	11,682	17,036	4,105	
1803-AM-1004	0,415	0,9	0,7	1,77	1	231	9,45	0,0942	1,977	6,760	1,629	5,50	6	10,62	11,682	31,233	7,526	
1803-AM-1005	0,415	0,9	0,7	1,77	1	220,5	9,45	0,0942	1,977	6,453	1,555	5,50	6	10,62	11,682	29,813	7,184	
1803-AM-1006	0,415	0,9	0,7	1,77	1	220,5	9,45	0,0942	1,977	6,453	1,555	5,50	6	10,62	11,682	29,813	7,184	
1803-ACM-201 H1	0,415	0,9	0,7	50,41	1	147	0,822	0,078	56,309	11,094	2,673	5,50	6	302,46	332,706	53,461	12,882	
1803-ACM-201 F2	0,415	0,9	0,7	50,41	1	147	0,822	0,078	56,309	11,094	2,673	5,50	6	302,46	332,706	53,461	12,882	
1803-ACM-201 G2	0,415	0,9	0,7	50,41	1	154,35	0,822	0,078	56,309	11,649	2,807	5,50	6	302,46	332,706	56,134	13,526	
1803-ACM-201 J1	0,415	0,9	0,7	50,41	1	154,35	0,822	0,078	56,309	11,649	2,807	5,50	6	302,46	332,706	56,134	13,526	
1803-ACM-201 K1	0,415	0,9	0,7	50,41	1	159,6	0,822	0,078	56,309	12,045	2,902	5,50	6	302,46	332,706	58,044	13,986	
1803-ACM-201 H2	0,415	0,9	0,7	50,41	1	159,6	0,822	0,078	56,309	12,045	2,902	5,50	6	302,46	332,706	58,044	13,986	
1803-ACM-201 J2	0,415	0,9	0,7	50,41	1	168	0,822	0,078	56,309	12,679	3,055	5,50	6	302,46	332,706	61,099	14,723	
1803-ACM-201 L1	0,415	0,9	0,7	50,41	1	168	0,822	0,078	56,309	12,679	3,055	5,50	6	302,46	332,706	61,099	14,723	
1803-ACM-201 M1	0,415	0,9	0,7	50,41	1	178,5	0,568	0,0742	56,309	9,463	2,280	5,50	6	302,46	332,706	46,349	11,168	
1803-ACM-201 K2	0,415	0,9	0,7	50,41	1	178,5	0,568	0,0742	56,309	9,463	2,280	5,50	6	302,46	332,706	46,349	11,168	
1803-ACM-201 L2	0,415	0,9	0,7	50,41	1	186,9	0,568	0,0742	56,309	9,908	2,387	5,50	6	302,46	332,706	48,530	11,694	
1803-ACM-201 M2	0,415	0,9	0,7	50,41	1	186,9	0,568	0,0742	56,309	9,908	2,387	5,50	6	302,46	332,706	48,530	11,694	
1803-ACM-201 N1	0,415	0,9	0,7	50,41	1	194,25	0,568	0,0742	56,309	10,298	2,481	5,50	6	302,46	332,706	50,439	12,154	
1803-ACM-201 P1	0,415	0,9	0,7	50,41	1	194,25	0,568	0,0742	56,309	10,298	2,481	5,50	6	302,46	332,706	50,439	12,154	
1803-ACM-201 N2	0,415	0,9	0,7	50,41	1	201,6	0,568	0,0742	56,309	10,687	2,575	5,50	6	302,46	332,706	52,347	12,614	
1803-ACM-201 P2	0,415	0,9	0,7	50,41	1	201,6	0,568	0,0742	56,309	10,687	2,575	5,50	6	302,46	332,706	52,347	12,614	
1803-ACM-201 Q1	0,415	0,9	0,7	50,41	1	210	0,568	0,0742	56,309	11,132	2,683	5,50	6	302,46	332,706	54,528	13,139	
1803-ACM-201 R1	0,415	0,9	0,7	50,41	1	210	0,568	0,0742	56,309	11,132	2,683	5,50	6	302,46	332,706	54,528	13,139	
1803-ACM-201 Q2	0,415	0,9	0,7	50,41	1	217,35	0,568	0,0742	56,309	11,522	2,776	5,50	6	302,46	332,706	56,437	13,599	

Table 123. MV Cables calculations: voltage drop verification (part 3).

PROJECT:		EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE								ELECTRICAL CABLE CALCULATIONS: VOLTAGE DROP VERIFICATION								
CLIENT:		INTEGRATION PROJECT “LuPech” (J-18) INDIAN OIL CORPORATION LIMITED																
LOAD DESCRIPTION					CABLE DESCRIPTION				VOLTAGE DROP CALCULATION				STARTING VOLTAGE DROP CALCULATION					
Associated load	Operating voltage (kV)	Power factor (Cos θ)	Starting Power factor (Cos θst)	Nominal current (A)	Nº of conductors per phase	Cable lenght (m)	Resistance Rc (Ohm/km)	Reactance Xc (Ohm/km)	Total load current (A)	AV Voltage drop calculated	% Voltage drop calculated	% Voltage drop required	Starting factor	Starting current (A)	Total starting current (A)	AVStarting Voltage drop	% Starting Voltage drop	
1803-ACM-201 R2	0.415	0.9	0.7	50.41	1	217.35	0.568	0.0742	56.309	11.522	2.776	5.5	6	302.46	332.706	56.437	13.599	
1803-ACM-202 A1	0.415	0.9	0.7	4.05	1	224.7	3.93	0.0839	4.524	6.292	1.516	5.50	6	24.3	26.73	29.242	7.046	
1803-ACM-202 B1	0.415	0.9	0.7	4.05	1	224.7	3.93	0.0839	4.524	6.292	1.516	5.50	6	24.3	26.73	29.242	7.046	
1803-ACM-204 A1	0.415	0.9	0.7	50.41	1	224.7	0.41	0.0725	56.309	8.779	2.115	5.50	6	302.46	332.706	43.867	10.570	
1803-ACM-204 B1	0.415	0.9	0.7	50.41	1	215.25	0.41	0.0725	56.309	8.410	2.027	5.50	6	302.46	332.706	42.022	10.126	
1803-ACM-204 C1	0.415	0.9	0.7	50.41	1	215.25	0.41	0.0725	56.309	8.410	2.027	5.50	6	302.46	332.706	42.022	10.126	
1803-ACM-204 D1	0.415	0.9	0.7	50.41	1	220.5	0.41	0.0725	56.309	8.615	2.076	5.50	6	302.46	332.706	43.047	10.373	
1803-ACM-204 A2	0.415	0.9	0.7	50.41	1	220.5	0.41	0.0725	56.309	8.615	2.076	5.50	6	302.46	332.706	43.047	10.373	
1803-ACM-204 B2	0.415	0.9	0.7	50.41	1	226.8	0.41	0.0725	56.309	8.861	2.135	5.50	6	302.46	332.706	44.277	10.669	
1803-ACM-204 C2	0.415	0.9	0.7	50.41	1	226.8	0.41	0.0725	56.309	8.861	2.135	5.50	6	302.46	332.706	44.277	10.669	
1803-ACM-204 D2	0.415	0.9	0.7	50.41	1	226.8	0.41	0.0725	56.309	8.861	2.135	5.50	6	302.46	332.706	44.277	10.669	
1803-ACM-207 A1	0.415	0.9	0.7	25.73	1	371.7	0.41	0.0725	28.741	7.413	1.786	5.50	6	154.38	169.818	37.038	8.925	
1803-ACM-205 A1	0.415	0.9	0.7	25.73	1	262.5	0.822	0.078	28.741	10.112	2.437	5.50	6	154.38	169.818	48.727	11.742	
1803-ACM-205 B1	0.415	0.9	0.7	25.73	1	262.5	0.822	0.078	28.741	10.112	2.437	5.50	6	154.38	169.818	48.727	11.742	
1803-ACM-205 C1	0.415	0.9	0.7	25.73	1	268.8	0.822	0.078	28.741	10.354	2.495	5.50	6	154.38	169.818	49.897	12.023	
1803-ACM-205 D1	0.415	0.9	0.7	25.73	1	268.8	0.822	0.078	28.741	10.354	2.495	5.50	6	154.38	169.818	49.897	12.023	
1803-ACM-205 E1	0.415	0.9	0.7	25.73	1	275.1	0.822	0.078	28.741	10.597	2.553	5.50	6	154.38	169.818	51.066	12.305	
1803-ACM-205 F1	0.415	0.9	0.7	25.73	1	275.1	0.822	0.078	28.741	10.597	2.553	5.50	6	154.38	169.818	51.066	12.305	
1803-ACM-205 G1	0.415	0.9	0.7	25.73	1	281.4	0.822	0.078	28.741	10.840	2.612	5.50	6	154.38	169.818	52.236	12.587	
1803-ACM-205 H1	0.415	0.9	0.7	25.73	1	281.4	0.822	0.078	28.741	10.840	2.612	5.50	6	154.38	169.818	52.236	12.587	
1803-ACM-205 A2	0.415	0.9	0.7	25.73	1	288.75	0.822	0.078	28.741	11.123	2.680	5.50	6	154.38	169.818	53.600	12.916	
1803-ACM-205 B2	0.415	0.9	0.7	25.73	1	288.75	0.822	0.078	28.741	11.123	2.680	5.50	6	154.38	169.818	53.600	12.916	
1803-ACM-205 C2	0.415	0.9	0.7	25.73	1	288.75	0.822	0.078	28.741	11.123	2.680	5.50	6	154.38	169.818	53.600	12.916	
1803-ACM-205 D2	0.415	0.9	0.7	25.73	1	296.1	0.822	0.078	28.741	11.406	2.748	5.50	6	154.38	169.818	54.965	13.244	
1803-ACM-205 E2	0.415	0.9	0.7	25.73	1	296.1	0.822	0.078	28.741	11.406	2.748	5.50	6	154.38	169.818	54.965	13.244	
1803-ACM-205 F2	0.415	0.9	0.7	25.73	1	302.4	0.822	0.078	28.741	11.649	2.807	5.50	6	154.38	169.818	56.134	13.526	
1803-ACM-205 G2	0.415	0.9	0.7	25.73	1	302.4	0.822	0.078	28.741	11.649	2.807	5.50	6	154.38	169.818	56.134	13.526	
1803-ACM-205 H2	0.415	0.9	0.7	25.73	1	315	0.822	0.078	28.741	12.134	2.924	5.50	6	154.38	169.818	58.473	14.090	
1803-ACM-207 B1	0.415	0.9	0.7	25.73	1	357	0.41	0.0725	28.741	7.119	1.716	5.50	6	154.38	169.818	35.573	8.572	
1803-MOV -2305	0.415	0.95	0.7	4.39	1	84	9.45	0.0942	4.904	6.426	1.548	5.50	6	26.34	28.974	28.169	6.788	
1803-MOV -2306	0.415	0.95	0.7	4.39	1	84	9.45	0.0942	4.904	6.426	1.548	5.50	6	26.34	28.974	28.169	6.788	
1803-MOV -4001	0.415	0.95	0.7	4.39	1	84	9.45	0.0942	4.904	6.426	1.548	5.50	6	26.34	28.974	28.169	6.788	
1803-MOV -5801	0.415	0.95	0.7	21.97	1	84	1.47	0.0767	24.541	5.072	1.222	5.50	6	131.82	145.002	22.864	5.509	
1803-MOV -5802	0.415	0.95	0.7	21.97	1	84	1.47	0.0767	24.541	5.072	1.222	5.50	6	131.82	145.002	22.864	5.509	
1803-MOV -5803	0.415	0.95	0.7	21.97	1	84	1.47	0.0767	24.541	5.072	1.222	5.50	6	131.82	145.002	22.864	5.509	
1803-MOV -5804	0.415	0.95	0.7	21.97	1	84	1.47	0.0767	24.541	5.072	1.222	5.50	6	131.82	145.002	22.864	5.509	
1803-X-106 A	0.415	0.9	0.7	72.23	1	168	0.41	0.0725	80.682	9.405	2.266	5.50	6	433.38	476.718	46.994	11.324	
1803-X-106 B	0.415	0.9	0.7	72.23	1	168	0.41	0.0725	80.682	9.405	2.266	5.50	6	433.38	476.718	46.994	11.324	
1803-X-106 LRSB	0.415	0.9	0.7	23.28	1	173.25	1.539	0.0808	26.004	11.083	2.671	5.50	6	139.68	153.648	52.331	12.610	
1803-X-106 MOV A	0.415	0.9	0.7	24.08	1	173.25	1.539	0.0808	26.898	11.464	2.762	5.50	6	144.48	158.928	54.129	13.043	
1803-X-106 MOV B	0.415	0.9	0.7	24.08	1	173.25	1.539	0.0808	26.898	11.464	2.762	5.50	6	144.48	158.928	54.129	13.043	
1803-X-106 MOV C	0.415	0.9	0.7	24.08	1	173.25	1.539	0.0808	26.898	11.464	2.762	5.50	6	144.48	158.928	54.129	13.043	
1803-X-107-P001A	0.415	0.88	0.3	2.49	1	84	9.45	0.0942	2.781	3.383	0.815	5.50	5	12.45	13.695	5.828	1.404	
1803-X-107-P001B	0.415	0.88	0.3	2.49	1	84	9.45	0.0942	2.781	3.383	0.815	5.50	5	12.45	13.695	5.828	1.404	
1803-X-107-P002A	0.415	0.88	0.3	36.5	1	84	1.539	0.0808	40.771	8.261	1.991	5.50	5	182.5	200.75	15.736	3.792	
1803-X-107-P002B	0.415	0.88	0.3	36.5	1	84	1.539	0.0808	40.771	8.261	1.991	5.50	5	182.5	200.75	15.736	3.792	
1803-X-107-P005A	0.415	0.88	0.3	2.49	1	84	9.45	0.0942	2.781	3.383	0.815	5.50	5	12.45	13.695	5.828	1.404	
1803-X-107-P005B	0.415	0.88	0.3	2.49	1	84	9.45	0.0942	2.781	3.383	0.815	5.50	5	12.45	13.695	5.828	1.404	
1803-X-107-P007A	0.415	0.88	0.3	36.5	1	84	1.539	0.0808	40.771	8.261	1.991	5.50	5	182.5	200.75	15.736	3.792	
1803-X-107-P007B	0.415	0.88	0.3	36.5	1	84	1.539	0.0808	40.771	8.261	1.991	5.50	5	182.5	200.75	15.736	3.792	
1803-X-107-P006A	0.415	0.88	0.3	6.14	1	84	9.45	0.0942	6.859	8.343	2.010	5.50	5	30.7	33.77	14.371	3.463	
1803-X-107-P006B	0.415	0.88	0.3	6.14	1	84	9.45	0.0942	6.859	8.343	2.010	5.50	5	30.7	33.77	14.371	3.463	
1803-X-205-P-001A	0.415	0.86	0.42	32.92	1	367.5	0.822	0.078	36.772	17.478	4.212	5.50	6	197.52	217.272	57.536	13.864	
1803-X-205-P-001B	0.415	0.86	0.42	32.92	1	367.5	0.822	0.078	36.772	17.478	4.212	5.50	6	197.52	217.272	57.536	13.864	
1803-X-205-P-002A	0.415	0.86	0.42	32.92	1	367.5	0.822	0.078	36.772	17.478	4.212	5.50	6	197.52	217.272	57.536	13.864	

Table 124. MV Cables calculations: voltage drop verification (part 4).

PROJECT:	EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT “LuPech” (J-18)								ELECTRICAL CABLE CALCULATIONS: VOLTAGE DROP VERIFICATION								
CLIENT:	INDIAN OIL CORPORATION LIMITED																
Associated load	LOAD DESCRIPTION				CABLE DESCRIPTION				VOLTAGE DROP CALCULATION				STARTING VOLTAGE DROP CALCULATION				
	Operating voltage (kV)	Power factor (Cos θ)	Starting Power factor (Cos θst)	Nominal current (A)	N° of conductors per phase	Cable lenght (m)	Resistance Rc (Ohm/km)	Reactance Xc (Ohm/km)	Total load current (A)	AV Voltage drop calculated	% Voltage drop calculated	% Voltage drop required	Starting factor	Starting current (A)	Total starting current (A)	AVStarting Voltage drop	% Starting Voltage drop
1803-X-205-P-002B	0.415	0.86	0.42	32.92	1	367.5	0.822	0.078	36,772	17.478	4.212	5.5	6	197.52	217,272	57.536	13.864
1803-X-205-P-003A	0.415	0.78	0.5	15.08	1	367.5	1.47	0.0767	16,845	12.809	3.086	5.50	6	90.48	99,528	50.772	12.234
1803-X-205-P-003B	0.415	0.78	0.5	15.08	1	367.5	1.47	0.0767	16,845	12.809	3.086	5.50	6	90.48	99,528	50.772	12.234
1803-X-205-P-004A	0.415	0.86	0.44	26.87	1	367.5	0.822	0.078	30,014	14.266	3.438	5.50	6	161.22	177,342	48.734	11.743
1803-X-205-P-004B	0.415	0.86	0.44	26.87	1	367.5	0.822	0.078	30,014	14.266	3.438	5.50	6	161.22	177,342	48.734	11.743
1803-X-205-P-005A	0.415	0.82	0.4	28.09	1	367.5	0.822	0.078	31,377	14.354	3.459	5.50	6	168.54	185,394	47.237	11.383
1803-X-205-P-005B	0.415	0.82	0.4	28.09	1	367.5	0.822	0.078	31,377	14.354	3.459	5.50	6	168.54	185,394	47.237	11.383
1803-X-205-P-007A	0.415	0.9	0.47	60.08	1	367.5	0.264	0.0718	67.111	11.487	2.768	5.50	6	360.48	396,528	47.314	11.401
1803-X-205-P-007B	0.415	0.9	0.47	60.08	1	367.5	0.264	0.0718	67.111	11.487	2.768	5.50	6	360.48	396,528	47.314	11.401
1803-X-205-P-008A	0.415	0.86	0.44	13.77	1	367.5	1.47	0.0767	15.381	12.761	3.075	5.50	6	82.62	90,882	41.401	9.976
1803-X-205-P-008B	0.415	0.86	0.44	13.77	1	367.5	1.47	0.0767	15.381	12.761	3.075	5.50	6	82.62	90,882	41.401	9.976
1803-X-205-P-011A	0.415	0.86	0.44	13.77	1	367.5	1.47	0.0767	15.381	12.761	3.075	5.50	6	82.62	90,882	41.401	9.976
1803-X-205-P-011B	0.415	0.86	0.44	13.77	1	367.5	1.47	0.0767	15.381	12.761	3.075	5.50	6	82.62	90,882	41.401	9.976
1803-X-205-P-012A	0.415	0.8	0.44	10.99	1	367.5	1.47	0.0767	12.276	9.549	2.301	5.50	6	65.94	72,534	33.043	7.962
1803-X-205-P-012B	0.415	0.8	0.44	10.99	1	367.5	1.47	0.0767	12.276	9.549	2.301	5.50	6	65.94	72,534	33.043	7.962
1803-X-205-P-014A	0.415	0.9	0.7	72.23	1	367.5	0.21	0.072	80.682	11.318	2.727	5.50	6	433.38	476,718	60.209	14.508
1803-X-205-P-014B	0.415	0.9	0.7	72.23	1	367.5	0.21	0.072	80.682	11.318	2.727	5.50	6	433.38	476,718	60.209	14.508
1803-X-108-P-XX1	0.415	0.9	0.7	3.53	1	150	9.45	0.0942	3.943	8.755	2.110	5.50	6	21.18	23,298	40.448	9.746
1803-X-108-P-XX2	0.415	0.9	0.7	0.88	1	150	9.45	0.0942	0.983	2.183	0.526	5.50	6	5.28	5.808	10.083	2.430
1803-X-108-P-XX3	0.415	0.9	0.7	17.66	1	150	2.33	0.0804	19.727	10.927	2.633	5.50	6	105.96	116,556	51.129	12.320
1803-ACM-206 A1	0.415	0.9	0.7	37.29	1	350.7	0.41	0.0725	41.654	10.136	2.442	5.50	6	223.74	246,114	50.646	12.204
1803-ACM-206 B1	0.415	0.9	0.7	37.29	1	350.7	0.41	0.0725	41.654	10.136	2.442	5.50	6	223.74	246,114	50.646	12.204
1803-ACM-206 A2	0.415	0.9	0.7	37.29	1	357	0.41	0.0725	41.654	10.318	2.486	5.50	6	223.74	246,114	51.556	12.423
1803-ACM-206 B2	0.415	0.9	0.7	37.29	1	357	0.41	0.0725	41.654	10.318	2.486	5.50	6	223.74	246,114	51.556	12.423
1803-ACM-207 C1	0.415	0.9	0.7	25.73	1	378	0.568	0.0742	28.741	10.228	2.465	5.50	6	154.38	169,818	50.098	12.072
1803-ACM-207 D1	0.415	0.9	0.7	25.73	1	378	0.568	0.0742	28.741	10.228	2.465	5.50	6	154.38	169,818	50.098	12.072
1803-ACM-207 A2	0.415	0.9	0.7	25.73	1	384.3	0.568	0.0742	28.741	10.398	2.506	5.50	6	154.38	169,818	50.933	12.273
1803-ACM-207 B2	0.415	0.9	0.7	25.73	1	384.3	0.568	0.0742	28.741	10.398	2.506	5.50	6	154.38	169,818	50.933	12.273
1803-ACM-207 C2	0.415	0.9	0.7	25.73	1	393.75	0.568	0.0742	28.741	10.654	2.567	5.50	6	154.38	169,818	52.185	12.575
1803-ACM-207 D2	0.415	0.9	0.7	25.73	1	393.75	0.568	0.0742	28.741	10.654	2.567	5.50	6	154.38	169,818	52.185	12.575
1803-ACM-208 A	0.415	0.9	0.7	19.02	1	399	0.822	0.078	21.246	11.361	2.738	5.50	6	114.12	125,532	54.751	13.193
1803-ACM-208 B	0.415	0.9	0.7	19.02	1	399	0.822	0.078	21.246	11.361	2.738	5.50	6	114.12	125,532	54.751	13.193
1803-ACM-208 C	0.415	0.9	0.7	19.02	1	399	0.822	0.078	21.246	11.361	2.738	5.50	6	114.12	125,532	54.751	13.193
1803-ACM-601 A	0.415	0.9	0.7	4.05	1	141.75	9.45	0.0942	4.524	9.492	2.287	5.50	6	24.3	26.73	43.854	10.567
1803-ACM-601 B	0.415	0.9	0.7	4.05	1	141.75	9.45	0.0942	4.524	9.492	2.287	5.50	6	24.3	26.73	43.854	10.567
HV-1401-1	0.415	0.95	0.7	8.05	1	6.3	5.88	0.0883	8.992	0.551	0.133	5.50	6	48.3	53.13	2.423	0.584
HV-1401-2	0.415	0.95	0.7	8.05	1	6.3	5.88	0.0883	8.992	0.551	0.133	5.50	6	48.3	53.13	2.423	0.584
HV-1601-1	0.415	0.95	0.7	8.05	1	6.3	5.88	0.0883	8.992	0.551	0.133	5.50	6	48.3	53.13	2.423	0.584
HV-1601-2	0.415	0.95	0.7	8.05	1	6.3	5.88	0.0883	8.992	0.551	0.133	5.50	6	48.3	53.13	2.423	0.584
HV-2201-1	0.415	0.95	0.7	8.05	1	6.3	5.88	0.0883	8.992	0.551	0.133	5.50	6	48.3	53.13	2.423	0.584
HV-2201-2	0.415	0.95	0.7	8.05	1	6.3	5.88	0.0883	8.992	0.551	0.133	5.50	6	48.3	53.13	2.423	0.584
XZV-2301-1	0.415	0.95	0.7	8.05	1	6.3	5.88	0.0883	8.992	0.551	0.133	5.50	6	48.3	53.13	2.423	0.584
XZV-2301-2	0.415	0.95	0.7	8.05	1	6.3	5.88	0.0883	8.992	0.551	0.133	5.50	6	48.3	53.13	2.423	0.584
H-4001	0.415	0.95	0.7	19.92	1	6.3	3.93	0.0839	22.251	0.913	0.220	5.50	6	119.52	131,472	4.033	0.972
1803-X-109	0.415	1	0.3	20.87	1	126	1.47	0.0767	23.312	7.479	1.802	5.50	6	125.22	137,742	15.456	3.724
1803-X-206	0.415	1	0.3	51.47	1	126	0.927	0.0767	57.493	11.631	2.803	5.50	6	308.82	339,702	26.042	6.275
HB-001-01	0.415	1	0.3	400.67	3	220.5	0.16	0.0713	149.186	9.116	2.197	5.50	6	2404.02	881.474	39.057	9.411
HB-002-01	0.415	1	0.3	400.67	4	462	0.16	0.0713	111.889	14.326	3.452	5.50	6	2404.02	661.1055	61.375	14.789
TRS-101A	0.415	1	0.3	62.6	1	52.5	1.113	0.0787	69.926	7.077	1.705	5.50	6	375.6	413.16	15.365	3.702
TRS-101B	0.415	1	0.3	62.6	1	47.25	1.113	0.0787	69.926	6.369	1.535	5.50	6	375.6	413.16	13.829	3.332
TRS-106A	0.415	1	0.3	62.6	1	68.25	1.113	0.0787	69.926	9.200	2.217	5.50	6	375.6	413.16	19.975	4.813
TRS-102A	0.415	1	0.3	62.6	1	44.1	1.113	0.0787	69.926	5.945	1.432	5.50	6	375.6	413.16	12.907	3.110
TRS-102B	0.415	1	0.3	62.6	1	44.1	1.113	0.0787	69.926	5.945	1.432	5.50	6	375.6	413.16	12.907	3.110
TRS-103A	0.415	1	0.3	62.6	1	52.5	1.113	0.0787	69.926	7.077	1.705	5.50	6	375.6	413.16	15.365	3.702
TRS-103B	0.415	1	0.3	62.6	1	42	1.113	0.0787	69.926	5.662	1.364	5.50	6	375.6	413.16	12.292	2.962

Table 125. MV Cables calculations: voltage drop verification (part 5).

PROJECT:		EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LuPech" (J-18)							ELECTRICAL CABLE CALCULATIONS: VOLTAGE DROP VERIFICATION								
CLIENT:		INDIAN OIL CORPORATION LIMITED															
LOAD DESCRIPTION					CABLE DESCRIPTION				VOLTAGE DROP CALCULATION				STARTING VOLTAGE DROP CALCULATION				
Associated load	Operating voltage (kV)	Power factor (Cos θ)	Starting Power factor (Cos θst)	Nominal current (A)	Nº of conductors per phase	Cable lenght (m)	Resistance Rc (Ohm/km)	Reactance Xc (Ohm/km)	Total load current (A)	AV Voltage drop calculated	% Voltage drop calculated	% Voltage drop required	Starting factor	Starting current (A)	Total starting current (A)	AVStarting Voltage drop	% Starting Voltage drop
TRS-104A	0,415	1	0,3	62,6	1	52,5	1,113	0,0787	69,926	7,077	1,705	5,5	6	375,6	413,16	15,365	3,702
TRS-104B	0,415	1	0,3	62,6	1	68,25	1,113	0,0787	69,926	9,200	2,217	5,50	6	375,6	413,16	19,975	4,813
TRS-105A	0,415	1	0,3	62,6	1	44,1	1,113	0,0787	69,926	5,945	1,432	5,50	6	375,6	413,16	12,907	3,110
TRS-105B	0,415	1	0,3	62,6	1	44,1	1,113	0,0787	69,926	5,945	1,432	5,50	6	375,6	413,16	12,907	3,110
TRS-105C	0,415	1	0,3	62,6	1	47,25	1,113	0,0787	69,926	6,369	1,535	5,50	6	375,6	413,16	13,829	3,332
1803-X-702	0,415	1	0,3	13,91	1	126	5,88	0,0883	15,538	19,939	4,805	5,50	6	83,46	91,806	37,030	8,923
1803-X-702	0,415	1	0,3	13,91	1	126	5,88	0,0883	15,538	19,939	4,805	5,50	6	83,46	91,806	37,030	8,923
1803-PM-614	0,415	1	0,3	13,91	1	6,3	5,88	0,0883	15,538	0,997	0,240	5,50	6	83,46	91,806	1,852	0,446
1803-PM-613	0,415	1	0,3	13,91	1	6,3	5,88	0,0883	15,538	0,997	0,240	5,50	6	83,46	91,806	1,852	0,446
1803-WO-101	0,415	1	0,3	62,6	1	57,75	0,669	0,0745	69,926	4,679	1,128	5,50	7,2	450,72	495,792	13,478	3,248
1803-WO-102	0,415	1	0,3	62,6	1	73,5	0,669	0,0745	69,926	5,955	1,435	5,50	7,2	450,72	495,792	17,153	4,133
1803-WO-103	0,415	1	0,3	62,6	1	162,75	0,669	0,0745	69,926	13,187	3,178	5,50	7,2	450,72	495,792	37,982	9,152
1803-WO-104	0,415	1	0,3	62,6	1	318,15	0,494	0,0735	69,926	19,035	4,587	5,50	7,2	450,72	495,792	59,645	14,372
1803-WO-105	0,415	1	0,3	62,6	1	428,4	0,247	0,071	69,926	12,816	3,088	5,50	7,2	450,72	495,792	52,177	12,573
1803-WO-106	0,415	1	0,3	62,6	1	330,75	0,494	0,0735	69,926	19,789	4,768	5,50	7,2	450,72	495,792	62,007	14,942
1803-WO-107	0,415	1	0,3	62,6	1	202,65	0,669	0,0745	69,926	16,420	3,957	5,50	7,2	450,72	495,792	47,294	11,396
1803-WO-108	0,415	1	0,3	62,6	1	428,4	0,247	0,071	69,926	12,816	3,088	5,50	7,2	450,72	495,792	52,177	12,573
1803-WO-109	0,415	1	0,3	62,6	1	393,75	0,342	0,0729	69,926	16,310	3,930	5,50	7,2	450,72	495,792	58,206	14,026
1803-WO-110	0,415	1	0,3	62,6	1	225,75	0,669	0,0745	69,926	18,292	4,408	5,50	7,2	450,72	495,792	52,685	12,695
1803-WO-111	0,415	1	0,3	62,6	1	244,65	0,669	0,0745	69,926	19,823	4,777	5,50	7,2	450,72	495,792	57,096	13,758
1803-WO-112	0,415	1	0,3	62,6	1	168	0,669	0,0745	69,926	13,612	3,280	5,50	7,2	450,72	495,792	39,207	9,448
044-NON-UPS PDB-1	0,415	0,95	0,3	54,18	1	105	0,822	0,078	60,520	8,863	2,136	5,50	7,2	390,096	429,1056	25,051	6,036
044-NON-UPS PDB-2	0,415	0,95	0,3	54,18	1	105	0,822	0,078	60,520	8,863	2,136	5,50	7,2	390,096	429,1056	25,051	6,036
044-MLDB-102 A	0,415	0,95	0,3	73,22	3	1260	0,324	0,0713	27,263	19,638	4,732	5,00	6	439,32	161,084	58,081	13,995
044-MLDB-102 B	0,415	0,95	0,3	73,22	3	1260	0,324	0,0713	27,263	19,638	4,732	5,00	6	439,32	161,084	58,081	13,995
044-ELDB-101	0,415	0,95	0,3	2,93	1	42	9,45	0,0942	3,273	2,144	0,517	5,00	6	17,58	19,338	4,115	0,991
044-ELDB-102	0,415	0,95	0,3	2,93	1	126	9,45	0,0942	3,273	6,433	1,550	5,00	6	17,58	19,338	12,344	2,974
044-ELDB-103	0,415	0,95	0,3	5,86	1	78,75	9,45	0,0942	6,546	8,042	1,938	5,00	6	35,16	38,676	15,430	3,718
044-ELDB-104	0,415	0,95	0,3	2,93	1	115,5	9,45	0,0942	3,273	5,897	1,421	5,00	6	17,58	19,338	11,315	2,727
044-ELDB-105	0,415	0,95	0,3	2,93	1	89,25	9,45	0,0942	3,273	4,557	1,098	5,00	6	17,58	19,338	8,744	2,107
044-ELDB-106	0,415	0,95	0,3	2,93	1	63	9,45	0,0942	3,273	3,217	0,775	5,00	6	17,58	19,338	6,172	1,487
044-ELDB-107	0,415	0,95	0,3	2,93	1	367,5	9,45	0,0942	3,273	18,764	4,521	5,00	6	17,58	19,338	36,003	8,675
044-ELDB-108	0,415	0,95	0,3	2,93	1	210	9,45	0,0942	3,273	10,722	2,584	5,00	6	17,58	19,338	20,573	4,957
044-ELDB-109	0,415	0,95	0,3	2,93	1	105	9,45	0,0942	3,273	5,361	1,292	5,00	6	17,58	19,338	10,286	2,479
044-ELDB-110	0,415	0,95	0,3	2,93	1	157,5	9,45	0,0942	3,273	8,042	1,938	5,00	6	17,58	19,338	15,430	3,718
044-ELDB-111	0,415	0,95	0,3	2,93	1	325,5	9,45	0,0942	3,273	16,619	4,005	5,00	6	17,58	19,338	31,888	7,684
044-ELDB-112	0,415	0,95	0,3	2,93	1	157,5	9,45	0,0942	3,273	8,042	1,938	5,00	6	17,58	19,338	15,430	3,718
044-ELDB-113	0,415	0,95	0,3	2,93	1	157,5	9,45	0,0942	3,273	8,042	1,938	5,00	6	17,58	19,338	15,430	3,718
044-ELDB-114	0,415	0,95	0,3	2,93	2	420	9,45	0,0942	1,636	10,722	2,584	5,00	6	17,58	9,669	20,573	4,957
044-ELDB-115	0,415	0,95	0,3	2,93	1	315	9,45	0,0942	3,273	16,083	3,876	5,00	6	17,58	19,338	30,859	7,436
044-LDB-101	0,415	0,95	0,3	4,39	1	42	9,45	0,0942	4,904	3,213	0,774	5,00	6	26,34	28,974	6,165	1,486
044-LDB-104	0,415	0,95	0,3	4,39	1	115,5	9,45	0,0942	4,904	8,836	2,129	5,00	6	26,34	28,974	16,953	4,085
044-LDB-105	0,415	0,95	0,3	13,91	1	89,25	5,88	0,0883	15,538	13,483	3,249	5,00	6	83,46	91,806	26,230	6,320
044-LDB-106	0,415	0,95	0,3	4,39	1	63	9,45	0,0942	4,904	4,820	1,161	5,00	6	26,34	28,974	9,247	2,228
044-LDB-103	0,415	0,95	0,3	4,39	1	168	9,45	0,0942	4,904	12,852	3,097	5,00	6	26,34	28,974	24,659	5,942
044-LDB-102	0,415	0,95	0,3	7,32	1	126	5,88	0,0883	8,177	10,017	2,414	5,00	6	43,92	48,312	19,487	4,696
044-LDB-107	0,415	0,95	0,3	7,32	2	367,5	5,88	0,0883	4,088	14,608	3,520	5,00	6	43,92	24,156	28,418	6,848
044-LDB-108	0,415	0,95	0,3	13,91	2	210	5,88	0,0883	7,769	15,863	3,822	5,00	6	83,46	45,903	30,859	7,436
044-LDB-109	0,415	0,95	0,3	7,32	1	105	5,88	0,0883	8,177	8,348	2,011	5,00	6	43,92	48,312	16,239	3,913
044-LDB-110	0,415	0,95	0,3	7,32	1	157,5	5,88	0,0883	8,177	12,521	3,017	5,00	6	43,92	48,312	24,359	5,870
044-LDB-111	0,415	0,95	0,3	7,32	2	325,5	5,88	0,0883	4,088	12,939	3,118	5,00	6	43,92	24,156	25,171	6,065
044-LDB-112	0,415	0,95	0,3	7,32	1	157,5	5,88	0,0883	8,177	12,521	3,017	5,00	6	43,92	48,312	24,359	5,870
044-LDB-113	0,415	0,95	0,3	7,32	1	157,5	9,45	0,0942	8,177	20,090	4,841	5,00	6	43,92	48,312	38,548	9,289
044-LDB-114	0,415	0,95	0,3	5,86	2	420	5,88	0,0883	3,273	13,365	3,221	5,00	6	35,16	19,338	26,000	6,265
044-LDB-115	0,415	0,95	0,3	13,91	1	315	2,33	0,0804	15,538	18,977	4,573	5,00	6	83,46	91,806	38,854	9,362

Table 126. MV Cables calculations: voltage drop verification (part 6).

 				ELECTRICAL CABLES LIST												
PROJECT: EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LaPech" (J-18)																
CLIENT: INDIAN OIL CORPORATION LIMITED																
CABLE TAG	RATED VOLTAGE (V)	RATED POWER (kW) (*) kVA	RATED CURRENT (A)	FROM		DESTINATION	CABLE DESCRIPTION									
				BOARD	USER TAG		INSULATION RATED VOLTAGE (kV)	TYPE	CORES	SIZE (mm²)	CONDUCTOR	INSULATION	SCREENED	ARMOUR	OUTER SHEATH	LENGTH (m)
044-HT33-101-1-P1	33000	35000 (*)	1250	33 kV Import Substation	044-HT33-101	Power cable for 044-HT33-101 Incomer 1	33/33	3PH	1	630	AL	XLPE	YES	AWA	PVC	1100
044-HT33-101-1-P2	33000	35000 (*)	1250	33 kV Import Substation	044-HT33-101	Power cable for 044-HT33-101 Incomer 1	33/33	3PH	1	630	AL	XLPE	YES	AWA	PVC	1100
044-HT33-101-1-P3	33000	35000 (*)	1250	33 kV Import Substation	044-HT33-101	Power cable for 044-HT33-101 Incomer 1	33/33	3PH	1	630	AL	XLPE	YES	AWA	PVC	1100
044-HT33-101-1-P4	33000	35000 (*)	1250	33 kV Import Substation	044-HT33-101	Power cable for 044-HT33-101 Incomer 1	33/33	3PH	1	630	AL	XLPE	YES	AWA	PVC	1100
044-HT33-101-1-P5	33000	35000 (*)	1250	33 kV Import Substation	044-HT33-101	Power cable for 044-HT33-101 Incomer 1	33/33	3PH	1	630	AL	XLPE	YES	AWA	PVC	1100
044-HT33-101-1-P6	33000	35000 (*)	1250	33 kV Import Substation	044-HT33-101	Power cable for 044-HT33-101 Incomer 1	33/33	3PH	1	630	AL	XLPE	YES	AWA	PVC	1100
044-HT33-101-1-P7	33000	35000 (*)	1250	33 kV Import Substation	044-HT33-101	Power cable for 044-HT33-101 Incomer 1	33/33	3PH	1	630	AL	XLPE	YES	AWA	PVC	1100
044-HT33-101-1-P8	33000	35000 (*)	1250	33 kV Import Substation	044-HT33-101	Power cable for 044-HT33-101 Incomer 1	33/33	3PH	1	630	AL	XLPE	YES	AWA	PVC	1100
044-HT33-101-1-P9	33000	35000 (*)	1250	33 kV Import Substation	044-HT33-101	Power cable for 044-HT33-101 Incomer 1	33/33	3PH	1	630	AL	XLPE	YES	AWA	PVC	1100
044-HT33-101-2-P1	33000	35000 (*)	1250	33 kV Import Substation	044-HT33-101	Power cable for 044-HT33-101 Incomer 2	33/33	3PH	1	630	AL	XLPE	YES	AWA	PVC	1100
044-HT33-101-2-P2	33000	35000 (*)	1250	33 kV Import Substation	044-HT33-101	Power cable for 044-HT33-101 Incomer 2	33/33	3PH	1	630	AL	XLPE	YES	AWA	PVC	1100
044-HT33-101-2-P3	33000	35000 (*)	1250	33 kV Import Substation	044-HT33-101	Power cable for 044-HT33-101 Incomer 2	33/33	3PH	1	630	AL	XLPE	YES	AWA	PVC	1100
044-HT33-101-2-P4	33000	35000 (*)	1250	33 kV Import Substation	044-HT33-101	Power cable for 044-HT33-101 Incomer 2	33/33	3PH	1	630	AL	XLPE	YES	AWA	PVC	1100
044-HT33-101-2-P5	33000	35000 (*)	1250	33 kV Import Substation	044-HT33-101	Power cable for 044-HT33-101 Incomer 2	33/33	3PH	1	630	AL	XLPE	YES	AWA	PVC	1100
044-HT33-101-2-P6	33000	35000 (*)	1250	33 kV Import Substation	044-HT33-101	Power cable for 044-HT33-101 Incomer 2	33/33	3PH	1	630	AL	XLPE	YES	AWA	PVC	1100
044-HT33-101-2-P7	33000	35000 (*)	1250	33 kV Import Substation	044-HT33-101	Power cable for 044-HT33-101 Incomer 2	33/33	3PH	1	630	AL	XLPE	YES	AWA	PVC	1100
044-HT33-101-2-P8	33000	35000 (*)	1250	33 kV Import Substation	044-HT33-101	Power cable for 044-HT33-101 Incomer 2	33/33	3PH	1	630	AL	XLPE	YES	AWA	PVC	1100
044-HT33-101-2-P9	33000	35000 (*)	1250	33 kV Import Substation	044-HT33-101	Power cable for 044-HT33-101 Incomer 2	33/33	3PH	1	630	AL	XLPE	YES	AWA	PVC	1100
044-TR-101A-P1	33000	16000 (*)		044-HT33-101	044-TR-101A	Power cable for 044-TR-101A	33/33	3PH	3	300	AL	XLPE	YES	SWA	PVC	25
044-TR-101A-P2	33000	16000 (*)		044-HT33-101	044-TR-101A	Power cable for 044-TR-101A	33/33	3PH	3	300	AL	XLPE	YES	SWA	PVC	25
044-TR-101A-P3	33000	16000 (*)		044-HT33-101	044-TR-101A	Power cable for 044-TR-101A	33/33	3PH	3	300	AL	XLPE	YES	SWA	PVC	25
044-TR-101B-P1	33000	16000 (*)		044-HT33-101	044-TR-101B	Power cable for 044-TR-101B	33/33	3PH	3	300	AL	XLPE	YES	SWA	PVC	25
044-TR-101B-P2	33000	16000 (*)		044-HT33-101	044-TR-101B	Power cable for 044-TR-101B	33/33	3PH	3	300	AL	XLPE	YES	SWA	PVC	25
044-TR-101B-P3	33000	16000 (*)		044-HT33-101	044-TR-101B	Power cable for 044-TR-101B	33/33	3PH	3	300	AL	XLPE	YES	SWA	PVC	25
044-HT11-101-P1	11000	6870 (*)		11 Kv import substation (CGP-1)	044-HT11-101	Power cable for 044-HT11-101 Incomer 1	8.7/15	3PH	1	500	AL	XLPE	YES	AWA	PVC	1160
044-HT11-101-P2	11000	6870 (*)		11 Kv import substation (CGP-1)	044-HT11-101	Power cable for 044-HT11-101 Incomer 1	8.7/15	3PH	1	500	AL	XLPE	YES	AWA	PVC	1160
044-HT11-101-P3	11000	6870 (*)		11 Kv import substation (CGP-1)	044-HT11-101	Power cable for 044-HT11-101 Incomer 1	8.7/15	3PH	1	500	AL	XLPE	YES	AWA	PVC	1160
044-TR-106A-P1	11000	4000 (*)		044-HT11-101	044-TR-106A	Power cable for 044-TR-106A	8.7/15	3PH	1	500	AL	XLPE	YES	SWA	PVC	25
044-NGR-101A-P1	6600	-	400	044-TR-101A	044-NGR-101A	Power cable for Neutral Grounding Resistor 044-NGR-101A	6/10	1PH	1	185	AL	XLPE	YES	AWA	PVC	30
044-NGR-101B-P1	6600	-	400	044-TR-101B	044-NGR-101B	Power cable for Neutral Grounding Resistor 044-NGR-101B	6/10	1PH	1	185	AL	XLPE	YES	AWA	PVC	30
044-NGR-106A-P1	6600	-	300	044-TR-106A	044-NGR-106A	Power cable for Neutral Grounding Resistor 044-NGR-106A	6/10	1PH	1	185	AL	XLPE	YES	AWA	PVC	30
1803-PM-101 A-P1	6600	225.00	23.48	044-HT6-101	1803-PM-101 A	Power cable for HOT FRESH FEED PUMPS	6/10	3PH	3	240	AL	XLPE	YES	SWA	PVC	170
1803-PM-101 B-P1	6600	225.00	23.48	044-HT6-101	1803-PM-101 B	Power cable for HOT FRESH FEED PUMPS	6/10	3PH	3	240	AL	XLPE	YES	SWA	PVC	170
1803-PM-202 A-P1	6600	290.00	32.27	044-HT6-101	1803-PM-202 A	Power cable for LCO PUMPAROUND PUMP	6/10	3PH	3	240	AL	XLPE	YES	SWA	PVC	260
1803-PM-202 B-P1	6600	290.00	32.27	044-HT6-101	1803-PM-202 B	Power cable for LCO PUMPAROUND PUMP	6/10	3PH	3	240	AL	XLPE	YES	SWA	PVC	260
1803-PM-202 C-P1	6600	290.00	32.27	044-HT6-101	1803-PM-202 C	Power cable for LCO PUMPAROUND PUMP	6/10	3PH	3	240	AL	XLPE	YES	SWA	PVC	260
1803-PM-204 A-P1	6600	210.00	23.80	044-HT6-101	1803-PM-204 A	Power cable for HCO PUMPAROUND PUMP	6/10	3PH	3	240	AL	XLPE	YES	SWA	PVC	315
1803-PM-204 B-P1	6600	210.00	23.80	044-HT6-101	1803-PM-204 B	Power cable for HCO PUMPAROUND PUMP	6/10	3PH	3	240	AL	XLPE	YES	SWA	PVC	315
1803-PM-204 C-P1	6600	210.00	23.80	044-HT6-101	1803-PM-204 C	Power cable for HCO PUMPAROUND PUMP	6/10	3PH	3	240	AL	XLPE	YES	SWA	PVC	315
1803-PM-205 A-P1	6600	480.00	51.89	044-HT6-101	1803-PM-205 A	Power cable for MAIN FRACTIONATOR BOTTOM PUMP	6/10	3PH	3	240	AL	XLPE	YES	SWA	PVC	235
1803-PM-205 B-P1	6600	480.00	51.89	044-HT6-101	1803-PM-205 B	Power cable for MAIN FRACTIONATOR BOTTOM PUMP	6/10	3PH	3	240	AL	XLPE	YES	SWA	PVC	235
1803-PM-213 A-P1	6600	250.00	28.33	044-HT6-101	1803-PM-213 A	Power cable for DEETHANIZER STRIPPER CHARGE PUMP	6/10	3PH	3	240	AL	XLPE	YES	SWA	PVC	185
1803-PM-213 B-P1	6600	250.00	28.33	044-HT6-101	1803-PM-213 B	Power cable for DEETHANIZER STRIPPER CHARGE PUMP	6/10	3PH	3	240	AL	XLPE	YES	SWA	PVC	185
1803-PM-214 A-P1	6600	170.00	18.27	044-HT6-101	1803-PM-214 A	Power cable for GASOLINE RECYCLE PUMP	6/10	3PH	3	240	AL	XLPE	YES	SWA	PVC	320
1803-PM-214 B-P1	6600	170.00	18.27	044-HT6-101	1803-PM-214 B	Power cable for GASOLINE RECYCLE PUMP	6/10	3PH	3	240	AL	XLPE	YES	SWA	PVC	320
1803-PM-222 A-P1	6600	275.00	29.14	044-HT6-101	1803-PM-222 A	Power cable for LEAN AMINE PUMP	6/10	3PH	3	240	AL	XLPE	YES	SWA	PVC	120
1803-PM-222 B-P1	6600	275.00	29.14	044-HT6-101	1803-PM-222 B	Power cable for LEAN AMINE PUMP	6/10	3PH	3	240	AL	XLPE	YES	SWA	PVC	120
1803-X-107-K-001A-P1	6600	200.00	22.67	044-HT6-101	1803-X-107-K-001A	Power cable for WGS OXIDATION BLOWER PUMP	6/10	3PH	3	240	AL	XLPE	YES	SWA	PVC	80
1803-X-107-K-001B-P1	6600	200.00	22.67	044-HT6-101	1803-X-107-K-001B	Power cable for WGS OXIDATION BLOWER PUMP	6/10	3PH	3	240	AL	XLPE	YES	SWA	PVC	80
1803-X-107-K-001C-P1	6600	200.00	22.67	044-HT6-101	1803-X-107-K-001C	Power cable for WGS OXIDATION BLOWER PUMP	6/10	3PH	3	240	AL	XLPE	YES	SWA	PVC	80
044-HT6-102 A-P1	6600	462.03	45.41	044-HT6-101 A	044-HT6-102	Power cable for 044-HT6-102 INCOMER 1 (6.6 KV EMERGENCY PANEL)	6/10	3PH	1	500	AL	XLPE	YES	AWA	PVC	37
044-HT6-102 A-P2	6600	462.03	45.41	044-HT6-101 A	044-HT6-102	Power cable for 044-HT6-102 INCOMER 1 (6.6 KV EMERGENCY PANEL)	6/10	3PH	1	500	AL	XLPE	YES	AWA	PVC	37
044-HT6-102 A-P3	6600	462.03	45.41	044-HT6-101 A	044-HT6-102	Power cable for 044-HT6-102 INCOMER 1 (6.6 KV EMERGENCY PANEL)	6/10	3PH	1	500	AL	XLPE	YES	AWA	PVC	37
044-HT6-102 B-P1	6600	462.98	45.51	044-HT6-101 B	044-HT6-102	Power cable for 044-HT6-102 INCOMER 2 (6.6 KV EMERGENCY PANEL)	6/10	3PH	1	500	AL	XLPE	YES	AWA	PVC	37
044-HT6-102 B-P2	6600	462.98	45.51	044-HT6-101 B	044-HT6-102	Power cable for 044-HT6-102 INCOMER 2 (6.6 KV EMERGENCY PANEL)	6/10	3PH	1	500	AL	XLPE	YES	AWA	PVC	37
044-HT6-102 B-P3	6600	462.98	45.51	044-HT6-101 B	044-HT6-102	Power cable for 044-HT6-102 INCOMER 2 (6.6 KV EMERGENCY PANEL)	6/10	3PH	1	500	AL	XLPE	YES	AWA	PVC	37
044-TR-102A-P1	6600	2500 (*)	218.72	044-HT6-101	044-TR-102A	Power cable for Distribution transformer 6.6 / 0.433 Kv (044-PMCC-101)	6/10	3PH	1	500	AL	XLPE	YES	AWA	PVC	45
044-TR-102A-P2	6600	2500 (*)	218.72	044-HT6-101	044-TR-102A	Power cable for Distribution transformer 6.6 / 0.433 Kv (044-PMCC-101)	6/10	3PH	1	500	AL	XLPE	YES	AWA	PVC	45
044-TR-102A-P3	6600	2500 (*)	218.72	044-HT6-101	044-TR-102A	Power cable for Distribution transformer 6.6 / 0.433 Kv (044										

 				ELECTRICAL CABLES LIST														
PROJECT:		EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE																
CLIENT:		INTEGRATION PROJECT "LuFeb" (J-18)																
		INDIAN OIL CORPORATION LIMITED																
CABLE TAG	RATED VOLTAGE (V)	RATED POWER (kW) (*) KVA	RATED CURRENT (A)	FROM		DESTINATION	DESCRIPTION	INSULATION RATED VOLTAGE (kV)	TYPE	CORES	SIZE (mm²)	CABLE DESCRIPTION						
				BOARD	USER TAG							CONDUCTOR	INSULATION	SCREENED	ARMOUR	OUTER SHEATH	LENGTH (m)	
044-TR-103B-P1	6600	2500 (*)	218,72	044-HT6-101	044-TR-103B		Power cable for Distribution transformer 6,6 / 0.433 Kv (044-PMCC-102)	6/10	3PH	1	500	AL	XLPE	YES	AWA	PVC	22	
044-TR-103B-P2	6600	2500 (*)	218,72	044-HT6-101	044-TR-103B		Power cable for Distribution transformer 6,6 / 0.433 Kv (044-PMCC-102)	6/10	3PH	1	500	AL	XLPE	YES	AWA	PVC	22	
044-TR-103B-P3	6600	2500 (*)	218,72	044-HT6-101	044-TR-103B		Power cable for Distribution transformer 6,6 / 0.433 Kv (044-PMCC-102)	6/10	3PH	1	500	AL	XLPE	YES	AWA	PVC	22	
044-TR-104A-P1	6600	2500 (*)	218,72	044-HT6-101	044-TR-104A		Power cable for Distribution transformer 6,6 / 0.433 Kv (044-PMCC-103)	6/10	3PH	1	500	AL	XLPE	YES	AWA	PVC	22	
044-TR-104A-P2	6600	2500 (*)	218,72	044-HT6-101	044-TR-104A		Power cable for Distribution transformer 6,6 / 0.433 Kv (044-PMCC-103)	6/10	3PH	1	500	AL	XLPE	YES	AWA	PVC	22	
044-TR-104A-P3	6600	2500 (*)	218,72	044-HT6-101	044-TR-104A		Power cable for Distribution transformer 6,6 / 0.433 Kv (044-PMCC-103)	6/10	3PH	1	500	AL	XLPE	YES	AWA	PVC	22	
044-TR-104B-P1	6600	2500 (*)	218,72	044-HT6-101	044-TR-104B		Power cable for Distribution transformer 6,6 / 0.433 Kv (044-PMCC-103)	6/10	3PH	1	500	AL	XLPE	YES	AWA	PVC	22	
044-TR-104B-P2	6600	2500 (*)	218,72	044-HT6-101	044-TR-104B		Power cable for Distribution transformer 6,6 / 0.433 Kv (044-PMCC-103)	6/10	3PH	1	500	AL	XLPE	YES	AWA	PVC	22	
044-TR-104B-P3	6600	2500 (*)	218,72	044-HT6-101	044-TR-104B		Power cable for Distribution transformer 6,6 / 0.433 Kv (044-PMCC-103)	6/10	3PH	1	500	AL	XLPE	YES	AWA	PVC	22	
044-TR-105A-P1	6600	2000 (*)	174,95	044-HT6-101	044-TR-105A		Power cable for Distribution transformer 6,6 / 0.433 Kv (044-EPMCC-101)	6/10	3PH	1	500	AL	XLPE	YES	AWA	PVC	30	
044-TR-105A-P2	6600	2000 (*)	174,95	044-HT6-101	044-TR-105A		Power cable for Distribution transformer 6,6 / 0.433 Kv (044-EPMCC-101)	6/10	3PH	1	500	AL	XLPE	YES	AWA	PVC	30	
044-TR-105A-P3	6600	2000 (*)	174,95	044-HT6-101	044-TR-105A		Power cable for Distribution transformer 6,6 / 0.433 Kv (044-EPMCC-101)	6/10	3PH	1	500	AL	XLPE	YES	AWA	PVC	30	
044-TR-105B-P1	6600	2000 (*)	174,95	044-HT6-101	044-TR-105B		Power cable for Distribution transformer 6,6 / 0.433 Kv (044-EPMCC-101)	6/10	3PH	1	500	AL	XLPE	YES	AWA	PVC	30	
044-TR-105B-P2	6600	2000 (*)	174,95	044-HT6-101	044-TR-105B		Power cable for Distribution transformer 6,6 / 0.433 Kv (044-EPMCC-101)	6/10	3PH	1	500	AL	XLPE	YES	AWA	PVC	30	
044-TR-105B-P3	6600	2000 (*)	174,95	044-HT6-101	044-TR-105B		Power cable for Distribution transformer 6,6 / 0.433 Kv (044-EPMCC-101)	6/10	3PH	1	500	AL	XLPE	YES	AWA	PVC	30	
044-TR-105C-P1	6600	2000 (*)	174,95	044-HT6-102	044-TR-105 C		Power cable for Emergency Distribution transformer 6,6/0,433 kV (044-EPMCC-101)	6/10	3PH	1	500	AL	XLPE	YES	AWA	PVC	25	
044-TR-105C-P2	6600	2000 (*)	174,95	044-HT6-102	044-TR-105 C		Power cable for Emergency Distribution transformer 6,6/0,433 kV (044-EPMCC-101)	6/10	3PH	1	500	AL	XLPE	YES	AWA	PVC	25	
044-TR-105C-P3	6600	2000 (*)	174,95	044-HT6-102	044-TR-105 C		Power cable for Emergency Distribution transformer 6,6/0,433 kV (044-EPMCC-101)	6/10	3PH	1	500	AL	XLPE	YES	AWA	PVC	25	
044-CB-101A-P1	6600	2400	209,95	044-HT6-101	044-CB-101A		Power cable for HV CAPACITOR BANK	6/10	3PH	1	500	AL	XLPE	YES	AWA	PVC	10	
044-CB-101A-P2	6600	2400	209,95	044-HT6-101	044-CB-101A		Power cable for HV CAPACITOR BANK	6/10	3PH	1	500	AL	XLPE	YES	AWA	PVC	10	
044-CB-101A-P3	6600	2400	209,95	044-HT6-101	044-CB-101A		Power cable for HV CAPACITOR BANK	6/10	3PH	1	500	AL	XLPE	YES	AWA	PVC	10	
044-CB-101B-P1	6600	2400	209,95	044-HT6-101	044-CB-101B		Power cable for HV CAPACITOR BANK	6/10	3PH	1	500	AL	XLPE	YES	AWA	PVC	10	
044-CB-101B-P2	6600	2400	209,95	044-HT6-101	044-CB-101B		Power cable for HV CAPACITOR BANK	6/10	3PH	1	500	AL	XLPE	YES	AWA	PVC	10	
044-CB-101B-P3	6600	2400	209,95	044-HT6-101	044-CB-101B		Power cable for HV CAPACITOR BANK	6/10	3PH	1	500	AL	XLPE	YES	AWA	PVC	10	
1803-PM-609 A-P1	6600	275	29,14	044-HT6-102	1803-PM-609 A		Power cable for HP BOILER FEED WATER PUMP	6/10	3PH	3	240	AL	XLPE	YES	SWA	PVC	180	
1803-PM-609 B-P1	6600	275	29,14	044-HT6-102	1803-PM-609 B		Power cable for HP BOILER FEED WATER PUMP	6/10	3PH	3	240	AL	XLPE	YES	SWA	PVC	180	
1803-PM-609 C-P1	6600	275	29,14	044-HT6-102	1803-PM-609 C		Power cable for HP BOILER FEED WATER PUMP	6/10	3PH	3	240	AL	XLPE	YES	SWA	PVC	180	
1803-PM-102 A-P1	415	110	173,2269565	044-PMCC-101	1803-PM-102 A		Power cable for COLD FRESH FEED PUMP	0.6/1	3PH	3	120	AL	XLPE	-	SWA	PVC	205	
1803-PM-102 A-P2	415	110	176,5692875	044-PMCC-101	1803-PM-102 A		Power cable for COLD FRESH FEED PUMP	0.6/1	3PH	3	120	AL	XLPE	-	SWA	PVC	205	
1803-PM-102 B-P1	415	150	92,67962783	044-PMCC-101	1803-PM-102 B		Power cable for COLD FRESH FEED PUMPS	0.6/1	3PH	3	120	AL	XLPE	-	SWA	PVC	205	
1803-PM-102 B-P2	415	150	92,67962783	044-PMCC-101	1803-PM-102 B		Power cable for COLD FRESH FEED PUMPS	0.6/1	3PH	3	120	AL	XLPE	-	SWA	PVC	205	
1803-PM-206 A-P1	415	132,00	222,43	044-PMCC-101	1803-PM-206 A		Power cable for CLO PRODUCT PUMP	0.6/1	3PH	3	185	AL	XLPE	-	SWA	PVC	290	
1803-PM-206 A-P2	415	132,00	222,43	044-PMCC-101	1803-PM-206 A		Power cable for CLO PRODUCT PUMP	0.6/1	3PH	3	185	AL	XLPE	-	SWA	PVC	290	
1803-PM-206 B-P1	415	132,00	222,43	044-PMCC-101	1803-PM-206 B		Power cable for CLO PRODUCT PUMP	0.6/1	3PH	3	185	AL	XLPE	-	SWA	PVC	290	
1803-PM-206 B-P2	415	132,00	222,43	044-PMCC-101	1803-PM-206 B		Power cable for CLO PRODUCT PUMP	0.6/1	3PH	3	185	AL	XLPE	-	SWA	PVC	290	
1803-PM-207 A-P1	415	132,00	218,97	044-PMCC-101	1803-PM-207 A		Power cable for FRACTIONATOR REFLUX PUMP	0.6/1	3PH	3	150	AL	XLPE	-	SWA	PVC	160	
1803-PM-207 A-P2	415	132,00	218,97	044-PMCC-101	1803-PM-207 A		Power cable for FRACTIONATOR REFLUX PUMP	0.6/1	3PH	3	150	AL	XLPE	-	SWA	PVC	160	
1803-PM-207 B-P1	415	132,00	218,97	044-PMCC-101	1803-PM-207 B		Power cable for FRACTIONATOR REFLUX PUMP	0.6/1	3PH	3	150	AL	XLPE	-	SWA	PVC	160	
1803-PM-207 B-P2	415	132,00	218,97	044-PMCC-101	1803-PM-207 B		Power cable for FRACTIONATOR REFLUX PUMP	0.6/1	3PH	3	150	AL	XLPE	-	SWA	PVC	160	
1803-PM-224 A-P1	415	75,00	124,42	044-PMCC-101	1803-PM-224 A		Power cable for HCN PUMP/AROUND PUMP	0.6/1	3PH	3	240	AL	XLPE	-	SWA	PVC	100	
1803-PM-224 B-P1	415	75,00	120,99	044-PMCC-101	1803-PM-224 B		Power cable for HCN PUMP/AROUND PUMP	0.6/1	3PH	3	240	AL	XLPE	-	SWA	PVC	100	
044-MCC-101 A-P1	415	-	630,00	044-PMCC-101	044-MCC-101 A		Power cable for 044-MCC-101 INCOMER 1	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	20	
044-MCC-101 A-P2	415	-	630,00	044-PMCC-101	044-MCC-101 A		Power cable for 044-MCC-101 INCOMER 1	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	20	
044-MCC-101 A-P3	415	-	630,00	044-PMCC-101	044-MCC-101 A		Power cable for 044-MCC-101 INCOMER 1	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	20	
044-MCC-101 B-P1	415	-	630,00	044-PMCC-101	044-MCC-101 B		Power cable for 044-MCC-101 INCOMER 2	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	20	
044-MCC-101 B-P2	415	-	630,00	044-PMCC-101	044-MCC-101 B		Power cable for 044-MCC-101 INCOMER 2	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	20	
044-MCC-101 B-P3	415	-	630,00	044-PMCC-101	044-MCC-101 B		Power cable for 044-MCC-101 INCOMER 2	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	20	
044-MCC-102 A-P1	415	-	630,00	044-PMCC-102	044-MCC-102 A		Power cable for 044-MCC-102 INCOMER 1	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	20	
044-MCC-102 A-P2	415	-	630,00	044-PMCC-102	044-MCC-102 A		Power cable for 044-MCC-102 INCOMER 1	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	20	
044-MCC-102 A-P3	415	-	630,00	044-PMCC-102	044-MCC-102 A		Power cable for 044-MCC-102 INCOMER 1	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	20	
044-MCC-102 B-P1	415	-	630,00	044-PMCC-102	044-MCC-102 B		Power cable for 044-MCC-102 INCOMER 2	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	20	
044-MCC-102 B-P2	415	-	630,00	044-PMCC-102	044-MCC-102 B		Power cable for 044-MCC-102 INCOMER 2	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	20	
044-MCC-102 B-P3	415	-	630,00	044-PMCC-102	044-MCC-102 B		Power cable for 044-MCC-102 INCOMER 2	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	20	
044-MCC-103 A-P1	415	-	630,00	044-PMCC-102	044-MCC-103 A		Power cable for 044-MCC-103 INCOMER 1	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	21	
044-MCC-103 A-P2	415	-	630,00	044-PMCC-102	044-MCC-103 A		Power cable for 044-MCC-103 INCOMER 1	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	21	
044-MCC-103 A-P3	415	-	630,00	044-PMCC-102	044-MCC-103 A		Power cable for 044-MCC-103 INCOMER 1	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	21	
044-MCC-103 B-P1	415	-	630,00	044-PMCC-102	044-MCC-103 B		Power cable for 044-MCC-103 INCOMER 2	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	21	
044-MCC-103 B-P2	415	-	630,00	044-PMCC-102	044-MCC-103 B		Power cable for 044-MCC-103 INCOMER 2	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	21	
044-MCC-103 B-P3	415	-	630,00	044-PMCC-1														

PROJECT:		EPC2-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LuPech" (J-18)		ELECTRICAL CABLES LIST														
CLIENT:		INDIAN OIL CORPORATION LIMITED																
CABLE TAG	RATED VOLTAGE (V)	RATED POWER (kW) (*): kVA	RATED CURRENT (A)	FROM		DESTINATION	DESCRIPTION	INSULATION RATED VOLTAGE (kV)	TYPE	CORES	SIZE (mm²)	CABLE DESCRIPTION						
				BOARD	USER TAG							CONDUCTOR	INSULATION	SCREENED	ARMOUR	OUTER SHEATH	LENGTH (m)	
044-MCC-105 A-P1	415	-	630	044-PMCC-102	044-MCC-105 A		Power cable for 044-MCC-105 INCOMER 1	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	21	
044-MCC-105 A-P2	415	-	630	044-MCC-105 A	044-MCC-105 A		Power cable for 044-MCC-105 INCOMER 1	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	21	
044-MCC-105 A-P3	415	-	630	044-PMCC-102	044-MCC-105 A		Power cable for 044-MCC-105 INCOMER 1	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	21	
044-MCC-105 B-P1	415	-	630	044-PMCC-102	044-MCC-105 B		Power cable for 044-MCC-105 INCOMER 2	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	21	
044-MCC-105 B-P2	415	-	630	044-MCC-105 B	044-MCC-105 B		Power cable for 044-MCC-105 INCOMER 2	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	21	
044-MCC-105 B-P3	415	-	630	044-PMCC-102	044-MCC-105 B		Power cable for 044-MCC-105 INCOMER 2	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	21	
044-MCC-106 A-P1	415	-	630	044-MCC-106 A	044-MCC-106 A		Power cable for 044-MCC-106 INCOMER 1	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	21	
044-MCC-106 A-P2	415	-	630	044-PMCC-102	044-MCC-106 A		Power cable for 044-MCC-106 INCOMER 1	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	21	
044-MCC-106 A-P3	415	-	630	044-MCC-106 A	044-MCC-106 A		Power cable for 044-MCC-106 INCOMER 1	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	21	
044-MCC-106 B-P1	415	-	630	044-PMCC-102	044-MCC-106 B		Power cable for 044-MCC-106 INCOMER 2	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	21	
044-MCC-106 B-P2	415	-	630	044-MCC-106 B	044-MCC-106 B		Power cable for 044-MCC-106 INCOMER 2	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	21	
044-MCC-106 B-P3	415	-	630	044-PMCC-102	044-MCC-106 B		Power cable for 044-MCC-106 INCOMER 2	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	21	
044-MCC-107 A-P1	415	-	630	044-PMCC-103	044-MCC-107 A		Power cable for 044-MCC-107 INCOMER 1	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	21	
044-MCC-107 A-P2	415	-	630	044-MCC-107 A	044-MCC-107 A		Power cable for 044-MCC-107 INCOMER 1	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	21	
044-MCC-107 A-P3	415	-	630	044-PMCC-103	044-MCC-107 A		Power cable for 044-MCC-107 INCOMER 1	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	21	
044-MCC-107 B-P1	415	-	630	044-PMCC-103	044-MCC-107 B		Power cable for 044-MCC-107 INCOMER 2	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	21	
044-MCC-107 B-P2	415	-	630	044-MCC-107 B	044-MCC-107 B		Power cable for 044-MCC-107 INCOMER 2	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	21	
044-MCC-107 B-P3	415	-	630	044-PMCC-103	044-MCC-107 B		Power cable for 044-MCC-107 INCOMER 2	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	21	
1803-PM-215 A-P1	415	75	126.41	044-PMCC-102	1803-PM-215 A		Power cable for PRIMARY ABSORBER INTERCOOLER-I PUMP	0.6/1	3PH	3	185	AL	XLPE	-	SWA	PVC	210	
1803-PM-215 B-P1	415	75	126.41	044-PMCC-102	1803-PM-215 B		Power cable for PRIMARY ABSORBER INTERCOOLER-I PUMP	0.6/1	3PH	3	185	AL	XLPE	-	SWA	PVC	210	
1803-PM-216 A-P1	415	110	186.14	044-PMCC-102	1803-PM-216 A		Power cable for PRIMARY ABSORBER INTERCOOLER-II PUMPS	0.6/1	3PH	3	120	AL	XLPE	-	SWA	PVC	220	
1803-PM-216 A-P2	415	110	186.14	044-PMCC-102	1803-PM-216 A		Power cable for PRIMARY ABSORBER INTERCOOLER-II PUMPS	0.6/1	3PH	3	120	AL	XLPE	-	SWA	PVC	220	
1803-PM-216 B-P1	415	110	186.14	044-PMCC-102	1803-PM-216 B		Power cable for PRIMARY ABSORBER INTERCOOLER-II PUMPS	0.6/1	3PH	3	120	AL	XLPE	-	SWA	PVC	220	
1803-PM-216 B-P2	415	110	186.14	044-PMCC-102	1803-PM-216 B		Power cable for PRIMARY ABSORBER INTERCOOLER-II PUMPS	0.6/1	3PH	3	120	AL	XLPE	-	SWA	PVC	220	
1803-PM-217 A-P1	415	132	222.89	044-PMCC-101	1803-PM-217 A		Power cable for PRIMARY ABSORBER BOTTOM PUMP	0.6/1	3PH	3	150	AL	XLPE	-	SWA	PVC	200	
1803-PM-217 A-P2	415	132	222.89	044-PMCC-101	1803-PM-217 A		Power cable for PRIMARY ABSORBER BOTTOM PUMP	0.6/1	3PH	3	150	AL	XLPE	-	SWA	PVC	200	
1803-PM-217 B-P1	415	132	222.89	044-PMCC-101	1803-PM-217 B		Power cable for PRIMARY ABSORBER BOTTOM PUMP	0.6/1	3PH	3	150	AL	XLPE	-	SWA	PVC	200	
1803-PM-217 B-P2	415	132	222.89	044-PMCC-101	1803-PM-217 B		Power cable for PRIMARY ABSORBER BOTTOM PUMP	0.6/1	3PH	3	150	AL	XLPE	-	SWA	PVC	200	
1803-PM-218 A-P1	415	132	222.89	044-PMCC-102	1803-PM-218 A		Power cable for DEBUTANIZER REFLUX PUMP	0.6/1	3PH	3	150	AL	XLPE	-	SWA	PVC	295	
1803-PM-218 A-P2	415	132	222.89	044-PMCC-102	1803-PM-218 A		Power cable for DEBUTANIZER REFLUX PUMP	0.6/1	3PH	3	150	AL	XLPE	-	SWA	PVC	295	
1803-PM-218 B-P1	415	132	222.89	044-PMCC-102	1803-PM-218 B		Power cable for DEBUTANIZER REFLUX PUMP	0.6/1	3PH	3	150	AL	XLPE	-	SWA	PVC	295	
1803-PM-218 B-P2	415	132,00	222.89	044-PMCC-102	1803-PM-218 B		Power cable for DEBUTANIZER REFLUX PUMP	0.6/1	3PH	3	150	AL	XLPE	-	SWA	PVC	295	
1803-PM-219 A-P1	415	160.00	260.89	044-PMCC-102	1803-PM-219 A		Power cable for LPG PRODUCT PUMP	0.6/1	3PH	3	185	AL	XLPE	-	SWA	PVC	305	
1803-PM-219 A-P2	415	160.00	260.89	044-PMCC-102	1803-PM-219 A		Power cable for LPG PRODUCT PUMP	0.6/1	3PH	3	185	AL	XLPE	-	SWA	PVC	305	
1803-PM-219 B-P1	415	160.00	260.89	044-PMCC-102	1803-PM-219 B		Power cable for LPG PRODUCT PUMP	0.6/1	3PH	3	185	AL	XLPE	-	SWA	PVC	305	
1803-PM-219 B-P2	415	160,00	260.89	044-PMCC-102	1803-PM-219 B		Power cable for LPG PRODUCT PUMP	0.6/1	3PH	3	185	AL	XLPE	-	SWA	PVC	305	
1803-X-107-P003A-P1	415	132.00	218.97	044-PMCC-102	1803-X-107-P003A		Power cable for SPRAY TOWER RECIRCULATION PUMP (WET GAS SCRUBBER PACKAGE)	0.6/1	3PH	3	150	AL	XLPE	-	SWA	PVC	80	
1803-X-107-P003A-P2	415	132.00	218.97	044-PMCC-102	1803-X-107-P003A		Power cable for SPRAY TOWER RECIRCULATION PUMP (WET GAS SCRUBBER PACKAGE)	0.6/1	3PH	3	150	AL	XLPE	-	SWA	PVC	80	
1803-X-107-P003B-P1	415	132.00	218.97	044-PMCC-102	1803-X-107-P003B		Power cable for SPRAY TOWER RECIRCULATION PUMP (WET GAS SCRUBBER PACKAGE)	0.6/1	3PH	3	150	AL	XLPE	-	SWA	PVC	80	
1803-X-107-P003B-P2	415	132,00	218.97	044-PMCC-102	1803-X-107-P003B		Power cable for SPRAY TOWER RECIRCULATION PUMP (WET GAS SCRUBBER PACKAGE)	0.6/1	3PH	3	150	AL	XLPE	-	SWA	PVC	80	
1803-X-107-P003C-P1	415	132.00	218.97	044-PMCC-102	1803-X-107-P003C		Power cable for SPRAY TOWER RECIRCULATION PUMP (WET GAS SCRUBBER PACKAGE)	0.6/1	3PH	3	150	AL	XLPE	-	SWA	PVC	80	
1803-X-107-P003C-P2	415	132,00	218.97	044-PMCC-102	1803-X-107-P003C		Power cable for SPRAY TOWER RECIRCULATION PUMP (WET GAS SCRUBBER PACKAGE)	0.6/1	3PH	3	150	AL	XLPE	-	SWA	PVC	80	
1803-X-107-P004A-P1	415	90.00	149.30	044-PMCC-102	1803-X-107-P004A		Power cable for FILTERING MODULES RECIRCULATION PUMP (WET GAS SCRUBBER PACKAGE)	0.6/1	3PH	3	240	AL	XLPE	-	SWA	PVC	80	
1803-X-107-P004B-P1	415	90.00	149.30	044-PMCC-102	1803-X-107-P004B		Power cable for FILTERING MODULES RECIRCULATION PUMP (WET GAS SCRUBBER PACKAGE)	0.6/1	3PH	3	240	AL	XLPE	-	SWA	PVC	80	
044-TR-107A-P1	415	125 (*)	278.24	044-PMCC-103	044-TR-107A		Power cable for Main Lighting transformer 0.415 / 0.433 Kv (044-MLDB-101)	0.6/1	3PH+N	4	300	AL	XLPE	-	SWA	PVC	20	
044-TR-107B-P1	415	126 (*)	278.24	044-PMCC-103	044-TR-107B		Power cable for Main Lighting transformer 0.415 / 0.433 Kv (044-MLDB-101)	0.6/1	3PH+N	4	300	AL	XLPE	-	SWA	PVC	20	
1803-PM-203 A-P1	415	55.00	94.37	044-PMCC-103	1803-PM-203 A		Power cable for LCO PRODUCT PUMP	0.6/1	3PH	3	120	AL	XLPE	-	SWA	PVC	270	
1803-PM-203 B-P1	415	55.00	94.37	044-PMCC-103	1803-PM-203 B		Power cable for LCO PRODUCT PUMP	0.6/1	3PH	3	120	AL	XLPE	-	SWA	PVC	270	
1803-PM-212 A-P1	415	75.00	126.41	044-PMCC-103	1803-PM-212 A		Power cable for COMPRESSOR INTERSTAGE LIQUID PUMP	0.6/1	3PH	3	185	AL	XLPE	-	SWA	PVC	305	
1803-PM-212 B-P1	415	75.00	126.41	044-PMCC-103	1803-PM-212 B		Power cable for COMPRESSOR INTERSTAGE LIQUID PUMP	0.6/1	3PH	3	185	AL	XLPE	-	SWA	PVC	305	
1803-PM-220 A-P1	415	75.00	126.41	044-PMCC-103	1803-PM-220 A		Power cable for LEAN OIL PUMP	0.6/1	3PH	3	185	AL	XLPE	-	SWA	PVC	100	
1803-PM-220 B-P1	415	75.00	126.41	044-PMCC-103	1803-PM-220 B		Power cable for LEAN OIL PUMP	0.6/1	3PH	3	185	AL	XLPE	-	SWA	PVC	100	
1803-PM-209 A-P1	415	132.00	218.11	044-PMCC-103	1803-PM-209 A		Power cable for DISTILLATE DRUM LIQUID PUMP	0.6/1	3PH	3	150	AL	XLPE	-	SWA	PVC	195	
1803-PM-209 A-P2	415	132.00	218.11	044-PMCC-103	1803-PM-209 A		Power cable for DISTILLATE DRUM LIQUID PUMP	0.6/1	3PH	3	150	AL	XLPE	-	SWA	PVC	195	
1803-PM-209 B-P1	415	132.00	218.11	044-PMCC-103	1803-PM-209 B		Power cable for DISTILLATE DRUM LIQUID PUMP	0.6/1	3PH	3	150	AL	XLPE	-	SWA	PVC	195	
1803-PM-209 B-P2	415	132,00	218.11	044-PMCC-103	1803-PM-209 B		Power cable for DISTILLATE DRUM LIQUID PUMP	0.6/1	3PH	3	150	AL	XLPE	-	SWA	PVC	195	
1803-PM-225 A-P1	415	75.00	132.14	044-PMCC-103	1803-PM-225 A		Power cable for RICH AMINE PUMP	0.6/1	3PH	3	240	AL	XLPE	-	SWA	PVC	115	
1803-PM-225 B-P1	415	75.00	132.14	044-PMCC-103	1803-PM-225 B		Power cable for RICH AMINE PUMP	0.6/1	3PH	3	240	AL	XLPE	-	SWA	PVC	115	
1803-X-205-P-006A-P1	415	90.00	151.49	044-PMCC-103	1803-X-205-P-006A		Power cable for REGENERATED CAUSTIC PUMPS (CR LPG TREATMENT PACKAGE)	0.6/1	3PH	3	240	AL	XLPE	-	SWA	PVC	350	
1803-X-205-P-006A-P2	415	90.00	151.49	044-PMCC-103	1803-X-205-P-006A		Power cable for REGENERATED CAUSTIC PUMPS (CR LPG TREATMENT PACKAGE)	0.6/1	3PH	3	240	AL	XLPE	-	SWA			

Table 129. Electrical cables list (part 3).

 				ELECTRICAL CABLES LIST												
PROJECT:				EPCC-2 PACKAGE (INDMAX RECCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LuPech" (J-18)												
CLIENT:				INDIAN OIL CORPORATION LIMITED												
CABLE TAG	RATED VOLTAGE (V)	RATED POWER (kW) (*) KVA	RATED CURRENT (A)	FROM		DESTINATION		CABLE DESCRIPTION								
				BOARD	USER TAG	DESCRIPTION	INSULATION RATED VOLTAGE (kV)	TYPE	CORES	SIZE (mm²)	CONDUCTOR	INSULATION	SCREENED	ARMOUR	OUTER SHEATH	LENGTH (m)
1803-X-205-P-010B-P2	415	125	210.41	044-PMCC-103	1803-X-205-P-010B	Power cable for LPG BOOSTER PUMPS (CR LPG TREATMENT PACKAGE)	0.6/1	3PH	3	150	AL	XLPE	-	SWA	PVC	350
OXTM-A-P1	415	75	124.42	044-PMCC-101	OXTM-A	Power cable for OXIDATION TANK MIXER MOTORS A (1803-X-107)	0.6/1	3PH	3	120	AL	XLPE	-	SWA	PVC	80
OXTM-B-P1	415	75	124.42	044-PMCC-101	OXTM-B	Power cable for OXIDATION TANK MIXER MOTORS B (1803-X-107)	0.6/1	3PH	3	120	AL	XLPE	-	SWA	PVC	80
OXTM-C-P1	415	75	124.42	044-PMCC-101	OXTM-C	Power cable for OXIDATION TANK MIXER MOTORS C (1803-X-107)	0.6/1	3PH	3	120	AL	XLPE	-	SWA	PVC	80
044-ASB-101A-P1	415	-	630	044-PMCC-103	044-ASB-101A	Power cable for 044-ASB-101 (WELDINGSOCKETS) INCOMER 1	0.6/1	3PH+N	4	120	AL	XLPE	-	AWA	PVC	20
044-ASB-101A-P2	415	-	630	044-PMCC-103	044-ASB-101A	Power cable for 044-ASB-101 (WELDINGSOCKETS) INCOMER 1	0.6/1	3PH+N	4	120	AL	XLPE	-	AWA	PVC	20
044-ASB-101B-P1	415	-	630	044-PMCC-103	044-ASB-101B	Power cable for 044-ASB-101 (WELDINGSOCKETS) INCOMER 2	0.6/1	3PH+N	4	120	AL	XLPE	-	AWA	PVC	20
044-ASB-101B-P2	415	-	630	044-PMCC-103	044-ASB-101B	Power cable for 044-ASB-101 (WELDINGSOCKETS) INCOMER 2	0.6/1	3PH+N	4	120	AL	XLPE	-	AWA	PVC	20
044-ASB-102A-P1	415	-	630	044-PMCC-103	044-ASB-102A	Power cable for 044-ASB-102 (WELDINGSOCKETS) INCOMER 1	0.6/1	3PH+N	4	150	AL	XLPE	-	AWA	PVC	20
044-ASB-102A-P2	415	-	630	044-PMCC-103	044-ASB-102A	Power cable for 044-ASB-102 (WELDINGSOCKETS) INCOMER 1	0.6/1	3PH+N	4	150	AL	XLPE	-	AWA	PVC	20
044-ASB-102B-P1	415	-	630	044-PMCC-103	044-ASB-102B	Power cable for 044-ASB-102 (WELDINGSOCKETS) INCOMER 2	0.6/1	3PH+N	4	150	AL	XLPE	-	AWA	PVC	20
044-ASB-102B-P2	415	-	630	044-PMCC-103	044-ASB-102B	Power cable for 044-ASB-102 (WELDINGSOCKETS) INCOMER 2	0.6/1	3PH+N	4	150	AL	XLPE	-	AWA	PVC	20
ESS-044-HVAC-1-P1	415	450	709.8	044-PMCC-103	ESS-044-HVAC-1	Power cable for ESS-044 HVAC MCC INCOMER 1	0.6/1	3PH+N	4	240	AL	XLPE	-	SWA	PVC	20
ESS-044-HVAC-1-P2	415	450	709.8	044-PMCC-103	ESS-044-HVAC-1	Power cable for ESS-044 HVAC MCC INCOMER 1	0.6/1	3PH+N	4	240	AL	XLPE	-	SWA	PVC	20
ESS-044-HVAC-1-P3	415	450	709.8	044-PMCC-103	ESS-044-HVAC-1	Power cable for ESS-044 HVAC MCC INCOMER 1	0.6/1	3PH+N	4	240	AL	XLPE	-	SWA	PVC	20
ESS-044-HVAC-2-P1	415	450	709.8	044-PMCC-103	ESS-044-HVAC-2	Power cable for ESS-044 HVAC MCC INCOMER 2	0.6/1	3PH+N	4	240	AL	XLPE	-	SWA	PVC	20
ESS-044-HVAC-2-P2	415	450	709.8	044-PMCC-103	ESS-044-HVAC-2	Power cable for ESS-044 HVAC MCC INCOMER 2	0.6/1	3PH+N	4	240	AL	XLPE	-	SWA	PVC	20
ESS-044-HVAC-2-P3	415	450	709.8	044-PMCC-103	ESS-044-HVAC-2	Power cable for ESS-044 HVAC MCC INCOMER 2	0.6/1	3PH+N	4	240	AL	XLPE	-	SWA	PVC	20
044-UPS-101A-P1	415	100(*)	-	044-PMCC-103	044-UPS-101A	Power cable for 044-UPS 101 (DCS/ESD) INCOMER 1	0.6/1	3PH+N	4	120	AL	XLPE	-	SWA	PVC	180
044-UPS-101A-P2	415	100(*)	-	044-PMCC-103	044-UPS-101A	Power cable for 044-UPS 101 (DCS/ESD) INCOMER 1	0.6/1	3PH+N	4	120	AL	XLPE	-	SWA	PVC	180
044-UPS-101C-P1	415	100(*)	-	044-PMCC-103	044-UPS-101C	Power cable for 044-UPS 101 (DCS/ESD) INCOMER 3	0.6/1	3PH+N	4	120	AL	XLPE	-	SWA	PVC	180
044-UPS-101C-P2	415	100(*)	-	044-PMCC-103	044-UPS-101C	Power cable for 044-UPS 101 (DCS/ESD) INCOMER 3	0.6/1	3PH+N	4	120	AL	XLPE	-	SWA	PVC	180
044-UPS-101B-P1	415	100(*)	-	044-EPMCC-101	044-UPS-101B	Power cable for 044-UPS 101 (INSTR LOAD DCS /ESD) INCOMER 2	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	180
044-UPS-101D-P1	415	100(*)	-	044-EPMCC-101	044-UPS-101D	Power cable for 044-UPS 101 (INSTR LOAD DCS /ESD) INCOMER 4	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	180
044-UPS-102A-P1	415	25(*)	-	044-PMCC-103	044-UPS-102A	Power cable for 044-UPS 102 (TELECOM, CCTV, PAGING & FDAS SYSTEM) INCOMER 1	0.6/1	3PH+N	4	70	AL	XLPE	-	SWA	PVC	180
044-UPS-102C-P1	415	25(*)	-	044-PMCC-103	044-UPS-102C	Power cable for 044-UPS 102 (TELECOM, CCTV, PAGING & FDAS SYSTEM) INCOMER 3	0.6/1	3PH+N	4	70	AL	XLPE	-	SWA	PVC	180
044-UPS-102B-P1	415	100(*)	-	044-EPMCC-101	044-UPS-102B	Power cable for 044-UPS 102 (TELECOM, CCTV, PAGING & FDAS SYSTEM) INCOMER 2	0.6/1	3PH+N	4	35	AL	XLPE	-	SWA	PVC	180
044-UPS-102D-P1	415	100(*)	-	044-EPMCC-101	044-UPS-102D	Power cable for 044-UPS 102 (TELECOM, CCTV, PAGING & FDAS SYSTEM) INCOMER 4	0.6/1	3PH+N	4	35	AL	XLPE	-	SWA	PVC	180
044-DC-101A-P1	415	50	79.05	044-PMCC-103	044-DC-101A	Power cable for 044-DC 101 (SWITCHGEAR CONTROL) INCOMER 1	0.6/1	3PH+N	4	70	AL	XLPE	-	SWA	PVC	30
044-DC-101B-P1	415	50	80.66	044-EPMCC-101	044-DC-101B	Power cable for 044-DC 101 (SWITCHGEAR CONTROL) INCOMER 2	0.6/1	3PH+N	4	95	AL	XLPE	-	SWA	PVC	30
044-DC-102-P1	415	50	80.66	044-EPMCC-101	044-DC-102	Power cable for 044-DC 102 (CRITICAL LIGHTING) INCOMER	0.6/1	3PH+N	4	25	AL	XLPE	-	SWA	PVC	30
044-ACDB-101A-P1	110	80.00	781.17	044-UPS-101 A	044-ACDB-101	Output Cable From UPS-101 A to ACDB-101	0.6/1	1PH	1	500	AL	XLPE	-	AWA	PVC	10
044-ACDB-101A-P2	110	80.00	781.17	044-UPS-101 A	044-ACDB-101	Output Cable From UPS-101 A to ACDB-101	0.6/1	N	1	500	AL	XLPE	-	AWA	PVC	10
044-ACDB-101A-P3	110	80.00	781.17	044-UPS-101 A	044-ACDB-101	Output Cable From UPS-101 A to ACDB-101	0.6/1	1PH	1	500	AL	XLPE	-	AWA	PVC	10
044-ACDB-101A-P4	110	80.00	781.17	044-UPS-101 A	044-ACDB-101	Output Cable From UPS-101 A to ACDB-101	0.6/1	N	1	500	AL	XLPE	-	AWA	PVC	10
044-ACDB-101B-P1	110	80.00	781.17	044-UPS-101 C	044-ACDB-101	Output Cable From UPS-101 C to ACDB-101	0.6/1	1PH	1	500	AL	XLPE	-	AWA	PVC	10
044-ACDB-101B-P2	110	80.00	781.17	044-UPS-101 C	044-ACDB-101	Output Cable From UPS-101 C to ACDB-101	0.6/1	N	1	500	AL	XLPE	-	AWA	PVC	10
044-ACDB-101B-P3	110	80.00	781.17	044-UPS-101 C	044-ACDB-101	Output Cable From UPS-101 C to ACDB-101	0.6/1	1PH	1	500	AL	XLPE	-	AWA	PVC	10
044-ACDB-101B-P4	110	80.00	781.17	044-UPS-101 C	044-ACDB-101	Output Cable From UPS-101 C to ACDB-101	0.6/1	N	1	500	AL	XLPE	-	AWA	PVC	10
044-ACDB-102A-P1	110	80.00	781.17	044-UPS-102 A	044-ACDB-102	Output Cable From UPS-102 A to ACDB-102	0.6/1	1PH	1	500	AL	XLPE	-	AWA	PVC	10
044-ACDB-102A-P2	110	80.00	781.17	044-UPS-102 A	044-ACDB-102	Output Cable From UPS-102 A to ACDB-102	0.6/1	N	1	500	AL	XLPE	-	AWA	PVC	10
044-ACDB-102B-P1	110	80.00	781.17	044-UPS-102 C	044-ACDB-102	Output Cable From UPS-102 C to ACDB-102	0.6/1	1PH	1	500	AL	XLPE	-	AWA	PVC	10
044-ACDB-102B-P2	110	80.00	781.17	044-UPS-102 C	044-ACDB-102	Output Cable From UPS-102 C to ACDB-102	0.6/1	N	1	500	AL	XLPE	-	AWA	PVC	10
044-NonDCSPDB-P1	110	15.00	146.47	044-ACDB-101A	NON DCS PDB FEEDER -1	Out Going From ACDB-101 to NON DCS PDB-1	0.6/1	1PH	1	500	AL	XLPE	-	AWA	PVC	50
044-NonDCSPDB-P2	110	15.00	146.47	044-ACDB-101A	NON DCS PDB FEEDER -1	Out Going From ACDB-101 to NON DCS PDB-1	0.6/1	N	1	500	AL	XLPE	-	AWA	PVC	50
044-DCSPDB-P1	110	65.00	634.70	044-ACDB-101A	DCS PDB FEEDER -1	Out Going From ACDB-101 to DCS PDB-1	0.6/1	1PH	1	500	AL	XLPE	-	AWA	PVC	50
044-DCSPDB-P2	110	65.00	634.70	044-ACDB-101A	DCS PDB FEEDER -1	Out Going From ACDB-101 to DCS PDB-1	0.6/1	N	1	500	AL	XLPE	-	AWA	PVC	50
044-DCSPDB-P3	110	65.00	634.70	044-ACDB-101A	DCS PDB FEEDER -1	Out Going From ACDB-101 to DCS PDB-1	0.6/1	1PH	1	500	AL	XLPE	-	AWA	PVC	50
044-DCSPDB-P4	110	65.00	634.70	044-ACDB-101A	DCS PDB FEEDER -1	Out Going From ACDB-101 to DCS PDB-1	0.6/1	N	1	500	AL	XLPE	-	AWA	PVC	50
044-DCSPDB-P5	110	65.00	634.70	044-ACDB-101A	DCS PDB FEEDER -1	Out Going From ACDB-101 to DCS PDB-1	0.6/1	1PH	1	500	AL	XLPE	-	AWA	PVC	50
044-DCSPDB-P6	110	65.00	634.70	044-ACDB-101A	DCS PDB FEEDER -1	Out Going From ACDB-101 to DCS PDB-1	0.6/1	N	1	500	AL	XLPE	-	AWA	PVC	50
044-DCSPDB-P7	110	65.00	634.70	044-ACDB-101A	DCS PDB FEEDER -1	Out Going From ACDB-101 to DCS PDB-1	0.6/1	1PH	1	500	AL	XLPE	-	AWA	PVC	50
044-DCSPDB-P8	110	65.00	634.70	044-ACDB-101A	DCS PDB FEEDER -1	Out Going From ACDB-101 to DCS PDB-1	0.6/1	N	1	500	AL	XLPE	-	AWA	PVC	50
044-NonDCSPDB-P3	110	15.00	146.47	044-ACDB-101A	DCS PDB FEEDER -1	Out Going From ACDB-101 to DCS PDB-1	0.6/1	1PH	1	500	AL	XLPE	-	AWA	PVC	50
044-NonDCSPDB-P4	110	15.00	146.47	044-ACDB-101A	NON DCS PDB FEEDER -2	Out Going From ACDB-101 to NON DCS PDB-2	0.6/1	N	1	500	AL	XLPE	-	AWA	PVC	50
044-DCSPDB-P9	110	65.00	634.70	044-ACDB-101A	NON DCS PDB FEEDER -2	Out Going From ACDB-101 to NON DCS PDB-2	0.6/1	1PH	1	500	AL	XLPE	-	AWA	PVC	50
044-DCSPDB-P10	110	65.00	634.70	044-ACDB-101A	DCS PDB FEEDER -2	Out Going From ACDB-101 to DCS PDB-2	0.6/1	N	1	500	AL	XLPE	-	AWA	PVC	50
044-DCSPDB-P11	110	65.00	634.70	044-ACDB-101A	DCS PDB FEEDER -2	Out Going From ACDB-101 to DCS PDB-2	0.6/1	1PH	1	500	AL	XLPE	-	AWA	PVC	50
044-DCSPDB-P12	110	65.00	634.70	044-ACDB-101A	DCS PDB FEEDER -2	Out Going From ACDB-101 to DCS PDB-2	0.6/1	N	1	500	AL	XLPE	-	AWA	PVC	50
044-DCSPDB-P13	110	65.00	634.70	044-ACDB-101A	DCS PDB FEEDER -2	Out Going From ACDB-101 to DCS PDB-2	0.6/1	1PH	1	500	AL	XLPE	-	AWA	PVC	50
044-DCSPDB-P14	110	65.00	634.70	044-ACDB-101A	DCS PDB FEEDER -2	Out Going From ACDB-101 to DCS PDB-2	0.6/1	N	1	500	AL	XLPE	-	AWA	PVC	50
044-DCSPDB-P15	110	65.00	634.70	044-ACDB-101A	DCS PDB FEEDER -2	Out Going From ACDB-101 to DCS PDB-2	0.6/1	1PH	1	500	AL	XLPE	-	AWA	PVC	50
044-DCSPDB-P16	110	65.00	634.70	044-ACDB-101A	DCS PDB FEEDER -2	Out Going From ACDB-101 to DCS PDB-2	0.6/1	N	1	500	AL	XLPE	-	AWA	PVC	50
044-DCDB-101A-P1	110	-	-	044-DCDB-101A Charger	044-DCDB-101A	Power Cable From Charger To Switchgear DCDB-101 (BUS-A)	0.6/1	1PH+N	2	35	CU	XLPE	-	SWA	PVC	10
044-DCDB-101B-P1	110	-	-	044-DCDB-101B Charger	044-DCDB-101B	Power Cable For Switchgear DCDB-101 (BUS-B)	0.6/1	1PH+N	2	35	CU	XLPE	-	SWA	PVC	10

Table 130. Electrical cables list (part 4).

 				ELECTRICAL CABLES LIST												
PROJECT: EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LaPeck" (J-18)																
CLIENT: INDIAN OIL CORPORATION LIMITED																
CABLE TAG	RATED VOLTAGE (V)	RATED POWER (kW) (*) KVA	RATED CURRENT (A)	FROM BOARD	USER TAG	DESCRIPTION	INSULATION RATED VOLTAGE (kV)	TYPE	CORES	SIZE (mm²)	CONDUCTOR	INSULATION	SCREENED	ARMOUR	OUTER SHEATH	LENGTH (m)
044-DCDB-102-P1	110	-	-	044-DCDB-102 Charger	044-DCDB-102	Power Cable From Critical Lighting Charger To DCDB-102	0.6/1	1PH+N	2	35	CU	XLPE	-	SWA	PVC	10
044-BBS-101A-P1	110	-	-	FROM	044-DB-101A Switch	DC Cable From Charger To Battery Bank Isolating Switch For 044-DC-101A	0.6/1	1PH+N	2	120	CU	XLPE	-	SWA	PVC	10
044-BB-101A-P1	110	-	-	044-BB-101A Switch	044-BB-101A	Battery Bank Isolating Switch For 044-DC-101A To Battery Bank-1	0.6/1	1PH+N	2	120	CU	XLPE	-	SWA	PVC	5
044-BBS-101B-P1	110	-	-	044-BB-101B Switch	044-BB-101B	DC Cable From Charger To Battery Bank Isolating Switch For 044-DC-101B	0.6/1	1PH+N	2	120	CU	XLPE	-	SWA	PVC	10
044-BB-101B-P1	110	-	-	044-BB-101B Switch	044-BB-101B	Battery Bank Isolating Switch For 044-DC-101B To Battery Bank-2	0.6/1	1PH+N	2	120	CU	XLPE	-	SWA	PVC	5
044-BBS-102-P1	110	-	-	044-DCDB-102 Charger	044-BB-102 Switch	DC Cable From Charger To Battery Bank Isolating Switch For 044-DC-102	0.6/1	1PH+N	2	25	CU	XLPE	-	SWA	PVC	10
044-BB-102-P1	110	-	-	044-BB-102 Switch	044-BB-102	Battery Bank Isolating Switch For 044-DC-102 To Battery Bank-1	0.6/1	1PH+N	2	25	CU	XLPE	-	SWA	PVC	5
044-BBS-103A-P1	110	-	-	044-UPS-101A	044-UPS-101A Switch	Battery Cable From UPS-101 A To Battery Bank Isolating Switch For UPS-101 A	0.6/1	1PH	1	185	CU	XLPE	-	SWA	PVC	20
044-BBS-103A-P2	110	-	-	044-UPS-101A	044-UPS-101A	Battery Cable From UPS-101 A To Battery Bank Isolating Switch For UPS-101 A	0.6/1	N	1	185	CU	XLPE	-	SWA	PVC	20
044-BB-103A-P1	110	-	-	044-UPS-101A Switch	044-BB-103A	Battery Bank Isolating Switch For 044-UPS-101 A To Battery Bank-1	0.6/1	1PH	1	185	CU	XLPE	-	SWA	PVC	10
044-BB-103A-P2	110	-	-	044-BB-103A	044-BB-103A	Battery Bank Isolating Switch For 044-UPS-101 A To Battery Bank-1	0.6/1	N	1	185	CU	XLPE	-	SWA	PVC	10
044-BBS-103B-P1	110	-	-	044-UPS-101C	044-UPS-101C Switch	Battery Cable From UPS-101 C To Battery Bank Isolating Switch For UPS-101 C	0.6/1	1PH	1	185	CU	XLPE	-	SWA	PVC	20
044-BBS-103B-P2	110	-	-	044-UPS-101C	044-UPS-101C	Battery Cable From UPS-101 C To Battery Bank Isolating Switch For UPS-101 C	0.6/1	N	1	185	CU	XLPE	-	SWA	PVC	20
04-BB-103B-P1	110	-	-	044-UPS-101C Switch	044-BB-103B	Battery Bank Isolating Switch For 044-UPS-101 C To Battery Bank-2	0.6/1	1PH	1	185	CU	XLPE	-	SWA	PVC	10
044-BB-103B-P2	110	-	-	044-UPS-101C	044-BB-103B	Battery Bank Isolating Switch For 044-UPS-101 C To Battery Bank-2	0.6/1	N	1	185	CU	XLPE	-	SWA	PVC	10
044-BBS-104A-P1	110	-	-	044-UPS-102A	044-UPS-102A Switch	Battery Cable From UPS-102 A To Battery Bank Isolating Switch For UPS-102 A	0.6/1	1PH+N	2	70	CU	XLPE	-	SWA	PVC	20
044-BB-104A-P1	110	-	-	044-UPS-102A Switch	044-BB-104A	Battery Bank Isolating Switch For 044-UPS-102 A To Battery Bank-1	0.6/1	1PH+N	2	70	CU	XLPE	-	SWA	PVC	10
044-BBS-104B-P1	110	-	-	044-UPS-102C	044-UPS-102C Switch	Battery Cable From UPS-102 C To Battery Bank Isolating Switch For UPS-102 C	0.6/1	1PH+N	2	70	CU	XLPE	-	SWA	PVC	20
044-BB-104B-P1	110	-	-	044-UPS-102C Switch	044-BB-104B	Battery Bank Isolating Switch For 044-UPS-102 C To Battery Bank-2	0.6/1	1PH+N	2	70	CU	XLPE	-	SWA	PVC	10
044-TR-108A-P1	415	-	139.12	044-PMCC-103	044-TR-108A	Power cable for Emergency Lighting transformer 415 / 433V (044-EMLDB-101)	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	30
044-TR-108B-P1	415	-	139.12	042-EPMCC-101	044-TR-108B	Power cable for Emergency Lighting transformer 0.415 / 0.433 Kv (044-EMLDB-101)	0.6/1	3PH+N	4	185	AL	XLPE	-	SWA	PVC	30
1803-PM-603-P1	415	15	24.2	042-EPMCC-101	1803-PM-603	Power cable for HEAVY HC CLOSED BLOWDOWN DRUM PUMP	0.6/1	3PH	3	16	CU	XLPE	-	SWA	PVC	300
1803-PM-604 A-P1	415	30	54.01	044-EPMCC-101	1803-PM-604 A	Power cable for FLARE KOD PUMP	0.6/1	3PH	3	95	AL	XLPE	-	SWA	PVC	305
1803-PM-604 B-P1	415	30	54.01	044-EPMCC-101	1803-PM-604 B	Power cable for FLARE KOD PUMP	0.6/1	3PH	3	95	AL	XLPE	-	SWA	PVC	305
1803-PM-608 A-P1	415	55	88.72	044-EPMCC-101	1803-PM-608 A	Power cable for FLUSHING OIL DRUM PUMP	0.6/1	3PH	3	95	AL	XLPE	-	SWA	PVC	345
1803-PM-608 B-P1	415	55	88.72	044-EPMCC-101	1803-PM-608 B	Power cable for FLUSHING OIL DRUM PUMP	0.6/1	3PH	3	95	AL	XLPE	-	SWA	PVC	345
1803-P-226 A-P1	415	0.37	0.59	044-EPMCC-101	1803-P-226 A	Power cable for CORROSION INHIBITOR INJECTION PUMP MOTOR (1803-X-202)	0.6/1	3PH	3	2.5	CU	XLPE	-	SWA	PVC	220
1803-P-227 A-P1	415	0.37	0.59	044-EPMCC-101	1803-P-227 A	Power cable for CORROSION INHIBITOR INJECTION PUMP MOTOR (1803-X-202)	0.6/1	3PH	3	2.5	CU	XLPE	-	SWA	PVC	220
1803-P-228 A-P1	415	0.37	0.59	044-EPMCC-101	1803-P-228 A	Power cable for CORROSION INHIBITOR INJECTION PUMP MOTOR (1803-X-202)	0.6/1	3PH	3	2.5	CU	XLPE	-	SWA	PVC	220
1803-P-229 A-P1	415	0.37	0.59	044-EPMCC-101	1803-P-229 A	Power cable for AMMONIUM POLYSULPHIDE DOSING PUMP MOTOR (1803-X-203)	0.6/1	3PH	3	2.5	CU	XLPE	-	SWA	PVC	220
1803-P-230 A-P1	415	0.37	0.59	044-EPMCC-101	1803-P-230 A	Power cable for ANTIFOAM INJECTION PUMP MOTOR (1803-X-204)	0.6/1	3PH	3	2.5	CU	XLPE	-	SWA	PVC	220
1803-P-231 A-P1	415	0.37	0.59	044-EPMCC-101	1803-P-1004 A	Power cable for PHOSPHATE INJECTION PUMP MOTOR (1803-X-601)	0.6/1	3PH	3	2.5	CU	XLPE	-	SWA	PVC	220
1803-P-231 S-P1	415	0.37	0.59	044-EPMCC-101	1803-P-1004 B	Power cable for PHOSPHATE INJECTION PUMP MOTOR (1803-X-601)	0.6/1	3PH	3	2.5	CU	XLPE	-	SWA	PVC	220
1803-P-232 A-P1	415	0.37	0.59	044-EPMCC-101	1803-P-1004 C	Power cable for PHOSPHATE INJECTION PUMP MOTOR (1803-X-601)	0.6/1	3PH	3	2.5	CU	XLPE	-	SWA	PVC	220
1803-P-232 S-P1	415	0.37	0.59	044-EPMCC-101	1803-P-1004 D	Power cable for PHOSPHATE INJECTION PUMP MOTOR (1803-X-601)	0.6/1	3PH	3	2.5	CU	XLPE	-	SWA	PVC	220
1803-P-233 A-P1	415	0.37	0.59	044-EPMCC-101	1803-P-1005 A	Power cable for ALKALINE INJECTION PUMP MOTOR (1803-X-604)	0.6/1	3PH	3	2.5	CU	XLPE	-	SWA	PVC	220
1803-P-233 S-P1	415	0.37	0.59	044-EPMCC-101	1803-P-1005 B	Power cable for ALKALINE INJECTION PUMP MOTOR (1803-X-604)	0.6/1	3PH	3	2.5	CU	XLPE	-	SWA	PVC	220
1803-P-234 A-P1	415	0.37	0.59	044-EPMCC-101	1803-P-1006 A	Power cable for OXYGEN SCAVENGER DOSING PUMP MOTOR (1803-X-605)	0.6/1	3PH	3	2.5	CU	XLPE	-	SWA	PVC	220
1803-P-234 S-P1	415	0.37	0.59	044-EPMCC-101	1803-P-1006 B	Power cable for OXYGEN SCAVENGER DOSING PUMP MOTOR (1803-X-605)	0.6/1	3PH	3	2.5	CU	XLPE	-	SWA	PVC	220
1803-X-105-P-2-P1	415	1.50	2.41	044-EPMCC-101	1803-X-105-P-2	Power cable for COOLING OIL PUMP MOTOR (MAIN AIR BLOWER 1803-K-101)	0.6/1	3PH	3	2.5	CU	XLPE	-	SWA	PVC	170
1803-X-105-P-1-P1	415	1.50	2.41	044-EPMCC-101	1803-X-105-P-1	Power cable for AUXILIARY LUBE OIL PUMP MOTOR (MAIN AIR BLOWER 1803-K-101)	0.6/1	3PH	3	2.5	CU	XLPE	-	SWA	PVC	170
1803-X-105-FD-1-P1	415	1.50	2.41	044-EPMCC-101	1803-X-105-FD-1	Power cable for OIL MIST FAN MOTOR (MAIN AIR BLOWER 1803-K-101)	0.6/1	3PH	3	2.5	CU	XLPE	-	SWA	PVC	170
1803-X-105-P-5-P1	415	1.50	2.41	044-EPMCC-101	1803-X-105-P-5	Power cable for JACKING OIL PUMP MOTOR (MAIN AIR BLOWER 1803-K-101)	0.6/1	3PH	3	2.5	CU	XLPE	-	SWA	PVC	170
ST Rotor Turning Gear Motor For MAB-P1	415	0.18	0.29	044-EPMCC-101	ST ROTOR TURNING GEAR MOTOR (MAIN AIR BLOWER 1803-K-101)	Power cable for ST ROTOR TURNING GEAR MOTOR (MAIN AIR BLOWER 1803-K-101)	0.6/1	3PH	3	2.5	CU	XLPE	-	SWA	PVC	170
1803-K-201-P-2-P1	415	1.50	2.41	044-EPMCC-101	1803-K-201-P-2	Power cable for COOLING OIL PUMP MOTOR (WET GAS COMPRESSOR 1803-K-201)	0.6/1	3PH	3	2.5	CU	XLPE	-	SWA	PVC	240
1803-K-201-P-1-P1	415	1.50	2.41	044-EPMCC-101	1803-K-201-P-1	Power cable for AUXILIARY LUBE OIL PUMP MOTOR (WET GAS COMPRESSOR 1803-K-201)	0.6/1	3PH	3	2.5	CU	XLPE	-	SWA	PVC	240
1803-K-201-FD-1-P1	415	1.50	2.41	044-EPMCC-101	1803-K-201-FD-1	Power cable for OIL MIST FAN MOTOR (WET GAS COMPRESSOR 1803-K-201)	0.6/1	3PH	3	2.5	CU	XLPE	-	SWA	PVC	240
1803-K-201-P-5-P1	415	1.50	2.41	044-EPMCC-101	1803-K-201-P-5	Power cable for JACKING OIL PUMP MOTOR (WET GAS COMPRESSOR 1803-K-201)	0.6/1	3PH	3	2.5	CU	XLPE	-	SWA	PVC	240
ST ROTOR TURNING GEAR MOTOR FOR WGC-P1	415	0.18	0.29	044-EPMCC-101	ST ROTOR TURNING GEAR MOTOR (WET GAS COMPRESSOR 1803-K-201)	Power cable for ST ROTOR TURNING GEAR MOTOR (WET GAS COMPRESSOR 1803-K-201)	0.6/1	3PH	3	2.5	CU	XLPE	-	SWA	PVC	240
1803-K-201-P-3-P1	415	3.00	4.83	044-EPMCC-101	1803-K-201-P-3	Power cable for CONTROL OIL PUMP 1 (WGC 1803-K-201)	0.6/1	3PH	3	2.5	CU	XLPE	-	SWA	PVC	240
1803-K-201-P-4-P1	415	3.00	4.83	044-EPMCC-101	1803-K-201-P-4	Power cable for CONTROL OIL PUMP 2 (WGC 1803-K-201)	0.6/1	3PH	3	2.5	CU	XLPE	-	SWA	PVC	240
1803-K-105-P-3-P1	415	3.00	4.83	044-EPMCC-101	1803-K-105-P-3	Power cable for CONTROL OIL PUMP 1(MAB 1803-K-101)	0.6/1	3PH	3	2.5	CU	XLPE	-	SWA	PVC	240
1803-K-105-P-4-P1	415	3.00	4.83	044-EPMCC-101	1803-K-105-P-4	Power cable for CONTROL OIL PUMP 2(MAB 1803-K-101)	0.6/1	3PH	3	2.5	CU	XLPE	-	SWA	PVC	240
1803-PM-610 A-P1	415	160.00	260.34	044-EPMCC-101	1803-PM-610 A	Power cable for FIRE WATER BOOSTER PUMP-1	0.6/1	3PH	3	185	AL	XLPE	-	SWA	PVC	420
1803-PM-610 A-P2	415	160.00	260.34	044-EPMCC-101	1803-PM-610 A	Power cable for FIRE WATER BOOSTER PUMP-1	0.6/1	3PH	3	185	AL	XLPE	-	SWA	PVC	420
1803-PM-610 B-P1	415	160.00	260.34	044-EPMCC-101	1803-PM-610 B	Power cable for FIRE WATER BOOSTER PUMP-2	0.6/1	3PH	3	185	AL	XLPE	-	SWA	PVC	420
1803-PM-610 B-P2	415	160.00	260.34	044-EPMCC-101	1803-PM-610 B	Power cable for FIRE WATER BOOSTER PUMP-2	0.6/1	3PH	3	185	AL	XLPE	-	SWA	PVC	420
CR-HVAC-P1	415	140.00	220.83	044-EPMCC-101	CR-HVAC-1	Power cable for CONTROL ROOM HVAC MCC INCOMER 1	0.6/1	3PH+N	4	240	AL	XLPE	-	AWA	PVC	220
CR-HVAC-P2	415	140.00	220.83	044-EPMCC-101	CR-HVAC-1	Power cable for CONTROL ROOM HVAC MCC INCOMER 1	0.6/1	3PH+N	4	240	AL	XLPE	-	AWA	PVC	220
1803-PM-201 A-P1	415	30.00	54.01	044-MCC-101	1803-PM-201 A	Power cable for HCN PRODUCT PUMP	0.6/1	3PH	3	50	AL	XLPE	-	SWA	PVC	260
1803-PM-201 B-P1	415	30.00	54.01	044-MCC-101	1803-PM-201 B	Power cable for HCN PRODUCT PUMP	0.6/1	3PH	3	50	AL	XLPE	-	SWA	PVC	260
1803-PM-208 A-P1	415	22.00	36.84	044-MCC-101	1803-PM-208 A	Power cable for REFLUX DRUM SOUR WATER PUMP	0.6/1	3PH	3	25	AL	XLPE	-	SWA	PVC	170
1803-PM-208 B-P1	415	22.00	36.84	044-MCC-101	1803-PM-208 B	Power cable for REFLUX DRUM SOUR WATER PUMP	0.6/1	3PH	3	25	AL	XLPE	-	SWA	PVC	170
1803-PM-210 A-P1	415	15.00	26.87	044-MCC-101	1803-PM-210 A	Power cable for DISTILLATE DRUM SOUR WATER PUMP	0.6/1	3PH	3	16	CU	XLPE	-	SWA	PVC	190
1803-PM-210 B-P1	415	15.00	26.87	044-MCC-101	1803-PM-210 B	Power cable for DISTILLATE DRUM SOUR WATER PUMP	0.6/1	3PH	3	16	CU	XLPE	-	SWA	PVC	190

Table 131. Electrical cables list (part 5).

 				ELECTRICAL CABLES LIST													
PROJECT:		EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LaPech" (J-18)															
CLIENT:		INDIAN OIL CORPORATION LIMITED															
CABLE TAG	RATED VOLTAGE (V)	RATED POWER (kW) (% KVA)	RATED CURRENT (A)	FROM		DESTINATION	INSULATION RATED VOLTAGE (KV)	TYPE	CORES	SIZE (mm²)	CABLE DESCRIPTION						
				BOARD	USER TAG	DESCRIPTION					CONDUCTOR	INSULATION	SCREENED	ARMOUR	OUTER SHEATH	LENGTH (m)	
1803-PM-211 A-P1	415	5,5	10,99	044-MCC-101	1803-PM-211 A	Power cable for COMPRESSOR SUCTION KO DRUM PUMP	0.6/1	3PH	3	6	CU	XLPE	-	SWA	PVC	175	
1803-PM-223 A-P1	415	37	61,83	044-MCC-101	1803-PM-223 A	Power cable for SOUR WATER PUMP	0.6/1	3PH	3	50	AL	XLPE	-	SWA	PVC	150	
1803-PM-223 B-P1	415	37	61,37866345	044-MCC-101	1803-PM-223 B	Power cable for SOUR WATER PUMP	0.6/1	3PH	3	50	AL	XLPE	-	SWA	PVC	150	
1803-PM-601 A-P1	415	7,5	24,2	044-MCC-101	1803-PM-601 A	Power cable for CLOSED BLOWDOWN DRUM PUMP	0.6/2	3PH	3	16	CU	XLPE	-	SWA	PVC	260	
1803-PM-602 A-P1	415	11	17,7449677	044-MCC-101	1803-PM-602 A	Power cable for AMINE DRAIN DRUM PUMP	0.6/1	3PH	3	10	CU	XLPE	-	SWA	PVC	260	
1803-PM-606 A-P1	415	15	26,87	044-MCC-101	1803-PM-606 A	Power cable for SUSPECT CONDENSATE PUMP	0.6/1	3PH	3	10	CU	XLPE	-	SWA	PVC	120	
1803-PM-606 B-P1	415	15	26,87	044-MCC-101	1803-PM-606 B	Power cable for SUSPECT CONDENSATE PUMP	0.6/1	3PH	3	10	CU	XLPE	-	SWA	PVC	120	
1803-PM-611 A-P1	415	45	70,97987081	044-MCC-101	1803-PM-611 A	Power cable for CONTAMINATED RAIN WATER SEWER PUMP	0.6/1	3PH	3	95	AL	XLPE	-	SWA	PVC	80	
1803-PM-611 B-P1	415	45	70,97987081	044-MCC-101	1803-PM-611 B	Power cable for CONTAMINATED RAIN WATER SEWER PUMP	0.6/1	3PH	3	95	AL	XLPE	-	SWA	PVC	80	
1803-PM-612 A-P1	415	7,5	24,2	044-MCC-101	1803-PM-612 A	Power cable for OILY WATER SEWER PUMP	0.6/1	3PH	3	6	CU	XLPE	-	SWA	PVC	80	
1803-AM-1001 -P1	415	1,1	1,765692875	044-MCC-101	1803-AM-1001	Power cable for CORROSION INHIBITOR DRUM AGITATOR MOTOR	0.6/1	3PH	3	2,5	CU	XLPE	-	SWA	PVC	220	
1803-AM-1002-P1	415	1,1	1,765692875	044-MCC-101	1803-AM-1002	Power cable for AMMONIUM POLYSULPHIDE DRUM AGITATOR MOTOR	0.6/1	3PH	3	2,5	CU	XLPE	-	SWA	PVC	200	
1803-AM-1003-P1	415	1,1	1,765692875	044-MCC-101	1803-AM-1003	Power cable for ANTIFOAM DRUM AGITATOR MOTOR	0.6/1	3PH	3	2,5	CU	XLPE	-	SWA	PVC	120	
1803-AM-1004-P1	415	1,1	1,765692875	044-MCC-101	1803-AM-1004	Power cable for PHOSPHATE DRUM AGITATOR MOTOR	0.6/1	3PH	3	2,5	CU	XLPE	-	SWA	PVC	220	
1803-AM-1005-P1	415	1,1	1,765692875	044-MCC-101	1803-AM-1005	Power cable for NEUTRALISING AMINE DRUM AGITATOR MOTOR	0.6/1	3PH	3	2,5	CU	XLPE	-	SWA	PVC	210	
1803-AM-1006-P1	415	1,1	1,765692875	044-MCC-101	1803-AM-1006	Power cable for OXYGEN SCAVENGER DRUM AGITATOR MOTOR	0.6/1	3PH	3	2,5	CU	XLPE	-	SWA	PVC	210	
1803-ACM-206 A1-P1	415	37	64,34782609	044-MCC-101	1803-ACM-206 A1	Power cable for GASOLINE RECYCLE AIR COOLER FAN-1	0.6/1	3PH	3	95	AL	XLPE	-	SWA	PVC	334	
1803-ACM-206 B1-P1	415	37	64,34782609	044-MCC-101	1803-ACM-206 B1	Power cable for GASOLINE RECYCLE AIR COOLER FAN-2	0.6/1	3PH	3	95	AL	XLPE	-	SWA	PVC	334	
1803-ACM-206 A2-P1	415	37	64,34782609	044-MCC-101	1803-ACM-206 A2	Power cable for GASOLINE RECYCLE AIR COOLER FAN-3	0.6/1	3PH	3	95	AL	XLPE	-	SWA	PVC	340	
1803-ACM-206 B2-P1	415	37	64,34782609	044-MCC-101	1803-ACM-206 B2	Power cable for GASOLINE RECYCLE AIR COOLER FAN-4	0.6/1	3PH	3	95	AL	XLPE	-	SWA	PVC	340	
1803-ACM-208 A-P1	415	15	26,08695652	044-MCC-101	1803-ACM-208 A	Power cable for LCO PRODUCT AIR COOLER FAN-1	0.6/1	3PH	3	50	AL	XLPE	-	SWA	PVC	380	
1803-ACM-208 B-P1	415	15	26,08695652	044-MCC-101	1803-ACM-208 B	Power cable for LCO PRODUCT AIR COOLER FAN-2	0.6/1	3PH	3	50	AL	XLPE	-	SWA	PVC	380	
1803-ACM-208 C-P1	415	15	26,08695652	044-MCC-101	1803-ACM-208 C	Power cable for LCO PRODUCT AIR COOLER FAN-3	0.6/1	3PH	3	50	AL	XLPE	-	SWA	PVC	380	
1803-ACM-201 A1-P1	415	30	48,15526023	044-MCC-102	1803-ACM-201 A1	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-1	0.6/1	3PH	3	50	AL	XLPE	-	SWA	PVC	155	
1803-ACM-201 A2-P1	415	30	48,15526023	044-MCC-102	1803-ACM-201 A2	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-2	0.6/1	3PH	3	50	AL	XLPE	YES	SWA	PVC	155	
1803-ACM-201 B1-P1	415	30	48,15526023	044-MCC-102	1803-ACM-201 B1	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-3	0.6/1	3PH	3	50	AL	XLPE	YES	SWA	PVC	155	
1803-ACM-201 C1-P1	415	30	48,15526023	044-MCC-102	1803-ACM-201 C1	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-4	0.6/1	3PH	3	50	AL	XLPE	YES	SWA	PVC	155	
1803-ACM-201 B2-P1	415	30	48,15526023	044-MCC-102	1803-ACM-201 B2	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-5	0.6/1	3PH	3	50	AL	XLPE	-	SWA	PVC	148	
1803-ACM-201 C2-P1	415	30	48,15526023	044-MCC-102	1803-ACM-201 C2	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-6	0.6/1	3PH	3	50	AL	XLPE	-	SWA	PVC	148	
1803-ACM-201 D1-P1	415	30	48,15526023	044-MCC-102	1803-ACM-201 D1	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-7	0.6/1	3PH	3	50	AL	XLPE	YES	SWA	PVC	105	
1803-ACM-201 E1-P1	415	30	48,15526023	044-MCC-102	1803-ACM-201 E1	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-8	0.6/1	3PH	3	50	AL	XLPE	YES	SWA	PVC	105	
1803-ACM-201 D2-P1	415	30,00	48,16	044-MCC-102	1803-ACM-201 D2	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-9	0.6/1	3PH	3	50	AL	XLPE	-	SWA	PVC	112	
1803-ACM-201 E2-P1	415	30,00	48,16	044-MCC-102	1803-ACM-201 E2	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-10	0.6/1	3PH	3	50	AL	XLPE	-	SWA	PVC	112	
1803-ACM-201 F1-P1	415	30,00	48,16	044-MCC-102	1803-ACM-201 F1	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-11	0.6/1	3PH	3	50	AL	XLPE	YES	SWA	PVC	120	
1803-ACM-201 G1-P1	415	30,00	48,16	044-MCC-102	1803-ACM-201 G1	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-12	0.6/1	3PH	3	50	AL	XLPE	YES	SWA	PVC	120	
1803-ACM-201 H1-P1	415	30,00	48,16	044-MCC-102	1803-ACM-201 H1	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-13	0.6/1	3PH	3	50	AL	XLPE	YES	SWA	PVC	140	
1803-ACM-201 F2-P1	415	30,00	48,16	044-MCC-102	1803-ACM-201 F2	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-14	0.6/1	3PH	3	50	AL	XLPE	-	SWA	PVC	140	
1803-ACM-201 G2-P1	415	30,00	48,16	044-MCC-102	1803-ACM-201 G2	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-15	0.6/1	3PH	3	50	AL	XLPE	-	SWA	PVC	147	
1803-ACM-201 H2-P1	415	30,00	48,16	044-MCC-102	1803-ACM-201 H2	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-16	0.6/1	3PH	3	50	AL	XLPE	YES	SWA	PVC	147	
1803-ACM-201 K1-P1	415	30,00	48,16	044-MCC-103	1803-ACM-201 K1	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-17	0.6/1	3PH	3	50	AL	XLPE	YES	SWA	PVC	152	
1803-ACM-201 H2-P1	415	30,00	48,16	044-MCC-103	1803-ACM-201 H2	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-18	0.6/1	3PH	3	50	AL	XLPE	-	SWA	PVC	152	
1803-ACM-201 J2-P1	415	30,00	48,16	044-MCC-103	1803-ACM-201 J2	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-19	0.6/1	3PH	3	50	AL	XLPE	-	SWA	PVC	160	
1803-ACM-201 L1-P1	415	30,00	48,16	044-MCC-103	1803-ACM-201 L1	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-20	0.6/1	3PH	3	50	AL	XLPE	YES	SWA	PVC	160	
1803-ACM-201 M1-P1	415	30,00	48,16	044-MCC-103	1803-ACM-201 M1	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-21	0.6/1	3PH	3	70	AL	XLPE	YES	SWA	PVC	170	
1803-ACM-201 K2-P1	415	30,00	48,16	044-MCC-103	1803-ACM-201 K2	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-22	0.6/1	3PH	3	70	AL	XLPE	-	SWA	PVC	170	
1803-ACM-201 L2-P1	415	30,00	48,16	044-MCC-103	1803-ACM-201 L2	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-23	0.6/1	3PH	3	70	AL	XLPE	-	SWA	PVC	178	
1803-ACM-201 M2-P1	415	30,00	48,16	044-MCC-103	1803-ACM-201 M2	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-24	0.6/1	3PH	3	70	AL	XLPE	-	SWA	PVC	178	
1803-ACM-201 N1-P1	415	30,00	48,16	044-MCC-103	1803-ACM-201 N1	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-25	0.6/1	3PH	3	70	AL	XLPE	YES	SWA	PVC	185	
1803-ACM-201 P1-P1	415	30,00	48,16	044-MCC-103	1803-ACM-201 P1	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-26	0.6/1	3PH	3	70	AL	XLPE	YES	SWA	PVC	185	
1803-ACM-201 N2-P1	415	30,00	48,16	044-MCC-103	1803-ACM-201 N2	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-27	0.6/1	3PH	3	70	AL	XLPE	-	SWA	PVC	192	
1803-ACM-201 P2-P1	415	30,00	48,16	044-MCC-103	1803-ACM-201 P2	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-28	0.6/1	3PH	3	70	AL	XLPE	-	SWA	PVC	192	
1803-ACM-201 Q1-P1	415	30,00	48,16	044-MCC-103	1803-ACM-201 Q1	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-29	0.6/1	3PH	3	70	AL	XLPE	YES	SWA	PVC	200	
1803-ACM-201 R1-P1	415	30,00	48,16	044-MCC-103	1803-ACM-201 R1	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-30	0.6/1	3PH	3	70	AL	XLPE	YES	SWA	PVC	200	
1803-ACM-201 Q2-P1	415	30,00	48,16	044-MCC-103	1803-ACM-201 Q2	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-31	0.6/1	3PH	3	70	AL	XLPE	-	SWA	PVC	207	
1803-ACM-201 R2-P1	415	30,00	48,16	044-MCC-103	1803-ACM-201 R2	Power cable for FRACTIONATOR OVERHEAD AIR CONDENSER FAN-32	0.6/1	3PH	3	70	AL	XLPE	-	SWA	PVC	207	
1803-ACM-202 A1-P1	415	2,20	6,43	044-MCC-104	1803-ACM-202 A1	Power cable for LCO PUMPAROUND AIR COOLER FAN-1	0.6/1	3PH	3	6	CU	XLPE	YES	SWA	PVC	214	
1803-ACM-202 B1-P1	415	2,20	6,43	044-MCC-104	1803-ACM-202 B1	Power cable for LCO PUMPAROUND AIR COOLER FAN-2	0.6/1	3PH	3	6	CU	XLPE	YES	SWA	PVC	214	
1803-ACM-204 A1-P1	415	30,00	59,39	044-MCC-104	1803-ACM-204 A1	Power cable for COMPRESSOR INTERSTAGE AIR CONDENSER FAN-1	0.6/1	3PH	3	95	AL	XLPE	-	SWA	PVC	214	
1803-ACM-204 B1-P1	415	30,00	59,39	044-MCC-104	1803-ACM-204 B1	Power cable for COMPRESSOR INTERSTAGE AIR CONDENSER FAN-2	0.6/1	3PH									

						ELECTRICAL CABLES LIST											
PROJECT:		EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LuPeck" (J-18)															
CLIENT:		INDIAN OIL CORPORATION LIMITED															
CABLE TAG	RATED VOLTAGE (V)	RATED POWER (kW) (*) KVA	RATED CURRENT (A)	FROM		DESTINATION		CABLE DESCRIPTION									
				BOARD	USER TAG			INSULATION RATED VOLTAGE (kV)	TYPE	CORES	SIZE (mm²)	CONDUCTOR	INSULATION	SCREENED	ARMOUR	OUTER SHEATH	LENGTH (m)
1803-ACM-601 A-P1	415	2,2	6,434782609	044-MCC-104	1803-ACM-601 A		Power cable for CONDENSATE FLASH DRUM AIR COOLER FAN-1	0.6/1	3PH	3	2,5	CU	XLPE	-	SWA	PVC	354
1803-ACM-601 B-P1	415	2,2	6,434782609	044-MCC-104	1803-ACM-601 B		Power cable for CONDENSATE FLASH DRUM AIR COOLER FAN-2	0.6/1	3PH	3	2,5	CU	XLPE	-	SWA	PVC	250
1803-ACM-207 A1-P1	415	15	35,3138575	044-MCC-104	1803-ACM-207 A1		Power cable for DEBUTANIZER OVERHEAD AIR CONDENSER FAN-1	0.6/1	3PH	3	95	AL	XLPE	-	SWA	PVC	250
1803-ACM-207 B1-P1	415	22	35,3138575	044-MCC-104	1803-ACM-207 B1		Power cable for DEBUTANIZER OVERHEAD AIR CONDENSER FAN-2	0.6/1	3PH	3	95	AL	XLPE	-	SWA	PVC	256
1803-ACM-207 C1-P1	415	15	35,3138575	044-MCC-104	1803-ACM-207 C1		Power cable for DEBUTANIZER OVERHEAD AIR CONDENSER FAN-3	0.6/1	3PH	3	70	AL	XLPE	-	SWA	PVC	256
1803-ACM-207 D1-P1	415	15	35,3138575	044-MCC-104	1803-ACM-207 D1		Power cable for DEBUTANIZER OVERHEAD AIR CONDENSER FAN-4	0.6/1	3PH	3	70	AL	XLPE	-	SWA	PVC	262
1803-ACM-207 A2-P1	415	15	35,3138575	044-MCC-104	1803-ACM-207 A2		Power cable for DEBUTANIZER OVERHEAD AIR CONDENSER FAN-5	0.6/1	3PH	3	70	AL	XLPE	-	SWA	PVC	262
1803-ACM-207 B2-P1	415	15	35,3138575	044-MCC-104	1803-ACM-207 B2		Power cable for DEBUTANIZER OVERHEAD AIR CONDENSER FAN-6	0.6/1	3PH	3	70	AL	XLPE	-	SWA	PVC	268
1803-ACM-207 C2-P1	415	15	35,3138575	044-MCC-104	1803-ACM-207 C2		Power cable for DEBUTANIZER OVERHEAD AIR CONDENSER FAN-7	0.6/1	3PH	3	70	AL	XLPE	-	SWA	PVC	268
1803-ACM-207 D2-P1	415	15	35,3138575	044-MCC-104	1803-ACM-207 D2		Power cable for DEBUTANIZER OVERHEAD AIR CONDENSER FAN-8	0.6/1	3PH	3	70	AL	XLPE	-	SWA	PVC	250
1803-ACM-205 A1-P1	415	15	29,69574381	044-MCC-105	1803-ACM-205 A1		Power cable for HIGH PRESSURE AIR CONDENSER FAN-1	0.6/1	3PH	3	50	AL	XLPE	-	SWA	PVC	250
1803-ACM-205 B1-P1	415	15	29,69574381	044-MCC-105	1803-ACM-205 B1		Power cable for HIGH PRESSURE AIR CONDENSER FAN-2	0.6/1	3PH	3	50	AL	XLPE	-	SWA	PVC	256
1803-ACM-205 C1-P1	415	15	29,69574381	044-MCC-105	1803-ACM-205 C1		Power cable for HIGH PRESSURE AIR CONDENSER FAN-3	0.6/1	3PH	3	50	AL	XLPE	-	SWA	PVC	256
1803-ACM-205 D1-P1	415	15	29,69574381	044-MCC-105	1803-ACM-205 D1		Power cable for HIGH PRESSURE AIR CONDENSER FAN-4	0.6/1	3PH	3	50	AL	XLPE	-	SWA	PVC	262
1803-ACM-205 E1-P1	415	15	29,69574381	044-MCC-105	1803-ACM-205 E1		Power cable for HIGH PRESSURE AIR CONDENSER FAN-5	0.6/1	3PH	3	50	AL	XLPE	-	SWA	PVC	262
1803-ACM-205 F1-P1	415	15	29,69574381	044-MCC-105	1803-ACM-205 F1		Power cable for HIGH PRESSURE AIR CONDENSER FAN-6	0.6/1	3PH	3	50	AL	XLPE	-	SWA	PVC	268
1803-ACM-205 G1-P1	415	15	29,69574381	044-MCC-105	1803-ACM-205 G1		Power cable for HIGH PRESSURE AIR CONDENSER FAN-7	0.6/1	3PH	3	50	AL	XLPE	-	SWA	PVC	268
1803-ACM-205 H1-P1	415	15	29,69574381	044-MCC-105	1803-ACM-205 H1		Power cable for HIGH PRESSURE AIR CONDENSER FAN-8	0.6/1	3PH	3	50	AL	XLPE	-	SWA	PVC	275
1803-ACM-205 A2-P1	415	15	29,69574381	044-MCC-105	1803-ACM-205 A2		Power cable for HIGH PRESSURE AIR CONDENSER FAN-9	0.6/1	3PH	3	50	AL	XLPE	-	SWA	PVC	275
1803-ACM-205 B2-P1	415	15	29,69574381	044-MCC-105	1803-ACM-205 B2		Power cable for HIGH PRESSURE AIR CONDENSER FAN-10	0.6/1	3PH	3	50	AL	XLPE	-	SWA	PVC	275
1803-ACM-205 C2-P1	415	15	29,69574381	044-MCC-105	1803-ACM-205 C2		Power cable for HIGH PRESSURE AIR CONDENSER FAN-11	0.6/1	3PH	3	50	AL	XLPE	-	SWA	PVC	282
1803-ACM-205 D2-P1	415	15	29,69574381	044-MCC-105	1803-ACM-205 D2		Power cable for HIGH PRESSURE AIR CONDENSER FAN-12	0.6/1	3PH	3	50	AL	XLPE	-	SWA	PVC	282
1803-ACM-205 E2-P1	415	15	29,69574381	044-MCC-105	1803-ACM-205 E2		Power cable for HIGH PRESSURE AIR CONDENSER FAN-13	0.6/1	3PH	3	50	AL	XLPE	-	SWA	PVC	288
1803-ACM-205 F2-P1	415	15	29,69574381	044-MCC-105	1803-ACM-205 F2		Power cable for HIGH PRESSURE AIR CONDENSER FAN-14	0.6/1	3PH	3	50	AL	XLPE	-	SWA	PVC	288
1803-ACM-205 G2-P1	415	15	29,69574381	044-MCC-105	1803-ACM-205 G2		Power cable for HIGH PRESSURE AIR CONDENSER FAN-15	0.6/1	3PH	3	50	AL	XLPE	-	SWA	PVC	300
1803-ACM-205 H2-P1	415	15	29,69574381	044-MCC-105	1803-ACM-205 H2		Power cable for HIGH PRESSURE AIR CONDENSER FAN-16	0.6/1	3PH	3	50	AL	XLPE	-	SWA	PVC	315
UNIT CONTROL PANEL NON UPS (MAIN AIR BLOWER 1803-K-101)-P1	415	30	48,16	044-MCC-106	UNIT CONTROL PANEL NON UPS (MAIN AIR BLOWER 1803-K-101)		Power cable for UNIT CONTROL PANEL NON UPS (MAIN AIR BLOWER 1803-K-101)	0.6/1	3PH+N	3,5	50	AL	XLPE	-	SWA	PVC	6
IGV (INLET GUIDE VANE MAIN AIR BLOWER 1803-K-101)-P1	415	30	48,16	044-MCC-106	IGV (INLET GUIDE VANE MAIN AIR BLOWER 1803-K-101)		Power cable for IGV (INLET GUIDE VANE MAIN AIR BLOWER 1803-K-101)	0.6/1	3PH+N	3,5	50	AL	XLPE	-	SWA	PVC	6
1803-K-201-F-1	415	30	48,16	044-MCC-101	1803-K-201-F-1		Power cable for HEATER-2 (WET GAS COMPRESSOR 1803-K-102)	0.6/1	3PH+N	3,5	50	AL	XLPE	-	SWA	PVC	6
1803-X-105-F-1	415	30	48,16	044-MCC-106	1803-X-105-F-1		Power cable for HEATER-1 (MAIN AIR BLOWER 1803-K-101)	0.6/1	3PH+N	3,5	50	AL	XLPE	-	SWA	PVC	6
1803-X-105-F-2	415	30	48,16	044-MCC-106	1803-X-105-F-2		Power cable for HEATER-2 (MAIN AIR BLOWER 1803-K-101)	0.6/1	3PH+N	3,5	50	AL	XLPE	-	SWA	PVC	6
UNIT CONTROL PANEL NON UPS (WET GAS COMPRESSOR 1803-K-102)-P1	415	30,00	48,16	044-MCC-106	UNIT CONTROL PANEL NON UPS (WET GAS COMPRESSOR 1803-K-102)		Power cable for UNIT CONTROL PANEL NON UPS (WET GAS COMPRESSOR 1803-K-102)	0.6/1	3PH+N	3,5	50	AL	XLPE	-	SWA	PVC	6
1803-K-201-F-1	415	30,00	48,16	044-MCC-106	1803-K-201-F-1		Power cable for HEATER-1 (WET GAS COMPRESSOR 1803-K-102)	0.6/1	3PH+N	3,5	50	AL	XLPE	-	SWA	PVC	6
1803-MOV-2305-P1	415	3,00	4,39	044-MCC-106	1803-MOV-2305		Power cable for WASTE HEAT BOILER INLET WHB-101	0.6/1	3PH	3	2,5	CU	XLPE	-	SWA	PVC	80
1803-MOV-2306-P1	415	3,00	4,39	044-MCC-106	1803-MOV-2306		Power cable for WASTE HEAT BOILER OUTLET WHB-101	0.6/1	3PH	3	2,5	CU	XLPE	-	SWA	PVC	80
1803-MOV-4001-P1	415	3,00	4,39	044-MCC-106	1803-MOV-4001		Power cable for HC VAP RECTR OVHRD TO FRACTIONATOR C-201	0.6/1	3PH	3	2,5	CU	XLPE	-	SWA	PVC	80
1803-MOV-5801-P1	415	15,00	21,97	044-MCC-106	1803-MOV-5801		Power cable for WGC 1ST STAGE COMPRESSOR SUCTION	0.6/1	3PH	3	16	CU	XLPE	-	SWA	PVC	80
1803-MOV-5802-P1	415	15,00	21,97	044-MCC-106	1803-MOV-5802		Power cable for WGC 1ST STAGE COMPRESSOR DISCHARGE	0.6/1	3PH	3	16	CU	XLPE	-	SWA	PVC	80
1803-MOV-5803-P1	415	15,00	21,97	044-MCC-106	1803-MOV-5803		Power cable for WGC 2ND STAGE COMPRESSOR SUCTION	0.6/1	3PH	3	16	CU	XLPE	-	SWA	PVC	80
1803-MOV-5804-P1	415	15,00	21,97	044-MCC-106	1803-MOV-5804		Power cable for WGC 2ND STAGE COMPRESSOR DISCHARGE	0.6/1	3PH	3	16	CU	XLPE	-	SWA	PVC	80
1803-X-106 A-P1	415	45,00	72,23	044-MCC-106	1803-X-106 A		Power cable for PURGE AIR FAN (WASTE HEAT BOILER)	0.6/1	3PH	3	95	AL	XLPE	-	SWA	PVC	160
1803-X-106 B-P1	415	45,00	72,23	044-MCC-106	1803-X-106 B		Power cable for PURGE AIR FAN (WASTE HEAT BOILER)	0.6/1	3PH	3	95	AL	XLPE	-	SWA	PVC	160
1803-X-106 LRSB-P1	415	14,50	23,28	044-MCC-106	1803-X-106 LRSB		Power cable for SOOT BLOWER POWER PANEL (WASTE HEAT BOILER)	0.6/1	3PH	3	25	AL	XLPE	-	SWA	PVC	165
1803-X-106 MOV A-P1	415	15,00	24,08	044-MCC-106	1803-X-106 MOV A		Power cable for Motorised Main Steam Stop Valve (MSSV) WASTE HEAT BOILER	0.6/1	3PH	3	25	AL	XLPE	-	SWA	PVC	165
1803-X-106 MOV B-P1	415	15,00	24,08	044-MCC-106	1803-X-106 MOV B		Power cable for Motorised Bypass Valve for MSSV (WASTE HEAT BOILER)	0.6/1	3PH	3	25	AL	XLPE	-	SWA	PVC	165
1803-X-106 MOV C-P1	415	15,00	24,08	044-MCC-106	1803-X-106 MOV C		Power cable for Motorised Start Up Vent Valve (WASTE HEAT BOILER)	0.6/1	3PH	3	25	AL	XLPE	-	SWA	PVC	165
1803-X-107-P001A-P1	415	1,50	2,49	044-MCC-106	1803-X-107-P001A		Power cable for CAUSTIC BOOSTER PUMP (WET GAS SCRUBBER PACKAGE)	0.6/1	3PH	3	2,5	CU	XLPE	-	SWA	PVC	80
1803-X-107-P001B-P1	415	1,50	2,49	044-MCC-106	1803-X-107-P001B		Power cable for CAUSTIC BOOSTER PUMP (WET GAS SCRUBBER PACKAGE)	0.6/1	3PH	3	2,5	CU	XLPE	-	SWA	PVC	80
1803-X-107-P002A-P1	415	22,00	36,50	044-MCC-106	1803-X-107-P002A		Power cable for MAKE-UP WATER BOOSTER PUMP (WET GAS SCRUBBER PACKAGE)	0.6/1	3PH	3	25	AL	XLPE	-	SWA	PVC	80
1803-X-107-P002B-P1	415	22,00	36,50	044-MCC-106	1803-X-107-P002B		Power cable for MAKE-UP WATER BOOSTER PUMP (WET GAS SCRUBBER PACKAGE)	0.6/1	3PH	3	25	AL	XLPE	-	SWA	PVC	80
1803-X-107-P005A-P1	415	1,50	2,49	044-MCC-106	1803-X-107-P005A		Power cable for COAGULANT METERING PUMP (WET GAS SCRUBBER PACKAGE)	0.6/1	3PH	3	2,5	CU	XLPE	-	SWA	PVC	80
1803-X-107-P005B-P1	415	1,50	2,49	044-MCC-106	1803-X-107-P005B		Power cable for COAGULANT METERING PUMP (WET GAS SCRUBBER PACKAGE)	0.6/1	3PH	3	2,5	CU	XLPE	-	SWA	PVC	80
1803-X-107-P007A-P1	415	22,00	36,50	044-MCC-106	1803-X-107-P007A		Power cable for EFFLUENT FILTER SUPPLY PUMP (WET GAS SCRUBBER PACKAGE)	0.6/1	3PH	3	25	AL	XLPE	-	SWA	PVC	80
1803-X-107-P007B-P1	415	22,00	36,50	044-MCC-106	1803-X-107-P007B		Power cable for EFFLUENT FILTER SUPPLY PUMP (WET GAS SCRUBBER PACKAGE)	0.6/1	3PH	3	25	AL	XLPE	-	SWA	PVC	80
1803-X-107-P006A-P1	415	3,70	6,14	044-MCC-106	1803-X-107-P006A		Power cable for FILTRATE PUMP (WET GAS SCRUBBER PACKAGE)	0.6/1	3PH	3	2,5	CU	XLPE	-	SWA	PVC	80
1803-X-107-P006B-P1	415	3,70	6,14	044-MCC-106	1803-X-107-P006B		Power cable for FILTRATE PUMP (WET GAS SCRUBBER PACKAGE)	0.									

PROJECT:		EPCC-2 PACKAGE (INDMAX RECCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LuPeel" (J-18)										ELECTRICAL CABLES LIST									
CLIENT:		INDIAN OIL CORPORATION LIMITED																			
CABLE TAG	RATED VOLTAGE (V)	RATED POWER (kW) (*): KVA	RATED CURRENT (A)	FROM	BOARD	USER TAG	DESCRIPTION	INSULATION RATED VOLTAGE (kV)	TYPE	CORES	SIZE (mm²)	CONDUCTOR	INSULATION	SCREENED	ARMOUR	OUTER SHEATH	LENGTH (m)				
1803-X-205-P-005B-P1	415	15	24.08	044-MCC-107		1803-X-205-P-005B	Power cable for WATER RECYCLE PUMP (CR LPG TREATMENT PACKAGE)	0.6/1	3PH	3	50	AL	XLPE	-	SWA	PVC	350				
1803-X-205-P-007A-P1	415	37	59.39	044-MCC-107		1803-X-205-P-007A	Power cable for SOLVENT RECYCLE PUMP (CR LPG TREATMENT PACKAGE)	0.6/1	3PH	3	150	AL	XLPE	-	SWA	PVC	350				
1803-X-205-P-007B-P1	415	37	59.39	044-MCC-107		1803-X-205-P-007B	Power cable for SOLVENT RECYCLE PUMP (CR LPG TREATMENT PACKAGE)	0.6/1	3PH	3	150	AL	XLPE	-	SWA	PVC	350				
1803-X-205-P-008A-P1	415	5.5	8.83	044-MCC-107		1803-X-205-P-008A	Power cable for SOLVENT / DSO PUMP (CR LPG TREATMENT PACKAGE)	0.6/1	3PH	3	16	CU	XLPE	-	SWA	PVC	350				
1803-X-205-P-008B-P1	415	5.5	8.83	044-MCC-107		1803-X-205-P-008B	Power cable for SOLVENT / DSO PUMP (CR LPG TREATMENT PACKAGE)	0.6/1	3PH	3	16	CU	XLPE	-	SWA	PVC	350				
1803-X-205-P-011A-P1	415	5.5	8.83	044-MCC-107		1803-X-205-P-011A	Power cable for BRINE RECYCLE PUMP (CR LPG TREATMENT PACKAGE)	0.6/1	3PH	3	16	CU	XLPE	-	SWA	PVC	350				
1803-X-205-P-011B-P1	415	5.5	8.83	044-MCC-107		1803-X-205-P-011B	Power cable for BRINE RECYCLE PUMP (CR LPG TREATMENT PACKAGE)	0.6/1	3PH	3	16	CU	XLPE	-	SWA	PVC	350				
1803-X-205-P-012A-P1	415	5.5	8.83	044-MCC-107		1803-X-205-P-012A	Power cable for SPENT CAUSTIC FEED PUMP (CR LPG TREATMENT PACKAGE)	0.6/1	3PH	3	16	CU	XLPE	-	SWA	PVC	350				
1803-X-205-P-012B-P1	415	5.5	8.83	044-MCC-107		1803-X-205-P-012B	Power cable for SPENT CAUSTIC FEED PUMP (CR LPG TREATMENT PACKAGE)	0.6/1	3PH	3	16	CU	XLPE	-	SWA	PVC	350				
1803-X-205-P-014A-P1	415	45	72.23	044-MCC-107		1803-X-205-P-014A	Power cable for PROCESS WATER PUMP (CR LPG TREATMENT PACKAGE)	0.6/1	3PH	3	185	AL	XLPE	-	SWA	PVC	350				
1803-X-205-P-014B-P1	415	45	72.23	044-MCC-107		1803-X-205-P-014B	Power cable for PROCESS WATER PUMP (CR LPG TREATMENT PACKAGE)	0.6/1	3PH	3	185	AL	XLPE	-	SWA	PVC	350				
1803-X-208-P-XX1-P1	415	2.2	3.53	044-MCC-107		1803-X-208-P-XX1	Power cable for HOIST MOTOR (1803-X-108 PACKAGE)	0.6/1	3PH	3	2.5	CU	XLPE	-	SWA	PVC	350				
1803-X-208-P-XX2-P1	415	0.55	0.88	044-MCC-107		1803-X-208-P-XX2	Power cable for TRAVEL MOTOR (1803-X-108 PACKAGE)	0.6/1	3PH	3	2.5	CU	XLPE	-	SWA	PVC	350				
1803-X-208-P-XX3-P1	415	11	17.66	044-MCC-107		1803-X-208-P-XX3	Power cable for VCM MOTOR (1803-X-108 PACKAGE)	0.6/1	3PH	3	10	CU	XLPE	-	SWA	PVC	350				
HV-1401-1-P1	415	5.5	8.05	044-MCC-107		H-1401-1	Power cable for HPCU for Regenerated catalyst slide valve motor 1	0.6/1	3PH	3	4	CU	XLPE	-	SWA	PVC	6				
HV-1401-2-P1	415	5.5	8.05	044-MCC-107		H-1401-2	Power cable for HPCU for Regenerated catalyst slide valve motor 2	0.6/1	3PH	3	4	CU	XLPE	-	SWA	PVC	6				
HV-1601-1-P1	415	5.5	8.05	044-MCC-107		H-1601-1	Power cable for HPCU for Spent catalyst valve slide motor 1	0.6/1	3PH	3	4	CU	XLPE	-	SWA	PVC	6				
HV-1601-2-P1	415	5.5	8.05	044-MCC-107		H-1601-2	Power cable for HPCU for Spent catalyst valve slide motor 2	0.6/1	3PH	3	4	CU	XLPE	-	SWA	PVC	6				
HV-2201-1-P1	415	5.5	8.05	044-MCC-107		H-2201-1	Power cable for HPCU for Double disc flue gas slide valve motor 1	0.6/1	3PH	3	4	CU	XLPE	-	SWA	PVC	6				
HV-2201-2-P1	415	5.5	8.05	044-MCC-107		H-2201-2	Power cable for HPCU for Double disc flue gas slide valve motor 2	0.6/1	3PH	3	4	CU	XLPE	-	SWA	PVC	6				
XZV-2301-1-P1	415	5.5	8.05	044-MCC-107		H-2301-1	Power cable for HPCU for Flue gas diverter valve motor 1	0.6/1	3PH	3	4	CU	XLPE	-	SWA	PVC	6				
XZV-2301-2-P1	415	5.5	8.05	044-MCC-107		H-2301-2	Power cable for HPCU for Flue gas diverter valve motor 2	0.6/1	3PH	3	4	CU	XLPE	-	SWA	PVC	6				
H-4001-P1	415	13.6	19.92	044-MCC-107		H-4001	Power cable for CCV Overhead line automatic isolation valve actuator	0.6/1	3PH	3	6	CU	XLPE	-	SWA	PVC	6				
1803-PM-201 A-LCS-C01	240	-	-	044-MCC-101		1803-PM-201 A-LCS	Local Control Station Cable For HCN Product Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	260				
1803-PM-201 B-LCS-C01	240	-	-	044-MCC-101		1803-PM-201 B-LCS	Local Control Station Cable For HCN Product Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	260				
1803-PM-208 A-LCS-C01	240	-	-	044-MCC-101		1803-PM-208 A-LCS	Local Control Station Cable For Reflux Drum Sour Water Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	170				
1803-PM-208 B-LCS-C01	240	-	-	044-MCC-101		1803-PM-208 B-LCS	Local Control Station Cable For Reflux Drum Sour Water Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	170				
1803-PM-210 A-LCS-C01	240	-	-	044-MCC-101		1803-PM-210 A-LCS	Local Control Station Cable For Distillate Drum Sour Water Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	190				
1803-PM-210 B-LCS-C01	240	-	-	044-MCC-101		1803-PM-210 B-LCS	Local Control Station Cable For Distillate Drum Sour Water Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	190				
1803-PM-223 A-LCS-C01	240	-	-	044-MCC-101		1803-PM-223 A-LCS	Local Control Station Cable For Sour Water Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	150				
1803-PM-223 B-LCS-C01	240	-	-	044-MCC-101		1803-PM-223 B-LCS	Local Control Station Cable For Sour Water Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	150				
1803-PM-606 A-LCS-C01	240	-	-	044-MCC-101		1803-PM-606 A-LCS	Local Control Station Cable For Suspect Condensate Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	120				
1803-PM-606 B-LCS-C01	240	-	-	044-MCC-101		1803-PM-606 B-LCS	Local Control Station Cable For Suspect Condensate Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	120				
1803-PM-604 A-LCS-C01	240	-	-	044-EPMCC-101		1803-PM-604 A-LCS	Local Control Station Cable For Flare KOD Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	305				
1803-PM-604 B-LCS-C01	240	-	-	044-EPMCC-101		1803-PM-604 B-LCS	Local Control Station Cable For Flare KOD Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	305				
1803-PM-611 A-LCS-C01	240	-	-	044-MCC-101		1803-PM-611 A-LCS	Local Control Station Cable For Contaminated Rain Water Sewer Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	80				
1803-PM-611 B-LCS-C01	240	-	-	044-MCC-101		1803-PM-611 B-LCS	Local Control Station Cable For Contaminated Rain Water Sewer Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	80				
1803-PM-211 A-LCS-C01	240	-	-	044-MCC-101		1803-PM-211 A-LCS	Local Control Station Cable For Compressor Suction KO Drum Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	175				
1803-PM-211 B-LCS-C01	240	-	-	044-MCC-101		1803-PM-211 B-LCS	Local Control Station Cable For Compressor Suction KO Drum Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	175				
1803-PM-601 A-LCS-C01	240	-	-	044-MCC-101		1803-PM-601 A-LCS	Local Control Station Cable For Closed Blowdown Drum Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	260				
1803-PM-601 B-LCS-C01	240	-	-	044-MCC-101		1803-PM-601 B-LCS	Local Control Station Cable For Closed Blowdown Drum Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	260				
1803-PM-602 A-LCS-C01	240	-	-	044-MCC-101		1803-PM-602 A-LCS	Local Control Station Cable For Amine Drain Drum Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	270				
1803-PM-602 B-LCS-C01	240	-	-	044-MCC-101		1803-PM-602 B-LCS	Local Control Station Cable For Amine Drain Drum Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	270				
1803-PM-603-LCS-C01	240	-	-	044-EPMCC-101		1803-PM-603-LCS	Local Control Station Cable For Heavy HC Closed Blowdown Drum Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	300				
1803-PM-612 A-LCS-C01	240	-	-	044-MCC-101		1803-PM-612 A-LCS	Local Control Station Cable For Oily Water Sewer Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	80				
1803-PM-612 B-LCS-C01	240	-	-	044-MCC-101		1803-PM-612 B-LCS	Local Control Station Cable For Oily Water Sewer Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	80				
1803-X-106 A-LCS-C01	240	-	-	044-MCC-106		1803-X-106 A-LCS	Local Control Station Cable For Purge Air Fan (Waste Heat Boiler)	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	168				
1803-X-106 A-LCS-C02	240	-	-	044-MCC-106		1803-X-106 A-LCS	Local Control Station Cable For Purge Air Fan (Waste Heat Boiler)	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	168				
1803-X-106 A-LCS-C03	240	-	-	044-MCC-106		1803-X-106 A-LCS	Local Control Station Cable For Purge Air Fan (Waste Heat Boiler)	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	168				
1803-X-106 B-LCS-C01	240	-	-	044-MCC-106		1803-X-106 B-LCS	Local Control Station Cable For Purge Air Fan (Waste Heat Boiler)	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	168				
1803-X-106 B-LCS-C02	240	-	-	044-MCC-106		1803-X-106 B-LCS	Local Control Station Cable For Purge Air Fan (Waste Heat Boiler)	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	168				
1803-X-106 B-LCS-C03	240	-	-	044-MCC-106		1803-X-106 B-LCS	Local Control Station Cable For Purge Air Fan (Waste Heat Boiler)	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	168				
1803-ACM-201 A1-LCS-C01	240	-	-	044-MCC-101		1803-ACM-201 A1-LCS	Local Control Station Cable For Fractionator Overhead Air Condenser Fan-2	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	160				
1803-ACM-201 A2-LCS-C01	240	-	-	044-MCC-101		1803-ACM-201 A2-LCS	Local Control Station Cable For Fractionator Overhead Air Condenser Fan-1	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	160				
1803-ACM-201 B1-LCS-C01	240	-	-	044-MCC-102		1803-ACM-201 B1-LCS	Local Control Station Cable For Fractionator Overhead Air Condenser Fan-3	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	155				
1803-ACM-201 B2-LCS-C01	240	-	-	044-MCC-102		1803-ACM-201 B2-LCS	Local Control Station Cable For Fractionator Overhead Air Condenser Fan-5	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	148				
1803-ACM-201 C01-LCS-C01	240	-	-	044-MCC-102		1803-ACM-201 C1-LCS	Local Control Station Cable For Fractionator Overhead Air Condenser Fan-4	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	155				
1803-ACM-201 C02-LCS-C01	240	-	-	044-MCC-102		1803-ACM-201 C2-LCS	Local Control Station Cable For Fractionator Overhead Air Condenser Fan-6	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	148				
1803-ACM-201 D1-LCS-C01	240	-	-	044-MCC-102		1803-ACM-201 D1-LCS	Local Control Station Cable For Fractionator Overhead Air Condenser Fan-7	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	105				
1803-ACM-201 D2-LCS-C01	240	-	-	044-MCC-102		1803-ACM-201 D2-LCS	Local Control Station Cable For Fractionator Overhead Air Condenser Fan-9	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	112				
1803-ACM-201 E1-LCS-C01	240	-	-	044-MCC-102		1803-ACM-201 E1-LCS	Local Control Station Cable For Fractionator Overhead Air Condenser Fan-8	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	105				
1803-ACM-201 E2-LCS-C02	240	-	-	044-MCC-102		1803-ACM-201 E2-LCS	Local Control Station Cable For Fractionator Overhead Air Condenser Fan-10	0.6/1	MULTIPOLAR	6P											

Table 134. Electrical cables list (part 8).

								ELECTRICAL CABLES LIST											
PROJECT:		EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LapTech" (J-18)																	
CLIENT:		INDIAN OIL CORPORATION LIMITED																	
CABLE TAG	RATED VOLTAGE (V)	RATED POWER (kW) (*) kVA	RATED CURRENT (A)	FROM		DESTINATION	INSULATION RATED VOLTAGE (kV)	TYPE	CORES	SIZE (mm²)	CABLE DESCRIPTION								
				BOARD	USER TAG	DESCRIPTION					CONDUCTOR	INSULATION	SCREENED	ARMOUR	OUTER SHEATH	LENGTH (m)			
1803-ACM-201 G2-LCS-C02	240	-	-	044-MCC-102	1803-ACM-201 G2-LCS	Local Control Station Cable For Fractionator Overhead Air Condenser Fan-15	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	120			
1803-ACM-201 H1-LCS-C02	240	-	-	044-MCC-102	1803-ACM-201 H1-LCS	Local Control Station Cable For Fractionator Overhead Air Condenser Fan-13	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	120			
1803-ACM-201 J1-LCS-C02	240	-	-	044-MCC-102	1803-ACM-201 J1-LCS	Local Control Station Cable For Fractionator Overhead Air Condenser Fan-16	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	120			
1803-ACM-204 A1-LCS-C01	240	-	-	044-MCC-104	1803-ACM-204 A1-LCS	Local Control Station Cable For Compressor Interstage Air Condenser Fan-1	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	214			
1803-ACM-204 A2-LCS-C01	240	-	-	044-MCC-104	1803-ACM-204 A2-LCS	Local Control Station Cable For Compressor Interstage Air Condenser Fan-5	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	214			
1803-ACM-204 B1-LCS-C01	240	-	-	044-MCC-104	1803-ACM-204 B1-LCS	Local Control Station Cable For Compressor Interstage Air Condenser Fan-2	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	205			
1803-ACM-204 B2-LCS-C01	240	-	-	044-MCC-104	1803-ACM-204 B2-LCS	Local Control Station Cable For Compressor Interstage Air Condenser Fan-6	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	205			
1803-ACM-204 C01-LCS-C01	240	-	-	044-MCC-104	1803-ACM-204 C1-LCS	Local Control Station Cable For Compressor Interstage Air Condenser Fan-3	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	205			
1803-ACM-204 C02-LCS-C01	240	-	-	044-MCC-104	1803-ACM-204 C2-LCS	Local Control Station Cable For Compressor Interstage Air Condenser Fan-7	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	205			
1803-ACM-204 D1-LCS-C01	240	-	-	044-MCC-104	1803-ACM-204 D1-LCS	Local Control Station Cable For Compressor Interstage Air Condenser Fan-4	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	210			
1803-ACM-204 D2-LCS-C01	240	-	-	044-MCC-104	1803-ACM-204 D2-LCS	Local Control Station Cable For Compressor Interstage Air Condenser Fan-8	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	210			
1803-ACM-205 A1-LCS-C01	240	-	-	044-MCC-105	1803-ACM-205 A1-LCS	Local Control Station Cable For High Pressure Air Condenser Fan-1	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	250			
1803-ACM-205 B1-LCS-C01	240	-	-	044-MCC-105	1803-ACM-205 B1-LCS	Local Control Station Cable For High Pressure Air Condenser Fan-2	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	250			
1803-ACM-205 C01-LCS-C01	240	-	-	044-MCC-105	1803-ACM-205 C1-LCS	Local Control Station Cable For High Pressure Air Condenser Fan-3	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	256			
1803-ACM-205 D1-LCS-C01	240	-	-	044-MCC-105	1803-ACM-205 D1-LCS	Local Control Station Cable For High Pressure Air Condenser Fan-4	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	256			
1803-ACM-205 E1-LCS-C01	240	-	-	044-MCC-105	1803-ACM-205 E1-LCS	Local Control Station Cable For High Pressure Air Condenser Fan-5	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	262			
1803-ACM-205 F1-LCS-C01	240	-	-	044-MCC-105	1803-ACM-205 F1-LCS	Local Control Station Cable For High Pressure Air Condenser Fan-6	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	262			
1803-ACM-205 G1-LCS-C01	240	-	-	044-MCC-105	1803-ACM-205 G1-LCS	Local Control Station Cable For High Pressure Air Condenser Fan-7	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	268			
1803-ACM-205 H1-LCS-C01	240	-	-	044-MCC-105	1803-ACM-205 H1-LCS	Local Control Station Cable For High Pressure Air Condenser Fan-8	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	268			
1803-ACM-205 A2-LCS-C01	240	-	-	044-MCC-105	1803-ACM-205 A2-LCS	Local Control Station Cable For High Pressure Air Condenser Fan-9	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	250			
1803-ACM-205 B2-LCS-C01	240	-	-	044-MCC-105	1803-ACM-205 B2-LCS	Local Control Station Cable For High Pressure Air Condenser Fan-10	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	250			
1803-ACM-205 C02-LCS-C01	240	-	-	044-MCC-105	1803-ACM-205 C2-LCS	Local Control Station Cable For High Pressure Air Condenser Fan-11	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	256			
1803-ACM-205 D2-LCS-C01	240	-	-	044-MCC-105	1803-ACM-205 D2-LCS	Local Control Station Cable For High Pressure Air Condenser Fan-12	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	256			
1803-ACM-205 E2-LCS-C01	240	-	-	044-MCC-105	1803-ACM-205 E2-LCS	Local Control Station Cable For High Pressure Air Condenser Fan-13	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	262			
1803-ACM-205 F2-LCS-C01	240	-	-	044-MCC-105	1803-ACM-205 F2-LCS	Local Control Station Cable For High Pressure Air Condenser Fan-14	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	262			
1803-ACM-205 G2-LCS-C01	240	-	-	044-MCC-105	1803-ACM-205 G2-LCS	Local Control Station Cable For High Pressure Air Condenser Fan-15	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	268			
1803-ACM-205 H2-LCS-C01	240	-	-	044-MCC-105	1803-ACM-205 H2-LCS	Local Control Station Cable For High Pressure Air Condenser Fan-16	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	268			
1803-ACM-206 A1-LCS-C01	240	-	-	044-MCC-101	1803-ACM-206 A1-LCS	Local Control Station Cable For Gasoline Recycle Air Cooler Fan-1	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	334			
1803-ACM-206 B1-LCS-C01	240	-	-	044-MCC-101	1803-ACM-206 B1-LCS	Local Control Station Cable For Gasoline Recycle Air Cooler Fan-2	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	334			
1803-ACM-206 A2-LCS-C01	240	-	-	044-MCC-101	1803-ACM-206 A2-LCS	Local Control Station Cable For Gasoline Recycle Air Cooler Fan-3	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	334			
1803-ACM-206 B2-LCS-C01	240	-	-	044-MCC-101	1803-ACM-206 B2-LCS	Local Control Station Cable For Gasoline Recycle Air Cooler Fan-4	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	334			
1803-ACM-207 A1-LCS-C01	240	-	-	044-MCC-104	1803-ACM-207 A1-LCS	Local Control Station Cable For Debutanizer Overhead Air Condenser Fan-1	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	360			
1803-ACM-207 B1-LCS-C01	240	-	-	044-MCC-104	1803-ACM-207 B1-LCS	Local Control Station Cable For Debutanizer Overhead Air Condenser Fan-2	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	360			
1803-ACM-207 C01-LCS-C01	240	-	-	044-MCC-104	1803-ACM-207 C1-LCS	Local Control Station Cable For Debutanizer Overhead Air Condenser Fan-3	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	360			
1803-ACM-207 D1-LCS-C01	240	-	-	044-MCC-104	1803-ACM-207 D1-LCS	Local Control Station Cable For Debutanizer Overhead Air Condenser Fan-4	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	360			
1803-ACM-207 A2-LCS-C01	240	-	-	044-MCC-104	1803-ACM-207 A2-LCS	Local Control Station Cable For Debutanizer Overhead Air Condenser Fan-5	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	360			
1803-ACM-207 B2-LCS-C01	240	-	-	044-MCC-104	1803-ACM-207 B2-LCS	Local Control Station Cable For Debutanizer Overhead Air Condenser Fan-6	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	360			
1803-ACM-207 C02-LCS-C01	240	-	-	044-MCC-104	1803-ACM-207 C2-LCS	Local Control Station Cable For Debutanizer Overhead Air Condenser Fan-7	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	360			
1803-ACM-207 D2-LCS-C01	240	-	-	044-MCC-104	1803-ACM-207 D2-LCS	Local Control Station Cable For Debutanizer Overhead Air Condenser Fan-8	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	360			
1803-ACM-208 A-LCS-C01	240	-	-	044-MCC-101	1803-ACM-208 A-LCS	Local Control Station Cable For Lco Product Air Cooler Fan-1	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	380			
1803-ACM-208 B-LCS-C01	240	-	-	044-MCC-101	1803-ACM-208 B-LCS	Local Control Station Cable For Lco Product Air Cooler Fan-2	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	380			
1803-PM-101 A-LCS-C01	240	-	-	044-HT6-101	1803-PM-101 A-LCS	Local Control Station Cable For HOT Fresh Feed Pumps	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	170			
1803-PM-101 B-LCS-C01	240	-	-	044-HT6-101	1803-PM-101 B-LCS	Local Control Station Cable For HOT Fresh Feed Pumps	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	170			
1803-PM-102 A-LCS-C01	240	-	-	044-PMCC-101	1803-PM-102 A-LCS	Local Control Station Cable For Cold Fresh Feed Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	205			
1803-PM-102 B-LCS-C01	240	-	-	044-PMCC-101	1803-PM-102 B-LCS	Local Control Station Cable For Cold Fresh Feed Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	205			
1803-PM-202 A-LCS-C01	240	-	-	044-HT6-101	1803-PM-202 A-LCS	Local Control Station Cable For LCO Pumparound Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	260			
1803-PM-202 B-LCS-C01	240	-	-	044-HT6-101	1803-PM-202 B-LCS	Local Control Station Cable For LCO Pumparound Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	260			
1803-PM-202 C-LCS-C01	240	-	-	044-HT6-101	1803-PM-202 C-LCS	Local Control Station Cable For LCO Pumparound Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	260			
1803-PM-203 A-LCS-C01	240	-	-	044-PMCC-103	1803-PM-203 A-LCS	Local Control Station Cable For LCO Product Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	270			
1803-PM-203 B-LCS-C01	240	-	-	044-PMCC-103	1803-PM-203 B-LCS	Local Control Station Cable For LCO Product Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	270			
1803-PM-204 A-LCS-C01	240	-	-	044-HT6-101	1803-PM-204 A-LCS	Local Control Station Cable For HCO Pumparound Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	315			
1803-PM-204 B-LCS-C01	240	-	-	044-HT6-101	1803-PM-204 B-LCS	Local Control Station Cable For HCO Pumparound Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	315			
1803-PM-204 C-LCS-C01	240	-	-	044-HT6-101	1803-PM-204 C-LCS	Local Control Station Cable For HCO Pumparound Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	315			
1803-PM-205 A-LCS-C01	240	-	-	044-HT6-101	1803-PM-205 A-LCS	Local Control Station Cable For Main Fractionator Bottom Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	235			
1803-PM-205 B-LCS-C01	240	-	-	044-HT6-101	1803-PM-205 B-LCS	Local Control Station Cable For Main Fractionator Bottom Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	235			
1803-PM-206 A-LCS-C01	240	-	-	044-PMCC-101	1803-PM-206 A-LCS	Local Control Station Cable For CLO Product Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	290			
1803-PM-206 B-LCS-C01	240	-	-	044-PMCC-101	1803-PM-206 B-LCS	Local Control Station Cable For CLO Product Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	290			
1803-PM-207 A-LCS-C01	240	-	-	044-PMCC-101	1803-PM-207 A-LCS	Local Control Station Cable For Fractionator Reflux Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	160			
1803-PM-207 B-LCS-C01	240	-	-	044-PMCC-101	1803-PM-207 B-LCS	Local Control Station Cable For Fractionator Reflux Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	160			
1803-PM-209 A-LCS-C01	240	-	-	044-PMCC-103	1803-PM-209 A-LCS	Local Control Station Cable For Distillate Drum Liquid Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	195			
1803-PM-209 B-LCS-C01	240	-	-	044-PMCC-103	1803-PM-209 B-LCS	Local Control Station Cable For Distillate Drum Liquid Pump	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	195			
1803-PM-212 A-LCS-C01	240	-	-	044-PMCC-103-															

Table 135. Electrical cables list (part 9).

				ELECTRICAL CABLES LIST													
PROJECT:		EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LaPech" (J-18)															
CLIENT:		INDIAN OIL CORPORATION LIMITED															
CABLE TAG	RATED VOLTAGE (V)	RATED POWER (kW) (*)	RATED CURRENT (A)	FROM		DESTINATION	DESCRIPTION	INSULATION RATED VOLTAGE (kV)	TYPE	CORES	SIZE (mm²)	CABLE DESCRIPTION					
				BOARD	USER TAG							CONDUCTOR	INSULATION	SCREENED	ARMOUR	OUTER SHEATH	LENGTH (m)
1803-PM-214 A-LCS-C01	240	-	-	044-HTG-101	1803-PM-214 A-LCS		Local Control Station Cable For Gasoline Recycle Pump	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	320
1803-PM-214 B-LCS-C01	240	-	-	044-HTG-101	1803-PM-214 B-LCS		Local Control Station Cable For Gasoline Recycle Pump	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	320
1803-PM-215 A-LCS-C01	240	-	-	044-PMCC-102	1803-PM-215 A-LCS		Local Control Station Cable For Primary Absorber Intercooler-I Pump	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	210
1803-PM-215 B-LCS-C01	240	-	-	044-PMCC-102	1803-PM-215 B-LCS		Local Control Station Cable For Primary Absorber Intercooler-I Pump	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	210
1803-PM-216 A-LCS-C01	240	-	-	044-PMCC-102	1803-PM-216 A-LCS		Local Control Station Cable For Primary Absorber Intercooler-II Pumps	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	220
1803-PM-216 B-LCS-C01	240	-	-	044-PMCC-102	1803-PM-216 B-LCS		Local Control Station Cable For Primary Absorber Intercooler-II Pumps	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	220
1803-PM-217 A-LCS-C01	240	-	-	044-PMCC-102	1803-PM-217 A-LCS		Local Control Station Cable For Primary Absorber Bottom Pump	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	200
1803-PM-217 B-LCS-C01	240	-	-	044-PMCC-102	1803-PM-217 B-LCS		Local Control Station Cable For Primary Absorber Bottom Pump	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	200
1803-PM-218 A-LCS-C01	240	-	-	044-PMCC-102	1803-PM-218 A-LCS		Local Control Station Cable For Debutanizer Reflux Pump	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	295
1803-PM-218 B-LCS-C01	240	-	-	044-PMCC-102	1803-PM-218 B-LCS		Local Control Station Cable For Debutanizer Reflux Pump	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	295
1803-PM-219 A-LCS-C01	240	-	-	044-PMCC-102	1803-PM-219 A-LCS		Local Control Station Cable For LPG Product Pump	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	305
1803-PM-219 B-LCS-C01	240	-	-	044-PMCC-102	1803-PM-219 B-LCS		Local Control Station Cable For LPG Product Pump	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	305
1803-PM-220 A-LCS-C01	240	-	-	044-PMCC-103	1803-PM-220 A-LCS		Local Control Station Cable For Compressor Interstage Liquid Pump	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	100
1803-PM-220 B-LCS-C01	240	-	-	044-PMCC-103	1803-PM-220 B-LCS		Local Control Station Cable For Compressor Interstage Liquid Pump	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	100
1803-PM-224 A-LCS-C01	240	-	-	044-PMCC-101	1803-PM-224 A-LCS		Local Control Station Cable For HCN Pumparound Pump	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	100
1803-PM-224 B-LCS-C01	240	-	-	044-PMCC-101	1803-PM-224 B-LCS		Local Control Station Cable For HCN Pumparound Pump	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	100
1803-PM-225 A-LCS-C01	240	-	-	044-PMCC-103	1803-PM-225 A-LCS		Local Control Station Cable For Rich Amine Pump	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	215
1803-PM-225 B-LCS-C01	240	-	-	044-PMCC-103	1803-PM-225 B-LCS		Local Control Station Cable For Rich Amine Pump	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	215
1803-PM-608 A-LCS-C01	240	-	-	044-EPMCC-101	1803-PM-608 A-LCS		Local Control Station Cable For Flushing Oil Drum Pump	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	345
1803-PM-608 B-LCS-C01	240	-	-	044-EPMCC-101	1803-PM-608 B-LCS		Local Control Station Cable For Flushing Oil Drum Pump	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	345
1803-PM-222 A-LCS-C01	240	-	-	044-HTG-101	1803-PM-222 A-LCS		Local Control Station Cable For Lean Amine Pump	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	120
1803-PM-222 B-LCS-C01	240	-	-	044-HTG-101	1803-PM-222 B-LCS		Local Control Station Cable For Lean Amine Pump	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	120
1803-P-1001 A-LCS-C01	240	-	-	044-EPMCC-101	1803-P-1001 A-LCS		Local Control Station Cable For Corrosion Inhibitor Injection Pump Motor	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	220
1803-P-1001 B-LCS-C01	240	-	-	044-EPMCC-101	1803-P-1001 B-LCS		Local Control Station Cable For Corrosion Inhibitor Injection Pump Motor	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	220
1803-P-1001 C-LCS-C01	240	-	-	044-EPMCC-101	1803-P-1001 C-LCS		Local Control Station Cable For Corrosion Inhibitor Injection Pump Motor	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	220
1803-P-1001 D-LCS-C01	240	-	-	044-EPMCC-101	1803-P-1001 D-LCS		Local Control Station Cable For Corrosion Inhibitor Injection Pump Motor	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	220
1803-P-1001 E-LCS-C01	240	-	-	044-EPMCC-101	1803-P-1001 E-LCS		Local Control Station Cable For Corrosion Inhibitor Injection Pump Motor	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	220
1803-P-1001 F-LCS-C01	240	-	-	044-EPMCC-101	1803-P-1001 F-LCS		Local Control Station Cable For Corrosion Inhibitor Injection Pump Motor	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	220
1803-P-1002 A-LCS-C01	240	-	-	044-EPMCC-101	1803-P-1002 A-LCS		Local Control Station Cable For Ammonium Polysulphide Dosing Pump Motor	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	220
1803-P-1002 B-LCS-C01	240	-	-	044-EPMCC-101	1803-P-1002 B-LCS		Local Control Station Cable For Ammonium Polysulphide Dosing Pump Motor	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	220
1803-P-1003 A-LCS-C01	240	-	-	044-EPMCC-101	1803-P-1003 A-LCS		Local Control Station Cable For Antifoam Injection Pump Motor	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	220
1803-P-1003 B-LCS-C01	240	-	-	044-EPMCC-101	1803-P-1003 B-LCS		Local Control Station Cable For Antifoam Injection Pump Motor	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	220
1803-P-1004 A-LCS-C01	240	-	-	044-EPMCC-101	1803-P-1004 A-LCS		Local Control Station Cable For Phosphate Dosing Pump Motor	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	220
1803-P-1004 B-LCS-C01	240	-	-	044-EPMCC-101	1803-P-1004 B-LCS		Local Control Station Cable For Phosphate Dosing Pump Motor	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	220
1803-P-1004 C-LCS-C01	240	-	-	044-EPMCC-101	1803-P-1004 C-LCS		Local Control Station Cable For Phosphate Dosing Pump Motor	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	220
1803-P-1004 D-LCS-C01	240	-	-	044-EPMCC-101	1803-P-1004 D-LCS		Local Control Station Cable For Phosphate Dosing Pump Motor	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	220
1803-P-1005 A-LCS-C01	240	-	-	044-EPMCC-101	1803-P-1005 A-LCS		Local Control Station Cable For Neutralising Amine Dosing Pump Motor	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	220
1803-P-1005 B-LCS-C01	240	-	-	044-EPMCC-101	1803-P-1005 B-LCS		Local Control Station Cable For Neutralising Amine Dosing Pump Motor	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	220
1803-P-1006 A-LCS-C01	240	-	-	044-EPMCC-101	1803-P-1006 A-LCS		Local Control Station Cable For Oxygen Scavenger Dosing Pump Motor	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	220
1803-P-1006 B-LCS-C01	240	-	-	044-EPMCC-101	1803-P-1006 B-LCS		Local Control Station Cable For Oxygen Scavenger Dosing Pump Motor	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	220
1803-AM-1001 A-LCS-C01	240	-	-	044-MCC-102	1803-AM-1001 A-LCS		Local Control Station Cable For Corrosion Inhibitor Drum Agitator Motor	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	220
1803-AM-1002 A-LCS-C01	240	-	-	044-MCC-102	1803-AM-1002 A-LCS		Local Control Station Cable For Ammonium Polysulphide Drum Agitator Motor	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	200
1803-AM-1003 A-LCS-C01	240	-	-	044-MCC-102	1803-AM-1003 A-LCS		Local Control Station Cable For Antifoam Drum Agitator Motor	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	120
1803-AM-1004 A-LCS-C01	240	-	-	044-MCC-102	1803-AM-1004 A-LCS		Local Control Station Cable For Phosphate Drum Agitator Motor	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	220
1803-AM-1005 A-LCS-C01	240	-	-	044-MCC-102	1803-AM-1005 A-LCS		Local Control Station Cable For Neutralising Amine Drum Agitator Motor	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	210
1803-AM-1006 A-LCS-C01	240	-	-	044-MCC-102	1803-AM-1006 A-LCS		Local Control Station Cable For Oxygen Scavenger Drum Agitator Motor	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	210
1803-ACM-202 A-LCS-C01	240	-	-	044-MCC-107	1803-ACM-202 A-LCS		Local Control Station Cable For Lco Pumparound Air Cooler Fan-1	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	320
1803-ACM-202 B-LCS-C01	240	-	-	044-MCC-107	1803-ACM-202 B-LCS		Local Control Station Cable For Lco Pumparound Air Cooler Fan-2	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	320
1803-ACM-601 A-LCS-C01	240	-	-	044-MCC-107	1803-ACM-601 A-LCS		Local Control Station Cable For Condensate Flash Drum Air Cooler Fan-1	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	135
1803-ACM-601 B-LCS-C01	240	-	-	044-MCC-107	1803-ACM-601 B-LCS		Local Control Station Cable For Condensate Flash Drum Air Cooler Fan-2	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	135
1803-PM-609 A-LCS-C01	240	-	-	044-HTG-102	1803-PM-609 A-LCS		Local Control Station Cable For HP BOILER FEED WATER PUMP	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	189
1803-PM-609 B-LCS-C01	240	-	-	044-HTG-102	1803-PM-609 B-LCS		Local Control Station Cable For HP BOILER FEED WATER PUMP	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	189
1803-PM-609 C-LCS-C01	240	-	-	044-HTG-102	1803-PM-609 C-LCS		Local Control Station Cable For HP BOILER FEED WATER PUMP	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	189
1803-PM-610 A-LCS-C01	240	-	-	044-EPMCC-101	1803-PM-610 A-LCS		Local Control Station Cable For FIRE WATER BOOSTER PUMP	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	441
1803-PM-610 B-LCS-C01	240	-	-	044-EPMCC-101	1803-PM-610 B-LCS		Local Control Station Cable For FIRE WATER BOOSTER PUMP	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	441
1803-X-107-P001A-LCS-C01	240	-	-	044-MCC-106	1803-X-107-P001A-LCS		Local Control Station Cable For CAUSTIC BOOSTER PUMP	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	84
1803-X-107-P001B-LCS-C01	240	-	-	044-MCC-106	1803-X-107-P001B-LCS		Local Control Station Cable For CAUSTIC BOOSTER PUMP	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	84
1803-X-107-P002A-LCS-C01	240	-	-	044-MCC-106	1803-X-107-P002A-LCS		Local Control Station Cable For MAKE-UP WATER BOOSTER PUMP	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	84
1803-X-107-P002B-LCS-C01	240	-	-	044-MCC-106	1803-X-107-P002B-LCS		Local Control Station Cable For MAKE-UP WATER BOOSTER PUMP	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	84
1803-X-107-P005A-LCS-C01	240	-	-	044-MCC-106	1803-X-107-P005A-LCS		Local Control Station Cable For COAGULANT METERING PUMP	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	84
1803-X-107-P005B-LCS-C01	240	-	-	044-MCC-106	1803-X-107-P005B-LCS		Local Control Station Cable For COAGULANT METERING PUMP	0.6/1	MULTIPOLAR	6P	2,5	CU	XLPE	-	SWA	PVC	84
1803-X-																	

Table 136. Electrical cables list (part 10).

				ELECTRICAL CABLES LIST												
PROJECT:		EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LaPeeh" (J-18)														
CLIENT:		INDIAN OIL CORPORATION LIMITED														
CABLE TAG	RATED VOLTAGE (V)	RATED POWER (kW) (*): kVA	RATED CURRENT (A)	FROM		DESTINATION	INSULATION RATED VOLTAGE (kV)	CABLE DESCRIPTION								
				BOARD	USER TAG			DESCRIPTION	TYPE	CORES	SIZE (mm²)	CONDUCTOR	INSULATION	SCREENED	ARMOUR	OUTER SHEATH
1803-X-107-P003A-LCS-C01	240	-	-	044-PMCC-102	1803-X-107-P003A-LCS	Local Control Station Cable For SPRAY TOWER RECIRCULATION PUMP	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	320
1803-X-107-P003B-LCS-C01	240	-	-	044-PMCC-102	1803-X-107-P003B-LCS	Local Control Station Cable For SPRAY TOWER RECIRCULATION PUMP	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	320
1803-X-107-P003C-LCS-C01	240	-	-	044-PMCC-102	1803-X-107-P003C-LCS	Local Control Station Cable For SPRAY TOWER RECIRCULATION PUMP	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	210
1803-X-107-P004A-LCS-C01	240	-	-	044-PMCC-102	1803-X-107-P004A-LCS	Local Control Station Cable For FILTERING MODULES RECIRCULATION PUMP	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	210
1803-X-107-P004B-LCS-C01	240	-	-	044-PMCC-102	1803-X-107-P004B-LCS	Local Control Station Cable For FILTERING MODULES RECIRCULATION PUMP	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	220
1803-X-107-K-001A-LCS-C01	240	-	-	044-HT6-101	1803-X-107-K-001A-LCS	Local Control Station Cable For WGS OXIDATION BLOWER PUMP	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	220
1803-X-107-K-001B-LCS-C01	240	-	-	044-HT6-101	1803-X-107-K-001B-LCS	Local Control Station Cable For WGS OXIDATION BLOWER PUMP	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	200
1803-X-107-K-001C-LCS-C01	240	-	-	044-HT6-101	1803-X-107-K-001C-LCS	Local Control Station Cable For WGS OXIDATION BLOWER PUMP	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	200
1803-X-205-P-006A-LCS-C01	240	-	-	044-PMCC-103	1803-X-205-P-006A-LCS	Local Control Station Cable For REGENERATED CAUSTIC PUMPS	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	295
1803-X-205-P-006B-LCS-C01	240	-	-	044-PMCC-103	1803-X-205-P-006B-LCS	Local Control Station Cable For REGENERATED CAUSTIC PUMPS	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	295
1803-X-205-P-010A-LCS-C01	240	-	-	044-PMCC-103	1803-X-205-P-010A-LCS	Local Control Station Cable For LPG BOOSTER PUMPS	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	305
1803-X-205-P-010B-LCS-C01	240	-	-	044-PMCC-103	1803-X-205-P-010B-LCS	Local Control Station Cable For LPG BOOSTER PUMPS	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	305
1803-X-205-P-001A-LCS-C01	240	-	-	044-MCC-107	1803-X-205-P-001A-LCS	Local Control Station Cable For AMINE TRANSFER PUMP	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	100
1803-X-205-P-001B-LCS-C01	240	-	-	044-MCC-107	1803-X-205-P-001B-LCS	Local Control Station Cable For AMINE TRANSFER PUMP	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	100
1803-X-205-P-002A-LCS-C01	240	-	-	044-MCC-107	1803-X-205-P-002A-LCS	Local Control Station Cable For AMINE TRANSFER PUMP	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	100
1803-X-205-P-002B-LCS-C01	240	-	-	044-MCC-107	1803-X-205-P-002B-LCS	Local Control Station Cable For AMINE TRANSFER PUMP	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	100
1803-X-205-P-003A-LCS-C01	240	-	-	044-MCC-107	1803-X-205-P-003A-LCS	Local Control Station Cable For SO2 TOWER RECYCLE PUMP	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	215
1803-X-205-P-003B-LCS-C01	240	-	-	044-MCC-107	1803-X-205-P-003B-LCS	Local Control Station Cable For SO2 TOWER RECYCLE PUMP	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	215
1803-X-205-P-004A-LCS-C01	240	-	-	044-MCC-107	1803-X-205-P-004A-LCS	Local Control Station Cable For CAUSTIC TRANSFER PUMP	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	345
1803-X-205-P-004B-LCS-C01	240	-	-	044-MCC-107	1803-X-205-P-004B-LCS	Local Control Station Cable For CAUSTIC TRANSFER PUMP	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	345
1803-X-205-P-005A-LCS-C01	240	-	-	044-MCC-107	1803-X-205-P-005A-LCS	Local Control Station Cable For WATER RECYCLE PUMP	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	120
1803-X-205-P-005B-LCS-C01	240	-	-	044-MCC-107	1803-X-205-P-005B-LCS	Local Control Station Cable For WATER RECYCLE PUMP	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	120
1803-X-205-P-007A-LCS-C01	240	-	-	044-MCC-107	1803-X-205-P-007A-LCS	Local Control Station Cable For SOLVENT RECYCLE PUMP	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	220
1803-X-205-P-007B-LCS-C01	240	-	-	044-MCC-107	1803-X-205-P-007B-LCS	Local Control Station Cable For SOLVENT RECYCLE PUMP	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	220
1803-X-205-P-008A-LCS-C01	240	-	-	044-MCC-107	1803-X-205-P-008A-LCS	Local Control Station Cable For SOLVENT / DSO PUMP	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	220
1803-X-205-P-008B-LCS-C01	240	-	-	044-MCC-107	1803-X-205-P-008B-LCS	Local Control Station Cable For SOLVENT / DSO PUMP	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	220
1803-X-205-P-011A-LCS-C01	240	-	-	044-MCC-107	1803-X-205-P-011A-LCS	Local Control Station Cable For BRINE RECYCLE PUMP	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	220
1803-X-205-P-011B-LCS-C01	240	-	-	044-MCC-107	1803-X-205-P-011B-LCS	Local Control Station Cable For BRINE RECYCLE PUMP	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	220
1803-X-205-P-012A-LCS-C01	240	-	-	044-MCC-107	1803-X-205-P-012A-LCS	Local Control Station Cable For SPENT CAUSTIC FEED PUMP	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	220
1803-X-205-P-012B-LCS-C01	240	-	-	044-MCC-107	1803-X-205-P-012B-LCS	Local Control Station Cable For SPENT CAUSTIC FEED PUMP	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	220
1803-X-205-P-014A-LCS-C01	240	-	-	044-MCC-107	1803-X-205-P-014A-LCS	Local Control Station Cable For PROCESS WATER PUMP	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	220
1803-X-205-P-014B-LCS-C01	240	-	-	044-MCC-107	1803-X-205-P-014B-LCS	Local Control Station Cable For PROCESS WATER PUMP	0.6/1	MULTIPOLAR	6P	2.5	CU	XLPE	-	SWA	PVC	220
1803-ACM-201 A1-LCS-C02	240	-	-	044-MCC-102	1803-ACM-201 A1-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	220
1803-ACM-201 A2-LCS-C02	240	-	-	044-MCC-102	1803-ACM-201 A2-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	220
1803-ACM-201 B1-LCS-C02	240	-	-	044-MCC-102	1803-ACM-201 B1-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	220
1803-ACM-201 C1-LCS-C02	240	-	-	044-MCC-102	1803-ACM-201 C1-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	220
1803-ACM-201 B2-LCS-C02	240	-	-	044-MCC-102	1803-ACM-201 B2-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	220
1803-ACM-201 C2-LCS-C02	240	-	-	044-MCC-102	1803-ACM-201 C2-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	220
1803-ACM-201 D1-LCS-C02	240	-	-	044-MCC-102	1803-ACM-201 D1-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	220
1803-ACM-201 E1-LCS-C02	240	-	-	044-MCC-102	1803-ACM-201 E1-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	220
1803-ACM-201 D2-LCS-C02	240	-	-	044-MCC-102	1803-ACM-201 D2-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	220
1803-ACM-201 E2-LCS-C02	240	-	-	044-MCC-102	1803-ACM-201 E2-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	200
1803-ACM-201 F1-LCS-C03	240	-	-	044-MCC-102	1803-ACM-201 F1-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	120
1803-ACM-201 G1-LCS-C02	240	-	-	044-MCC-102	1803-ACM-201 G1-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	220
1803-ACM-201 H1-LCS-C02	240	-	-	044-MCC-102	1803-ACM-201 H1-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	210
1803-ACM-201 F2-LCS-C02	240	-	-	044-MCC-102	1803-ACM-201 F2-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	210
1803-ACM-201 G2-LCS-C02	240	-	-	044-MCC-102	1803-ACM-201 G2-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	320
1803-ACM-201 J1-LCS-C02	240	-	-	044-MCC-102	1803-ACM-201 J1-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	320
1803-ACM-201 K1-LCS-C02	240	-	-	044-MCC-103	1803-ACM-201 K1-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	135
1803-ACM-201 H2-LCS-C02	240	-	-	044-MCC-103	1803-ACM-201 H2-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	135
1803-ACM-201 J2-LCS-C02	240	-	-	044-MCC-103	1803-ACM-201 J2-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	189
1803-ACM-201 L1-LCS-C02	240	-	-	044-MCC-103	1803-ACM-201 L1-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	189
1803-ACM-201 M1-LCS-C02	240	-	-	044-MCC-103	1803-ACM-201 M1-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	189
1803-ACM-201 K2-LCS-C02	240	-	-	044-MCC-103	1803-ACM-201 K2-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	441
1803-ACM-201 L2-LCS-C02	240	-	-	044-MCC-103	1803-ACM-201 L2-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	441
1803-ACM-201 M2-LCS-C02	240	-	-	044-MCC-103	1803-ACM-201 M2-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	84
1803-ACM-201 N1-LCS-C02	240	-	-	044-MCC-103	1803-ACM-201 N1-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	84
1803-ACM-201 P1-LCS-C02	240	-	-	044-MCC-103	1803-ACM-201 P1-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	84
1803-ACM-201 N2-LCS-C02	240	-	-	044-MCC-103	1803-ACM-201 N2-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	84
1803-ACM-201 P2-LCS-C02	240	-	-	044-MCC-103	1803-ACM-201 P2-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	84
1803-ACM-201 Q1-LCS-C02	240	-	-	044-MCC-103	1803-ACM-201 Q1-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	84
1803-ACM-201 R1-LCS-C02	240	-	-	044-MCC-103	1803-ACM-201 R1-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU					

Table 137. Electrical cables list (part 11).

 				ELECTRICAL CABLES LIST												
PROJECT:				EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE												
CLIENT:				INTEGRATION PROJECT "LaPech" (J-18)												
				INDIAN OIL CORPORATION LIMITED												
CABLE TAG	RATED VOLTAGE (V)	RATED POWER (kW) (*): KVA	RATED CURRENT (A)	FROM	DESTINATION		CABLE DESCRIPTION									
				BOARD	USER TAG	DESCRIPTION	INSULATION RATED VOLTAGE (kV)	TYPE	CORES	SIZE (mm²)	CONDUCTOR	INSULATION	SCREENED	ARMOUR	OUTER SHEATH	LENGTH (m)
1803-ACM-204 B1-LCS-C02	240			044-MCC-104	1803-ACM-204 B1-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	368
1803-ACM-204 C1-LCS-C02	240			044-MCC-104	1803-ACM-204 C1-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	368
1803-ACM-204 D1-LCS-C02	240			044-MCC-104	1803-ACM-204 D1-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	368
1803-ACM-204 A2-LCS-C02	240			044-MCC-104	1803-ACM-204 A2-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	368
1803-ACM-204 B2-LCS-C02	240			044-MCC-104	1803-ACM-204 B2-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	368
1803-ACM-204 C2-LCS-C02	240			044-MCC-104	1803-ACM-204 C2-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	368
1803-ACM-204 D2-LCS-C02	240			044-MCC-104	1803-ACM-204 D2-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	368
1803-ACM-207 A1-LCS-C02	240			044-MCC-104	1803-ACM-207 A1-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	368
1803-ACM-207 B1-LCS-C02	240			044-MCC-104	1803-ACM-207 B1-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	368
1803-ACM-207 C1-LCS-C02	240			044-MCC-104	1803-ACM-207 C1-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	368
1803-ACM-207 D1-LCS-C02	240			044-MCC-104	1803-ACM-207 D1-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	368
1803-ACM-207 A2-LCS-C02	240			044-MCC-104	1803-ACM-207 A2-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	368
1803-ACM-207 B2-LCS-C02	240			044-MCC-104	1803-ACM-207 B2-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	368
1803-ACM-207 C2-LCS-C02	240			044-MCC-104	1803-ACM-207 C2-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	368
1803-ACM-207 D2-LCS-C02	240			044-MCC-104	1803-ACM-207 D2-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	368
1803-ACM-202 A1-LCS-C02	240			044-MCC-104	1803-ACM-202 A1-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	368
1803-ACM-202 B1-LCS-C02	240			044-MCC-104	1803-ACM-202 B1-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	368
1803-ACM-601 A-LCS-C02	240			044-MCC-104	1803-ACM-601 A-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	368
1803-ACM-601 B-LCS-C02	240			044-MCC-104	1803-ACM-601 B-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	368
1803-ACM-205 A1-LCS-C02	240			044-MCC-105	1803-ACM-205 A1-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	368
1803-ACM-205 B1-LCS-C02	240			044-MCC-105	1803-ACM-205 B1-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	368
1803-ACM-205 C1-LCS-C02	240			044-MCC-105	1803-ACM-205 C1-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	368
1803-ACM-205 D1-LCS-C02	240			044-MCC-105	1803-ACM-205 D1-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	368
1803-ACM-205 E1-LCS-C02	240			044-MCC-105	1803-ACM-205 E1-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	368
1803-ACM-205 F1-LCS-C02	240			044-MCC-105	1803-ACM-205 F1-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	368
1803-ACM-205 G1-LCS-C02	240			044-MCC-105	1803-ACM-205 G1-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	368
1803-ACM-205 H1-LCS-C02	240			044-MCC-105	1803-ACM-205 H1-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	368
1803-ACM-205 A2-LCS-C02	240			044-MCC-105	1803-ACM-205 A2-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	368
1803-ACM-205 B2-LCS-C02	240			044-MCC-105	1803-ACM-205 B2-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	368
1803-ACM-205 C2-LCS-C02	240			044-MCC-105	1803-ACM-205 C2-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	368
1803-ACM-205 D2-LCS-C02	240			044-MCC-105	1803-ACM-205 D2-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	368
1803-ACM-205 E2-LCS-C02	240			044-MCC-105	1803-ACM-205 E2-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	368
1803-ACM-205 F2-LCS-C02	240			044-MCC-105	1803-ACM-205 F2-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	368
1803-ACM-205 G2-LCS-C02	240			044-MCC-105	1803-ACM-205 G2-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	368
1803-ACM-205 H2-LCS-C02	240			044-MCC-105	1803-ACM-205 H2-E.STOP	E.STOP (Grade Level)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	368
1803-PM-101 A-SH-P1	240	0.12	0.50	044-HTG-101	1803-PM-101 A-SH	Power Cable For HOT Fresh Feed Pumps Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	170
1803-PM-101 B-SH-P1	240	0.12	0.50	044-HTG-101	1803-PM-101 B-SH	Power Cable For HOT Fresh Feed Pumps Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	170
1803-PM-202 A-SH-P1	240	0.12	0.50	044-HTG-101	1803-PM-202 A-SH	Power Cable For LCO Pumparound Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	260
1803-PM-202 B-SH-P1	240	0.12	0.50	044-HTG-101	1803-PM-202 B-SH	Power Cable For LCO Pumparound Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	260
1803-PM-202 C-SH-P1	240	0.12	0.50	044-HTG-101	1803-PM-202 C-SH	Power Cable For LCO Pumparound Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	260
1803-PM-204 A-SH-P1	240	0.12	0.50	044-HTG-101	1803-PM-204 A-SH	Power Cable For HCO Pumparound Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	315
1803-PM-204 B-SH-P1	240	0.12	0.50	044-HTG-101	1803-PM-204 B-SH	Power Cable For HCO Pumparound Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	315
1803-PM-204 C-SH-P1	240	0.12	0.50	044-HTG-101	1803-PM-204 C-SH	Power Cable For HCO Pumparound Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	315
1803-PM-205 A-SH-P1	240	0.12	0.50	044-HTG-101	1803-PM-205 A-SH	Power Cable For Main Fractionator Bottom Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	235
1803-PM-205 B-SH-P1	240	0.12	0.50	044-HTG-101	1803-PM-205 B-SH	Power Cable For Main Fractionator Bottom Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	235
1803-PM-213 A-SH-P1	240	0.12	0.50	044-HTG-101	1803-PM-213 A-SH	Power Cable For Deethanizer Stripper Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	185
1803-PM-213 B-SH-P1	240	0.12	0.50	044-HTG-101	1803-PM-213 B-SH	Power Cable For Deethanizer Stripper Charge Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	185
1803-PM-214 A-SH-P1	240	0.12	0.50	044-HTG-101	1803-PM-214 A-SH	Power Cable For Gasoline Recycle Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	320
1803-PM-214 B-SH-P1	240	0.12	0.50	044-HTG-101	1803-PM-214 B-SH	Power Cable For Gasoline Recycle Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	320
1803-PM-222 A-SH-P1	240	0.12	0.50	044-HTG-101	1803-PM-222 A-SH	Power Cable For Lean Amine Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	120
1803-PM-222 B-SH-P1	240	0.12	0.50	044-HTG-101	1803-PM-222 B-SH	Power Cable For Lean Amine Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	120
1803-PM-102 A-SH-P1	240	0.12	0.50	044-PMCC-101	1803-PM-102 A-SH	Power Cable For Cold Fresh Feed Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	205
1803-PM-102 B-SH-P1	240	0.12	0.50	044-PMCC-101	1803-PM-102 B-SH	Power Cable For Cold Fresh Feed Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	205
1803-PM-206 A-SH-P1	240	0.12	0.50	044-PMCC-101	1803-PM-206 A-SH	Power Cable For CLO Product Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	290
1803-PM-206 B-SH-P1	240	0.12	0.50	044-PMCC-101	1803-PM-206 B-SH	Power Cable For CLO Product Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	290
1803-PM-207 A-SH-P1	240	0.12	0.50	044-PMCC-101	1803-PM-207 A-SH	Power Cable For Fractionator Reflux Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	160
1803-PM-207 B-SH-P1	240	0.12	0.50	044-PMCC-101	1803-PM-207 B-SH	Power Cable For Fractionator Reflux Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	160
1803-PM-224 A-SH-P1	240	0.12	0.50	044-PMCC-101	1803-PM-224 A-SH	Power Cable For HCN Pumparound Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	100
1803-PM-224 B-SH-P1	240	0.12	0.50	044-PMCC-101	1803-PM-224 B-SH	Power Cable For HCN Pumparound Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	100
1803-PM-215 A-SH-P1	240	0.12	0.50	044-PMCC-102	1803-PM-215 A-SH	Power Cable For Primary Absorber Intercooler-I Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	210
1803-PM-215 B-SH-P1	240	0.12	0.50	044-PMCC-102	1803-PM-215 B-SH	Power Cable For Primary Absorber Intercooler-I Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	210
1803-PM-216 A-SH-P1	240	0.12	0.50	044-PMCC-102	1803-PM-216 A-SH	Power Cable For Primary Absorber Intercooler-II Pumps Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	220
1803-PM-216 B-SH-P1	240	0.12	0.50	044-PMCC-102	1803-PM-216 B-SH	Power Cable For Primary Absorber Intercooler-II Pumps Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	220
1803-PM-217 A-SH-P1	240	0.12	0.50	044-PMCC-102	1803-PM-217 A-SH	Power Cable For Primary Absorber Bottom Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	200
1803-PM-217 B-SH-P1	240	0.12	0.50	044-PMCC-102	1803-PM-217 B-SH	Power Cable For Primary Absorber Bottom Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	200

Table 138. Electrical cables list (part 12).

				ELECTRICAL CABLES LIST												
PROJECT: EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LaPech" (J-18)																
CLIENT: INDIAN OIL CORPORATION LIMITED																
CABLE TAG	RATED VOLTAGE (V)	RATED POWER (kW) (*): KVA	RATED CURRENT (A)	FROM	DESTINATION	CABLE DESCRIPTION										
				BOARD	USER TAG	DESCRIPTION	INSULATION RATED VOLTAGE (kV)	TYPE	CORES	SIZE (mm²)	CONDUCTOR	INSULATION	SCREENED	ARMOUR	OUTER SHEATH	LENGTH (m)
1803-PM-218 A-SH-P1	240	0.12	0.5	044-PMCC-102	1803-PM-218 A-SH	Power Cable For Debutanizer Reflux Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	295
1803-PM-218 B-SH-P1	240	0.12	0.5	044-PMCC-102	1803-PM-218 B-SH	Power Cable For Debutanizer Reflux Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	295
1803-PM-219 A-SH-P1	240	0.12	0.5	044-PMCC-102	1803-PM-219 A-SH	Power Cable For LPG Product Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	305
1803-PM-219 B-SH-P1	240	0.12	0.5	044-PMCC-102	1803-PM-219 B-SH	Power Cable For LPG Product Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	305
1803-PM-203 A-SH-P1	240	0.12	0.5	044-PMCC-103	1803-PM-203 A-SH	Power Cable For LCO Product Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	270
1803-PM-203 B-SH-P1	240	0.12	0.5	044-PMCC-103	1803-PM-203 B-SH	Power Cable For LCO Product Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	270
1803-PM-212 A-SH-P1	240	0.12	0.5	044-PMCC-103	1803-PM-212 A-SH	Power Cable For Compressor Interstage Liquid Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	175
1803-PM-212 B-SH-P1	240	0.12	0.5	044-PMCC-103	1803-PM-212 B-SH	Power Cable For Compressor Interstage Liquid Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	175
1803-PM-220 A-SH-P1	240	0.12	0.5	044-PMCC-103	1803-PM-220 A-SH	Power Cable For Lean Oil Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	100
1803-PM-220 B-SH-P1	240	0.12	0.5	044-PMCC-103	1803-PM-220 B-SH	Power Cable For Lean Oil Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	100
1803-PM-209 A-SH-P1	240	0.12	0.5	044-PMCC-103	1803-PM-209 A-SH	Power Cable For Distillate Drum Liquid Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	195
1803-PM-209 B-SH-P1	240	0.12	0.5	044-PMCC-103	1803-PM-209 B-SH	Power Cable For Distillate Drum Liquid Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	195
1803-PM-225 A-SH-P1	240	0.12	0.5	044-PMCC-103	1803-PM-225 A-SH	Power Cable For Rich Amine Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	215
1803-PM-225 B-SH-P1	240	0.12	0.5	044-PMCC-103	1803-PM-225 B-SH	Power Cable For Rich Amine Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	215
1803-PM-604 A-SH-P1	240	0.12	0.5	044-EPMCC-101	1803-PM-604 A-SH	Power Cable For Flare KOD Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	305
1803-PM-604 B-SH-P1	240	0.12	0.5	044-EPMCC-101	1803-PM-604 B-SH	Power Cable For Flare KOD Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	305
1803-PM-608 A-SH-P1	240	0.12	0.5	044-EPMCC-101	1803-PM-608 A-SH	Power Cable For Flushing Oil Drum Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	345
1803-PM-608 B-SH-P1	240	0.12	0.5	044-EPMCC-101	1803-PM-608 B-SH	Power Cable For Flushing Oil Drum Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	345
1803-PM-201 A-SH-P1	240	0.12	0.5	044-MCC-101	1803-PM-201 A-SH	Power Cable For HCN Product Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	260
1803-PM-201 B-SH-P1	240	0.12	0.5	044-MCC-101	1803-PM-201 B-SH	Power Cable For HCN Product Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	260
1803-PM-223 A-SH-P1	240	0.12	0.5	044-MCC-101	1803-PM-223 A-SH	Power Cable For Sour Water Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	150
1803-PM-223 B-SH-P1	240	0.12	0.5	044-MCC-101	1803-PM-223 B-SH	Power Cable For Sour Water Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	150
1803-PM-611 A-SH-P1	240	0.12	0.5	044-MCC-101	1803-PM-611 A-SH	Power Cable For Contaminated Rain Water Sewer Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	80
1803-PM-611 B-SH-P1	240	0.12	0.5	044-MCC-101	1803-PM-611 B-SH	Power Cable For Contaminated Rain Water Sewer Pump Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	80
1803-ACM-201 A2-SH-P1	240	0.12	0.5	044-MCC-101	1803-ACM-201 A2-SH	Power Cable For Fractionator Overhead Air Condenser Fan-1 Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	160
1803-ACM-201 A1-SH-P1	240	0.12	0.5	044-MCC-101	1803-ACM-201 A1-SH	Power Cable For Fractionator Overhead Air Condenser Fan-2 Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	160
1803-ACM-201 B1-SH-P1	240	0.12	0.5	044-MCC-102	1803-ACM-201 B1-SH	Power Cable For Fractionator Overhead Air Condenser Fan-3 Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	155
1803-ACM-201 C1-SH-P1	240	0.12	0.5	044-MCC-102	1803-ACM-201 C1-SH	Power Cable For Fractionator Overhead Air Condenser Fan-4 Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	155
1803-ACM-201 B2-SH-P1	240	0.12	0.5	044-MCC-102	1803-ACM-201 B2-SH	Power Cable For Fractionator Overhead Air Condenser Fan-5 Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	148
1803-ACM-201 C2-SH-P1	240	0.12	0.5	044-MCC-102	1803-ACM-201 C2-SH	Power Cable For Fractionator Overhead Air Condenser Fan-6 Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	148
1803-ACM-201 D1-SH-P1	240	0.12	0.5	044-MCC-102	1803-ACM-201 D1-SH	Power Cable For Fractionator Overhead Air Condenser Fan-7 Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	105
1803-ACM-201 E1-SH-P1	240	0.12	0.50	044-MCC-102	1803-ACM-201 E1-SH	Power Cable For Fractionator Overhead Air Condenser Fan-8 Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	105
1803-ACM-201 D2-SH-P1	240	0.12	0.50	044-MCC-102	1803-ACM-201 D2-SH	Power Cable For Fractionator Overhead Air Condenser Fan-9 Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	112
1803-ACM-201 E2-SH-P1	240	0.12	0.50	044-MCC-102	1803-ACM-201 E2-SH	Power Cable For Fractionator Overhead Air Condenser Fan-10 Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	112
1803-ACM-201 F1-SH-P1	240	0.12	0.50	044-MCC-102	1803-ACM-201 F1-SH	Power Cable For Fractionator Overhead Air Condenser Fan-11 Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	120
1803-ACM-201 G1-SH-P1	240	0.12	0.50	044-MCC-102	1803-ACM-201 G1-SH	Power Cable For Fractionator Overhead Air Condenser Fan-12 Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	120
1803-ACM-201 H1-SH-P1	240	0.12	0.50	044-MCC-103	1803-ACM-201 H1-SH	Power Cable For Fractionator Overhead Air Condenser Fan-13 Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	140
1803-ACM-201 F2-SH-P1	240	0.12	0.50	044-MCC-103	1803-ACM-201 F2-SH	Power Cable For Fractionator Overhead Air Condenser Fan-14 Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	140
1803-ACM-201 G2-SH-P1	240	0.12	0.50	044-MCC-103	1803-ACM-201 G2-SH	Power Cable For Fractionator Overhead Air Condenser Fan-15 Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	147
1803-ACM-201 J1-SH-P1	240	0.12	0.50	044-MCC-103	1803-ACM-201 J1-SH	Power Cable For Fractionator Overhead Air Condenser Fan-16 Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	147
1803-ACM-201 K1-SH-P1	240	0.12	0.50	044-MCC-103	1803-ACM-201 K1-SH	Power Cable For Fractionator Overhead Air Condenser Fan-17 Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	152
1803-ACM-201 H2-SH-P1	240	0.12	0.50	044-MCC-103	1803-ACM-201 H2-SH	Power Cable For Fractionator Overhead Air Condenser Fan-18 Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	152
1803-ACM-201 J2-SH-P1	240	0.12	0.50	044-MCC-103	1803-ACM-201 J2-SH	Power Cable For Fractionator Overhead Air Condenser Fan-19 Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	160
1803-ACM-201 L1-SH-P1	240	0.12	0.50	044-MCC-103	1803-ACM-201 L1-SH	Power Cable For Fractionator Overhead Air Condenser Fan-20 Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	160
1803-ACM-201 M1-SH-P1	240	0.12	0.50	044-MCC-103	1803-ACM-201 M1-SH	Power Cable For Fractionator Overhead Air Condenser Fan-21 Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	170
1803-ACM-201 K2-SH-P1	240	0.12	0.50	044-MCC-103	1803-ACM-201 K2-SH	Power Cable For Fractionator Overhead Air Condenser Fan-22 Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	170
1803-ACM-201 L2-SH-P1	240	0.12	0.50	044-MCC-104	1803-ACM-201 L2-SH	Power Cable For Fractionator Overhead Air Condenser Fan-23 Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	178
1803-ACM-201 M2-SH-P1	240	0.12	0.50	044-MCC-104	1803-ACM-201 M2-SH	Power Cable For Fractionator Overhead Air Condenser Fan-24 Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	178
1803-ACM-201 N1-SH-P1	240	0.12	0.50	044-MCC-104	1803-ACM-201 N1-SH	Power Cable For Fractionator Overhead Air Condenser Fan-25 Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	185
1803-ACM-201 P1-SH-P1	240	0.12	0.50	044-MCC-104	1803-ACM-201 P1-SH	Power Cable For Fractionator Overhead Air Condenser Fan-26 Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	185
1803-ACM-201 N2-SH-P1	240	0.12	0.50	044-MCC-104	1803-ACM-201 N2-SH	Power Cable For Fractionator Overhead Air Condenser Fan-27 Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	192
1803-ACM-201 P2-SH-P1	240	0.12	0.50	044-MCC-104	1803-ACM-201 P2-SH	Power Cable For Fractionator Overhead Air Condenser Fan-28 Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	192
1803-ACM-201 Q1-SH-P1	240	0.12	0.50	044-MCC-104	1803-ACM-201 Q1-SH	Power Cable For Fractionator Overhead Air Condenser Fan-29 Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	200
1803-ACM-201 R1-SH-P1	240	0.12	0.50	044-MCC-104	1803-ACM-201 R1-SH	Power Cable For Fractionator Overhead Air Condenser Fan-30 Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	200
1803-ACM-201 Q2-SH-P1	240	0.12	0.50	044-MCC-104	1803-ACM-201 Q2-SH	Power Cable For Fractionator Overhead Air Condenser Fan-31 Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	207
1803-ACM-201 R2-SH-P1	240	0.12	0.50	044-MCC-104	1803-ACM-201 R2-SH	Power Cable For Fractionator Overhead Air Condenser Fan-32 Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	207
1803-ACM-204 A-SH-P1	240	0.12	0.50	044-MCC-105	1803-ACM-204 A-SH	Power Cable For Compressor Interstage Air Condenser Fan-1 Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	214
1803-ACM-204 B-SH-P1	240	0.12	0.50	044-MCC-105	1803-ACM-204 B-SH	Power Cable For Compressor Interstage Air Condenser Fan-2 Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	205
1803-ACM-204 C-SH-P1	240	0.12	0.50	044-MCC-105	1803-ACM-204 C-SH	Power Cable For Compressor Interstage Air Condenser Fan-3 Space Heater	0.6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	205
1803-ACM-204 D-SH-P1	240	0.12	0.50	044-MCC-105	1803-ACM-204 D-SH	Power Cable For Compressor Interstage Air Condenser Fan-4 Space Heater	0.6/1	1PH+N	2							

Table 139. Electrical cables list (part 13).

				ELECTRICAL CABLES LIST														
PROJECT:		EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LuPech" (J-18)																
CLIENT:		INDIAN OIL CORPORATION LIMITED																
CABLE TAG	RATED VOLTAGE (V)	RATED POWER (kW) (*): kVA	RATED CURRENT (A)	FROM		DESTINATION		CABLE DESCRIPTION										
				BOARD	USER TAG	DESCRIPTION	INSULATION RATED VOLTAGE (kV)	TYPE	CORES	SIZE (mm²)	CONDUCTOR	INSULATION	SCREENED	ARMOUR	OUTER SHEATH	LENGTH (m)		
1803-X-106 B-SH-P1	240	0,12	0,5	044-MCC-106	1803-X-106 B-SH			Power Cable For Purge Air Fan (Waste Heat Boiler) Space Heater	0,6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	160
1803-ACM-206 A-SH-P1	240	0,12	0,5	044-MCC-107	1803-ACM-206 A-SH			Power Cable For Gasoline Recycle Air Cooler Fan-1 Space Heater	0,6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	334
1803-ACM-206 B-SH-P1	240	0,12	0,5	044-MCC-107	1803-ACM-206 B-SH			Power Cable For Gasoline Recycle Air Cooler Fan-2 Space Heater	0,6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	334
1803-ACM-206 C-SH-P1	240	0,12	0,5	044-MCC-107	1803-ACM-206 C-SH			Power Cable For Gasoline Recycle Air Cooler Fan-3 Space Heater	0,6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	340
1803-ACM-206 D-SH-P1	240	0,12	0,5	044-MCC-107	1803-ACM-206 D-SH			Power Cable For Gasoline Recycle Air Cooler Fan-4 Space Heater	0,6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	340
1803-PM-609 A-SH-P1	240	0,12	0,5	044-HT6-102	1803-PM-609 A-SH			Power Cable For HP BOILER FEED WATER PUMP Space Heater	0,6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	334
1803-PM-609 B-SH-P1	240	0,12	0,5	044-HT6-102	1803-PM-609 B-SH			Power Cable For HP BOILER FEED WATER PUMP Space Heater	0,6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	334
1803-PM-609 C-SH-P1	240	0,12	0,5	044-HT6-102	1803-PM-609 C-SH			Power Cable For HP BOILER FEED WATER PUMP Space Heater	0,6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	334
1803-PM-610 A-SH-P1	240	0,12	0,5	044-EPMCC-101	1803-PM-610 A-SH			Power Cable For FIRE WATER BOOSTER PUMP Space Heater	0,6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	340
1803-PM-610 B-SH-P1	240	0,12	0,5	044-EPMCC-101	1803-PM-610 B-SH			Power Cable For FIRE WATER BOOSTER PUMP Space Heater	0,6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	340
1803-X-106 A-SH-P1	240	0,12	0,5	044-MCC-106	1803-X-106 A-SH			Power Cable For PURGE AIR FAN (WASTE HEAT BOILER) Space Heater	0,6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	334
1803-X-106 B-SH-P1	240	0,12	0,5	044-MCC-106	1803-X-106 B-SH			Power Cable For PURGE AIR FAN (WASTE HEAT BOILER) Space Heater	0,6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	334
1803-X-107-K-001A-SH-P1	240	0,12	0,5	044-HT6-101	1803-X-107-K-001A-SH			Power Cable For WGS OXIDATION BLOWER PUMP Space Heater	0,6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	334
1803-X-107-K-001B-SH-P1	240	0,12	0,5	044-HT6-101	1803-X-107-K-001B-SH			Power Cable For WGS OXIDATION BLOWER PUMP Space Heater	0,6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	334
1803-X-107-K-001C-SH-P1	240	0,12	0,5	044-HT6-101	1803-X-107-K-001C-SH			Power Cable For WGS OXIDATION BLOWER PUMP Space Heater	0,6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	334
OXTM-A-SH-P1	240	0,12	0,5	044-PMCC-101	OXTM-A-SH			Power Cable For OXIDATION TANK MIXER MOTORS A (1803-X-107) Space Heater	0,6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	340
OXTM-B-SH-P1	240	0,12	0,5	044-PMCC-101	OXTM-B-SH			Power Cable For OXIDATION TANK MIXER MOTORS B (1803-X-107) Space Heater	0,6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	340
OXTM-C-SH-P1	240	0,12	0,5	044-PMCC-101	OXTM-C-SH			Power Cable For OXIDATION TANK MIXER MOTORS C (1803-X-107) Space Heater	0,6/1	1PH+N	2	4	CU	XLPE	-	SWA	PVC	340
1803-PM-101 A-RTD01	240	225	-	044-HT6-101	1803-PM-101 A			RTD Winding temp. signal cable for HOT FRESH FEED PUMPS	0,6/1	MULTIPOLAR	6x3	0,75	CU	XLPE	-	SWA	PVC	179
1803-PM-101 A-RTD02	240	225	-	044-HT6-101	1803-PM-101 A			RTD Winding temp. signal cable for HOT FRESH FEED PUMPS	0,6/1	MULTIPOLAR	6x3	0,75	CU	XLPE	-	SWA	PVC	179
1803-PM-101 A-RTD03	240	225	-	044-HT6-101	1803-PM-101 A			RTD Bearing temp. signal cable for HOT FRESH FEED PUMPS	0,6/1	MULTIPOLAR	12	2,5	CU	XLPE	-	SWA	PVC	179
1803-PM-101 B-RTD01	240	225	-	044-HT6-101	1803-PM-101 B			RTD Winding temp. signal cable for HOT FRESH FEED PUMPS	0,6/1	MULTIPOLAR	6x3	0,75	CU	XLPE	-	SWA	PVC	179
1803-PM-101 B-RTD02	240	225	-	044-HT6-101	1803-PM-101 B			RTD Winding temp. signal cable for HOT FRESH FEED PUMPS	0,6/1	MULTIPOLAR	6x3	0,75	CU	XLPE	-	SWA	PVC	179
1803-PM-101 B-RTD03	240	225	-	044-HT6-101	1803-PM-101 B			RTD Bearing temp. signal cable for HOT FRESH FEED PUMPS	0,6/1	MULTIPOLAR	12	2,5	CU	XLPE	-	SWA	PVC	179
1803-PM-202 A-RTD01	240	290	-	044-HT6-101	1803-PM-202 A			RTD Winding temp. signal cable for LCO PUMPAROUND PUMP	0,6/1	MULTIPOLAR	6x3	0,75	CU	XLPE	-	SWA	PVC	273
1803-PM-202 A-RTD02	240	290	-	044-HT6-101	1803-PM-202 A			RTD Winding temp. signal cable for LCO PUMPAROUND PUMP	0,6/1	MULTIPOLAR	6x3	0,75	CU	XLPE	-	SWA	PVC	273
1803-PM-202 A-RTD03	240	290	-	044-HT6-101	1803-PM-202 A			RTD Bearing temp. signal cable for LCO PUMPAROUND PUMP	0,6/1	MULTIPOLAR	12	2,5	CU	XLPE	-	SWA	PVC	273
1803-PM-202 B-RTD01	240	290	-	044-HT6-101	1803-PM-202 B			RTD Winding temp. signal cable for LCO PUMPAROUND PUMP	0,6/1	MULTIPOLAR	6x3	0,75	CU	XLPE	-	SWA	PVC	273
1803-PM-202 B-RTD02	240	290	-	044-HT6-101	1803-PM-202 B			RTD Winding temp. signal cable for LCO PUMPAROUND PUMP	0,6/1	MULTIPOLAR	6x3	0,75	CU	XLPE	-	SWA	PVC	273
1803-PM-202 B-RTD03	240	290	-	044-HT6-101	1803-PM-202 B			RTD Bearing temp. signal cable for LCO PUMPAROUND PUMP	0,6/1	MULTIPOLAR	12	2,5	CU	XLPE	-	SWA	PVC	273
1803-PM-202 C-RTD01	240	290	-	044-HT6-101	1803-PM-202 C			RTD Winding temp. signal cable for LCO PUMPAROUND PUMP	0,6/1	MULTIPOLAR	6x3	0,75	CU	XLPE	-	SWA	PVC	273
1803-PM-202 C-RTD02	240	290,00	-	044-HT6-101	1803-PM-202 C			RTD Winding temp. signal cable for LCO PUMPAROUND PUMP	0,6/1	MULTIPOLAR	6x3	0,75	CU	XLPE	-	SWA	PVC	273
1803-PM-202 C-RTD03	240	290,00	-	044-HT6-101	1803-PM-202 C			RTD Bearing temp. signal cable for LCO PUMPAROUND PUMP	0,6/1	MULTIPOLAR	12	2,5	CU	XLPE	-	SWA	PVC	273
1803-PM-204 A-RTD01	240	210,00	-	044-HT6-101	1803-PM-204 A			RTD Winding temp. signal cable for HCO PUMPAROUND PUMP	0,6/1	MULTIPOLAR	6x3	0,75	CU	XLPE	-	SWA	PVC	331
1803-PM-204 A-RTD02	240	210,00	-	044-HT6-101	1803-PM-204 A			RTD Winding temp. signal cable for HCO PUMPAROUND PUMP	0,6/1	MULTIPOLAR	6x3	0,75	CU	XLPE	-	SWA	PVC	331
1803-PM-204 A-RTD03	240	210,00	-	044-HT6-101	1803-PM-204 A			RTD Bearing temp. signal cable for HCO PUMPAROUND PUMP	0,6/1	MULTIPOLAR	12	2,5	CU	XLPE	-	SWA	PVC	331
1803-PM-204 B-RTD01	240	210,00	-	044-HT6-101	1803-PM-204 B			RTD Winding temp. signal cable for HCO PUMPAROUND PUMP	0,6/1	MULTIPOLAR	6x3	0,75	CU	XLPE	-	SWA	PVC	331
1803-PM-204 B-RTD02	240	210,00	-	044-HT6-101	1803-PM-204 B			RTD Winding temp. signal cable for HCO PUMPAROUND PUMP	0,6/1	MULTIPOLAR	6x3	0,75	CU	XLPE	-	SWA	PVC	331
1803-PM-204 B-RTD03	240	210,00	-	044-HT6-101	1803-PM-204 B			RTD Bearing temp. signal cable for HCO PUMPAROUND PUMP	0,6/1	MULTIPOLAR	12	2,5	CU	XLPE	-	SWA	PVC	331
1803-PM-204 C-RTD01	240	210,00	-	044-HT6-101	1803-PM-204 C			RTD Winding temp. signal cable for HCO PUMPAROUND PUMP	0,6/1	MULTIPOLAR	6x3	0,75	CU	XLPE	-	SWA	PVC	331
1803-PM-204 C-RTD02	240	210,00	-	044-HT6-101	1803-PM-204 C			RTD Winding temp. signal cable for HCO PUMPAROUND PUMP	0,6/1	MULTIPOLAR	6x3	0,75	CU	XLPE	-	SWA	PVC	331
1803-PM-204 C-RTD03	240	210,00	-	044-HT6-101	1803-PM-204 C			RTD Bearing temp. signal cable for HCO PUMPAROUND PUMP	0,6/1	MULTIPOLAR	12	2,5	CU	XLPE	-	SWA	PVC	331
1803-PM-205 A-RTD01	240	480,00	-	044-HT6-101	1803-PM-205 A			RTD Winding temp. signal cable for MAIN FRACTIONATOR BOTTOM PUMP	0,6/1	MULTIPOLAR	6x3	0,75	CU	XLPE	-	SWA	PVC	247
1803-PM-205 A-RTD02	240	480,00	-	044-HT6-101	1803-PM-205 A			RTD Winding temp. signal cable for MAIN FRACTIONATOR BOTTOM PUMP	0,6/1	MULTIPOLAR	6x3	0,75	CU	XLPE	-	SWA	PVC	247
1803-PM-205 A-RTD03	240	480,00	-	044-HT6-101	1803-PM-205 A			RTD Bearing temp. signal cable for MAIN FRACTIONATOR BOTTOM PUMP	0,6/1	MULTIPOLAR	12	2,5	CU	XLPE	-	SWA	PVC	247
1803-PM-205 B-RTD01	240	480,00	-	044-HT6-101	1803-PM-205 B			RTD Winding temp. signal cable for MAIN FRACTIONATOR BOTTOM PUMP	0,6/1	MULTIPOLAR	6x3	0,75	CU	XLPE	-	SWA	PVC	247
1803-PM-205 B-RTD02	240	480,00	-	044-HT6-101	1803-PM-205 B			RTD Winding temp. signal cable for MAIN FRACTIONATOR BOTTOM PUMP	0,6/1	MULTIPOLAR	6x3	0,75	CU	XLPE	-	SWA	PVC	247
1803-PM-205 B-RTD03	240	480,00	-	044-HT6-101	1803-PM-205 B			RTD Bearing temp. signal cable for MAIN FRACTIONATOR BOTTOM PUMP	0,6/1	MULTIPOLAR	12	2,5	CU	XLPE	-	SWA	PVC	247
1803-PM-213 A-RTD01	240	250,00	-	044-HT6-101	1803-PM-213 A			RTD Winding temp. signal cable for DEETHANIZER STRIPPER CHARGE PUMP	0,6/1	MULTIPOLAR	6x3	0,75	CU	XLPE	-	SWA	PVC	194
1803-PM-213 A-RTD02	240	250,00	-	044-HT6-101	1803-PM-213 A			RTD Winding temp. signal cable for DEETHANIZER STRIPPER CHARGE PUMP	0,6/1	MULTIPOLAR	6x3	0,75	CU	XLPE	-	SWA	PVC	194
1803-PM-213 A-RTD03	240	250,00	-	044-HT6-101	1803-PM-213 A			RTD Bearing temp. signal cable for DEETHANIZER STRIPPER CHARGE PUMP	0,6/1	MULTIPOLAR	12	2,5	CU	XLPE	-	SWA	PVC	194
1803-PM-213 B-RTD01	240	250,00	-	044-HT6-101	1803-PM-213 B			RTD Winding temp. signal cable for DEETHANIZER STRIPPER CHARGE PUMP	0,6/1	MULTIPOLAR	6x3	0,75	CU	XLPE	-	SWA	PVC	194
1803-PM-213 B-RTD02	240	250,00	-	044-HT6-101	1803-PM-213 B			RTD Winding temp. signal cable for DEETHANIZER STRIPPER CHARGE PUMP	0,6/1	MULTIPOLAR	6x3	0,75	CU	XLPE	-	SWA	PVC	194
1803-PM-213 B-RTD03	240	250,00	-	044-HT6-101	1803-PM-213 B			RTD Bearing temp. signal cable for DEETHANIZER STRIPPER CHARGE PUMP	0,6/1	MULTIPOLAR	12	2,5	CU	XLPE	-	SWA	PVC	194
1803-PM-214 A-RTD01	240	170,00	-	044-HT6-101	1803-PM-214 A			RTD Winding temp. signal cable for GASOLINE RECYCLE PUMP	0,6/1	MULTIPOLAR	6x3	0,75	CU	XLPE	-	SWA	PVC	336
1803-PM-214 A-RTD02	240	170,00	-	044-HT6-101	1803-PM-214 A			RTD Winding temp. signal cable for GASOLINE RECYCLE PUMP	0,6/1	MULTIPOLAR	6x3	0,75	CU	XLPE	-	SWA	PVC	336
1803-PM-214 A-RTD03	240	170,00	-	044-HT6-101	1803-PM-214 A			RTD Bearing temp. signal cable for GASOLINE RECYCLE PUMP	0,6/1									

Table 140. Electrical cables list (part 14).

								ELECTRICAL CABLES LIST											
PROJECT:		EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LuPech" (4-18)																	
CLIENT:		INDIAN OIL CORPORATION LIMITED																	
CABLE TAG	RATED VOLTAGE (V)	RATED POWER (kW) (*): kVA	RATED CURRENT (A)	FROM		DESTINATION		CABLE DESCRIPTION											
				BOARD	USER TAG		DESCRIPTION	INSULATION RATED VOLTAGE (kV)	TYPE	CORES	SIZE (mm²)	CONDUCTOR	INSULATION	SCREENED	ARMOUR	OUTER SHEATH	LENGTH (m)		
1803-PM-222 B-RTD03	240	275	-	044-HT6-101	1803-PM-222 B		RTD Bearing temp. signal cable for LEAN AMINE PUMP	0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	126		
1803-PM-609 A-RTD01	240	275	-	044-HT6-102	1803-PM-609 A		RTD Winding temp. signal cable for HP BOILER FEED WATER PUMP	0.6/1	MULTIPOLAR	6x3	0.75	CU	XLPE	-	SWA	PVC	189		
1803-PM-609 A-RTD02	240	275	-	044-HT6-102	1803-PM-609 A		RTD Winding temp. signal cable for HP BOILER FEED WATER PUMP	0.6/1	MULTIPOLAR	6x3	0.75	CU	XLPE	-	SWA	PVC	189		
1803-PM-609 A-RTD03	240	275	-	044-HT6-102	1803-PM-609 A		RTD Bearing temp. signal cable for HP BOILER FEED WATER PUMP	0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	189		
1803-PM-609 B-RTD01	240	275	-	044-HT6-102	1803-PM-609 B		RTD Winding temp. signal cable for HP BOILER FEED WATER PUMP	0.6/1	MULTIPOLAR	6x3	0.75	CU	XLPE	-	SWA	PVC	189		
1803-PM-609 B-RTD02	240	275	-	044-HT6-102	1803-PM-609 B		RTD Winding temp. signal cable for HP BOILER FEED WATER PUMP	0.6/1	MULTIPOLAR	6x3	0.75	CU	XLPE	-	SWA	PVC	189		
1803-PM-609 B-RTD03	240	275	-	044-HT6-102	1803-PM-609 B		RTD Bearing temp. signal cable for HP BOILER FEED WATER PUMP	0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	189		
1803-PM-609 C-RTD01	240	275	-	044-HT6-102	1803-PM-609 C		RTD Winding temp. signal cable for HP BOILER FEED WATER PUMP	0.6/1	MULTIPOLAR	6x3	0.75	CU	XLPE	-	SWA	PVC	189		
1803-PM-609 C-RTD02	240	275	-	044-HT6-102	1803-PM-609 C		RTD Winding temp. signal cable for HP BOILER FEED WATER PUMP	0.6/1	MULTIPOLAR	6x3	0.75	CU	XLPE	-	SWA	PVC	189		
1803-PM-609 C-RTD03	240	275	-	044-HT6-102	1803-PM-609 C		RTD Bearing temp. signal cable for HP BOILER FEED WATER PUMP	0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	189		
044-H33-101-D01	-	-	-	044-HT33-101 (INC. A)	Patch Panel (To upstream SW)		Intertrip from/to + inhibit close from	0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-H33-101-D02	-	-	-	044-HT33-101 (INC. A)	Patch Panel (To upstream SW)		Differential protection 87L	0.6/1	MULTIPOLAR	4	2.5	CU	XLPE	-	SWA	PVC	50		
044-H33-101-D03	-	-	-	044-HT33-101 (INC. B)	Patch Panel (To upstream SW)		Intertrip from/to + inhibit close from	0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-H33-101-D04	-	-	-	044-HT33-101 (INC. B)	Patch Panel (To upstream SW)		Differential protection 87L	0.6/1	MULTIPOLAR	4	2.5	CU	XLPE	-	SWA	PVC	50		
044-HT6-101-D01	-	-	-	044-HT33-101	044-HT6-101 (INC. A)		Intertrip from/to upstream CB trip coil + inhibit close from/to + intertrip from/to upstream	0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-HT6-101-D02	-	-	-	044-HT33-101	044-HT6-101 (INC. B)		Intertrip from/to upstream CB trip coil + inhibit close from/to + intertrip from/to upstream	0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-HT6-101-CT01	-	-	-	044-HT33-101	044-HT6-101 (INC. A)		Differential protection 87T + protection 86-2	0.6/1	MULTIPOLAR	4	2.5	CU	XLPE	-	SWA	PVC	50		
044-HT6-101-CT02	-	-	-	044-HT33-101	044-HT6-101 (INC. B)		Differential protection 87T + protection 86-2	0.6/1	MULTIPOLAR	4	2.5	CU	XLPE	-	SWA	PVC	50		
044-H11-101-D01	-	-	-	044-HT11-101 (INC. A)	Patch Panel (To upstream SW)		Intertrip from/to + inhibit close from	0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-H11-101-D02	-	-	-	044-HT11-101 (INC. A)	Patch Panel (To upstream SW)		Differential protection 87L	0.6/1	MULTIPOLAR	4	2.5	CU	XLPE	-	SWA	PVC	50		
044-HT6-102-D01	-	-	-	044-HT6-101	044-HT6-102 (INC. A)		Intertrip from/to upstream+inhibit close from upstream	0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-HT6-102-D02	-	-	-	044-HT6-101	044-HT6-102 (INC. A)		Differential protection 87L / protection upstream	0.6/1	MULTIPOLAR	4	2.5	CU	XLPE	-	SWA	PVC	50		
044-HT6-102-D03	-	-	-	044-HT6-101	044-HT6-102 (INC. B)		Intertrip from/to upstream+inhibit close from upstream	0.6/1	MULTIPOLAR	5	2.5	CU	XLPE	-	SWA	PVC	50		
044-HT6-102-D04	-	-	-	044-HT6-101	044-HT6-102 (INC. B)		Differential protection 87L / protection upstream	0.6/1	MULTIPOLAR	4	2.5	CU	XLPE	-	SWA	PVC	50		
044-HT6-102-D05	-	-	-	044-HT11-101	044-HT6-102 (INC. C)		Trip from upstream+inhibit close+intertrip from/to upstream	0.6/1	MULTIPOLAR	5	2.5	CU	XLPE	-	SWA	PVC	50		
044-HT6-102-D06	-	-	-	044-HT11-101	044-HT6-102 (INC. C)		Differential protection 87T / protection upstream	0.6/1	MULTIPOLAR	4	2.5	CU	XLPE	-	SWA	PVC	50		
044-PMCC-101-D01	-	-	-	044-HT6-101	044-PMCC-101 (INC. A)		Trip from upstream + inhibit close from/to + intertrip from/to + To upstream breaker CB position	0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-PMCC-101-D02	-	-	-	044-HT6-101	044-PMCC-101 (INC. B)		Trip from upstream + inhibit close from/to + intertrip from/to + To upstream breaker CB position	0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-PMCC-102-D01	-	-	-	044-HT6-101	044-PMCC-102 (INC. A)		Trip from upstream + inhibit close from/to + intertrip from/to + To upstream breaker CB position	0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-PMCC-102-D02	-	-	-	044-HT6-101	044-PMCC-102 (INC. B)		Trip from upstream + inhibit close from/to + intertrip from/to + To upstream breaker CB position	0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-PMCC-103-D01	-	-	-	044-HT6-101	044-PMCC-103 (INC. A)		Trip from upstream + inhibit close from/to + intertrip from/to + To upstream breaker CB position	0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-PMCC-103-D02	-	-	-	044-HT6-101	044-PMCC-103 (INC. B)		Trip from upstream + inhibit close from/to + intertrip from/to + To upstream breaker CB position	0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-EPMCC-101-D01	-	-	-	044-HT6-101	044-EPMCC-101 (INC. A)		Trip from upstream + inhibit close from/to + intertrip from/to + To upstream breaker CB position	0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-EPMCC-101-D02	-	-	-	044-HT6-101	044-EPMCC-101 (INC. B)		Trip from upstream + inhibit close from/to + intertrip from/to + To upstream breaker CB position	0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-EPMCC-101-D03	-	-	-	044-HT6-102	044-EPMCC-101 (INC. C)		Trip from upstream + inhibit close from/to + intertrip from/to + To upstream breaker CB position	0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-MCC-101-D01	-	-	-	044-MCC-101 (INC. A)	044-PMCC-101		Intertrip from/to upstream+inhibit close	0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-MCC-101-D02	-	-	-	044-MCC-101 (INC. B)	044-PMCC-101		Intertrip from/to upstream+inhibit close	0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-MCC-102-D01	-	-	-	044-MCC-102 (INC. A)	044-PMCC-101		Intertrip from/to upstream+inhibit close	0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-MCC-102-D02	-	-	-	044-MCC-102 (INC. B)	044-PMCC-101		Intertrip from/to upstream+inhibit close	0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-MCC-103-D01	-	-	-	044-MCC-103 (INC. A)	044-PMCC-102		Intertrip from/to upstream+inhibit close	0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-MCC-103-D02	-	-	-	044-MCC-103 (INC. B)	044-PMCC-102		Intertrip from/to upstream+inhibit close	0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-MCC-104-D01	-	-	-	044-MCC-104 (INC. A)	044-PMCC-101		Intertrip from/to upstream+inhibit close	0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-MCC-104-D02	-	-	-	044-MCC-104 (INC. B)	044-PMCC-101		Intertrip from/to upstream+inhibit close	0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-MCC-105-D01	-	-	-	044-MCC-105 (INC. A)	044-PMCC-102		Intertrip from/to upstream+inhibit close	0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-MCC-105-D02	-	-	-	044-MCC-105 (INC. B)	044-PMCC-102		Intertrip from/to upstream+inhibit close	0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-MCC-106-D01	-	-	-	044-MCC-106 (INC. A)	044-PMCC-102		Intertrip from/to upstream+inhibit close	0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-MCC-106-D02	-	-	-	044-MCC-106 (INC. B)	044-PMCC-102		Intertrip from/to upstream+inhibit close	0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-MCC-107-D01	-	-	-	044-MCC-107 (INC. A)	044-PMCC-102		Intertrip from/to upstream+inhibit close	0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-MCC-107-D02	-	-	-	044-MCC-107 (INC. B)	044-PMCC-102		Intertrip from/to upstream+inhibit close	0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-TR-101A-D01	-	-	-	044-HT33-101	044-TR-101A		Alarms/trip signals	0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-TR-101A-D02	-	-	-	044-HT33-101	044-TR-101A		Alarms/trip signals	0.6/1	MULTIPOLAR	4	2.5	CU	XLPE	-	SWA	PVC	50		
044-TR-101A-D03	-	-	-	044-HT33-101	044-TR-101A		Breaker trip (Transformer emergency push button)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	50		
044-TR-101B-D01	-	-	-	044-HT33-101	044-TR-101B		Alarms/trip signals	0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-TR-101B-D02	-	-	-	044-HT33-101	044-TR-101B		Alarms/trip signals	0.6/1	MULTIPOLAR	4	2.5	CU	XLPE	-	SWA	PVC	50		
044-TR-101B-D03	-	-	-	044-HT33-101	044-TR-101B		Breaker trip (Transformer emergency push button)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	50		
044-TR-106A-D01	-	-	-	044-HT11-101	044-TR-106A		Alarms/trip signals	0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-TR-106A-D02	-	-	-	044-HT11-101	044-TR-106A		Breaker trip (Transformer emergency push button)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	50		
044-TR-102A-D01	-	-	-	044-HT6-101	044-TR-102A		Alarms/trip signals	0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-TR-102A-D02	-	-	-	044-HT6-101	044-TR-102A		Breaker trip (Transformer emergency push button)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	50		
044-TR-102A-D03	-	-	-	044-PMCC-101 (INC. A)	044-TR-102A		64R trip signal 042-PMCC-101	0.6/1	MULTIPOLAR	2	2.5	CU	XLPE	-	SWA	PVC	65		
044-TR-102A-D04	-	-	-	044-PMCC-101 (INC. A)	044-TR-102A		51G trip signal 042-PMCC-101	0.6/1	MULTIPOLAR	2	2.5	CU	XLPE	-	SWA	PVC	65		
044-TR-102B-D01	-	-	-	044-HT6-101	044-TR-102B		Alarms/trip signals	0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-TR-102B-D02	-	-	-	044-HT6-101	044-TR-102B		Breaker trip (Transformer emergency push button)	0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	50		
044-TR-102B-D03	-	-	-	044-PMCC-101 (INC. B)	044-TR-102B		64R trip signal 042-PMCC-101	0.6/1	MULTIPOLAR	2	2.5	CU	XLPE	-	SWA	PVC	65		
044-TR-102B-D04	-	-	-	044-PMCC-101 (INC. B)	044-TR-102B		51G trip signal 042-PMCC-101	0.6/1	MULTIPOLAR	2	2.5	CU	XLPE	-	SWA	PVC	65		

Table 141. Electrical cables list (part 15).

 				ELECTRICAL CABLES LIST															
PROJECT:		EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LuPech" (J-18)																	
CLIENT:		INDIAN OIL CORPORATION LIMITED																	
CABLE TAG	RATED VOLTAGE (V)	RATED POWER (kW) (*) KVA	RATED CURRENT (A)	FROM		DESTINATION		CABLE DESCRIPTION											
				BOARD	USER TAG	DESCRIPTION	INSULATION RATED VOLTAGE (kV)	TYPE	CORES	SIZE (mm²)	CONDUCTOR	INSULATION	SCREENED	ARMOUR	OUTER SHEATH	LENGTH (m)			
044-TR-103A-D01	-	-	-	044-HT6-101	044-TR-103A			0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-TR-103A-D02	-	-	-	044-HT6-101	044-TR-103A	Breaker trip (Transformer emergency push button)		0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	50		
044-TR-103A-D03	-	-	-	044-PMCC-102 (INC. A)	044-TR-103A	64R trip signal 044-PMCC-102		0.6/1	MULTIPOLAR	2	2.5	CU	XLPE	-	SWA	PVC	65		
044-TR-103A-D04	-	-	-	044-PMCC-102 (INC. A)	044-TR-103A	51G trip signal 044-PMCC-102		0.6/1	MULTIPOLAR	2	2.5	CU	XLPE	-	SWA	PVC	65		
044-TR-103B-D01	-	-	-	044-HT6-101	044-TR-103B	Alarms/trip signals		0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-TR-103B-D02	-	-	-	044-HT6-101	044-TR-103B	Breaker trip (Transformer emergency push button)		0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	50		
044-TR-103B-D03	-	-	-	044-PMCC-102 (INC. B)	044-TR-103B	64R trip signal 044-PMCC-102		0.6/1	MULTIPOLAR	2	2.5	CU	XLPE	-	SWA	PVC	65		
044-TR-103B-D04	-	-	-	044-PMCC-102 (INC. B)	044-TR-103B	51G trip signal 044-PMCC-102		0.6/1	MULTIPOLAR	2	2.5	CU	XLPE	-	SWA	PVC	65		
044-TR-104A-D01	-	-	-	044-HT6-101	044-TR-104A	Alarms/trip signals		0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-TR-104A-D02	-	-	-	044-HT6-101	044-TR-104A	Breaker trip (Transformer emergency push button)		0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	50		
044-TR-104A-D03	-	-	-	044-PMCC-103 (INC. A)	044-TR-104A	64R trip signal 044-PMCC-103		0.6/1	MULTIPOLAR	2	2.5	CU	XLPE	-	SWA	PVC	65		
044-TR-104A-D04	-	-	-	044-PMCC-103 (INC. A)	044-TR-104A	51G trip signal 044-PMCC-103		0.6/1	MULTIPOLAR	2	2.5	CU	XLPE	-	SWA	PVC	65		
044-TR-104B-D01	-	-	-	044-HT6-101	044-TR-104B	Alarms/trip signals		0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-TR-104B-D02	-	-	-	044-HT6-101	044-TR-104B	Breaker trip (Transformer emergency push button)		0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	50		
044-TR-104B-D03	-	-	-	044-PMCC-103 (INC. B)	044-TR-104B	64R trip signal 044-PMCC-103		0.6/1	MULTIPOLAR	2	2.5	CU	XLPE	-	SWA	PVC	65		
044-TR-104B-D04	-	-	-	044-PMCC-103 (INC. B)	044-TR-104B	51G trip signal 044-PMCC-103		0.6/1	MULTIPOLAR	2	2.5	CU	XLPE	-	SWA	PVC	65		
044-TR-105A-D01	-	-	-	044-HT6-101	044-TR-102A	Alarms/trip signals		0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-TR-105A-D02	-	-	-	044-HT6-101	044-TR-102A	Breaker trip (Transformer emergency push button)		0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	50		
044-TR-105A-D03	-	-	-	044-EPMCC-101 (INC. A)	044-TR-102A	64R trip signal 044-EPMCC-101		0.6/1	MULTIPOLAR	2	2.5	CU	XLPE	-	SWA	PVC	65		
044-TR-105A-D04	-	-	-	044-EPMCC-101 (INC. A)	044-TR-102A	51G trip signal 044-EPMCC-101		0.6/1	MULTIPOLAR	2	2.5	CU	XLPE	-	SWA	PVC	65		
044-TR-105B-D01	-	-	-	044-HT6-101	044-TR-102B	Alarms/trip signals		0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-TR-105B-D02	-	-	-	044-HT6-101	044-TR-102B	Breaker trip (Transformer emergency push button)		0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	50		
044-TR-105B-D03	-	-	-	044-EPMCC-101 (INC. B)	044-TR-102B	64R trip signal 044-EPMCC-101		0.6/1	MULTIPOLAR	2	2.5	CU	XLPE	-	SWA	PVC	65		
044-TR-105B-D04	-	-	-	044-EPMCC-101 (INC. B)	044-TR-102B	51G trip signal 044-EPMCC-101		0.6/1	MULTIPOLAR	2	2.5	CU	XLPE	-	SWA	PVC	65		
044-TR-105C-D01	-	-	-	044-HT6-102	044-TR-105C	Alarms/trip signals		0.6/1	MULTIPOLAR	12	2.5	CU	XLPE	-	SWA	PVC	50		
044-TR-105C-D02	-	-	-	044-HT6-102	044-TR-105C	Breaker trip (Transformer emergency push button)		0.6/1	MULTIPOLAR	2P	2.5	CU	XLPE	-	SWA	PVC	50		
044-TR-105C-D03	-	-	-	044-EPMCC-101	044-TR-105C	64R trip signal 044-EPMCC-101		0.6/1	MULTIPOLAR	2	2.5	CU	XLPE	-	SWA	PVC	65		
044-TR-105C-D04	-	-	-	044-EPMCC-101	044-TR-105C	51G trip signal 044-EPMCC-101		0.6/1	MULTIPOLAR	2	2.5	CU	XLPE	-	SWA	PVC	65		
1803-WO-001-P1	415	45	63	044-ASB-102	1803-WO-101	Power cable for Welding Socket RFCC Unit 1		0.6/1	3PH+N	4	35	AL	XLPE	-	SWA	PVC	55		
1803-WO-002-P1	415	45	63	044-ASB-102	1803-WO-102	Power cable for Welding Socket RFCC Unit 2		0.6/1	3PH+N	4	35	AL	XLPE	-	SWA	PVC	70		
1803-WO-003-P1	415	45	63	044-ASB-102	1803-WO-103	Power cable for Welding Socket RFCC Unit 3		0.6/1	3PH+N	4	35	AL	XLPE	-	SWA	PVC	155		
1803-WO-004-P1	415	45.00	63.00	044-ASB-102	1803-WO-104	Power cable for Welding Socket RFCC Unit 4		0.6/1	3PH+N	4	50	AL	XLPE	-	SWA	PVC	303		
1803-WO-005-P1	415	45.00	63.00	044-ASB-102	1803-WO-105	Power cable for Welding Socket RFCC Unit 5		0.6/1	3PH+N	4	95	AL	XLPE	-	SWA	PVC	408		
1803-WO-006-P1	415	45.00	63.00	044-ASB-102	1803-WO-106	Power cable for Welding Socket RFCC Unit 6		0.6/1	3PH+N	4	50	AL	XLPE	-	SWA	PVC	315		
1803-WO-007-P1	415	45.00	63.00	044-ASB-102	1803-WO-107	Power cable for Welding Socket RFCC Unit 7		0.6/1	3PH+N	4	35	AL	XLPE	-	SWA	PVC	193		
1803-WO-008-P1	415	45.00	63.00	044-ASB-102	1803-WO-108	Power cable for Welding Socket RFCC Unit 8		0.6/1	3PH+N	4	95	AL	XLPE	-	SWA	PVC	408		
1803-WO-009-P1	415	45.00	63.00	044-ASB-102	1803-WO-109	Power cable for Welding Socket RFCC Unit 9		0.6/1	3PH+N	4	70	AL	XLPE	-	SWA	PVC	375		
1803-WO-010-P1	415	45.00	63.00	044-ASB-102	1803-WO-110	Power cable for Welding Socket RFCC Unit 10		0.6/1	3PH+N	4	35	AL	XLPE	-	SWA	PVC	215		
1803-WO-011-P1	415	45.00	63.00	044-ASB-102	1803-WO-111	Power cable for Welding Socket RFCC Unit 11		0.6/1	3PH+N	4	35	AL	XLPE	-	SWA	PVC	224		
1803-WO-012-P1	415	45.00	63.00	044-ASB-103	1803-WO-112	Power cable for Welding Socket RFCC Unit 12		0.6/1	3PH+N	4	35	AL	XLPE	-	SWA	PVC	224		
044-NON-UPS PDB-1-P1	415	37.00	55.00	044-ASB-102	044-NON-UPS PDB-1	NON UPS DB-1 (CONTROL ROOM)		0.6/1	3PH+N	4	35	AL	XLPE	-	SWA	PVC	100		
044-NON-UPS PDB-2-P1	415	37.00	55.00	044-ASB-102	044-NON-UPS PDB-2	NON UPS DB-2 (CONTROL ROOM)		0.6/1	3PH+N	4	35	AL	XLPE	-	SWA	PVC	100		
HB-001-P1	415	288.00	63.00	044-ASB-101	HB-001	Power cable for Hydro Blasting RFCC Unit 1		0.6/1	3PH+N	4	240	AL	XLPE	-	SWA	PVC	210		
HB-001-P2	415	288.00	63.00	044-ASB-101	HB-001	Power cable for Hydro Blasting RFCC Unit 1		0.6/1	3PH+N	4	240	AL	XLPE	-	SWA	PVC	210		
HB-001-P3	415	288.00	63.00	044-ASB-101	HB-001	Power cable for Hydro Blasting RFCC Unit 1		0.6/1	3PH+N	4	240	AL	XLPE	-	SWA	PVC	210		
HB-002-P1	415	288.00	63.00	044-ASB-101	HB-002	Power cable for Hydro Blasting RFCC Unit 2		0.6/1	3PH+N	4	240	AL	XLPE	-	SWA	PVC	440		
HB-002-P2	415	288.00	63.00	044-ASB-101	HB-002	Power cable for Hydro Blasting RFCC Unit 2		0.6/1	3PH+N	4	240	AL	XLPE	-	SWA	PVC	440		
HB-002-P3	415	288.00	63.00	044-ASB-101	HB-002	Power cable for Hydro Blasting RFCC Unit 2		0.6/1	3PH+N	4	240	AL	XLPE	-	SWA	PVC	440		
HB-002-P4	415	288.00	63.00	044-ASB-101	HB-002	Power cable for Hydro Blasting RFCC Unit 2		0.6/1	3PH+N	4	240	AL	XLPE	-	SWA	PVC	440		
TRS-101A-P1	415	45.00	100.00	044-ASB-101	TRS-101A	Power cable for 100A Socket at Transformer Area (TR-101A)		0.6/1	3PH+N	4	35	AL	XLPE	-	SWA	PVC	50		
TRS-101B-P1	415	45.00	100.00	044-ASB-101	TRS-101B	Power cable for 100A Socket at Transformer Area (TR-101B)		0.6/1	3PH+N	4	35	AL	XLPE	-	SWA	PVC	45		
TRS-106A-P1	415	45.00	100.00	044-ASB-101	TRS-106A	Power cable for 100A Socket at Transformer Area (TR-106A)		0.6/1	3PH+N	4	35	AL	XLPE	-	SWA	PVC	65		
TRS-102A-P1	415	45.00	100.00	044-ASB-101	TRS-102A	Power cable for 100A Socket at Transformer Area (TR-102A)		0.6/1	3PH+N	4	35	AL	XLPE	-	SWA	PVC	42		
TRS-102B-P1	415	45.00	100.00	044-ASB-101	TRS-102B	Power cable for 100A Socket at Transformer Area (TR-102B)		0.6/1	3PH+N	4	35	AL	XLPE	-	SWA	PVC	42		
TRS-103A-P1	415	45.00	100.00	044-ASB-101	TRS-103A	Power cable for 100A Socket at Transformer Area (TR-103A)		0.6/1	3PH+N	4	35	AL	XLPE	-	SWA	PVC	50		
TRS-103B-P1	415	45.00	100.00	044-ASB-101	TRS-103B	Power cable for 100A Socket at Transformer Area (TR-103B)		0.6/1	3PH+N	4	35	AL	XLPE	-	SWA	PVC	40		
TRS-104A-P1	415	45.00	100.00	044-ASB-101	TRS-104A	Power cable for 100A Socket at Transformer Area (TR-104A)		0.6/1	3PH+N	4	35	AL	XLPE	-	SWA	PVC	50		
TRS-104B-P1	415	45.00	100.00	044-ASB-101	TRS-104B	Power cable for 100A Socket at Transformer Area (TR-104B)		0.6/1	3PH+N	4	35	AL	XLPE	-	SWA	PVC	65		
TRS-105A-P1	415	45.00	100.00	044-ASB-101	TRS-105A	Power cable for 100A Socket at Transformer Area (TR-105A)		0.6/1	3PH+N	4	35	AL	XLPE	-	SWA	PVC	42		
TRS-105B-P1	415	45.00	100.00	044-ASB-101	TRS-105B	Power cable for 100A Socket at Transformer Area (TR-105B)		0.6/1	3PH+N	4	35	AL	XLPE	-	SWA	PVC	42		
TRS-105C-P1	415	45.00	100.00	044-ASB-101	TRS-105C	Power cable for 100A Socket at Transformer Area (TR-105C)		0.6/1	3PH+N	4	35	AL	XLPE	-	SWA	PVC	45		
1803-PM-614-P1	415	15.00	-	044-ASB-101	1803-PM-614	Drain Pump 1		0.6/1	3PH	3	4	CU	XLPE	-	SWA	PVC	100		
1803-PM-613-P1	415	10.00	-	044-ASB-101	1803-PM-613	Drain Pump 2		0.6/1	3PH	3	4	CU	XLPE	-	SWA	PVC	100		

 				ELECTRICAL CABLES LIST												
PROJECT:				EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT) FOR PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LaPeck" (J-18)												
CLIENT:				INDIAN OIL CORPORATION LIMITED												
CABLE TAG	RATED VOLTAGE (V)	RATED POWER (kW) (*) KVA	RATED CURRENT (A)	FROM	TO	DESCRIPTION	INSULATION RATED VOLTAGE (kV)	TYPE	CORES	SIZE (mm²)	CONDUCTOR	INSULATION	SCREENED	ARMOUR	OUTER SHEATH	LENGTH (m)
1803-X-206-P1	415	37	-	044-ASB-101	1803-X-206	EOT Crane 2	0.6/1	3PH+N	4	25	CU	XLPE	-	SWA	PVC	120
044-MLDB-102-P1	415	160	160	044-MLDB-101	044-MLDB-102	MLDB IN SGH INCOMER-1	0.6/1	3PH+N	3.5	120	AL	XLPE	-	SWA	PVC	1200
044-MLDB-102-P2	415	160	160	044-MLDB-101	044-MLDB-102	MLDB IN SGH INCOMER-1	0.6/1	3PH+N	3.5	120	AL	XLPE	-	SWA	PVC	1200
044-MLDB-102-P4	415	160	160	044-MLDB-101	044-MLDB-102	MLDB IN SGH INCOMER-1	0.6/1	3PH+N	3.5	120	AL	XLPE	-	SWA	PVC	1200
044-MLDB-102-P5	415	160	160	044-MLDB-101	044-MLDB-102	MLDB IN SGH INCOMER-2	0.6/1	3PH+N	3.5	120	AL	XLPE	-	SWA	PVC	1200
044-MLDB-102-P6	415	160	160	044-MLDB-101	044-MLDB-102	MLDB IN SGH INCOMER-2	0.6/1	3PH+N	3.5	120	AL	XLPE	-	SWA	PVC	1200
044-LDB-101-P1	415	20(*)	-	044-MLDB-101	044-LDB-101	Indoor Lighting Distribution Board in SS-044 Third floor	0.6/1	3PH+N	4	2.5	CU	XLPE	-	SWA	PVC	40
044-LDB-104-P1	415	20(*)	-	044-MLDB-101	044-LDB-104	Indoor Lighting Distribution Board in SS-044 Ground floor	0.6/1	3PH+N	4	2.5	CU	XLPE	-	SWA	PVC	110
044-LDB-105-P1	415	20(*)	-	044-MLDB-101	044-LDB-105	Indoor Lighting Distribution Board in SS-044 First floor	0.6/1	3PH+N	4	4	CU	XLPE	-	SWA	PVC	85
044-LDB-103-P1	415	30(*)	-	044-MLDB-101	044-LDB-103	Indoor Lighting Distribution Board (044-LDB-101) (Control Room)	0.6/1	3PH+N	4	2.5	CU	XLPE	-	SWA	PVC	160
044-LDB-102-P1	415	30(*)	-	044-MLDB-101	044-LDB-102	OUTDOOR LDB AT LAYDOWN AREA	0.6/1	3PH+N	4	4	CU	XLPE	-	SWA	PVC	120
044-LDB-109-P1	415			044-MLDB-101	044-LDB-109	OUTDOOR LDB AT RECIRCULATION PUMPS	0.6/1	3PH+N	4	4	CU	XLPE	-	SWA	PVC	100
044-LDB-110-P1	415			044-MLDB-101	044-LDB-110	OUTDOOR LDB AT DEETHENIZER AND DEBUTANIZER AREA	0.6/1	3PH+N	4	4	CU	XLPE	-	SWA	PVC	150
044-LDB-111-P1	415			044-MLDB-101	044-LDB-111	OUTDOOR LDB AT REACTOR & REGENERATOR AREA	0.6/1	3PH+N	4	4	CU	XLPE	-	SWA	PVC	310
044-LDB-112-P1	415			044-MLDB-101	044-LDB-112	OUTDOOR LDB AT WET GAS SCRUBBER AREA	0.6/1	3PH+N	4	4	CU	XLPE	-	SWA	PVC	150
044-LDB-113-P1	415			044-MLDB-101	044-LDB-113	OUTDOOR LDB AT FLUE GAS WH BOILER AREA	0.6/1	3PH+N	4	2.5	CU	XLPE	-	SWA	PVC	150
044-LDB-114-P1	415			044-MLDB-101	044-LDB-114	OUTDOOR LDB STREET LIGHT AT PIPERACK (WEST)	0.6/1	3PH+N	4	4	CU	XLPE	-	SWA	PVC	400
044-LDB-115-P1	415			044-MLDB-101	044-LDB-115	OUTDOOR LDB STREET LIGHT AT PIPERACK (EAST)	0.6/1	3PH+N	4	10	CU	XLPE	-	SWA	PVC	300
044-PDB-101-P1	415	15(*)	-	044-MLDB-101	044-PDB-101	Power Distribution Board in SS-044 (044-PDB-101) Third floor	0.6/1	3PH+N	4	2.5	CU	XLPE	-	SWA	PVC	40
044-PDB-102-P1	415	15(*)	-	044-MLDB-101	044-PDB-102	Power Distribution Board in SS-044 (044-PDB-102) Second floor	0.6/1	3PH+N	4	2.5	CU	XLPE	-	SWA	PVC	60
044-PDB-103-P1	415			044-MLDB-101	044-PDB-103	Power Distribution Board in SS-044 (044-PDB-103) First floor	0.6/1	3PH+N	4	2.5	CU	XLPE	-	SWA	PVC	85
044-PDB-104-P1	415			044-MLDB-101	044-PDB-104	Power Distribution Board in SS-044 (044-PDB-104) Ground floor	0.6/1	3PH+N	4	2.5	CU	XLPE	-	SWA	PVC	100
044-PDB-105-P1	415			044-MLDB-101	044-PDB-105	Power Distribution Board (044-PDB-102) (Control Room)	0.6/1	3PH+N	4	10	CU	XLPE	-	SWA	PVC	120
044-ELDB-101-P1	415	20(*)	-	044-ELDB-101	044-ELDB-101	INDOOR ELDB IN SS-044 THIRD FLOOR	0.6/1	3PH+N	4	2.5	CU	XLPE	-	SWA	PVC	40
044-ELDB-102-P1	415	20(*)	-	044-ELDB-101	044-ELDB-102	OUTDOOR ELDB AT LAYDOWN AREA	0.6/1	3PH+N	4	2.5	CU	XLPE	-	SWA	PVC	120
044-ELDB-103-P1	415	30(*)	-	044-ELDB-101	044-ELDB-103	INDOOR ELDB IN CRB	0.6/1	3PH+N	4	2.5	CU	XLPE	-	SWA	PVC	75
044-ELDB-104-P1	415	30(*)	-	044-ELDB-101	044-ELDB-104	INDOOR ELDB IN SS-044 GROUND FLOOR	0.6/1	3PH+N	4	2.5	CU	XLPE	-	SWA	PVC	110
044-ELDB-105-P1	415			044-ELDB-101	044-ELDB-105	INDOOR ELDB IN SS-044 FIRST FLOOR	0.6/1	3PH+N	4	2.5	CU	XLPE	-	SWA	PVC	85
044-ELDB-106-P1	415			044-ELDB-101	044-ELDB-106	INDOOR ELDB IN SS-044 SECOND FLOOR	0.6/1	3PH+N	4	2.5	CU	XLPE	-	SWA	PVC	60
044-ELDB-107-P1	415			044-ELDB-101	044-ELDB-107	OUTDOOR ELDB AT DELUGE HOUSE	0.6/1	3PH+N	4	2.5	CU	XLPE	-	SWA	PVC	350
044-ELDB-108-P1	415			044-ELDB-101	044-ELDB-108	OUTDOOR ELDB AT LPG TREATER UNIT	0.6/1	3PH+N	4	2.5	CU	XLPE	-	SWA	PVC	200
044-ELDB-109-P1	415			044-ELDB-101	044-ELDB-109	OUTDOOR ELDB AT RECIRCULATION PUMPS	0.6/1	3PH+N	4	2.5	CU	XLPE	-	SWA	PVC	100
044-ELDB-110-P1	415			044-ELDB-101	044-ELDB-110	OUTDOOR ELDB AT DEETHENIZER AND DEBUTANIZER AREA	0.6/1	3PH+N	4	2.5	CU	XLPE	-	SWA	PVC	150
044-ELDB-111-P1	415			044-ELDB-101	044-ELDB-111	OUTDOOR ELDB AT REACTOR & REGENERATOR AREA	0.6/1	3PH+N	4	2.5	CU	XLPE	-	SWA	PVC	310
044-ELDB-112-P1	415			044-ELDB-101	044-ELDB-112	OUTDOOR ELDB AT WET GAS SCRUBBER AREA	0.6/1	3PH+N	4	2.5	CU	XLPE	-	SWA	PVC	150
044-ELDB-113-P1	415			044-ELDB-101	044-ELDB-113	OUTDOOR ELDB AT FLUE GAS WH BOILER AREA	0.6/1	3PH+N	4	2.5	CU	XLPE	-	SWA	PVC	150
044-ELDB-114-P1	415			044-ELDB-101	044-ELDB-114	OUTDOOR ELDB STREET LIGHT AT PIPERACK (WEST)	0.6/1	3PH+N	4	2.5	CU	XLPE	-	SWA	PVC	400
044-ELDB-115-P1	415			044-ELDB-101	044-ELDB-115	OUTDOOR ELDB STREET LIGHT AT PIPERACK (EAST)	0.6/1	3PH+N	4	2.5	CU	XLPE	-	SWA	PVC	300
044-APFC-101A-CT01	-	-	-	044-HTG-101	044-CB-101A / 044-APFC-101A	Current busbar analog signal	0.6/1	MULTIPOLAR	5	2.5	CU	XLPE	-	SWA	PVC	50
044-APFC-101A-VT01	-	-	-	044-HTG-101	044-CB-101A / 044-APFC-101A	Voltage busbar analog signal	0.6/1	MULTIPOLAR	5	2.5	CU	XLPE	-	SWA	PVC	50
044-APFC-101B-CT01	-	-	-	044-HTG-101	044-CB-101B / 044-APFC-101B	Current busbar analog signal	0.6/1	MULTIPOLAR	5	2.5	CU	XLPE	-	SWA	PVC	50
044-APFC-101B-VT01	-	-	-	044-HTG-101	044-CB-101B / 044-APFC-101B	Voltage busbar analog signal	0.6/1	MULTIPOLAR	5	2.5	CU	XLPE	-	SWA	PVC	50

Table 143. Electrical cables list (part 17).

Chapter 6. Grounding system

6.1. INTRODUCTION

All electrical equipment must be suitably earthed. Earthing system shall, in general cover the following:

- Equipment earthing for personnel safety.
- System neutral earthing.
- Protection against static and lightning discharges.
- Separate clean earth system for UPS, Instrumentation, DCS and ECS.

This study will verify that electric currents into the earth under normal and fault conditions won't exceed any operating and equipment limits or adversely affecting continuity of service. It also will ensure that a person in the vicinity of grounding facilities is not exposed to the danger of critical electric shock.

The following shall be earthed:

- Current and potential transformer secondary neutral.
- Metallic non-current carrying parts of all electrical apparatus such as transformers, switchgears, motors, lighting / power panels, terminal boxes, control stations, lighting fixtures, receptacles etc.
- Steel structures, loading platform etc.
- Cable trays and racks, lighting mast and poles.
- Storage tanks, spheres, vessels, columns and all other process equipment.
- Electrical equipment fencing (e.g. transformer bay, etc.)
- Cable shields and armour.
- Flexible earth provision for wagon, truck.
- Pump handling hydrocarbon if its base plate is separate from motor's base plate.
- Turbo driven pump handling hydrocarbon, etc.

6.2. DESIGN REQUIREMENTS

The resistance values of an earthing system to the general mass of earth should be as below:

- For the electrical system and equipment, a value that ensures the operation of the protective device in the electrical circuit but not in excess of 4 Ohms. However, the generating stations and large substations, this value shall not be more than 1 Ohm.
- 10 Ohms in the case of all non-current carrying metallic parts of major electric apparatus or any metallic object.

- All joints in pipelines, valves, plants, storage tanks and associated facilities and equipment for petroleum shall be made electrically continuous by bonding or otherwise; the resistance value between each joint shall not exceed 1 Ohm.

The main earthing network shall be used for earthing equipment to protect it against static electricity. An independent earthing network shall be provided for lightning protection, and this shall be bonded with the main earthing network below ground, minimum at two points.

A single earth pit shall not be used for any system. Instead, an earth-grid (earth-pit network) shall be made of a minimum of two numbers of earth pits connected in parallel. The number of earth pits required for an earth-grid will depend on the permissible earth-resistance specified by the respective system manufacturer. A suitable distance shall be maintained between various earth pits (minimum 3 meters) as per guidelines of API RP550. Unit wise segregation of earth-pit network is desirable for higher reliability and ease of shut down maintenance of these earth-pit networks.

Earthing grid size shall be of 75x10mm GI (Galvanized Iron) flat as minimum. The earthing electrode shall be 65mm diameter, 3.0 m long GI pipe. Earth strips brought from substation shall be anchored at area just below trench slab for easy identification.

6.3. EARTHING CALCULATION

According to the design requirements, the earthing system will be an earth-grid connection that shall comprise G.I earth electrodes interconnected through an underground network of bare earth conductors (hot dip G.I flat). The earth-grid and earth electrodes are bonded to the general mass of earth and the dissipation of the earth fault current will be through this bonding.

6.3.1. PROCEDURE DESCRIPTION

Calculations have been performed according to IEEE Std 80 - 2017 "Guide for Safety in AC Substation Grounding". According to this standard, these steps must be followed to earthing calculation:

- Step 1: Define the area to be grounded and soil resistivity profile.
- Step 2: Calculate the expected maximum fault current and required minimum grid conductor size.
- Step 3: Calculate the maximum allowable step and touch potentials.
- Step 4: Preliminary design, including a conductor loop surrounding grounded area, conductor spacing, ground rod, locations, etc.
- Step 5: Resistance of the grounding system in uniform soil calculation.
- Step 6: Obtain maximum earthing grid current which contribute to GPR (Ground Potential Rise).
- Step 7: Check if GPR is below tolerable touch voltage (in this case, no further analysis is necessary) or not.
- Step 8: Calculation of the mesh and step voltages for designed grid.

- Step 9: If mesh voltage is below the tolerable touch voltage, design may be complete. If not, design must be revised.
- Step 10: If both touch and step voltages for designed grid are below the tolerable voltages, design needs only the refinements required to provide access to equipment rods. If not, design must be revised.
- Step 11: If either the step or touch tolerable voltages limits are exceed, revision of the grid design is required.
- Step 12: After satisfying the step and touch voltage requirements, detail design will continue.

All the parameters that will be used are defined:

A	Total area enclosed by ground grid, m^2
α_r	Thermal coefficient of resistivity at reference temperature, $1/^\circ C$
C_s	Surface layer derating factor
d	Diameter of grid conductor, m
D	Spacing between parallel conductors, m
δ_c	Pipeline coating thickness, m
D_m	Maximum distance between any two points on the earth grid, m
D_p	Pipeline diameter, m
D_f	Decrement factor for duration of fault t_f .
ϵ_0	Permittivity of free space ($8.8542 \times 10^{-12} \text{ } \phi/m$)
E_M	Mesh voltage at the center of the corner mesh, V
ϵ_r	Relative permittivity of coating
E_S	Step voltage between the outer corner of the grid and a point 1m diagonally outside the grid, V
$E_{\text{step}50}$	Tolerable step voltage for a 50 kg human, V
$E_{\text{touch}50}$	Tolerable touch voltage for a 50 kg human, V
f	Frequency, Hz

GPR	Ground Potential Rise, V
h	Depth of grid conductors, m
h _s	Surface layer thickness, m
I _F	Effective RMS value of asymmetrical ground fault current, kA
I _G	Grid current, A
I _g	rms symmetrical grid current A
I ₀	Zero sequence fault current, A
K ₀	1/a ₀ , °C
K _h	Corrective weighting factor that emphasises the effect of grid depth
K _i	Corrective factor for grid geometry
K _{ii}	Corrective weighting factor that adjusts for the effects of inner conductors on the corner mesh
K _m	Spacing factor for mesh voltage
K _S	Spacing factor for step voltage
L _C	Total length of grid conductor, m
L _M	Effective length of L _C + L _R for mesh voltage, m
L _P	Peripheral length of grid, m
L _R	Total length of ground rods, m
L _{rod}	Length of each ground rod, m
L _S	Effective length of L _C + L _R for step voltage, m
L _T	Total effective length of grounding system conductor, m
L _x	Maximum length of grid conductor in x direction, m
L _y	Maximum length of grid conductor in y direction, m

μ_o	Permeability of free space ($4\pi \times 10^{-7}$ H/m)
μ_r	Relative permeability of metal
n	Geometric factor composed of factors n_a , n_b , n_c and n_d
n_R	Number of ground rods
r	Soil resistivity, $\Omega.m$
R_g	Resistance of grounding system, Ω
ρ_p	Resistivity of metal, $\Omega.m$
r_r	Resistivity of the ground conductor at reference temperature, $\Omega.m$
r_s	Surface layer resistivity, $\Omega.m$
S	Minimum conductor cross-sectional area, mm^2
S_f	Fault current division factor
T_{amb}	Ambient temperature, $^{\circ}C$
TCAP	Thermal capacity of ground conductor material
t_f	Duration of fault current, s
T_{max}	Maximum allowable temperature, $^{\circ}C$
t_s	Duration of shock current, s
Y_i	Pipeline longitudinal conductance, Ω^{-1}/m
Z_i	Pipeline longitudinal impedance, Ω/m
Z_0	Pipeline characteristic impedance, Ω
T_a	dc offset time constant in s $T_a = X / (R \times \omega)$ Hz, X/R at power station

6.3.2. CALCULATION

The number of rods considered for the design of the substation is 50 (Table 144). The grid geometry will be rectangular and two electrodes per each transformer have been considered.

Earthing Electrodes Considered	Nº
At the corners of ESS-44	4
No. of power transformers and converter transformers	7
Electrodes/Transformer	2
No. of electrodes for power transformers	14
No. of distribution transformers	16
No. of electrodes for distribution transformers	32
Total electrodes considered for substation grid design	50

Table 144. Substation earthing electrodes.

A) Step 1: Area definition and initial data

A body weight of 50 kg (typical engineering reference) is assumed for the purposes of this calculation. Duration of ground fault used in calculations for maximum allowable step and touch potential shall be 1 second to allow operation of back up protection. Therefore, it is assumed that the earthing grids between the substation and the power generation source are uncoupled, and that the earth fault current flows entirely through earth back to the source (thus a current division factor of 1). The resistivity of the soil has been calculated as the average of electrical resistivity tomography (ERT) studies provided by the client (Table 145).

A 100x12 mm GI earth strip size for the conductor has been selected, as it is the size used at the process area. Since main earthing grid for unit and substation are going to be interconnected, same size will be maintained for both.

Electrode Spacing (m)	Average ERT-1	Average ERT-2	Average ERT-3	Average ERT-4	UoM
0,5	12,614	8,948	8,025	6,966	ohm-m
1	11,172	7,191	8,857	10,088	ohm-m
2	11,432	7,793	9,538	9,726	ohm-m
3	13,414	8,886	10,590	11,534	ohm-m
4	14,432	10,117	10,160	13,449	ohm-m
5	14,966	10,870	10,603	14,883	ohm-m
6	15,578	11,382	11,693	15,550	ohm-m
7	16,155	11,769	11,989	15,885	ohm-m
8	13,887	11,818	12,261	13,820	ohm-m
9	13,633	11,600	12,256	13,289	ohm-m
10	13,904	11,935	12,446	13,463	ohm-m
Total	151,187	112,309	118,418	138,653	ohm-m
Individual ERT Average	13,744	10,210	10,765	12,605	ohm-m
Overall Average				11,831	ohm-m

Table 145. Average resistivity of the soil calculation.

The initial data needed for the calculation is summarized in the following Table 146.

Description	Parameter		Units
Depth of burial	Db	50	cm
Average resistivity of soil	ρ	11,831	ohm-m
Length of pipe electrode	L	300	cm
Diameter of pipe electrode	d	65	mm
Earth fault duration	t	1	sec
System fault current	Isc	65	kA
Earth strip constant for GI (IS-3043 Table 11 A)	K	80	-
Length of strip (As per Unit Earthing Layout drawing)	L	2367	m
Surface layer resistivity z (As per Table no.7 IEEE 80 for 25-50mm washed Granite)	ρ_s	5000	ohm-m
Surface layer thickness	hs	0,2	m
Overall length of earth grid in the x direction	Lx	115	m
Overall length of earth grid in the y direction	Ly	28	m
Length of horizontal earthing grid conductor	$L_c = (L_x/D+1)*L_y + (L_y/D+1)*L_x$	824	m
Total length of conductor loop around area	$L_p = 2*(L_x+L_y)$	286	m
Number of rods	Nr	50	nos.
Length of earth rods	$L_r=L$	3	m
Total Length of earth rods	$L_R=N_r*L_r$	150	m
Depth of burial of earthing grid	$h=Db$	0,5	m
Conductor spacing	D	10	m
Conductor width	D2	100	mm
Conductor thickness	D3	12	mm
Total Effective Length of Ground Conductor including Grid and Ground Rods	$L_t=L_R+L_c$	974	m
Total Area Enclosed by Ground Grid	$A=L_x*L_y$	3220	m ²
Diagonal length	$D_m=\sqrt{L_x^2+L_y^2}$	118,360	m

Table 146. Earthing parameters.

B) Step 2: Conductor size calculation

This step is used for determining the expected maximum fault current and required minimum grid conductor size. Once the grid conductor material has been selected, an earth grid can be designed such that step and touch potentials are within safe limits.

The required conductor size as a function of conductor current is determined using IEEE Std. 80 equation 40, which evaluates the ampacity of any conductor for which the material constants are known.

$$S_{mm^2} = I_F \frac{1}{\sqrt{\left(\frac{TCAP \times 10^{-4}}{t_f \alpha_r \rho_r} \right) \ln \left(\frac{K_0 + T_{max}}{K_0 + T_{amb}} \right)}}$$

Where,

- I_F is the highest fault current as per short circuit calculations.
- $TCAP = 3.80 \text{ J/(cm}^3 \cdot ^\circ\text{C)}$ is the thermal capacity per unit volume (IEEE Std. 80 Table 1 - for steel).
- $t_f = 1\text{s}$ is the duration of current, as per electrical design basis.
- $\alpha_r = 0.003 \text{ 1/}^\circ\text{C}$ is the thermal coefficient of resistivity at reference temperature (IEEE Std. 80 Table 1 - for steel).
- $\rho_r = 13.8 \text{ }\mu\Omega \cdot \text{cm}$ is the resistivity of the ground conductor at reference temperature (IEEE Std. 80 Table 1 - for steel).
- $K_0 = 202^\circ\text{C} = 1/\alpha_0$ where α_0 is the thermal coefficient of resistivity at 0°C (IEEE Std. 80 Table 1 - for steel).

- $T_{\max} = 500\text{ }^{\circ}\text{C}$ is the maximum allowable temperature (IS 3043 Table 11A).
- $T_{\text{amb}} = 47^{\circ}\text{C}$ is the ambient temperature.

A 30% margin of allowance corrosion must be added, as per clause 13.6.1. standard IS-3043. By applying this calculation, the result of minimum conductor cross-sectional area will be:

For 33kV, 11kV and 6.6kV systems, highest fault current is $I_f = 40\text{ kA}$, as a result S_{mm^2} will be:

$$S_{\text{mm}^2} = 410.1 \cdot 1,3 = 533\text{ mm}^2$$

For 415V system, highest fault current is $I_f = 65\text{ kA}$, as a result S_{mm^2} will be:

$$S_{\text{mm}^2} = 666.4 \cdot 1,3 = 866.32\text{ mm}^2$$

C) Step 3: Allowable step and touch potentials calculation

The safety of a person depends on preventing the critical amount of shock energy from being absorbed before the fault is cleared and the system de-energized. The maximum driving voltage of any accidental circuit should not exceed the limits defined as follows.

$$C_s = 1 - \frac{0.09 \cdot (1 - \frac{\rho}{\rho_s})}{2 \cdot h_s + 0.09} = 0.816$$

$$E_{\text{touch}50} = (1000 + 1.5 \cdot C_s \cdot \rho_s) \frac{0.116}{\sqrt{t_s}} = 826.79\text{ V}$$

$$E_{\text{step}50} = (1000 + 6 \cdot C_s \cdot \rho_s) \frac{0.116}{\sqrt{t_s}} = 2959.16\text{ V}$$

Where,

- $E_{\text{step}50}$ is the step voltage in V.
- $E_{\text{touch}50}$ is the touch voltage in V.
- C_s is a corrective factor to compute the effective foot resistance in the presence of a finite thickness of surface material.
- $\rho_s = 5000\text{ }\Omega \cdot m$ is the resistivity of the surface material.
- $t_s = 1\text{ s}$ is the duration of shock current.
- $h_s = 0.2\text{ m}$ is the surface layer thickness.

D) Step 4: Earth grid design.

For the earth grid design some corrective factors must be calculated: n , K_{ij} , K_h , K_i , K_m and K_s .

The effective number of parallel conductors in a given grid, n , can be made applicable to rectangular or irregularly shaped grids that represent the number of parallel conductors of an equivalent rectangular grid.

$$n_a = \frac{2L_c}{L_p} = 5.7622$$

$$n_b = \sqrt{\frac{L_p}{4\sqrt{A}}} = 1.1225$$

$$n_c = 1 \text{ for square and rectangular grids}$$

$$n_d = 1 \text{ for square, rectangular and L-shaped grids}$$

$$n = n_a \cdot n_b \cdot n_c \cdot n_d = 6.4681$$

Where,

- L_c is the total length of the conductor in the horizontal grid in m.
- L_p is the peripheral length of the grid in m.

K_i is the irregularity correction factor for grid geometry and is defined as follows:

$$K_i = 0.644 + 0.14 \cdot n = 1.6012$$

K_{ii} is the corrective weighting factor that adjusts for the effects of inner conductors on the corner mesh. For grids with ground rods along the perimeter, or for grids with ground rods in the grid corners, as well as both along the perimeter and throughout the grid area $K_{ii} = 1$.

K_h Corrective weighting factor that emphasizes the effects of grid depth:

$$K_h = \sqrt{1 + \frac{h}{h_0}} = 1.2247$$

Where,

- h is the depth of ground grid conductors in m.
- $h_0 = 1 \text{ m}$ is the grid reference depth.

The spacing factor for mesh voltage, $K_m = 4.035$, is defined as follows:

$$K_m = \frac{1}{2\pi} \left[\ln \left[\frac{D^2}{16 \cdot h \cdot d} + \frac{(D + 2 \cdot h)^2}{8 \cdot D \cdot d} - \frac{h}{4 \cdot d} \right] + \frac{K_{ii}}{K_h} \ln \left[\frac{8}{\pi(2 \cdot n - 1)} \right] \right]$$

Where,

- h is the depth of ground grid conductors in m.
- d is the diameter of grid conductor in m.
- D is the spacing between parallel conductors in m.

The step voltage geometrical factor, $K_S = 0.3792$, is defined by:

$$K_s = \frac{1}{\pi} \left[\frac{1}{2h} + \frac{1}{D+h} + \frac{1}{D} (1 - 0.5^{n-2}) \right]$$

Where,

- h is the depth of ground grid conductors in m.
- D is the spacing between parallel conductors in m.

Finally, the effective lengths for the grid calculation are L_S and L_M .

L_S is the effective length for step voltage:

$$L_S = 0.75 \cdot L_C + 0.85 \cdot L_R = 745.5m$$

For grids with ground rods in the corners, as well as along the perimeter and throughout the grid, the effective buried length is $L_M = 1061.138 m$.

$$L_M = L_C + L_R \left[1.55 + 1.22 \left(\frac{L_{rod}}{\sqrt{L_x^2 + L_y^2}} \right) \right]$$

Where,

- L_C is the total length of the conductor in the horizontal grid in m.
- L_R is the total length of ground rods.
- L_{rod} is the length of earth rod.
- L_x is the maximum length of grid conductor in x direction.
- L_y is the maximum length of grid conductor in y direction.

E) Step 5: Grid resistance calculation.

The grid resistance of the earthing grid design is calculated according to following formula:

$$R_g = \rho \left[\frac{1}{L_T} + \frac{1}{\sqrt{20 \cdot A}} \left(1 + \frac{1}{1 + h \sqrt{\frac{20}{A}}} \right) \right]$$

Where,

- A is the total area enclosed by ground grid.

- h is the depth of ground grid conductors in m.
- L_T is the total effective length of grounding system conductor, including grid and ground rods.
- ρ is the average soil resistivity.

The obtained grid resistance is: $R_g = 0.1036 \Omega$. According to electrical design basis, the maximum resistance stipulated must be 1Ω . The result respects the requirements.

F) Step 6: Fault current verification.

The maximum mesh and step voltages can be calculated from the maximum grid current.

Firstly, the RMS symmetrical grid current is calculated:

$$I_g = S_f \cdot 3 \cdot I_o = 1200 \text{ A}$$

Where,

- S_f is the fault current division factor, which typical assumed value as per engineering practice is $S_f = 1$.
- I_o is the zero-sequence fault current in A. Based on neutral grounding resistor, $I_o = 400 \text{ A}$.

The maximum grid current I_G , taking into account the effects of asymmetry that may be experienced by this earthing grid is I_G :

$$T_a = \frac{X}{R\omega}$$

$$D_f = \sqrt{1 + \frac{T_a}{t_f}} \left(1 - e^{-\frac{2t_f}{T_a}}\right) = 1.02206$$

$$I_G = D_f \cdot I_g = 1226.47 \text{ A}$$

Where,

- T_a is the dc offset time constant in s.
- $X/R = 14$ is the ratio of the system inductive reactance to resistance.
- $t_f = 1\text{s}$ is the duration of current, as per electrical design basis.
- $\omega = 50 \text{ Hz}$ is the frequency.
- D_f is decrement factor for the entire duration of fault.

G) Step 7: GPR (Ground Potential Rise) check.

If the GPR of the preliminary design is below the tolerable touch voltage, no further analysis is necessary.

The Ground Potential Rise is calculated as follows:

$$GPR = I_G \cdot R_g = 127.09 \text{ V}$$

GPR is lower than calculated $E_{touch50} = 826.8 \text{ V}$. Therefore, no further analysis is required.

H) Step 12: final calculation.

Finally, the mesh voltage at the center of the corner mesh E_m and step voltage between a point above the outer corner of the grid and a point 1 m diagonally outside the grid E_S are calculated.

$$E_m = \frac{\rho \cdot K_s \cdot K_i \cdot I_G}{L_M} = 88.36 \text{ V}$$

$$E_S = \frac{\rho \cdot K_s \cdot K_i \cdot I_G}{L_S} = 11.81 \text{ V}$$

Where,

- K_S is the step voltage geometrical factor.
- K_i is the irregularity correction factor for grid geometry.
- $I_G = 1226.47 \text{ A}$ is the maximum grid current that flows between ground grid and surrounding earth.
- ρ is the average soil resistivity.
- L_S is the effective length for step voltage.
- L_M is the effective buried length.

This earthing grid design results in step and touch voltage limits which are below the permissible levels, the system is correctly designed.

Chapter 7. Lightning system

7.1. INTRODUCTION

The lightning protection system (LPS) is a complete system to reduce physical damage due to lightning flashes to a structure. The system can be composed of two parts: internal and external protection. Internal failure might be caused due to lightning electromagnetic impulse (LEMP) within structures through the effects of radiated electromagnetic fields directly into equipment itself. Regarding the external lightning protection system, it should include:

- Air-termination system to intercept lightning flashes using metallic rods, mesh conductors or catenary wires.
- Down-conductor system to conduct lightning current from air-termination system to the earth-termination system.
- Earth-termination system to conduct and disperse lightning current into the earth.

7.2. DESIGN REQUIREMENTS

Where installed, lightning protection shall be provided as per the requirements of IEC-62305. As per IEC 62305-1 section 7.3, lightning protection measures to reduce failure of electrical and electronic systems including (used alone or in combination):

- Earthing and bonding measures.
- Magnetic shielding.
- Line routing.
- Coordinate SPD (surge protective devices) protection.

Lightning protection system and the selection of the adequate level of protection shall be determined by IEC 62305-2. It is based on the calculated risk R , which is the value of a probable average annual loss and its comparison to a tolerable risk R_T . The probability of structure penetration by a lightning current is considerably decreased by the presence of a properly designed protection system.

LPL (lightning protection levels) is a number related to a set of lightning current parameters values relevant to the probability that the associated maximum and minimum design values will not be exceeded in naturally occurring lightning. Four lightning protection levels (I to IV) are introduced. For each LPL a set of maximum and minimum lightning current parameters are fixed. The maximum values of lightning current parameters for the different lightning protection levels are given in IEC 62305-1 Table 5 and are

used to design lightning protection components. In this project, LPL is considered level II which implies a class of LPS II.

Air-termination systems can be composed of any combination of the following elements:

- Rods (including free-standing masts).
- Catenary wires.
- Meshed conductors.

According to IEC 62305-3, section E.5.2.1, no criteria is provided for the choice of the air termination system because it considers rods, stretched wires and meshed conductors as equivalent. In this case, air-terminals shall be galvanized rods of minimum diameter 20 mm and pointed at the aerial end. The rod end shall be no less than 1000 mm above the structure to which is attached.

The external ring of earth electrodes should preferably be buried at a depth of at least 0.7 m but not closer than 1.0 m to the building walls, they should be distributed as uniformly as possible to minimize electrical coiling effects in the earth. Embedded depth and type of the earth electrodes shall be such as to minimize the effects of corrosion, soil drying and freezing and thereby stabilize the equivalent earth resistance. For lightning protection, the value of 5 ohms as earth resistance shall be desirable but in no case, it shall be more than 10 ohms. An independent earthing network shall be provided for lightning protection, and this shall be bonded with the main earthing network below ground, minimum at two points.

In order to reduce the probability of damage due to lightning current flowing in the LPS, down- conductors shall be arranged in such a way that from the point of strike to earth:

- Several parallel current paths exist.
- Length of the current paths is kept to a minimum.
- Equipotential bonding to conducting parts of the structure is performed according to the requirements of IEC 62305-3 Section 6.2.

According to IEC 62305-3 Table 4, a typical distance between down-conductors according to class II is 10 meters. The number of down-conductors shall be not less than two and will be distributed around the perimeter of the structure to be protected, subject to architectural and practical constraints. An equal spacing of the down-conductors is preferred around the perimeter.

According to the client's design basis considerations, 50 x 6 mm GI strip has been considered for lightning protection of substation and the earthing electrode shall be 65mm diameters, 3.0 m long Galvanized Iron pipe.

Three design methods will be combined for the lightning protection design: the rolling sphere method, the protection angle method, and the mesh method.

In the rolling sphere method, the positioning of the air-termination system is adequate if no point of the structure to be protected comes into contact with a sphere with radius, r , depending on the class of LPS, rolling around and on top of the structure in all possible directions. In this way, the sphere only touches the air-termination system.

Regarding the protection angle method, air-termination conductors should be positioned so that all parts of the structure to be protected are inside the envelope surface generated by projecting points on the air-termination conductors to the reference plane, at an angle α to the vertical in all directions. The protective angle α and mesh size are provided by IEC-62305-3 5.2 table 2, with h being the height of the air termination above the surface to be protected. The protective angle α is different for different heights of air-termination above the surface to be protected. A single point generates a cone. Figure 27 below shows how the protected space is generated by the different air-termination conductors in the LPS.

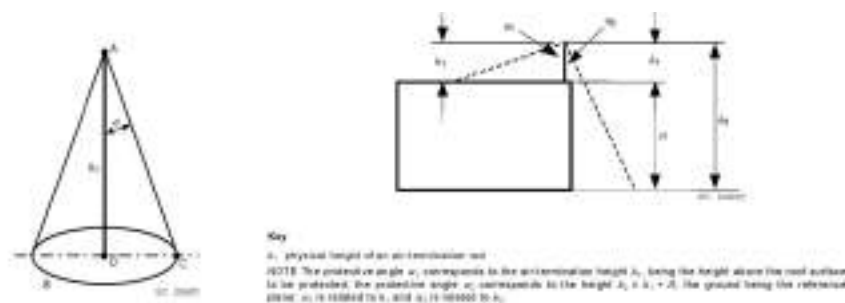


Figure 27. Volume protected by a vertical air-termination rod. Source: IEC-62305-3 Annex A

The mesh method is a suitable form of protection where plane surfaces are to be protected. The following Figure 28 indicates the combined lightning protection with the two methods: protection angle method and the mesh method.

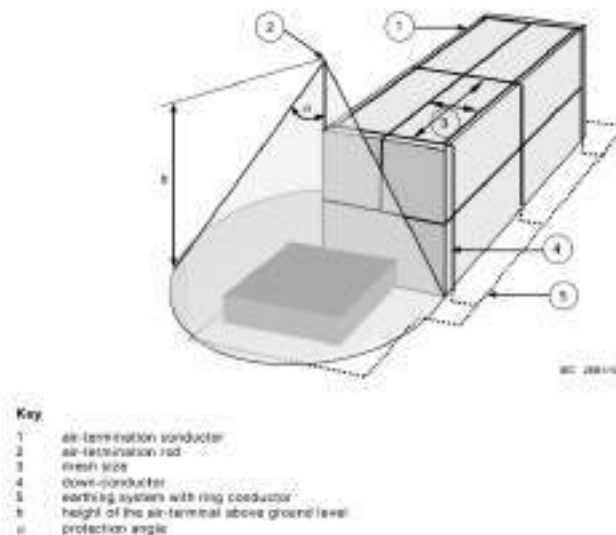


Figure 28. Design of an LPS air-termination according to the protection angle method, mesh method and general arrangement. Source: IEC-62305-3 Annex E

7.3. LIGHTNING CALCULATION

According to IEC-62305-2, the risk R , is the relative value of probable average annual loss. For each type of loss which may appear in a structure, the relevant risk shall be evaluated. In this case, two different risks will be analyzed:

- Risk of loss of a human life or permanent injuries (R_1) for external lightning protection.
- Risk of loss of service to the public (R_2) for internal lightning protection.

ESS-044 Substation is defined as a building containing electrical equipment which overall dimensions are 115 m length, 28 m width and 28.5 m height.

7.3.1. RISK OF LOSS OF HUMAN LIFE

External protection must be implemented in order to reduce risk if tolerance risk $R_T = 10^{-5}$ is lower than the risk of loss of human life R_1 . Tolerance risk value is indicated in IEC-62305-2 table 4.

According to IEC-62305-2, the risk of loss of human life R_1 is defined as follows:

$$R_1 = R_{A1} + R_{B1} + R_{U1} + R_{V1} \approx R_{B1}$$

Where,

- R_{A1} is the risk of injury to living beings because of a direct strike on the structure.
- R_{B1} is the risk of physical damage because of a direct strike on the structure.
- R_{U1} is the risk of injury to living beings because of a strike on external installations.
- R_{V1} is the risk of physical damage because of a strike on external installations.

$$N_D = N_G \cdot A_d \cdot C_d \cdot 10^{-6}$$

$$A_d = L \cdot W + 2 \cdot (3 \cdot H) \cdot (L + W) + \pi \cdot (3 \cdot H)^2$$

$$R_B = N_D \cdot P_B \cdot L_B = N_D \cdot P_{B1} \cdot r_p \cdot h_z \cdot r_f \cdot L_f$$

These parameters are calculated by taking into account the following formulas and criteria:

- N_D is the number of dangerous events.
- C_d is the factor of location.
 $C_d = 0.25$ as structure is surrounded by other higher object or trees. (IEC-62305-2 table A.1)
- P_{B1} is the probability of damage.
 $P_{B1} = 1$ as structure is not protected by LPS. (IEC-62305-2 table B.2)
- L_f is the consequent loss regarding physical damage.

$L_f = 2 \times 10^{-2}$ as loss for physical damage for a structure which is considered an industrial and commercial plant. (IEC-62305-2 table C.2)

- r_p is the reduction factor depending on the measures taken to reduce the consequences of fire.
 $r_p = 0.5$ as provisions taken to reduce fire are fire extinguishers, fixed manually operated fire extinguishing installations, manual alarm installations, hydrants, fire compartments or escape routes. (IEC-62305-2 table C.4)
- r_f is the reduction factor depending on the risk of fire on the structure.
 $r_f = 10^{-1}$ as there is a high risk of fire (assumed the worst condition). (IEC-62305-2 table C.5)
- h_z is the factor which increases the relative value of a loss in case of special risk.
 $h_z = 2$ as there is a low risk of panic (structures limited to two floors with up to 100 people) in presence of a special hazard. (IEC-62305-2 table C.6)
- N_G is the lightning ground flash density (lightning flashes/km²/year).
 $N_G = 0.1 * T_D = 1.5$ where T_D is the thunderstorm days per year. (IEC-62305-2 Annex A eq. A.1) For the Gujarat area, $T_D = 15$ days.
- A_d as collection area for rectangular structure with L, W and H as the area dimensions. (IEC-62305-2 Annex A eq. A.2)

The results of the calculation of the risk of loss of human life R_1 are summarized in Table 147.

Parameters		Results	
A_d	50638,83	Ra1	0
L	115	Rb1	0,000038
w	28	Ru1	0
H	28,5	Rv1	0
N_d	0,01899		
C_d	0,25	R1	0,000038
P_{B1}	1	Rt	0,00001
r_p	0,5		
h_z	2		
r_f	0,1		
L_f	0,02		

Table 147. Risk of loss of human life calculation.

As $R_1 < R_T$, the system requires external lightning protection.

Taking into account that the substation has been considered as a flat roof building with a LPS of class II, external lightning protection system will be provided through a 10x10 meters grid (as per IEC-62305-3 5.2.2 table 2 for class II protection level) with a 50x6 mm G.I. strip size (as per design requirements) which meets IEC 62503-3 Table 6 minimum size requirements (50 mm²). A down-conductor has been installed at each exposed corner of the structure, where this is possible. The rest of down-conductors will be distributed around the perimeter of the structure to be protected, with a 10 meters distance between them (as per IEC-62305-3 5.3.3 table 4 for class II protection level). Air-termination rods will be placed

following the rolling sphere method with a distance $r=30$ m (as per IEC-62305-3 5.2 table 2 class II protection level). The substation's external lightning protection system layout is shown in Figure 29.

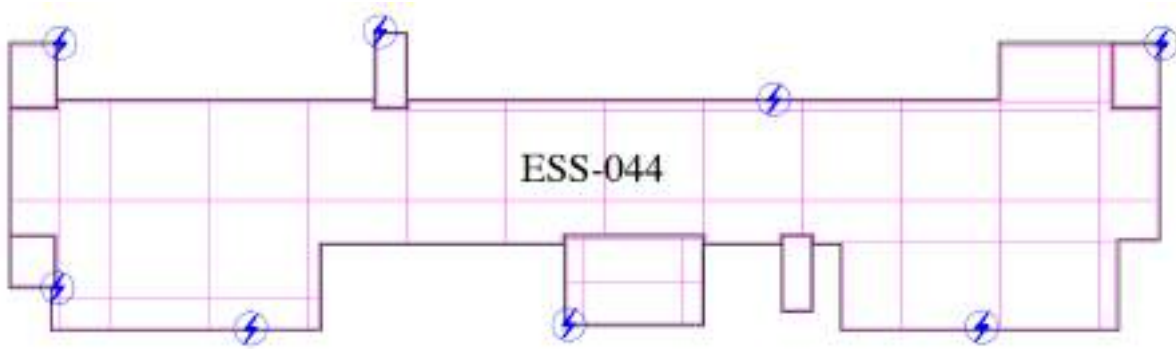


Figure 29. Lightning protection system layout.

7.3.2. RISK OF LOSS OF SERVICE TO THE PUBLIC

Now it is necessary to check if additional protection is required to reduce the risk of failure of internal systems. To do so, protection must be implemented in order to reduce risk if tolerance risk $R_T = 10^{-3}$ is lower than the risk of loss of service to the public R_2 . Tolerance risk value is indicated in IEC-62305-2 table 4.

According to IEC-62305-2, the risk of loss of service to the public R_2 is defined as follows:

$$R_2 = R_{B2} + R_{C2} + R_{M2} + R_{V2} + R_{W2} + R_{Z2}$$

Where,

- R_{B2} is the risk of physical damage because of a direct strike on the structure:

$$R_{B2} = N_D \cdot P_B \cdot L_B = N_D \cdot P_{B2} \cdot r_p \cdot h_z \cdot r_f \cdot L_f$$

With,

$$N_D = N_G \cdot A_d \cdot C_d \cdot 10^{-6}$$

$$A_d = L \cdot W + 2 \cdot (3 \cdot H) \cdot (L + W) + \pi \cdot (3 \cdot H)^2$$

- R_{C2} is the risk of failure of internal systems because of a direct strike on the structure:

$$R_{C2} = N_D \cdot P_{SPD} \cdot C_{LD} \cdot L_O$$

- R_{M2} is the risk of failure of internal systems because of a direct strike near the structure:

$$R_{M2} = N_D \cdot P_{SPD} \cdot (K_{S1} \cdot K_{S2} \cdot K_{S3} \cdot K_{S4}) \cdot L_O$$

- R_{V2} is the risk of physical damage because of a strike on external installations:

$$R_{V2} = (N_L + N_{DJ}) \cdot P_V \cdot L_V$$

$$= [(N_G \cdot A_L \cdot C_I \cdot C_E \cdot C_T) \cdot 10^{-6} + (N_G \cdot A_{DJ} \cdot C_{DJ} \cdot C_T) \cdot 10^{-6}] \cdot P_{EB} \cdot P_{LD} \cdot C_{LD} \cdot r_p \cdot h_z \cdot r_f \cdot L_f$$

- R_{W2} is the risk of failure of internal systems because of a strike on external installations:

$$R_{W2} = (N_L + N_{DJ}) \cdot P_W \cdot L_W = [(N_G \cdot A_L \cdot C_I \cdot C_E \cdot C_T \cdot 10^{-6}) + (N_G \cdot A_{DJ} \cdot C_{DJ} \cdot C_T \cdot 10^{-6})] \cdot P_{SPD} \cdot P_{LD} \cdot C_{LD} \cdot L_O$$

- R_{Z2} is the risk of failure of internal systems because of a strike near external installations:

$$R_{Z2} = N_I \cdot P_Z \cdot L_Z = (N_G \cdot A_I \cdot C_I \cdot C_E \cdot C_T \cdot 10^{-6}) \cdot P_{SPD} \cdot P_{LI} \cdot C_{LI} \cdot L_O$$

All the required parameters for the calculation that must be taken into account follow these criteria:

- N_D is the number of dangerous events.
- C_d is the factor of location.
 $C_d = 0.25$ as structure is surrounded by other higher object or trees. (IEC-62305-2 table A.1)
- P_{B2} is the probability of damage.
 $P_{B2} = 0.05$ as structure is protected by LPS II. (IEC-62305-2 table B.2)
- L_f is the consequent loss regarding physical damage.
 $L_f = 2 \times 10^{-2}$ as loss for physical damage for a structure which is considered an industrial and commercial plant. (IEC-62305-2 table C.2)
- r_p is the reduction factor depending on the measures taken to reduce the consequences of fire.
 $r_p = 0.5$ as provisions taken to reduce fire are fire extinguishers, fixed manually operated fire extinguishing installations, manual alarm installations, hydrants, fire compartments or escape routes. (IEC-62305-2 table C.4)
- r_f is the reduction factor depending on the risk of fire on the structure.
 $r_f = 10^{-1}$ as there is a high risk of fire (assumed the worst condition). (IEC-62305-2 table C.5)
- h_z is the factor which increases the relative value of a loss in case of special risk.
 $h_z = 2$ as there is a low risk of panic (structures limited to two floors with up to 100 people) in presence of a special hazard. (IEC-62305-2 table C.6)
- N_G is the lightning ground flash density (lightning flashes/km²/year).
 $N_G = 0.1 \cdot T_D = 1.5$ where T_D is the thunderstorm days per year. (IEC-62305-2 Annex A eq. A.1) For the Gujarat area, $T_D = 15$ days.
- A_d as collection area for rectangular structure with L, W and H as the area dimensions. (IEC-62305-2 Annex A eq. A.2)
- P_{SPD} is the factor depending on the coordinated SPD system conforming to the lightning protection level (LPL) for which its SPDs are designed.
 $P_{SPD} = 0.02$ as structure is protected by LPL II. (IEC-62305-2 Annex B table B.3)
- C_{LD} is the factor depending on shielding, grounding and isolation conditions of the line to which the internal system is connected.
 $C_{LD} = 1$ for aerial line unshielded conditions. (IEC-62305-2 Annex B table B.4)
- L_O are the typical mean relative numbers of victims by failure of internal systems due to one dangerous event.
 $L_O = 0.1$ as structure has risk of explosion. (IEC-62305-2 Annex C table C.2)
- K_{S1} is the screening effectiveness of the structure, LPS or other shields at boundary LPZ 0/1.

- $K_{S1} = 0.0001$ for continuous metal shields with thicknesses not lower than 0.1mm. (IEC-62305-2 Annex B.5)
- K_{S2} is the screening effectiveness of shields internal to the structure at boundary LPZ X/Y ($X > 0$, $Y > 1$).
 $K_{S2} = 0.001$ for continuous metal shields with thicknesses not lower than 0.1mm. (IEC-62305-2 Annex B.5)
- K_{S3} is the factor depending on the characteristics of internal.
 $K_{S3} = 0.2$ as unshielded cable for internal wiring. (IEC-62305-2 Annex B table B.5)
- K_{S4} is the factor depending on the impulse withstand voltage of the system to be protected.
 $K_{S4} = 1$ as the maximum value for the equipment. (IEC-62305-2 Annex B eq. B.7)
- A_L is the collection area of flashes striking the line (m²).
 $A_L = 40 \cdot L_L = 40 \cdot 100 = 4000$ m where L_L is the length of the line section.
- C_I is the installation factor of the line.
 $C_I = 0.5$ for buried line installation. (IEC-62305-2 Annex A table A.2)
- C_E is the environmental factor.
 $C_E = 1$ for rural environment. (IEC-62305-2 Annex A table A.4)
- C_T is the line type factor.
 $C_T = 1$ for low voltage line installation. (IEC-62305-2 Annex A table A.3)
- $A_{DJ} = A_d$ is the collection area of the adjacent structure (m²)
- C_{DJ} is the location factor of the adjacent structure.
 $C_{DJ} = 0.25$ as structure is surrounded by other higher object or trees. (IEC-62305-2 table A.1)
- P_{EB} is the factor depending on lightning equipotential bonding (EB) conforming to IEC 62305-3 and to the lightning protection level (LPL) for which its SPDs are designed.
 $P_{EB} = 0.02$ as structure is protected by LPL II. (IEC-62305-2 Annex B table B.7)
- P_{LD} is the probability of failure of internal systems due to a flash to the connected line, depending on the line characteristics.
 $P_{LD} = 1$ for buried line. (IEC-62305-2 Annex B table B.8)
- A_I is the collection area of flashes to ground near the line (m²).
 $A_I = 4000 \cdot L_L = 4000 \cdot 100 = 400\,000$ where L_L is the length of the line section.
- P_{LI} is the is the probability of failure of internal systems due to a flash near the connected line depending on the line and equipment characteristics.
 $P_{LI} = 1$ for 1kV power lines. (IEC-62305-2 Annex B table B.9)
- C_{LI} is a factor depending on shielding, grounding and isolation conditions of the line.
 $C_{LI} = 1$ for buried line unshielded conditions (IEC-62305-2 Annex B table B.4)

The results of the calculation of the risk of loss of service to the public R_2 are summarized in Table 148. As $R_2 > R_T$, the system doesn't require additional internal lightning protection.

Parameters				Results	
C_T	1	A_d	50638,82767	Rb2	1,899E-06
C_E	1	L	115	Rc2	3,7979E-05
A_{DJ}	50638,8277	w	28	Rm2	7,5958E-13
C_{DJ}	0,25	H	28,5	Rv2	8,7958E-07
PSPD	0,02	N_d	0,01898956	Rw2	4,3979E-05
c_{LD}	1	C_d	0,25	Rz2	0,00006
L_O	0,1	P_{B2}	0,05		
P_{EB}	0,02	r_p	0,5	R2	0,00014474
P_{LD}	1	h_z	2	Rt	0,001
K_{S1}	0,0001	r_f	0,1		
K_{S2}	0,0001	L_f	0,02		
K_{S3}	0,2	N_G	1,5		
K_{S4}	1	C_I	0,5		
P_{LI}	1	A_L	4000		
c_{LI}	1				

Table 148. Risk of loss of service to the public calculation.

Chapter 8. Lighting system

8.1. INTRODUCTION

The lighting system of all substation floors has been designed. Lighting calculations shall be made to achieve the appropriate lighting levels to provide security to workers and the adequate conditions to carry out their work properly. In order to fulfil the project requirements, sufficient illumination to ensure safe evacuation during emergency escape shall be supplied, and maintenance and electrical load requirements shall be also minimized. The lighting system is designed based on lighting calculations using the point-by-point method. Lighting calculation software Dialux 4.13, was used to aid the calculation required, with Philips library data.

8.2. DESIGN REQUIREMENTS

Separate Main Lighting Distribution Boards (MLDB) shall be provided for normal and emergency lighting in the substation to meet the lighting requirements. These shall receive power from 415V switchboards through 415/433V lighting transformers of suitable rating. Both normal and emergency MLDB shall be of two bus sections with bus coupler with manual change over facility for normal MLDB and auto changeover for emergency MLDB. Outdoor feeders shall have MCCB (Molded Case Circuit Breaker) with contactor and controlled by synchronous clock timer or photocell contact multiplier. Each new substation lighting system shall have single control (Hardwired and SCADA) to enable or disable the lighting of entire unit including substation and plant lighting. The hard and soft signals shall be wired to CGP-2 DCS. The lighting panels shall be provided with MCB (Miniature Circuit Breaker) and ELCB (Earth Leakage Circuit Breaker) with 100mA sensitivity as incomer. Also, the lighting panels shall be provided with MCBs in outgoing feeders for control and protection of lighting circuits. The small power panels shall be provided with MCB as incomer and MCB + ELCB with 30mA sensitivity in outgoing feeders for control and protection of power circuits. MCBs shall not be loaded beyond 80% of rated capacity. A minimum of 20% of miniature circuit breakers of each panel shall be left as spares. In general, the load on each circuit shall be limited to 1.5 kW.

The lighting control should have local and remote selection at the electrical switchgear. In remote mode, the lighting will be controlled centrally through ECS. In Local mode, the Auto / Manual mode will be there for Timer / manual control. Auxiliary relays as required for remote switching ON / OFF of lighting system shall be included.

The system must also have a DC critical lighting system from the 110V DC power supply. DC critical light fixture to be provided shall be red in color for easy identification. The DC lighting system shall be from dedicated emergency light charger and battery bank with auto switching on AC power failure.

The lighting system design shall be based on average illumination levels measured at 1 m above floor level. The following Table 149 indicates the required illumination levels.

S.No.	APPLICATION AREA	LUX LEVEL
1	Plant roads and tank farm	20
2	Loading/unloading areas	50
3	Open areas	10
4	Substation	
4.1	Switchgear room	200
4.2	Battery room	150
4.3	AHU room	150
4.4	Transformer room	100
4.5	Cable Cellar	70
4.6	UPS / HMI / Operator room	300
5	Control Rooms	
5.1	Console area	500
5.2	Rack room	200
5.3	Corridors / walkway Lift	20
6	Offices	300
7	Stores / warehouse, Toilet	100
8	Stair Cases	
8.1	Building	100
8.2	Plant area	100

Table 149. Lux level minimum requirements.

Lighting factors to take into account in lighting design are:

- For indoor lighting, minimum lux level shall not be less than 80% of the average illumination level.
- For outdoor lighting, minimum lux level shall not be less than 40% of average value and 25% of maximum value.
- A maintenance factor (f_m) of 0.7 shall be assumed for lighting illumination level calculations for outdoor areas.
- Reflection factors for indoor lighting must be:
 - o Floor – 20%,
 - o Ceiling – 70%,
 - o Wall – 50%.

The fixture type for the substation's lighting system will be industrial LED (Light Emitting Diode) with 18 or 22 wattages.

8.3. DIALUX RESULTS

The complete results provided by the Dialux program are attached in the annexes. The lighting of all rooms on each floor of the substation has been designed. The lux results obtained in each case are summarized in the following tables (Table 150, Table 151, Table 153 and Table 153). It can be seen how the minimum lux requirements and ratios requested by the client have been maintained.

SURFACE NAME	CALCULATED	REQUIRED	MINIMUM	Emin/Eav	MAXIMUM	Emin/Emax
	Eav [lx]	Em [lx]	Emin [lx]	u0	Emax [lx]	-
Substation ES-044 Ground floor						
044-TR-201 typical	113	60	48	0,425	185	0,259
CFU Room	345	100	281	0,814	408	-
044-TR-106A	146	60	58	0,397	228	0,254
044-TR-101 typical	118	60	49	0,415	207	0,237
044-TR-110/111/202 typical	90	60	36	0,400	172	0,209
044-TR-102/103/104/105 typical	92	60	37	0,402	175	0,211
WC typical	90	60	79	0,878	99	-
Toilet typical						
Calculation Surface 1	191	60	150	0,785	210	-
Calculation Surface 2	174	60	141	0,810	207	-
Stairs typical	272	100	217	0,798	301	-
Cable cellar	181	70	154	0,851	224	-

Table 150. ESS-044 ground floor DIALUX illumination results.

SURFACE NAME	CALCULATED	REQUIRED	MINIMUM	Emin/Eav
	Eav [lx]	Em [lx]	Emin [lx]	u0
Substation ES-044 First floor				
Operator Room				
Calculation Surface 1	182	300	208	0,769
Calculation Surface 2	185	300	145	0,785
ECS RTU Room				
Calculation Surface 1	240	300	211	0,881
Calculation Surface 2	267	300	214	0,801
AHU Room 1	284	150	231	0,813
Platform 1st floor typical 1				
Calculation Surface 1	401	100	313	0,781
Calculation Surface 2	504	100	450	0,891
Calculation Surface 3	419	100	313	0,747
Platform 1st floor typical 2				
Calculation Surface 1	338	100	244	0,721
Calculation Surface 2	447	100	473	0,858
Calculation Surface 3	376	100	276	0,734
Switchgear Room	264	200	220	0,83

Table 151. ESS-044 first floor DIALUX illumination results.

SURFACE NAME	CALCULATED	REQUIRED	MINIMUM	Emin/Eav
	Eav [lx]	Em [lx]	Emin [lx]	u0
Substation ES-044 Second floor				
Cable Cellar	171	70	142	0,83
Platform type 2nd floor	244	100	272	0,772
CFU Room	237	150	183	0,769

Table 152. ESS-044 second floor DIALUX illumination results.

SURFACE NAME	CALCULATED	REQUIRED	MINIMUM	E _{min} /E _{av}
	E _{av} [lx]	E _m [lx]	E _{min} [lx]	u ₀
Substation ES-044 Third floor				
Switchgear Room	358	200	308	0,862
Battery Room 1	197	150	162	0,824
AHU Room	300	150	236	0,787
Battery Room 2	472	150	359	0,761
Maintenance Room	340	100	273	0,805
Operation Room	310	100	280	0,9

Table 153. ESS-044 third floor DIALUX illumination results.

The luminaire models used are:

- Philips BN308C LED60S-6500 L120 PSU WH.
Luminaire used for outdoor lighting in transformer bays, cable cellar and stairs platform. It is also used for indoor lighting rooms when there is not false ceiling: AHU room, CFU room, battery room, maintenance room and operation room. In this case, these luminaires are placed suspended from the ceiling at a height of 3.8m or on the wall.
- Philips RC136B PSU W60L60 1 x28S_34S_40S/830 NOC.
Luminaires placed in the rooms where there is false ceiling. The luminaires, measuring 30x30cm, are placed in a grid pattern and at a distance that is a multiple of 30cm in order to respect the conditions of the false ceiling.
- Philips SM251C LED20S-6500 PSU WH.
Luminaires used to light the substation restroom.

Two figures are attached as an example of the lighting design in a transformer bay (Figure 30), a switchgear room (Figure 31), AHU room (Figure 32), platform stairs (Figure 33) and cable cellar room (Figure 34).



Figure 30. Transformer bay's 3D rendering. Source: Dialux



Figure 31. Switchgear room 3D rendering. Source: Dialux

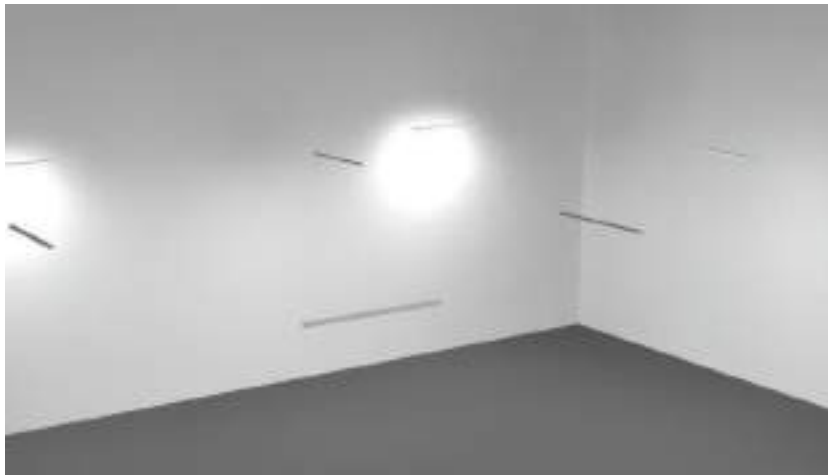


Figure 32. AHU room 3D rendering. Source: Dialux

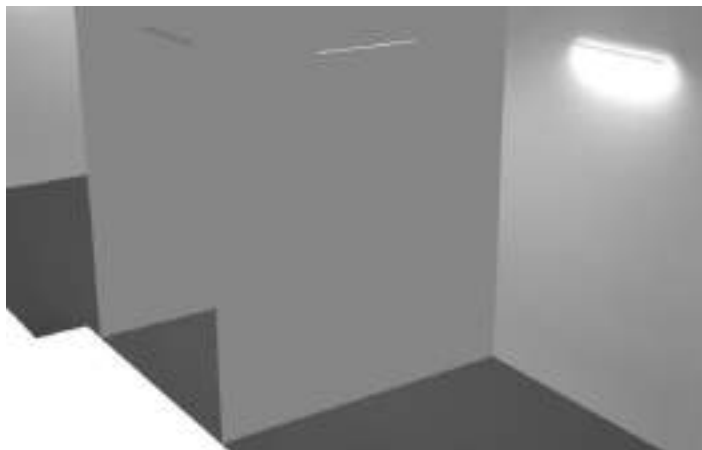


Figure 33. Platform stairs 3D rendering. Source: Dialux



Figure 34. Cable cellar 3D rendering. Source: Dialux

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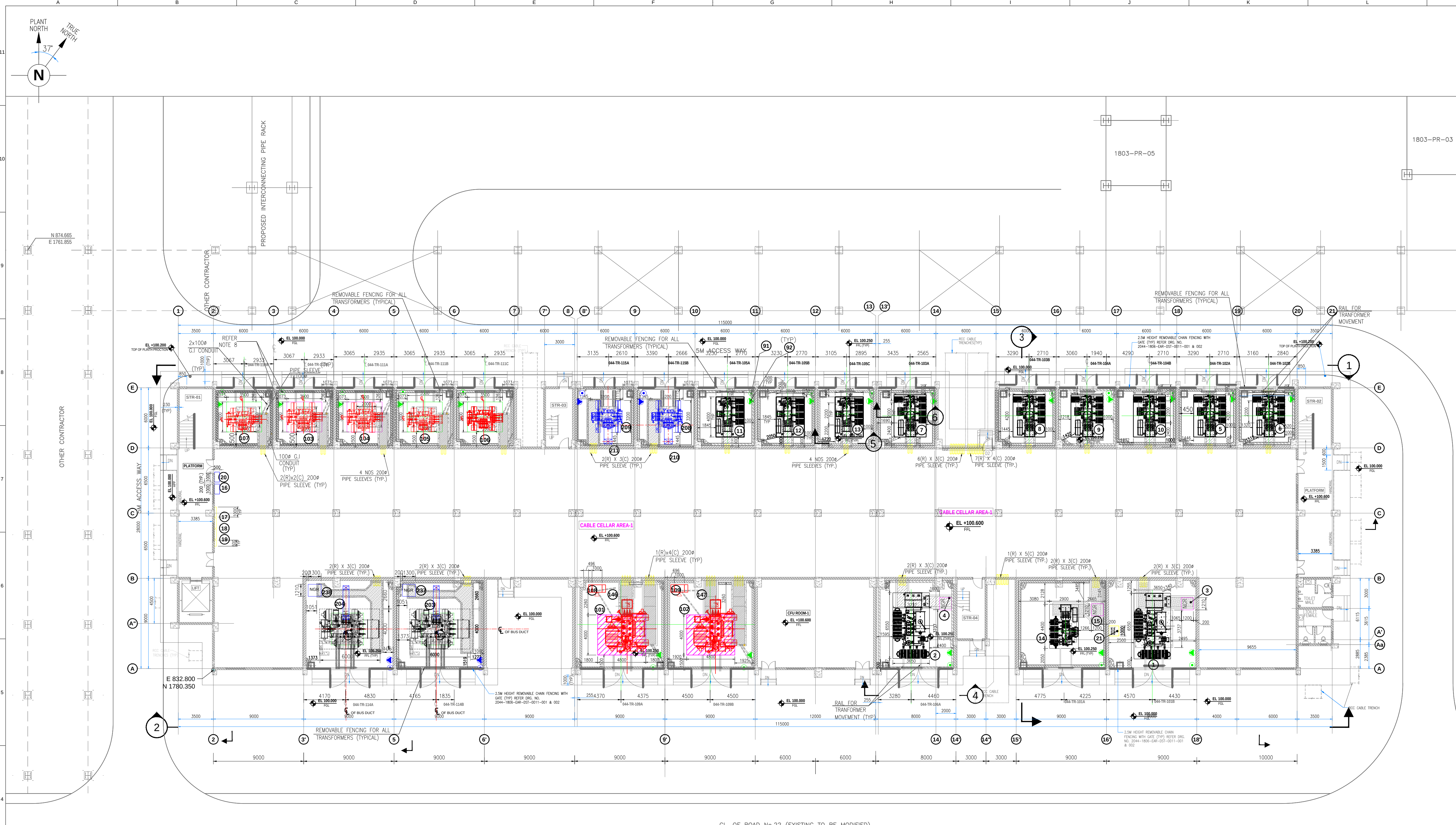
Annexes

All the plans drawn up by the Intecsa Industrial electrical team and the results obtained in the ETAP and DIALux software simulations are attached in this section.

This is the order of the documents:

- Electrical equipment substation layout
- General single line diagram for RFCC
- 033-HT33-101 single line diagram
- 033-HT11-101 single line diagram
- 033-HT6-101 single line diagram
- 033-HT6-102 single line diagram
- 033-PMCC-101 single line diagram
- 033-PMCC-102 single line diagram
- 033-PMCC-103 single line diagram
- 033-EPMCC-101 single line diagram
- 033-MCC-101 single line diagram
- 033-MCC-102 single line diagram
- 033-MCC-103 single line diagram
- 033-MCC-104 single line diagram
- 033-MCC-105 single line diagram
- 033-MCC-106 single line diagram
- 033-MCC-107 single line diagram
- 033-ASB-101 single line diagram
- 033-ASB-102 single line diagram
- 033-UPS-101 single line diagram
- 033-UPS-102 single line diagram
- 033-DC-101 single line diagram
- 033-DC-102 single line diagram
- 033-MLDB-101 single line diagram
- 033-EMLDB-101 single line diagram
- Grounding installation standards
- Grounding distribution layout for substation
- DIALux calculation results:
 - o Ground floor report
 - o First floor report

- o Second floor report
 - o Third floor report
- ETAP calculation results:
 - o Load Flow Normal case report
 - o Load Flow Contingency case report
 - o Load Flow Emergency case report
 - o Short Circuit Normal case report
 - o Short Circuit Contingency case report
 - o Short Circuit Emergency case report
 - o Harmonic Normal case report
 - o Motor Starting EPMCC-101 report
 - o Motor Starting HT6-101 report
 - o Motor Starting HT6-102 report
 - o Motor Starting PMCC-101 report
 - o Motor Starting PMCC-102 report
 - o Motor Starting PMCC-103 report



CL. OF ROAD No.22 (EXISTING TO BE MODIFIED)

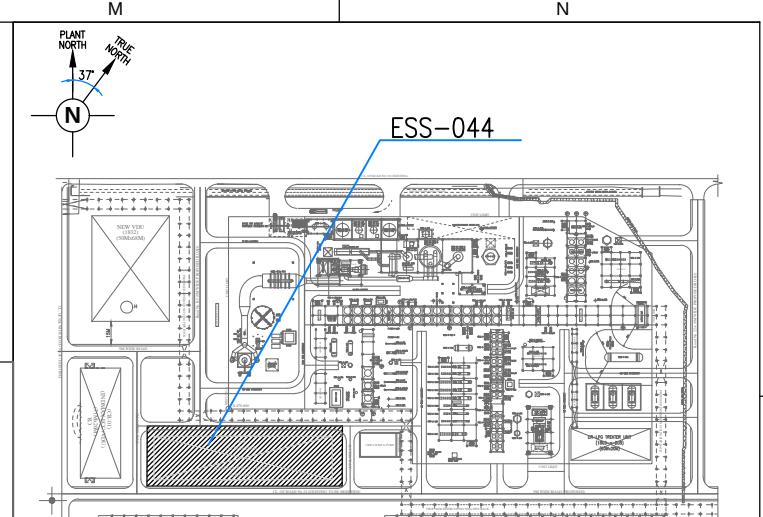
GROUND FLOOR PLAN
(AT EL +100.600 FFL)

NOTES :

1. ALL DIMENSIONS & ELEVATIONS ARE IN MILLIMETERS, UNLESS NOTED OTHERWISE
2. THE DRAWING WILL BE UPDATED BASED ON FINAL APPROVED VENDOR DRAWING
3. FOR SECTION & ELEVATION DETAILS REFER ABOVE ARCHITECTURE DRAWINGS
4. HVAC DETAILS WILL BE SHOWN IN HVAC DISCIPLINE DRAWING.
5. CABLE TRENCHES AND CABLE ENTRY WILL BE SHOWN IN CABLE ROUTING DRAWINGS
6. 6MM THICK REMOVABLE CHEQUERED PLATE WILL BE INSTALLED FOR REMAINING/UNUSED OPENINGS IN SWITCHGEAR FLOOR.
7. FLOOR OF BATTERY ROOM AND WALLS UP TO 2.5 METERS HEIGHT WILL BE ACID/ALKALINE RESISTANCE PROTECTIVE COATING/TILING.
8. BATTERY ROOM SHALL BE ADEQUATELY VENTILATED WITH EXHAUST FANS AS PER HVAC DESIGN AND WILL BE FLAMEPROOF TYPE AND SUITABLE FOR GAS GROUP IIC.
9. DIELECTRIC PAINT (EPOXY COATING) WILL BE PROVIDED BY CONSIDERING MAXIMUM VOLTAGE FOR SWITCHGEAR HALL IN THE SUBSTATION FLOOR.
10. TRANSFORMER/CAPACITOR BAYS WILL BE ENCLOSED WITH SUITABLE ROOF AND METAL FENCE.
11. EXHAUST FANS FOR VENTILATION TO BE PROVIDED IN CABLE CELLAR.
12. PANEL MOUNTING, BUSDUCT VIEWS AND CUTOUT DETAILS WILL BE REVISED AFTER FINALIZATION OF VENDOR DRAWINGS.
13. ILLUMINATED SLD WILL BE PROVIDED IN SUBSTATION AFTER COMPLETION OF ERECTION.

14. REMOVABLE MONORAIL WILL BE PROVIDED FROM SUBSTATION TO ADJACENT PIPE RACK.
15. EARTH CONDUCTOR WILL BE PROVIDED ALONG ONE OF THE CABLE TRAY AND WILL BE SUITABLY CLEATED WELDED. THE EARTHING CONDUCTOR ELECTRICALLY BONDED TO ALL THE OTHER CABLE TRAYS AS PER ELECTRICAL STANDARDS.
16. EVERY TRANSFORMER BAY WILL BE PROVIDED WITH ONE NO. OF 100A SOCKET AND SOCKETS OF TWO TRANSFORMER BAYS CAN BE LOOPED IN ONE CIRCUIT.
17. EMERGENCY STOP BUTTON SHALL BE LOCATED INSIDE THE BAY AND CUTOUT SHALL BE PROVIDED IN THE FENCE TO ACCESS THE EPB FROM OUTSIDE. EPB SHALL BE BREAK GLASS TYPE.
18. OTHER CONTACTOR EPB AND WELDING SOCKETS SHALL BE SUPPLIED AND INSTALLATION BY OTHER CONTACTOR ONLY.
19. FIRE BARRIER WILL BE PROVIDED AT EVERY CABLE ENTRY POINT FOR WITHSTANDING CAPACITY OF 3HOURS.
20. SUBSTATION BUILDING SHALL BE AIR CONDITIONED. AIR CONDITIONING FOR THE BUILDING WILL BE INTERFACED WITH F&G SYSTEM IN SUCH A WAY THAT AIR CONDITIONING UNIT IS TRIPPED ON DETECTION OF HYDROCARBON.
21. SMOKE DETECTOR AND FIRE DETECTORS WILL BE PROVIDED IN SUBSTATION CABLE CELLAR. LINEAR HEAT SENSING (LHS) CABLE TO BE PROVIDED ON ALL CABLE TRAYS IN CABLE CELLAR ROOM FOR FIRE DETECTION. CABLE CELLAR WILL BE PROVIDED WITH EXHAUST FANS FOR ADEQUATE VENTILATION.
22. SUBSTATION SHALL HAVE FIRE EXTINGUISHERS, FIRST AID BOXES AND OTHER SAFETY EQUIPMENT AS PER STATUTORY REQUIREMENTS.
23. LOCATION OF BUS DUCT SUPPORTS IS TENTATIVE, WILL BE UPADTED AFTER FINALIZATION OF BUS DUCT VENDOR,

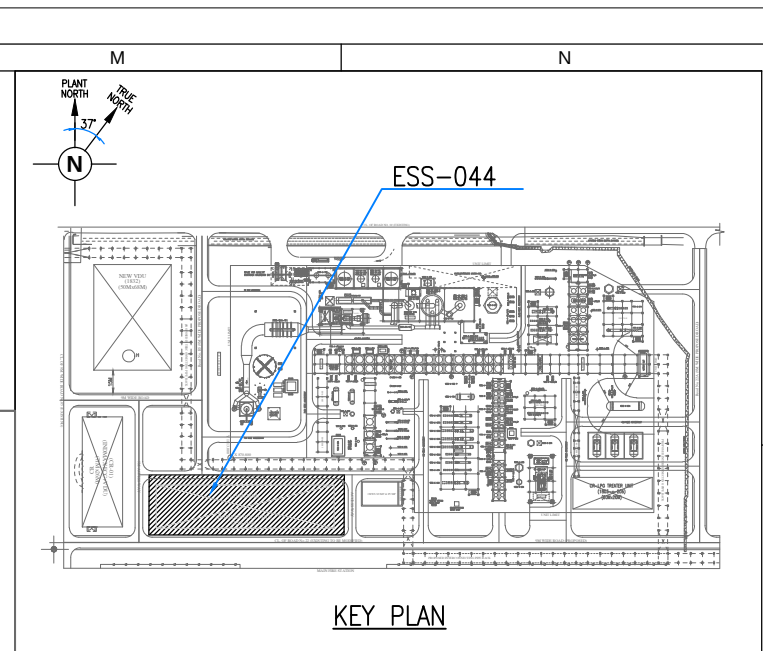
23. SWITCHGEAR ROOM SHALL BE PROVIDED WITH THE FOLLOWING MINIMUM EQUIPMENT(SI CERTIFIED & APPROVED MAKE):
 - > FRAMED LAMINATED SHOCK TREATMENT CHART, CONFORMING TO IE RULES, IN ENGLISH AND LOCAL LANGUAGE. NAME, ADDRESS AND TELEPHONE NUMBER OF NEAREST DOCTOR SHALL BE MENTIONED IN IT.
 - > EASILY ACCESSIBLE FIRST AID BOX CONTAINING OINTMENTS AND MEDICINES FOR TREATMENT OF ELECTRICAL BURNS, CONFORMING TO IE RULES.
 - > SELF CONTAINED PORTABLE HAND LAMP, COMPLETE WITH RECHARGEABLE BATTERY.
 - > PORTABLE BATTERY OPERATED EMERGENCY LIGHT.
 - > ADEQUATE NUMBER AND SIZE OF CO2 FIRE EXTINGUISHERS AND DRY CHEMICAL POWDER SUITABLE FOR DEALING WITH FIRE.
 - > ROUND BOTTOM FIRE BUCKETS FILLED WITH CLEAN DRY SAND.
 - > FRAMED SINGLE LINE DIAGRAM (AC AND DC).
 - > ONE NO. EARTHING ROD.
 - > EARTHING TRUCK (FOR BOTH CIRCUIT AND BUS).
 - > HT LINE TESTER
 - > INSULATION TESTER, TONG TESTER
 - > BATTERY IMPEDANCE TESTER
 - > CAUTION NOTICES SHALL BE PROVIDED FOR ALL ENERGIZED ELECTRICAL EQUIPMENT.
 - > HT & LT MEGGER
 - > ARTIFICIAL RESPIRATION SYSTEM
 - > FACE SHIELD
 - > HV AND MV INSULATED GLOVES
 - > BREAKER LIFTING TROLLEY



LEGENDS	
EXP	EXPANSION
FGL	FINISHED GRADE LEVEL
FFL	FINISHED FLOOR LEVEL
TOG	TOP OF GRAVEL
RS	ROLLING SHUTTER
STR	STAIRCASE
TR	TRANSFORMER
100A	100A RECEPTACLE
EMERGENCY STOP PUSH BUTTON (BREAK GLASS TYPE)	
PANEL FRONT DIRECTION	
SPACE FOR FUTURE PANELS / EQUIPMENT	
EQUIPMENT FOR INDMAX FCC / CR LPG UNITS	
EQUIPMENT FOR NEW VDU UNIT	
EQUIPMENT FOR AU-V REVAMP UNIT	
SOLAR PANELS	
FIRE RATED WALL	
OTHER CONTACTOR	

REFERENCE DOCUMENTS / DRAWINGS	
077154C-000-JSD-1800-001	DESIGN BASIS
2047-1803-EEL-SLD-0001	GENERAL SINGLE LINE DIAGRAM RFCC
2047-1803-EPD-DPP-0001	OVERALL PLOT PLAN
2047-1803-EEL-DST-0001	TYPICAL POWER INSTALLATION STANDARDS FOR CONSTRUCTION
2047-1803-ECV-DLA-0431	LAYOUT OF ELECTRIC CABLE TRENCH 33KV AND 11KV INDMAX FCCU (UNIT 180)
077154C-145413-1832-ELE-DW-015	SUBSTATION EQUIPMENT LAYOUT FOR VDU UNITS
2047-1803-EEL-DLA-0006	CABLE ROUTING LAYOUT

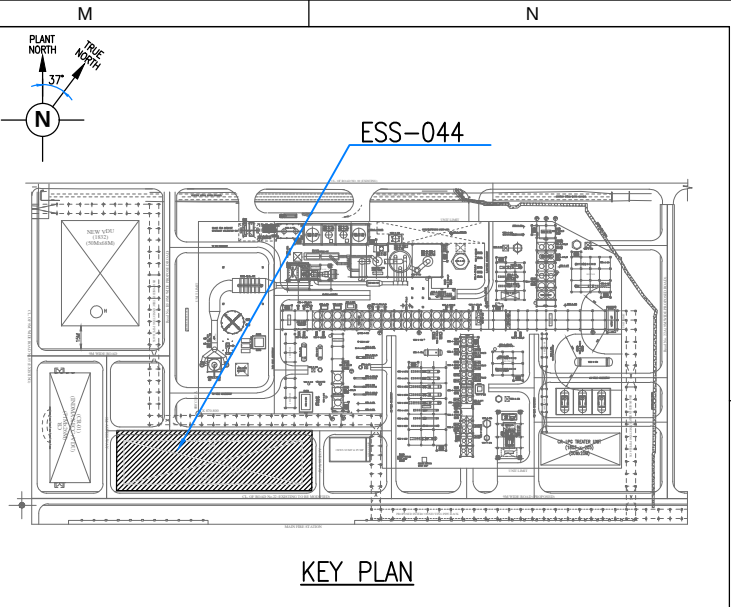
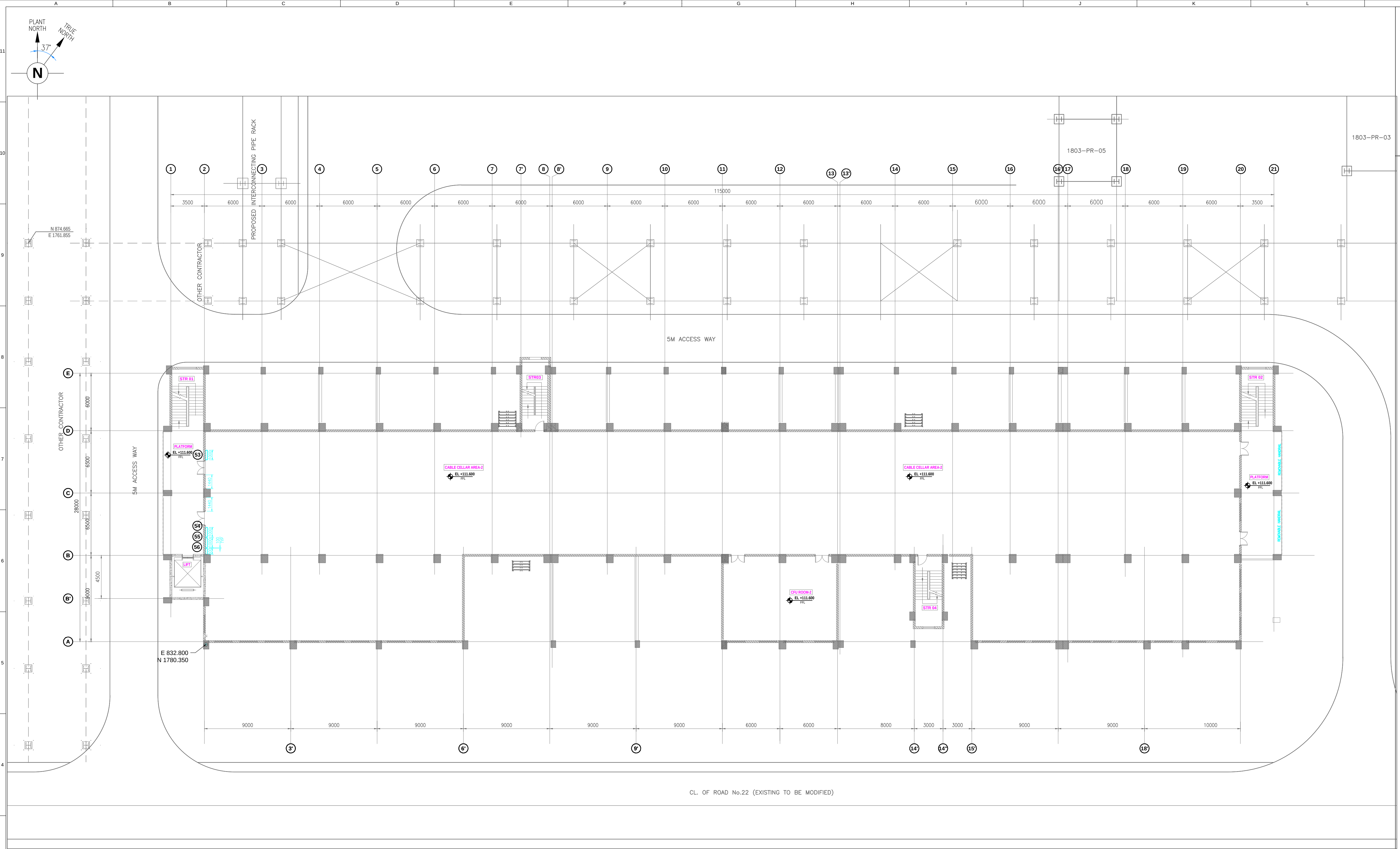
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EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT)				TITLE			
ELECTRICAL EQUIPMENT LAYOUT SUBSTATION (ESS-044) RFCC UNIT				DRAWING NUMBER			
SCALE	DRAWING NO	UNIT	2047-1803-EEL-DLA-0001	PAGE	REV		
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PROJECT	PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LuPech (J-18)" AT IOCL GUJARAT REFINERY, VADODARA, GUJARAT, INDIA EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT)

SCALE	DRAWING NUMBER						
	PROJECT NO	UNIT	2047-1803-EEL-DLA-0001			PAGE	REV
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FIRST FLOOR PLAN
(AT EL. +105.100)



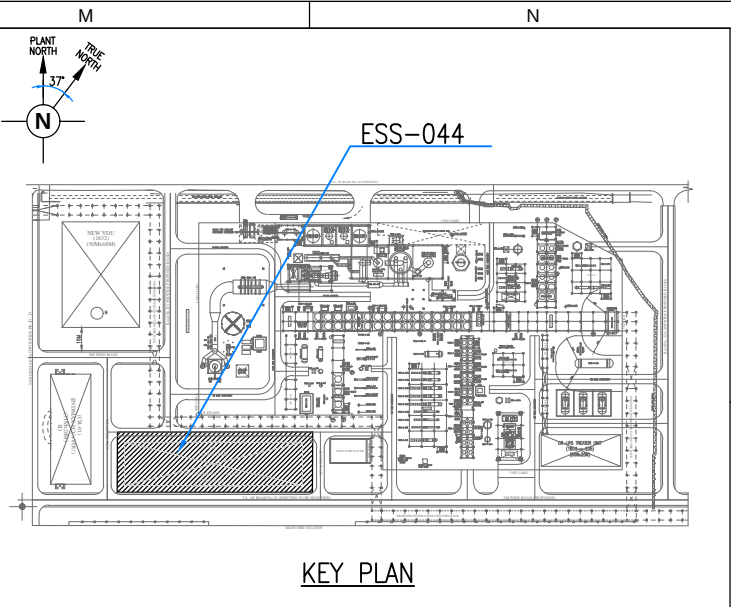
FOR NOTES AND REFERENCE DRAWINGS,
REFER PAGE 1

SECOND FLOOR PLAN

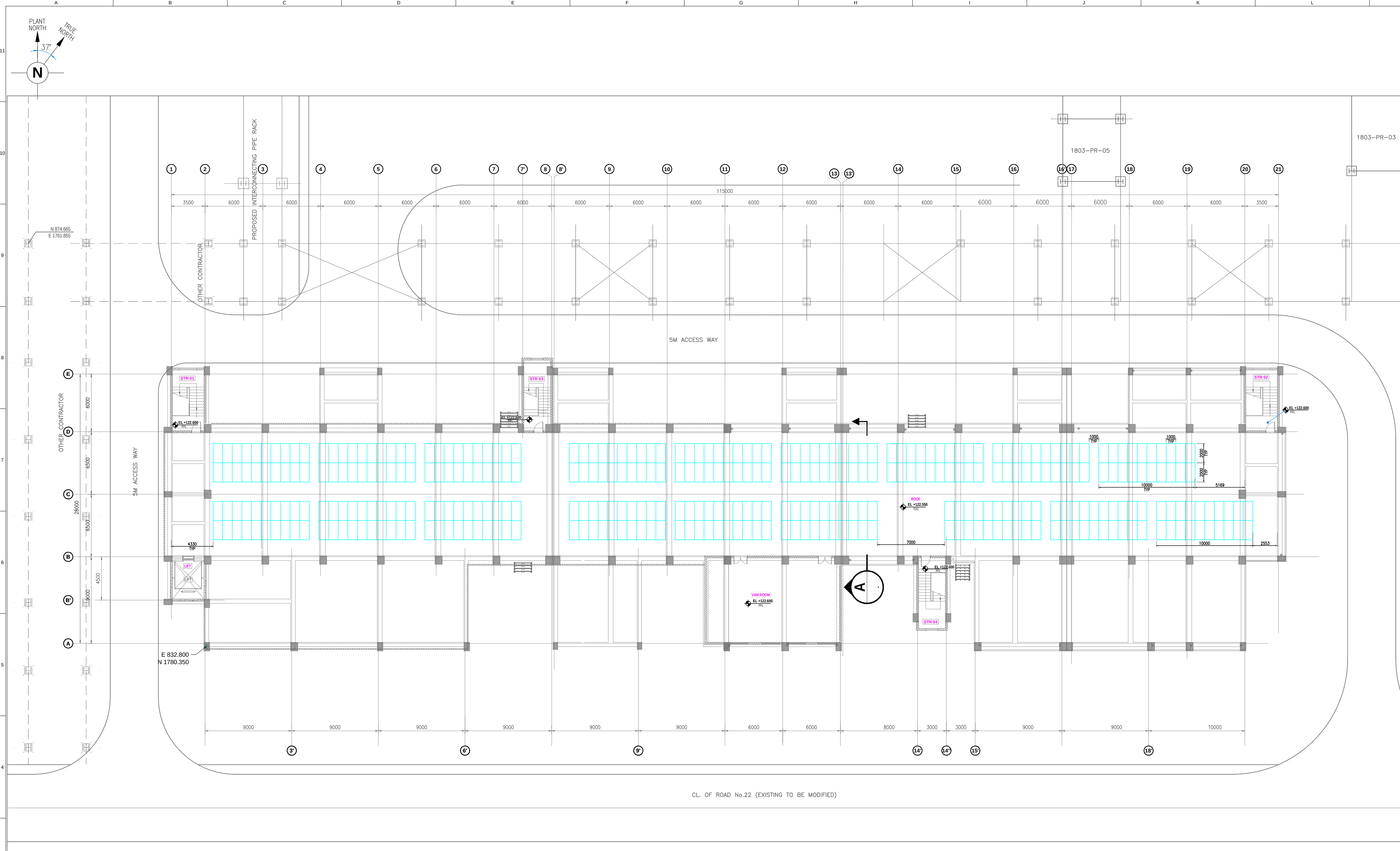
(AT EL +111.600 FFL)

PROJECT	PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LuPech (J-18)" AT IOCL GUJARAT REFINERY, VADODARA, GUJARAT, INDIA EPPC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT)
TITLE	ELECTRICAL EQUIPMENT LAYOUT SUBSTATION (ESS-044) RFCC UNIT

SCALE	DRAWING NUMBER						
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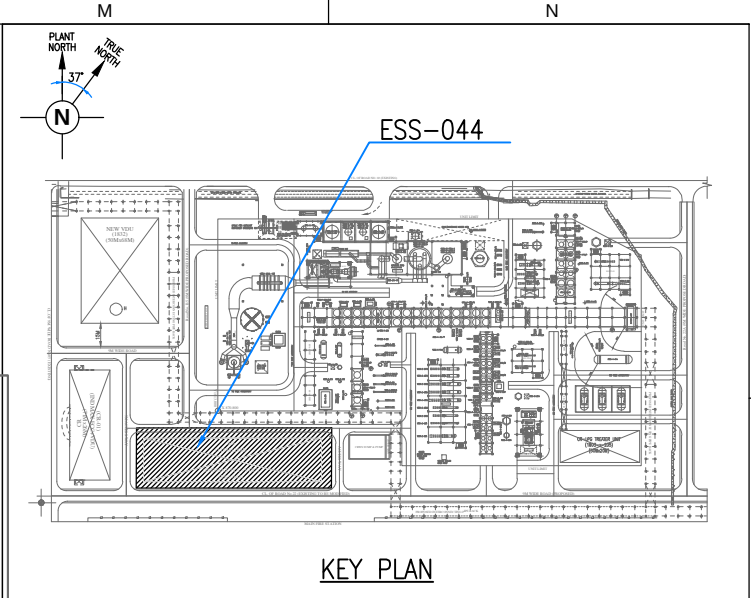
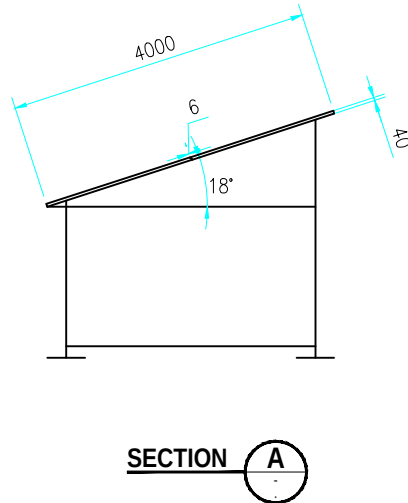


PROJECT						
PETROCHEMICAL AND LUBE INTEGRATION						
PROJECT "LuPech (J-18)" AT IOCL GUJARAT						
REFINERY, VADODARA, GUJARAT, INDIA						
EPC-C2 PACKAGE (INDMAX RFCCU + CR LPG TREATR UNIT)						
TITLE						
ELECTRICAL EQUIPMENT LAYOUT						
SUBSTATION (ESS-044) RFCC UNIT						
SCALE	DRAWING NUMBER					
	PROJECT NO	2047-1803-ESS-ELA-0001				
	2047	1803	EEL	DILA	0001	
					PAGE	REV
					4 OF 10	F
					N	



ROOF PLAN
(AT EL +122.550 TOC)

Power Required	kWp	125
	Wp	125000
Panel (Polycrystalline)	Wp	350
	Nos	358
Number of Modules Required	Nos	358
Invertor Rating	kW	150
No. of Strings Considered	Nos	18
Modules per String Considered	Nos	20
No. of Modules Considered	Nos	360
Final Power Sized	Wp	126000

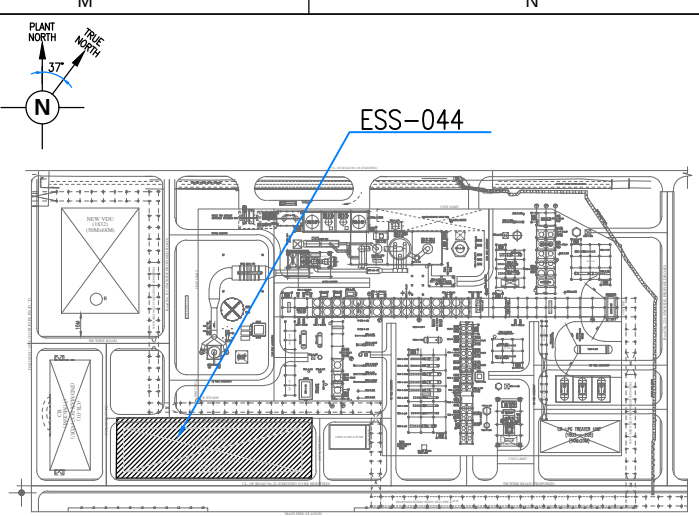


FOR NOTES AND REFERENCE DRAWINGS,
REFER PAGE 1

PROJECT
PETROCHEMICAL AND LUBE INTEGRATION
PROJECT "LuPech (J-18)" AT IOCL GUJARAT
REFINERY, VADODARA, GUJARAT, INDIA
EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT)

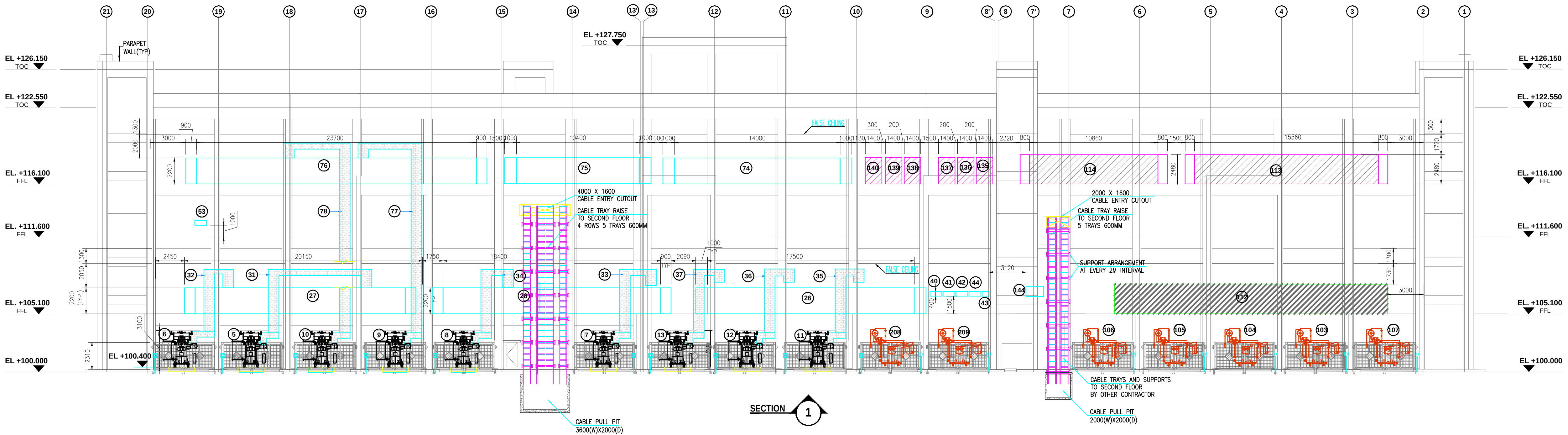
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ELECTRICAL EQUIPMENT LAYOUT
SUBSTATION (ESS-044) RFCC UNIT

SCALE	DRAWING NUMBER						
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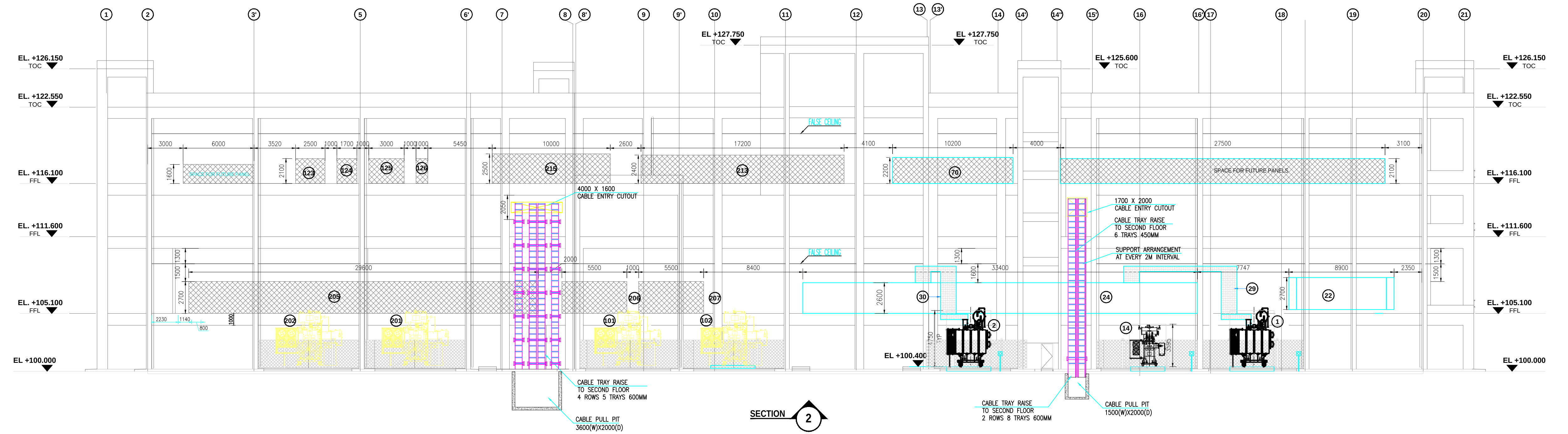


KEY PLAN

FOR NOTES AND REFERENCE DRAWINGS,
REFER PAGE 1



SECTION 1

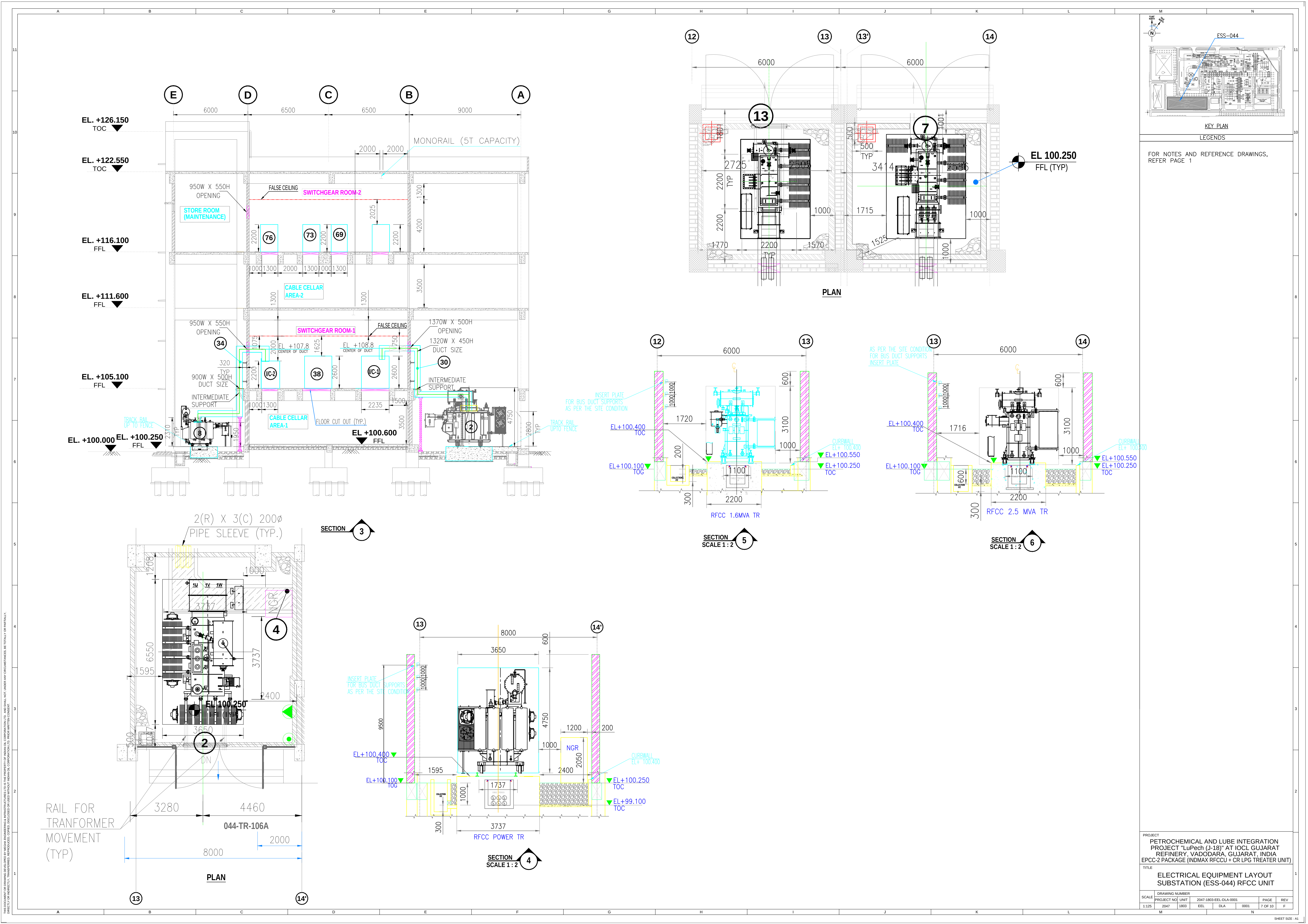


SECTION 2

PROJECT
PETROCHEMICAL AND LUBE INTEGRATION
PROJECT "LuPech (J-18)" AT IOCL GUJARAT
REFINERY, VADODARA, GUJARAT, INDIA
EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT)

TITLE
ELECTRICAL EQUIPMENT LAYOUT
SUBSTATION (ESS-044) RFCC UNIT

SCALE		DRAWING NUMBER				PAGE		REV
PROJECT	UNIT	PROJECT NO	UNIT	EEL	DLA	0001	6 OF 10	
1:200	2047	1803	EEL	DLA	0001	6 OF 10	F	



SL. NO	EQUIPMENT TAG NO	LOAD DESCRIPTION	LENGTH (mm)	WIDTH (mm)	HEIGHT (mm)	WEIGHT (kg)	MAKE	REMARKS
1	044-TR-101 A	33/6.9kV POWER TRAF0 FROM 044-HT33-101	6550	3680	4750	33500	CG	
2	044-TR-101 B	33/6.9kV POWER TRAF0 FROM 044-HT33-101	6550	3680	4750	33500	CG	
3	044-NGR-101 A	NGR FOR POWER TRANSFORMER 044-TR-101 A	1210	1200	2050	600	RSI	
4	044-NGR-101 B	NGR FOR POWER TRANSFORMER 044-TR-101 B	1210	1200	2050	600	RSI	
5	044-TR-102 A	6.6/0.433kV DISTRIBUTION TRAF0 FROM 044-HT6-101	4200	3200	3100	10100	CG	
6	044-TR-102 B	6.6/0.433kV DISTRIBUTION TRAF0 FROM 044-HT6-101	4200	3200	3100	10100	CG	
7	044-TR-103 A	6.6/0.433kV DISTRIBUTION TRAF0 FROM 044-HT6-101	4200	3200	3100	10100	CG	
8	044-TR-103 B	6.6/0.433kV DISTRIBUTION TRAF0 FROM 044-HT6-101	4200	3200	3100	10100	CG	
9	044-TR-104 A	6.6/0.433kV DISTRIBUTION TRAF0 FROM 044-HT6-101	4200	3200	3100	10100	CG	
10	044-TR-104 B	6.6/0.433kV DISTRIBUTION TRAF0 FROM 044-HT6-101	4200	3200	3100	10100	CG	
11	044-TR-105 A	6.6/0.433kV DISTRIBUTION TRAF0 FROM 044-HT6-101	4000	2800	3100	7550	CG	
12	044-TR-105 B	6.6/0.433kV DISTRIBUTION TRAF0 FROM 044-HT6-101	4000	2800	3100	7550	CG	
13	044-TR-105 C	6.6/0.433kV DISTRIBUTION TRAF0 FROM 044-HT6-101	4000	2800	3100	7550	CG	
14	044-TR-106 A	11/6.9kV POWER TRAF0 FROM 044-HT11-101	4400	2747	3350	10500	CG	
15	044-NGR-106 A	NGR FOR POWER TRANSFORMER 044-TR-106 A	1210	1200	2050	600	RSI	
16	044-LDB-104	LIGHTING DISTRIBUTION BOARD	1000	200	400	-	NA	
17	044-ELDB-104	EMERGENCY LIGHTING DISTRIBUTION BOARD	1000	200	400	-	NA	
18	044-PDB-104	POWER DISTRIBUTION BOARD	1000	200	400	-	NA	
19	044-CLDB-104	CRITICAL LIGHTING DISTRIBUTION BOARD	600	200	400	-	NA	
20	044-SASB-001	SUB AUXILIARY SERVICE BOARD	1000	200	400	-	NA	
21	044-TR-101A/B	ONLINE MOISTURE REMOVAL KIT FOR POWER TRAF0'S	1000	1000	2000	800	NA	
22	044-HT33-101	33kV GIS SWITCHGEAR	7700	2700	2700	30000		SIEMENS
23	044-HT11-101	11kV AIS SWITCHGEAR	5200	2235	2600	25000	ABB	
24	044-HT6-101	6.6kV AIS SWITCHGEAR	38900	2235	2600	36000	ABB	
25	044-HT6-102	6.6kV AIS SWITCHGEAR	9750	2235	2600	15000	ABB	
26	044-EPGCC-101	415V EPMCC	17500	1300	2200	12000	NA	
27	044-PMCC-101	415V PMCC	17800	1300	2200	10000	NA	
28	044-PMCC-102	415V PMCC	18400	1300	2200	10000	NA	
29	044-BD-101 A	6.6kV BUS DUCT	-	800	400	-	NA	
30	044-BD-101 B	6.6kV BUS DUCT	-	800	400	-	NA	
31	044-BD-102 A	415V BUS DUCT	-	600	300	-	NA	
32	044-BD-102 B	415V BUS DUCT	-	600	300	-	NA	
33	044-BD-103 A	415V BUS DUCT	-	600	300	-	NA	
34	044-BD-103 B	415V BUS DUCT	-	600	300	-	NA	
35	044-BD-105 A	415V BUS DUCT	-	600	300	-	NA	
36	044-BD-105 B	415V BUS DUCT	-	600	300	-	NA	
37	044-BD-105 C	415V BUS DUCT	-	600	300	-	NA	
38	044-CB-101 A	CAPACITOR BANK WITH APFC	4500	2200	2300	4000	NA	
39	044-CB-101 B	CAPACITOR BANK WITH APFC	4500	2200	2300	4000	NA	
40	044-LDB-103	LIGHTING DISTRIBUTION BOARD	1000	200	400	-	NA	
41	044-ELDB-103	EMERGENCY LIGHTING DISTRIBUTION BOARD	1000	200	400	-	NA	
42	044-PDB-103	POWER DISTRIBUTION BOARD	1000	200	400	-	NA	
43	044-CLDB-103	CRITICAL LIGHTING DISTRIBUTION BOARD	600	200	400	-	NA	
44	044-SASB-002	SUB AUXILIARY SERVICE BOARD	1000	200	400	-	NA	
45	044-UPS-103	UPS WITH BATTERY FOR ECS SYSTEM	1000	800	2200	600	NA	
46	044-DCC-101	ECS DATA CONCENTRATOR	1000	800	2200	300	NA	
46A	044-DCC-102	ECS DATA CONCENTRATOR	1000	800	2200			
47	044-RTU-101	ECS RTU PANEL	1000	800	2200	300	NA	
48	044-RTU-102	ECS RTU PANEL	1000	800	2200	300	NA	
49	044-RTU-103	ECS RTU PANEL	1000	800	2200	300	NA	
50	044-RTU-104	ECS RTU PANEL	1000	800	2200	300	NA	
51	044-OWS-101	ECS OPERATOR WORKSTATION	1200	800	1000	500	NA	
51A	044-RTU-105	ECS RTU PANEL	1200	800	1000	500		
52	044-EWS-101	ECS ENGINEERING WORKSTATION	1200	800	1000	500	NA	
53	044-LDB-102	LIGHTING DISTRIBUTION BOARD	1000	200	400	-	NA	
54	044-ELDB-102	EMERGENCY LIGHTING DISTRIBUTION BOARD	1000	200	400	-	NA	
55	044-PDB-102	POWER DISTRIBUTION BOARD	1000	200	400	-	NA	
56	044-CLDB-102	CRITICAL LIGHTING DISTRIBUTION BOARD	600	200	400	-	NA	
57	044-TR-107 A	415/433V LIGHTING TRAF0 FROM PMCC-103	1500	1220	1500	1300	NA	
58	044-TR-107 B	415/433V LIGHTING TRAF0 FROM PMCC-103	1500	1220	1500	1300	NA	
59	044-TR-108 A	415/433V EMERGENCY LIGHTING TRAF0 FROM EPMCC-101	1500	1100	1320	1060	NA	
60	044-TR-108 B	415/433V EMERGENCY LIGHTING TRAF0 FROM EPMCC-101	1500	1100	1320	1060	NA	
61	044-EMLDB-101	415V EMERGENCY LIGHTING DISTRIBUTION BOARD	3300	800	1800	500	NA	
62	044-MLDB-101	415V MAIN LIGHTING DISTRIBUTION BOARD	4300	800	1800	500	NA	
63	044-DC-101	110V DC UPS (SWITCHGEAR CONTROL)	3000	800	2000	200	NA	
64	044-DCDB-101	110V DC UPS BOARD (SWITCHGEAR CONTROL)	3000	800	2000	200	NA	
65	044-DC-102	110V DC UPS (CRITICAL LIGHTING CONTROL)	3000	800	2000	200	NA	
66	044-DCDB-102	110V DC UPS BOARD (CRITICAL LIGHTING CONTROL)	3000	800	2000	200	NA	
67	044-ASB-101	AUXILIARY SERVICE BOARD	5600	1300	2200	400	NA	
68	044-ASB-102	AUXILIARY SERVICE BOARD	5600	1300	2200	400	NA	
69	044-MCC-101	415V MCC	16900	1300	2200	600	NA	
70	044-MCC-102	415V MCC	10200	1300	2200	600	NA	
71	044-MCC-103	415V MCC	10200	1300	2200	600	NA	
72	044-MCC-104	415V MCC	10400	1300	2200	600	NA	
73	044-MCC-105	415V MCC	10900	1300	2200	600	NA	
74	044-MCC-106	415V MCC	14000	1300	2200	600	NA	
75	044-MCC-107	415V MCC	10400	1300	2200	600	NA	
76	044-PMCC-103	415V PMCC	23700	1300	2200	1200	NA	
77	044-BD-104 A	415V BUS DUCT	-	600	300	NA	NA	
78	044-BD-104 B	415V BUS DUCT	-	600	300	NA	NA	
79	044-SI-101	SOLAR INVERTER	1200	800	800	NA	NA	
80	044-LDB-101	LIGHTING DISTRIBUTION BOARD	1000	200	400	NA	NA	
81	044-ELDB-101	EMERGENCY LIGHTING DISTRIBUTION BOARD	1000	200	400	NA	NA	
82	044-PDB-101	POWER DISTRIBUTION BOARD	1000	200	400	NA	NA	
83	044-CLDB-101	CRITICAL LIGHTING DISTRIBUTION BOARD	600	200	400	NA	NA	
84	044-SASB-003	SUB AUXILIARY SERVICE BOARD	1000	200	400	NA	NA	
85	044-BB-101 A	BATTERY BANK FOR 044-DC-101	2480	1030	1500	NA	NA	
86	044-BB-101 B	BATTERY BANK FOR 044-DC-101	2480	1030	1500	NA	NA	
87	044-BB-102	BATTERY BANK FOR 044-DC-102	2480	1030	1500	NA	NA	
88	044-BBI-101 A	ISOLATING SWITCH FOR BATTERY BANK FOR 044-DC-101	500	400	600	NA	NA	
89	044-BBI-101 B	ISOLATING SWITCH FOR BATTERY BANK FOR 044-DC-101	500	400	600	NA	NA	
90	044-BBI-102	ISOLATING SWITCH FOR BATTERY BANK FOR 044-DC-102	500	400	600	NA	NA	
91	044-EPB	EMERGENCY STOP PUSH BUTTON (TYP)	300	200	150	NA	NA	
92	044-WSB	WELDING SOCKET (TYP)	250	150	250	NA	NA	
93	-	LOAD SHEDDING PANEL	800	800	2200	NA	NA	
94	-	DO SIGNAL PANEL	800	800	2200	NA	NA	

S.NO	ITEM TAG	DESCRIPTION	QTY	DIMENSIONS ** (MM)			WEIGHT (KG)	MAKE	REMARKS
				LENGTH	WIDTH	HEIGHT			
101	044-TR-109A	6.3/8MVA POWER TRANSFORMER		4800	4000	4000	15000	HOLD	
102	044-TR-109B	6.3/8MVA POWER TRANSFORMER		4800	4000	4000	15000	HOLD	
103	044-TR-110A	2MVA DISTRIBUTION TRANSFORMER		3500	3000	3450	8175	HOLD	
104	044-TR-110B	2MVA DISTRIBUTION TRANSFORMER		3500	3000	3450	8175	HOLD	
105	044-TR-111A	2MVA DISTRIBUTION TRANSFORMER		3500	3000	3450	8175	HOLD	
106	044-TR-111B	2MVA DISTRIBUTION TRANSFORMER		3500	3000	3450	8175	HOLD	
107	044-TR-111C	2MVA DISTRIBUTION TRANSFORMER		3500	3000	3450	8175	HOLD	
108	044-NGR-109A	NEUTRAL GROUNDING RESISTER		1300	1210	1950	750	HOLD	
109	044-NGR-109B	NEUTRAL GROUNDING RESISTER		1300	1210	1950	750	HOLD	
110	044-HT6-103	6.9KV H V. SWITCHGEAR PANEL		2530	2400	2600	40800	HOLD	
111	044-PMCC-105	0.415KV POWER CUM MOTOR CONTROL CENTER (PMCC)		1951	1750	2530	25300	HOLD	
112	044-EPMCC-102	0.415KV EMERGENCY POWER CUM MOTOR CONTROL CENTER (EPMCC)		2315	1750	2530	24600	HOLD	
113	044-MCC-108	0.415KV MOTOR CONTROL CENTER (MCC)		15560	1250	2480	15300	HOLD	
114	044-ASB-103	0.415KV AUXILIARY SWITCH BOARD (ASB)		10860	1250	2480	10700	HOLD	
115	044-MLDB-102	0.415KV MAIN LIGHTING DISTRIBUTION BOARD (MLDB)		6660	600	2480	6700	HOLD	
116	044-EMLDB-102	0.415KV EMERGENCY MAIN LIGHTING DISTRIBUTION BOARD (EMLDB)		4260	600	2480	2800	HOLD	
117	044-TR-112A	160KVA DRY TYPE LIGHTING TRANSFORMER		1800	1400	1300	845	HOLD	
118	044-TR-112B	160KVA DRY TYPE LIGHTING TRANSFORMER		1800	1400	1300	845	HOLD	
119	044-TR-113A	50KVA DRY TYPE LIGHTING TRANSFORMER		1400	925	1200	590	HOLD	
120	044-TR-113B	50KVA DRY TYPE LIGHTING TRANSFORMER		1400	925	1200	590	HOLD	
121	044-APFC-103A	APFC PANEL WITH CAPACITOR BANK		5150	2000	3000	HOLD	HOLD	
122	044-APFC-103B	APFC PANEL WITH CAPACITOR BANK		5150	2000	3000	HOLD	HOLD	
123	044-DC-103	110V DC BATTERY CHARGER FOR SWITCHGEAR CONTROL		2500	1000	2100	1500	HOLD	
124	044-DC-104	110V DC BATTERY CHARGER FOR CRITICAL LIGHTING		1700	800	2100	1500	HOLD	
125	044-DCDB-103	DCDB PANEL FOR SWITCHGEAR CONTROL		3000	600	2100	3000	HOLD	
126	044-DCDB-104	DCDB PANEL FOR CRITICAL LIGHTING		1000	600	2100	1500	HOLD	
127	044-BT-103A	BATTERY RACK-01 FOR SWITCHGEAR CONTROL		4500	500	2000	HOLD	HOLD	
128	044-BT-103B	BATTERY RACK-02 FOR SWITCHGEAR CONTROL		4500	500	2000	HOLD	HOLD	
129	044-BT-104	BATTERY RACK FOR CRITICAL LIGHTING		2000	500	2000	HOLD	HOLD	
130	044-IS-103A	BATTERY BREAKER BOX-1 FOR 110V DC BATTERY CHARGER FOR SWITCHGEAR CONTROL		500	250	800	HOLD	HOLD	
131	044-IS-103B	BATTERY BREAKER BOX-2 FOR 110V DC BATTERY CHARGER FOR SWITCHGEAR CONTROL		500	250	800	HOLD	HOLD	
132	044-IS-104	BATTERY BREAKER BOX-2 FOR 110V DC BATTERY CHARGER FOR CRITICAL LIGHTING		500	250	800	HOLD	HOLD	
133	HOLD	ECS RTU PANEL-1		1200	800	2200	300	HOLD	
134	HOLD	ECS RTU PANEL-2		1200	800	2200	300	HOLD	
135	VFD-1832-ACM-001-D	VFD FOR AIR COOLER FAN		1400	654	2250	650	HOLD	
136	VFD-1832-ACM-001-E	VFD FOR AIR COOLER FAN		1400	654	2250	650	HOLD	
137	VFD-1832-ACM-001-F	VFD FOR AIR COOLER FAN		1400	654	2250	650	HOLD	
138	VFD-1832-ACM-002-D	VFD FOR AIR COOLER FAN		1400	654	2250	650	HOLD	
139	VFD-1832-ACM-002-E	VFD FOR AIR COOLER FAN		1400	654	2250	650	HOLD	
140	VFD-1832-ACM-002-F	VFD FOR AIR COOLER FAN		1400	654	2250	650	HOLD	
141	VFD-1832-F-001-ID	VACUUM HEATER ID FAN		4000	1200	2388	3500	HOLD	
142	VFD-1832-F-001-FD	VACUUM HEATER FD FAN		4000	1200	2388	3500	HOLD	
143	VFD-1832-F-002-FD	VACUUM HEATER FD FAN		4000	1200	2388	3500	HOLD	
144	044-SHP-101	SPACE HEATER CUM POWER PANEL-1		1500	250	850	—	HOLD	
145	044-SHP-102	SPACE HEATER CUM POWER PANEL-2		1500	250	850	—	HOLD	
146	044-BD-109A	6.6 KV BUSDUCT		HOLD	HOLD	HOLD	—	HOLD	
147	044-BD-109B	6.6 KV BUSDUCT		HOLD	HOLD	HOLD	—	HOLD	
148	044-BD-110A	415 V BUSDUCT		HOLD	HOLD	HOLD	—	HOLD	
149	044-BD-110B	416 V BUSDUCT		HOLD	HOLD	HOLD	—	HOLD	
150	044-BD-111A	417 V BUSDUCT		HOLD	HOLD	HOLD	—	HOLD	
151	044-BD-111B	418 V BUSDUCT		HOLD	HOLD	HOLD	—	HOLD	
152	044-BD-111C	419 V BUSDUCT		HOLD	HOLD	HOLD	—	HOLD	

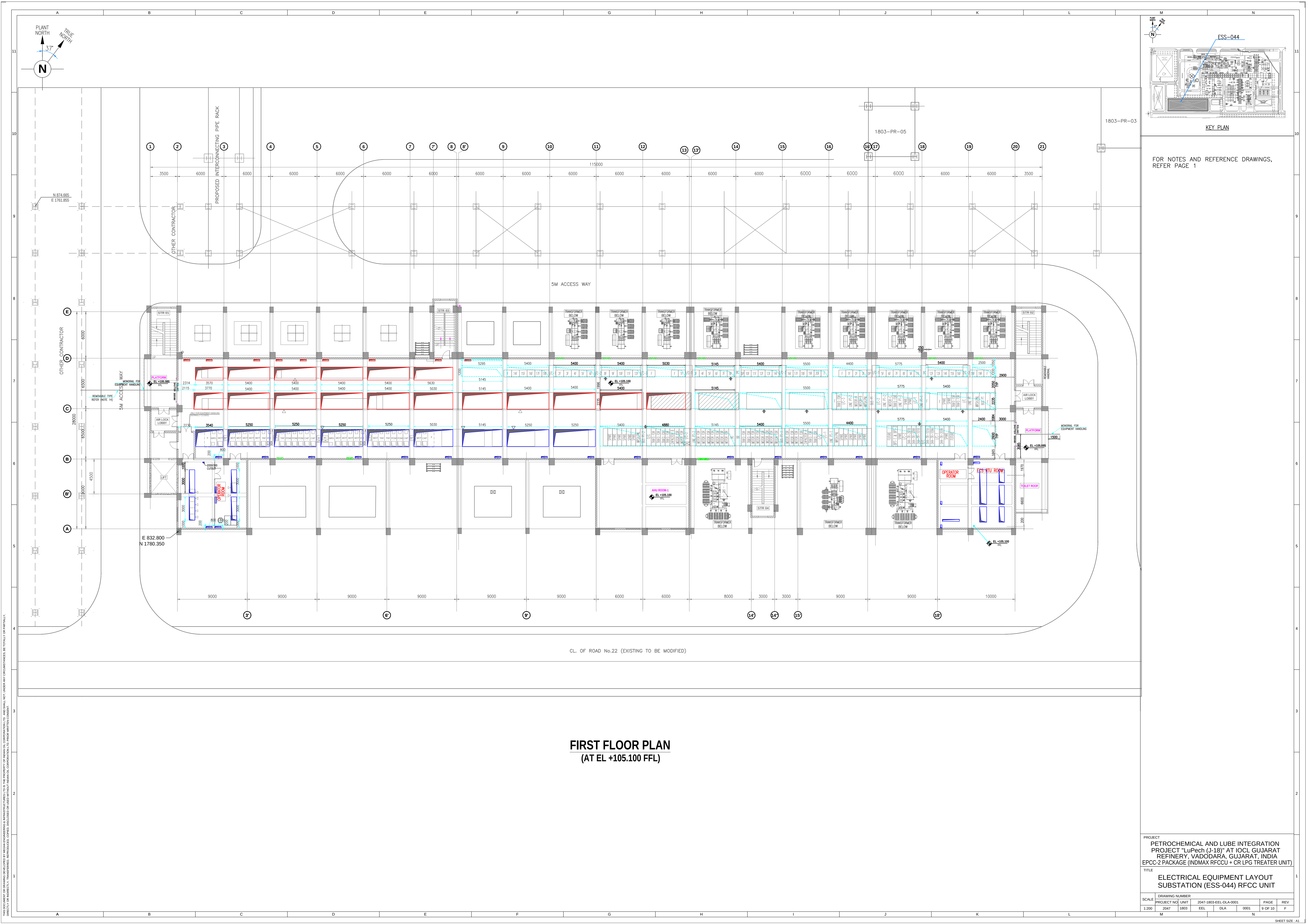
S.NO	ITEM TAG	DESCRIPTION	QTY	DIMENSIONS ** (MM)			WEIGHT (KG)	MAKE	REMARKS
				LENGTH	WIDTH	HEIGHT			
201	044-TR-201A	33/6.9 KV POWER TRANSFORMER		6000	4000	4100	19000	HOLD	
202	044-TR-201B	33/6.9 KV POWER TRANSFORMER		6000	4000	4100	19000	HOLD	
203	044-BD-201A	6.6 KV BUSDUCT		HOLD	HOLD	HOLD	—	HOLD	
204	044-BD-201B	6.6 KV BUSDUCT		HOLD	HOLD	HOLD	—	HOLD	
205	044-HT6-201	6.6 KV SWITCHBOARD (AIR INSULATED TYPE)		29600	2235	2700	39600	HOLD	
206	044-CB-201A	6.6 KV INDOOR CAPACITOR BANK WITH APFC PANEL		5500	2200	HOLD	5000	HOLD	
207	044-CB-201B	6.6 KV INDOOR CAPACITOR BANK WITH APFC PANEL		5500	2200	HOLD	5000	HOLD	
208	044-TR-202B	6.6/0.433 KV DISTRIBUTION TRANSFORMER		3200	3200	3600	10000	HOLD	
209	044-TR-202A	6.6/0.433 KV DISTRIBUTION TRANSFORMER		3200	3200	3600	10000	HOLD	
210	044-BD-202A	415 V BUSDUCT		HOLD	HOLD	HOLD	—	HOLD	
211	044-BD-202B	415 V BUSDUCT		HOLD	HOLD	HOLD	—	HOLD	
212	044-PMCC-201	415 V SWITCHBOARD (PMCC)		29810	1754	2400	21800	HOLD	
213	044-MCC-201	415 V SWITCHBOARD (MCC)		17200	1300	2400	9750	HOLD	
214	044-MCC-202	415 V SWITCHBOARD (MCC)		14200	1300	2400	8250	HOLD	
215	044-ASB-201	415 V SWITCHBOARD (ASB)		10000	1300	2400	6000	HOLD	
216	044-DC-211	110 V DC RECTIFIER		6000	800	2200	3200	HOLD	
217	044-DCDB-211	110 V DCDB		3200	600	2200	1330	HOLD	
218	044-BB-211	110 V DC BATTERY BANK		HOLD	HOLD	HOLD	4594	HOLD	
219	HOLD	VFD FOR AIR COOLER MOTOR 05-EAM-00-201A		800	1000	2200	500	HOLD	
220	HOLD	VFD FOR AIR COOLER MOTOR 05-EAM-00-201B		800	1000	2200	500	HOLD	
221	HOLD	VFD FOR CHARGE HEATER FD FAN MOTOR -1 (05-FF-00-1001)		2000	1000	2200	2000	HOLD	
222	HOLD	VFD FOR CHARGE HEATER FD FAN MOTOR -2 (05-FF-00-1001)		2000	1000	2200	2000	HOLD	
223	HOLD	VFD ISOLATION BREAKER FOR CHARGE HEATER ID FAN MOTOR (05-FF-00-1001)		3000	1500	2200	2000	HOLD	
227	HOLD	INTERPOSING RELAY PANEL		800	800	2100	300	HOLD	
228	HOLD	INTERPOSING RELAY PANEL		800	800	2100	300	HOLD	
229	HOLD	INTERPOSING RELAY PANEL		800	800	2100	300	HOLD	
230	HOLD	INTERPOSING RELAY PANEL		800	800	2100	300	HOLD	
231	HOLD	ECS RTU PANELS		1200	800	800	300	HOLD	
232	044-SPDB-201	SMALL POWER DISTRIBUTION BOARD		1000	500	HOLD	250	HOLD	
233	044-SPDB-202	SMALL POWER DISTRIBUTION BOARD		1000	500	HOLD	250	HOLD	
234	044-SPDB-203	SMALL POWER DISTRIBUTION BOARD		1000	500	HOLD	250	HOLD	
235	HOLD	BATTERY ISOLATOR		500	500	HOLD	20	HOLD	
236	HOLD	BATTERY ISOLATOR		500	500	HOLD	20	HOLD	
237	044-NGR-201A	NEUTRAL GROUNDING RESISTOR		1300	1210	HOLD	750	HOLD	
238	044-NGR-201B	NEUTRAL GROUNDING RESISTOR		1300	1210	HOLD	750	HOLD	
239	HOLD	ECS RTU PANELS		1200	800	800	300	HOLD	
240	HOLD	CONSOLE DESK FOR WORK STATION		1250	1500	1000	—	HOLD	
241	HOLD	FIRE ALARM PANEL		800	800	2200	—	HOLD	
242	HOLD	SMOKE DETECTOR PANEL		HOLD	HOLD	HOLD	—	HOLD	
243	HOLD	O-RING PANEL		HOLD	HOLD	HOLD	—	HOLD	

FOR NOTES AND REFERENCE DRAWINGS,
REFER PAGE 1

PROJECT
PETROCHEMICAL AND LUBE INTEGRATION
PROJECT "LuPech (J-18)" AT IOCL GUJARAT
REFINERY, VADODARA, GUJARAT, INDIA
EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT)

TITLE	ELECTRICAL EQUIPMENT LAYOUT SUBSTATION (ESS-044) RFCC UNIT

SCALE	DRAWING NUMBER						
	PROJECT NO	UNIT	2047-1803-EEL-DLA-0001			PAGE	REV
1:125	2047	1803	EEL	DLA	0001	8 OF 10	F
M				N			



FIRST FLOOR PLAN
(AT EL +105.100 FFL)

KEY PLAN

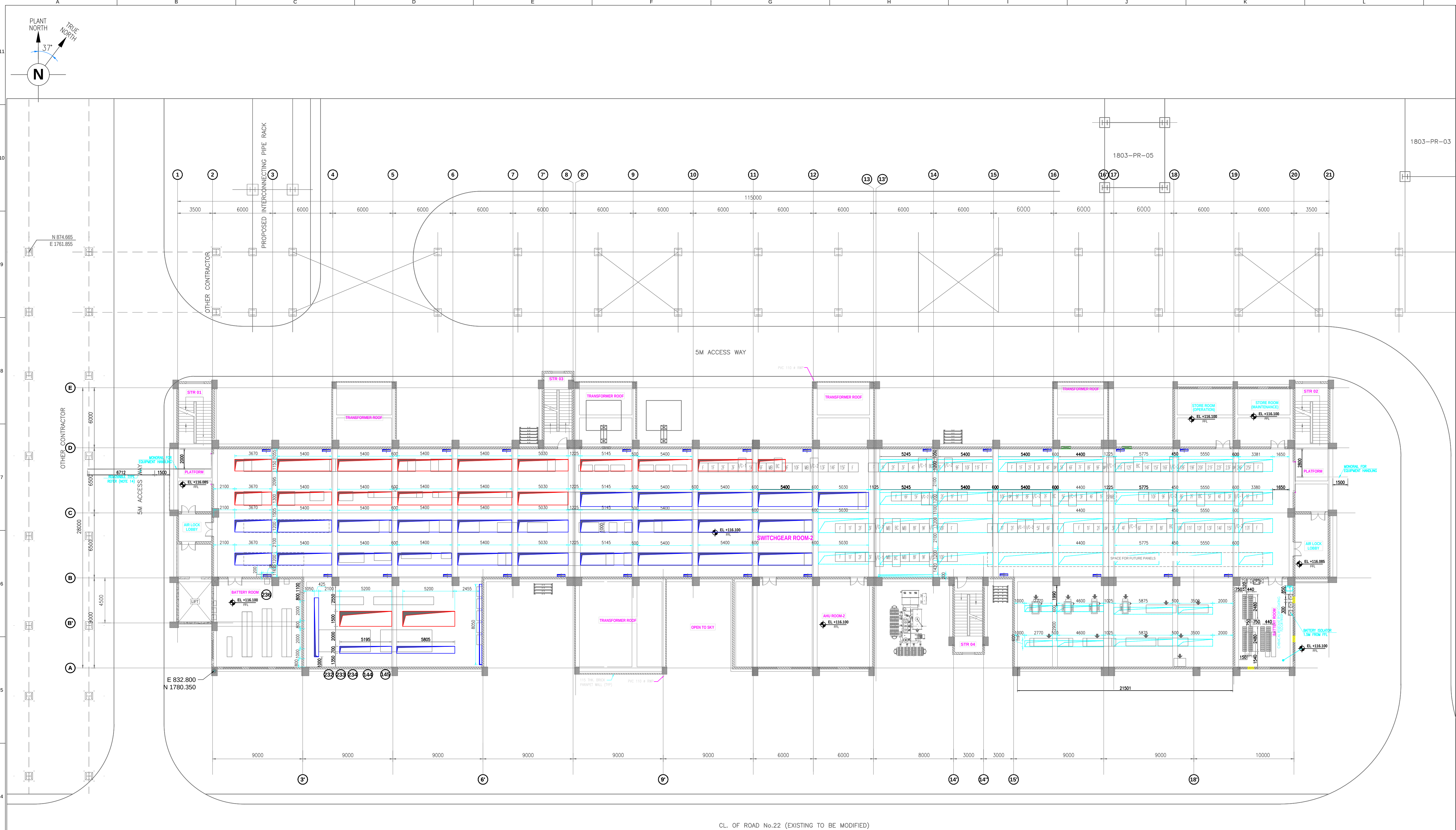
FOR NOTES AND REFERENCE DRAWINGS,
REFER PAGE 1

PROJECT
PETROCHEMICAL AND LUBE INTEGRATION
PROJECT "LuPech (J-18)" AT IOCL GUJARAT
REFINERY, VADODARA, GUJARAT, INDIA
EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT)

TITLE
ELECTRICAL EQUIPMENT LAYOUT
SUBSTATION (ESS-044) RFCCU UNIT

SCALE		DRAWING NUMBER		PROJECT NO		UNIT		PAGE		REV	
1:200		2047	1803	EEL	DLA	0001		9	OF 10	F	
M		E		DLA		0001		N			

SHEET SIZE



THIRD FLOOR PLAN
(AT EL +116.100 FFL)

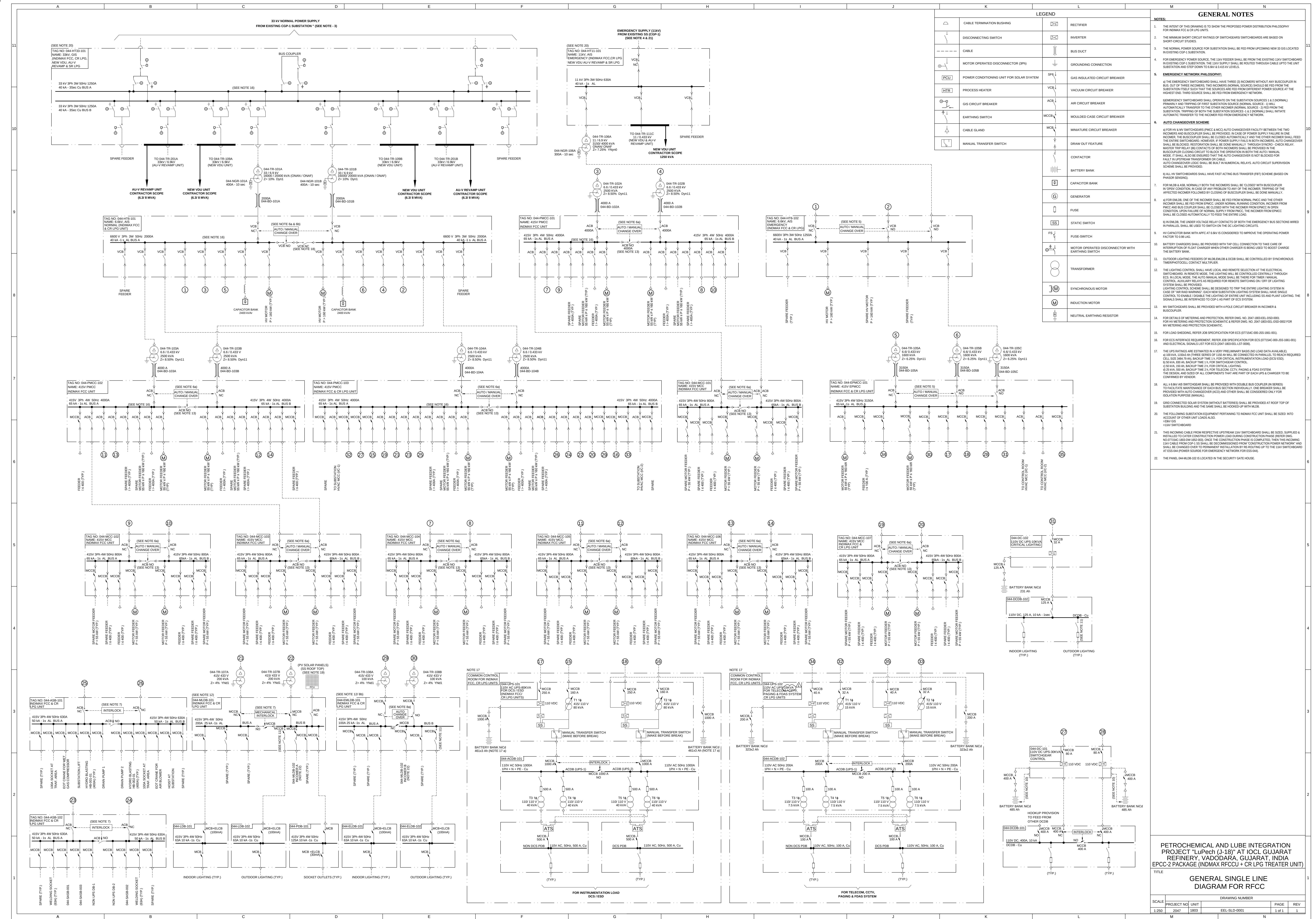
FOR NOTES AND REFERENCE DRAWINGS,
REFER PAGE 1

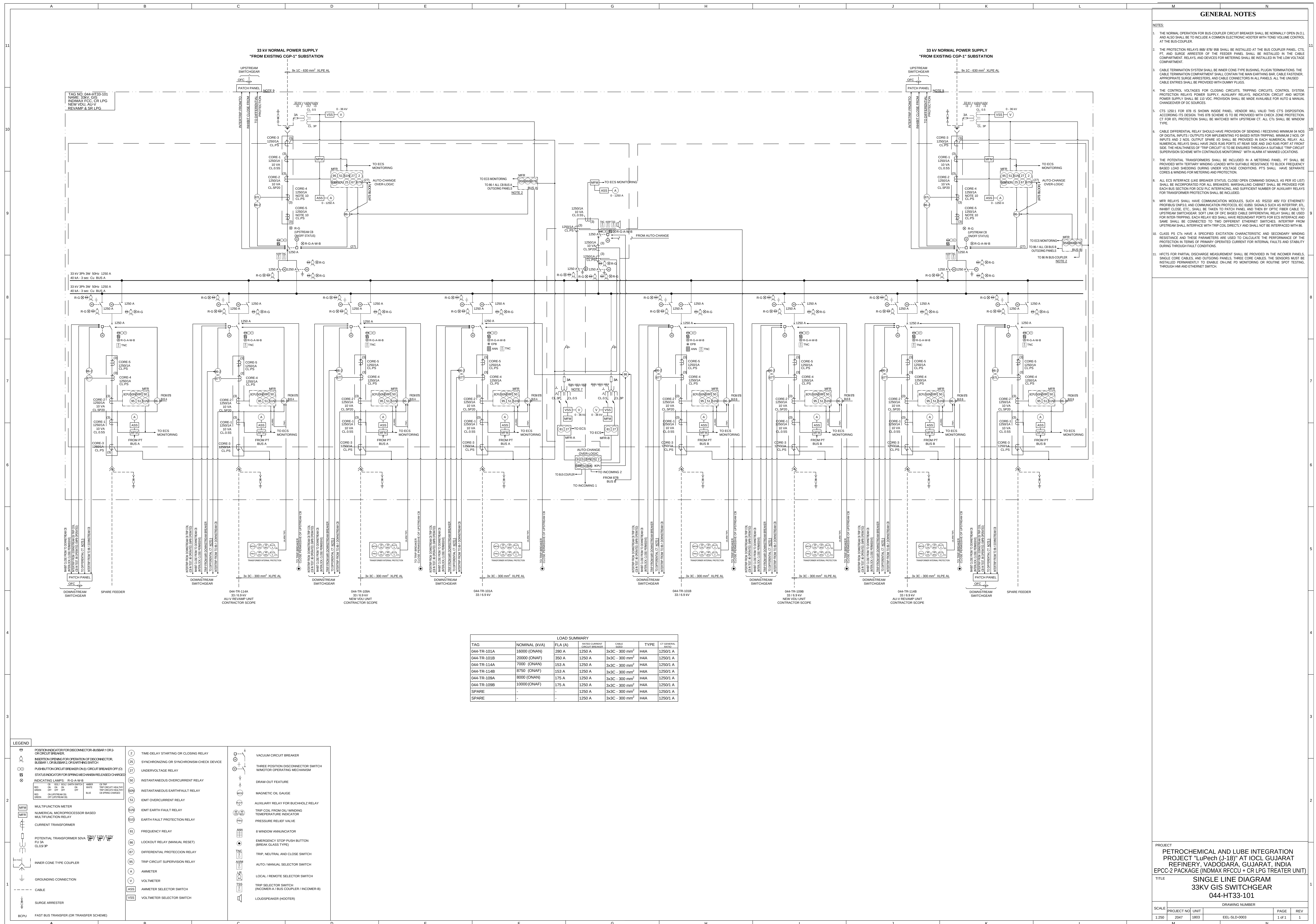
PROJECT
PETROCHEMICAL AND LUBE INTEGRATION
PROJECT "LuPech (J-18)" AT IOCL GUJARAT
REFINERY, VADODARA, GUJARAT, INDIA
EPCC-2 PACKAGE (NDMAX RFCCU + CR LPG TREATER UNIT)

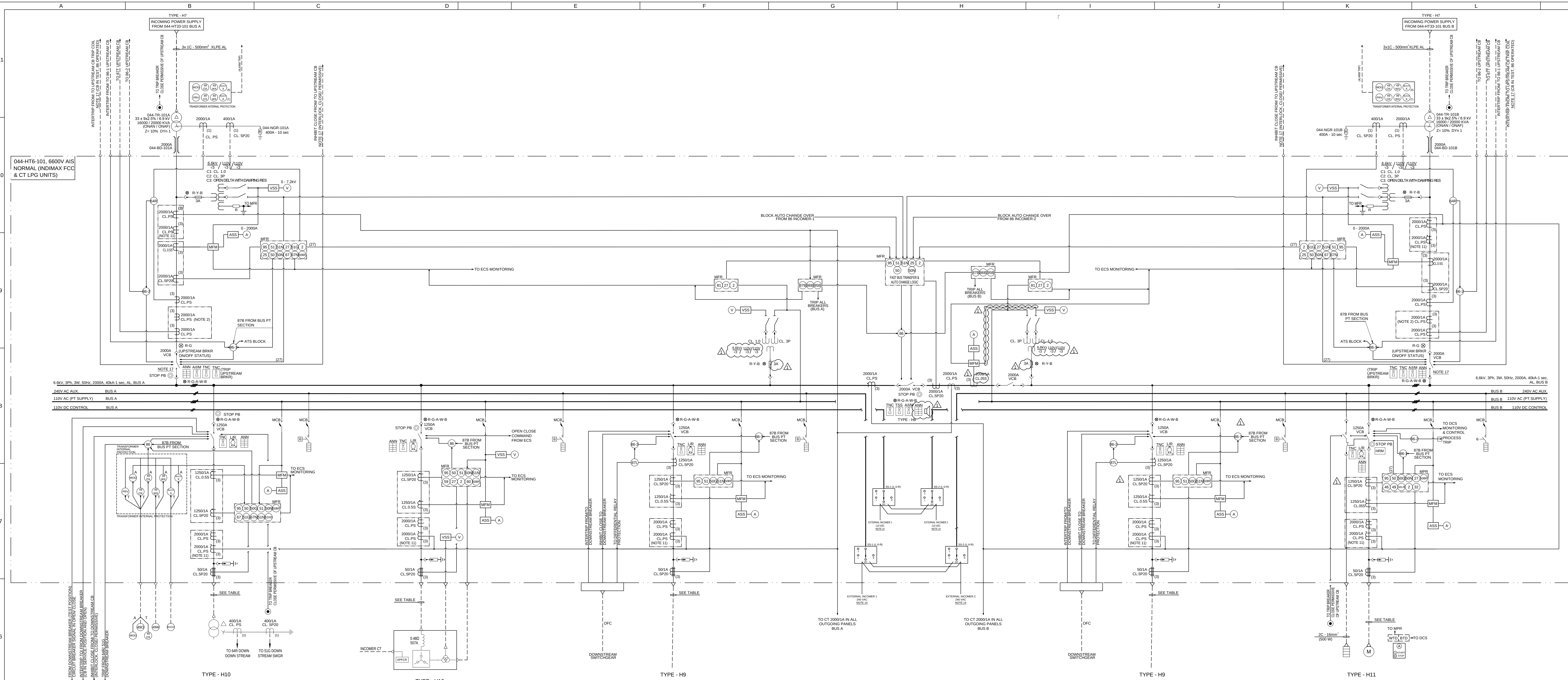
TITLE
ELECTRICAL EQUIPMENT LAYOUT
SUBSTATION (ESS-044) RFCC UNIT

SCALE		DRAWING NUMBER		PAGE		REV	
PROJECT NO	UNIT	PROJECT NO	UNIT	10 OF 10	F		
1200	2047	1803	EEL	DLA	0001		
M		N					

SHEET SIZE: A1







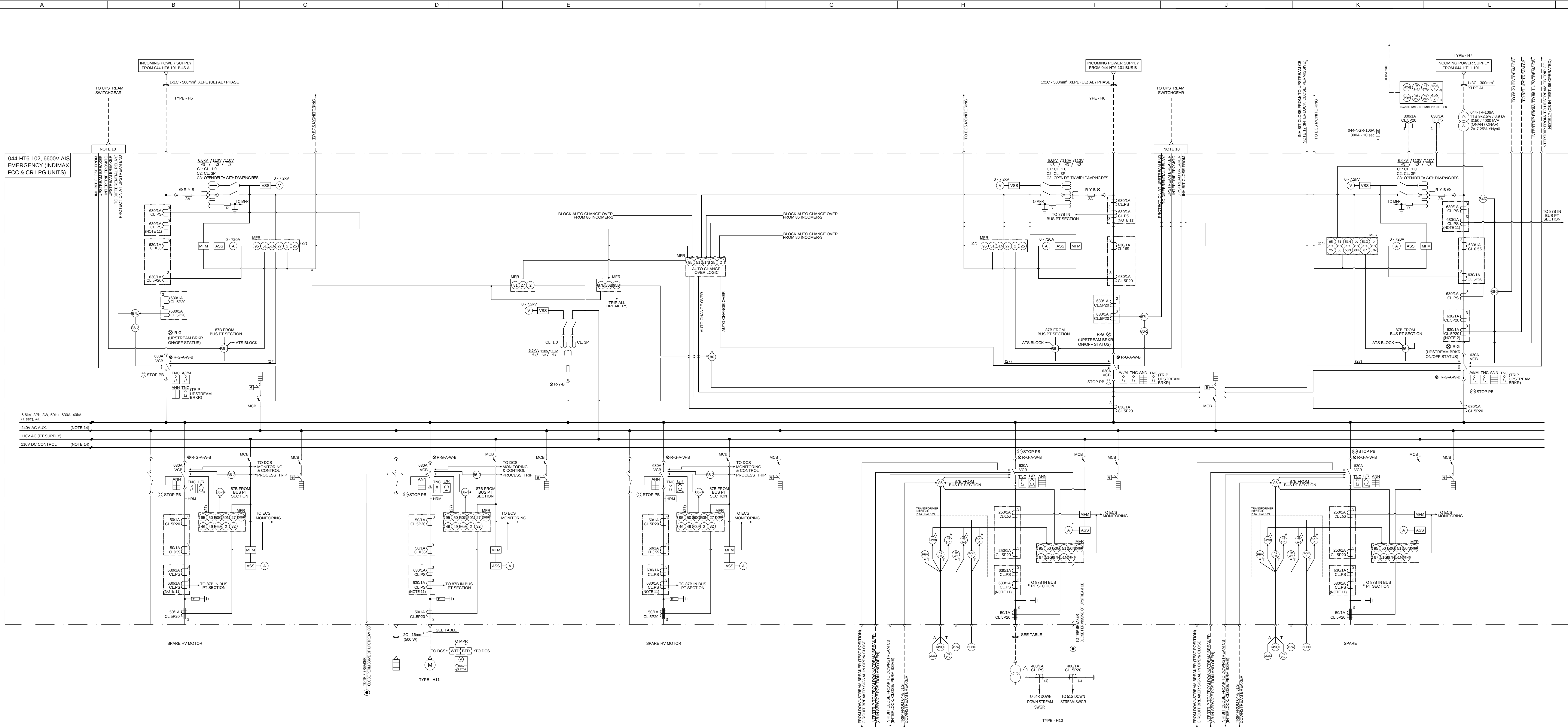
- GENERAL NOTES**
- NOTES:**
- CURRENT TRANSFORMERS FOR PROTECTION SHALL BE SP20, FOR METERING SHALL BE 0.5S. ALL CTs SHALL BE WINDOW (OR TOROIDAL-CORE) TYPE.
 - CTs MUST BE INSTALLED IN DELTA CONFIGURATION. SAME AS DELTA OF TRANSFORMER. HIGH-SIDE WINDINGS. CLASS PS CT SHALL BE USED FOR DIFFERENTIAL PROTECTIONS (87B, 87L, 87T, 87M) AND RESTRICTED EARTH FAULT RELAY (84F).
 - THE DEGREES OF PROTECTION OF THE SWITCHGEAR CONFORM WITH IEC 60529 STANDARDS. RAK FOR THE ENCLOSURE IP20 FOR THE PARTITION BETWEEN COMPARTMENTS.
 - THE BUSBAR COMPARTMENT CONTAINS THE MAIN BUSBAR SYSTEM CONNECTED TO THE UPPER ISOLATING CONTACTS OF THE CIRCUIT-BREAKER BY MEANS OF BRANCH CONNECTIONS. ALL THE INSTALLATION, OPERATION AND MAINTENANCE OPERATIONS CAN BE CARRIED OUT FROM THE FRONT OF THE UNIT.
 - THE EARTHING BUSBAR IS MADE OF ELECTROLYTIC COPPER AND IT RUNS LONGITUDINALLY THROUGHOUT THE SWITCHGEAR, THEREBY GUARANTEEING MAXIMUM PERSONNEL AND INSTALLATION SAFETY.
 - THE CIRCUIT-BREAKER SHALL BE WITHDRAWABLE TYPE AND USE VACUUM INTERRUPTERS (VCB) EMBEDDED IN POLES TO EXTINGUISH THE ELECTRIC ARC AND EQUIPPED WITH A MECHANICAL STORED ENERGY TYPE OPERATING MECHANISM. VCB SHALL BE FITTED WITH FOLLOWING POSITIONS: INSERTED-TEST-WITHDRAWN.
 - THE SWITCHGEAR SHALL BE CLASSIFIED FOR IAC AFLR, 40 KA - 0.5 SEC.
 - THE CONTROL VOLTAGES FOR CLOSING CIRCUITS, TRIPPING CIRCUITS, CONTROL SYSTEM, PROTECTION RELAYS, POWER SUPPLY, AUXILIARY RELAYS, INDICATION CIRCUIT AND MOTOR POWER SUPPLY SHALL BE 110 VDC.
 - ANTI-CONDENSATION HEATERS SHALL BE PROVIDED WITH THERMOSTAT CONTROL - RANGE OF 10°C TO 40°C - AND INSTALLED AT THE BOTTOM OF EACH VERTICAL SECTION ACCORDING TO THE MANUFACTURERS STANDARD AND AS PER PROJECT REQUIREMENT. SHALL BE INDIVIDUALLY PROTECTED BY MCB. EACH HEATER SHALL BE COMPLETE WITH A ROTARY TYPE ON/OFF SWITCH.
 - ALL NECESSARY PROTECTION INTERFACE FOR VFD AND VFD CONVERTER TRANSFORMER, IF ANY, SHALL BE PROVIDED IN THE UPSTREAM SWITCHGEAR.
 - THE DIFFERENTIAL RELAY (87L) AS WELL AS CT AT OTHER END SHALL BE IDENTICAL IN ALL ASPECTS. BUS DIFFERENTIAL PROTECTION SCHEME IS TO BE PROVIDED WITH CHECK ZONE PROTECTION.
 - MARSHALLING CABINETS SHALL BE PROVIDED FOR EACH BUS SECTION FOR DCS PLC INTERFACING.
 - EACH RELAYED SHALL HAVE REDUNDANT PORTS FOR ECS INTERFACE WHICH SHALL BE SHOWN AS PER ECS ARCHITECTURE. AS WELL AS MOTOR CURRENTS SIGNAL OF 4.50 IN SHALL BE REQUIRED FOR DCS. CURRENT TRANSducer SHALL BE MOUNTED IN SWITCHGEAR PANEL.
 - THE EXTERNAL SUPPLY 240 VAC SHALL BE FED FROM 044-ASB-101, 110 VDC SHALL BE FED FROM 044-DC-101.
 - THE HEALTHINESS OF "TRIP" CIRCUIT IS TO BE ENSURED THROUGH A SUITABLE "TRIP" CIRCUIT SUPERVISION SCHEME WITH CONTINUOUS MONITORING" WITH ALARM AT MANNED LOCATIONS.
 - PTS SHALL HAVE SEPARATE CORES & WINDING FOR METERING AND PROTECTION AND TERTIARY WINDING TO BE SHOWN IN SLD. PT SHALL BE PROVIDED WITH TERTIARY WINDING LOADED WITH SUITABLE RESISTANCE TO BLOCK FREQUENCY BASED LOAD SHEDDING DURING UNDER VOLTAGE CONDITIONS.
 - THE FOLLOWING CONTROL SIGNALS FOR THE CIRCUIT BREAKER INCOMERS SHALL BE INTERFACED WITH UPSTREAM CIRCUIT BREAKERS TRIP COIL AND NOT WITH 86 LOCKOUT RELAY:
 - INTERLOCK TO UPSTREAM (CABLE NOT INSERTED)
 - INTERLOCK FROM UPSTREAM (CS IN TEST)
 - INTERRIP FROM UPSTREAM BREAKER (CS IN SERVICE POSITION & OPEN)
 - CLOSE PERMISSIVE FROM UPSTREAM (CS IN SERVICE POSITION & OPEN)
 - TO UPSTREAM BREAKER TRIP COIL (CS IN TEST, 86 OPERATED, 86B NOT OPERATED)
 - CLOSE PERMISSIVE TO UPSTREAM (CS IN SERVICE POSITION & OPEN - 86 NOT OPERATED)
 - TRIP UPSTREAM BREAKER LOCK-OUT RELAY (86B OPERATED)
 - MFH HAS THE FOLLOWING METERING PARAMETERS AS MINIMUM: A, V, PF, KW, KVAR, KVA, KWH, KVARH, KVAH.

S.No.	DESCRIPTION	TAG	POWER (KVA, KW, OR KVAR)	FULL LOAD CURRENT	RATED CURRENT CIRCUIT BREAKER	CABLE SIZE	BUSBAR	TYPE	CT GENERAL RATIO	TYPICAL ESDDCS NOTE a)
1	TRANSFORMER INCOMER (BUS A)	INC-A	20000 KVA (ONAF)	1752 A	2000 A	BUS DUCT	BUS A	H7	2000/1 A	-
2	DISTRIBUTION TRANSFORMER 6.6 / 0.433 KV (044-PMCC-101)	044-TR-102A	2500 KVA	219 A	1250 A	3x 1C - 500 mm ² AL	BUS A	H10	400/1 A	-
3	DISTRIBUTION TRANSFORMER 6.6 / 0.433 KV (044-PMCC-102)	044-TR-103A	2500 KVA	219 A	1250 A	3x 1C - 500 mm ² AL	BUS A	H10	400/1 A	-
4	DISTRIBUTION TRANSFORMER 6.6 / 0.433 KV (044-PMCC-103)	044-TR-104A	2500 KVA	219 A	1250 A	3x 1C - 500 mm ² AL	BUS A	H10	400/1 A	-
5	DISTRIBUTION TRANSFORMER 6.6 / 0.433 KV (044-PMCC-101)	044-TR-105A	1600 KVA	175 A	1250 A	3x 1C - 500 mm ² AL	BUS A	H10	400/1 A	-
6	044-HT6-102 INCOMER 1 (6.6 KV EMERGENCY PANEL)	044-HT6-102 A	462 kW	45 A	630 A	3x 1C - 500 mm ² AL	BUS B	H9	630/1 A	-
7	HV CAPACITOR BANK	044-CB-101A	2400 KVar	210 A	1250 A	3x 1C - 500 mm ² AL	BUS A	H16	400/1 A	-
8	HOT FRESH FEED PUMPS	1803-PM-101 A	225 kW	23 A	1250 A	1x 3C - 240 mm ² AL	BUS A	H11	75/1 A	3/M20
9	LCO PUMP/AROUND PUMP	1803-PM-202 A	290 kW	32 A	1250 A	1x 3C - 240 mm ² AL	BUS A	H11	75/1 A	3/M20
10	HCO PUMP/AROUND PUMP	1803-PM-204 A	210 kW	24 A	1250 A	1x 3C - 240 mm ² AL	BUS A	H11	75/1 A	3/M20
11	HCO PUMP/AROUND PUMP	1803-PM-204 B	210 kW	24 A	1250 A	1x 3C - 240 mm ² AL	BUS A	H11	75/1 A	3/M20
12	MAIN FRACTIONATOR BOTTOM PUMP	1803-PM-205 A	480 kW	52 A	1250 A	1x 3C - 240 mm ² AL	BUS A	H11	75/1 A	3/M20
13	DEETHANIZER STRIPPER CHARGE PUMP	1803-PM-213 A	250 kW	28 A	1250 A	1x 3C - 240 mm ² AL	BUS A	H11	75/1 A	3/M20
14	GASOLINE RECYCLE PUMP	1803-PM-214 A	170 kW	18 A	1250 A	1x 3C - 240 mm ² AL	BUS A	H11	75/1 A	3/M20
15	LEAN AMINE PUMP	1803-PM-222 A	275 kW	29 A	1250 A	1x 3C - 240 mm ² AL	BUS A	H11	75/1 A	2/M1
16	WGS OXIDATION BLOWER PUMP	1803-X-107-K-001A	200 kW	23 A	1250 A	1x 3C - 240 mm ² AL	BUS A	H11	75/1 A	-
17	WGS OXIDATION BLOWER PUMP	1803-X-107-K-001C	200 kW	23 A	1250 A	1x 3C - 240 mm ² AL	BUS A	H11	75/1 A	-
18	SPARE(x2)				1250A	-	BUS A	H11	75/1 A	-
19	SPARE				1250A	-	BUS A	H10	400/1 A	-
20	SPARE				1250A	-	BUS A	H16	400/1 A	-
21	BUS COUPLER AND BUS RISER PANEL	-	-	-	2000 A	BARE COPPER	BUS ASB	H8	2000/1 A	-
22	TRANSFORMER INCOMER (BUS B)	INC-B	20000 KVA (ONAF)	1752 A	2000 A	BUS DUCT	BUS B	H7	2000/1 A	-
23	HOT FRESH FEED PUMPS	1803-PM-101 B	225 kW	23 A	1250 A	1x 3C - 240 mm ² AL	BUS B	H11	75/1 A	3/M20
24	LCO PUMP/AROUND PUMP	1803-PM-202 B	290 kW	32 A	1250 A	1x 3C - 240 mm ² AL	BUS B	H11	75/1 A	3/M20
25	LCO PUMP/AROUND PUMP	1803-PM-202 C	290 kW	32 A	1250 A	1x 3C - 240 mm ² AL	BUS B	H11	75/1 A	3/M20
26	HCO PUMP/AROUND PUMP	1803-PM-204 C	210 kW	24 A	1250 A	1x 3C - 240 mm ² AL	BUS B	H11	75/1 A	3/M20
27	MAIN FRACTIONATOR BOTTOM PUMP	1803-PM-205 B	480 kW	52 A	1250 A	1x 3C - 240 mm ² AL	BUS B	H11	75/1 A	3/M20
28	DEETHANIZER STRIPPER CHARGE PUMP	1803-PM-213 B	250 kW	28 A	1250 A	1x 3C - 240 mm ² AL	BUS B	H11	75/1 A	3/M20
29	GASOLINE RECYCLE PUMP	1803-PM-214 B	170 kW	18 A	1250 A	1x 3C - 240 mm ² AL	BUS B	H11	75/1 A	3/M20
30	LEAN AMINE PUMP	1803-PM-222 B	275 kW	29 A	1250 A	1x 3C - 240 mm ² AL	BUS B	H11	75/1 A	2/M1
31	WGS OXIDATION BLOWER PUMP	1803-X-107-K-001B	200 kW	23 A	1250 A	1x 3C - 240 mm ² AL	BUS B	H11	75/1 A	-
32	HV CAPACITOR BANK	044-CB-101B	2400 KVar	210 A	1250 A	3x 1C - 500 mm ² AL	BUS B	H16	400/1 A	-
33	044-HT6-102 INCOMER 2 (6.6 KV EMERGENCY PANEL)	044-HT6-102 B	462 kW	46 A	630 A	3x 1C - 500 mm ² AL	BUS B	H9	630/1 A	-
34	DISTRIBUTION TRANSFORMER 6.6 / 0.433 KV (044-PMCC-101)	044-TR-102B	2500 KVA	219 A	1250 A	3x 1C - 500 mm ² AL	BUS B	H10	400/1 A	-
35	DISTRIBUTION TRANSFORMER 6.6 / 0.433 KV (044-PMCC-102)	044-TR-103B	2500 KVA	219 A	1250 A	3x 1C - 500 mm ² AL	BUS B	H10	400/1 A	-
36	DISTRIBUTION TRANSFORMER 6.6 / 0.433 KV (044-PMCC-103)	044-TR-104B	2500 KVA	219 A	1250 A	3x 1C - 500 mm ² AL	BUS B	H10	400/1 A	-
37	DISTRIBUTION TRANSFORMER 6.6 / 0.433 KV (044-PMCC-101)	044-TR-105B	1600 KVA	175 A	1250 A	3x 1C - 500 mm ² AL	BUS B	H10	400/1 A	-
38	SPARE (x2)				1250A	-	BUS B	H11	75/1 A	-
39	SPARE				1250A	-	BUS B	H10	400/1 A	-
40	SPARE				630A	-	BUS B	H9	630/1 A	-
41	SPARE				1250A	-	BUS B	H16	400/1 A	-

a) FOR MOTOR TYPICAL SCHEMES SEE DRAWINGS NO. 2047-1803-EPR-PID-0008-01 AND 2047-1803-EPR-PID-0008-02.

LEGENDS





S.No.	DESCRIPTION	TAG	POWER (KVA, KW, OR KVAR)	FULL LOAD CURRENT	RATED CURRENT CIRCUIT BREAKER	CABLE SIZE	BUSBAR	TYPE	CT GENERAL RATIO	TYPICAL ES/DOS (NOTE a)
1	044-HT6-102 INCOMER 1 (6.6 kV EMERGENCY PANEL)	044-HT6-102 A	462 kW	45 A	630 A	1x 1C - 500 mm ² AL/Ph	BUS A	H6	630/1 A	-
2	044-HT6-102 INCOMER 2 (6.6 kV EMERGENCY PANEL)	044-HT6-102 B	463 kW	46 A	630 A	1x 1C - 500 mm ² AL/Ph	BUS A	H6	630/1 A	-
3	HV/HV TRANSFORMER INCOMER FEEDER 11/6.6KV	044-TR-106 A	3150-4000 KVA	350 A	630 A	1x 3C - 300 mm ² AL	BUS A	H7	630/1 A	-
4	HP BOILER FEED WATER PUMP	1803-PM-609 A	275 kW	29 A	630 A	1x 3C - 240 mm ² AL	BUS A	H11	50/1 A	3M20
5	HP BOILER FEED WATER PUMP	1803-PM-609 B	275 kW	29 A	630 A	1x 3C - 240 mm ² AL	BUS A	H11	50/1 A	3M20
6	HP BOILER FEED WATER PUMP	1803-PM-609 C	275 kW	29 A	630 A	1x 3C - 240 mm ² AL	BUS A	H11	50/1 A	3M20
7	EMERGENCY DISTRIBUTION TRANSFORMER 6.6 / 0.433 kV (044-EP/MCC-101)	044-TR-105 C	1600 KVA	140 A	630 A	1x 1C - 500 mm ² AL/Ph	BUS A	H10	250/1 A	-
8	SPARE	-	-	-	630 A	-	BUS A	H11	50/1 A	-
9	SPARE	-	-	-	630 A	-	BUS A	H10	250/1 A	-

a) FOR MOTOR TYPICAL SCHEMES SEE DRAWINGS NO. 2047-1803-EPR-PID-0008-01 AND 2047-1803-EPR-PID-0008-02

GENERAL NOTES

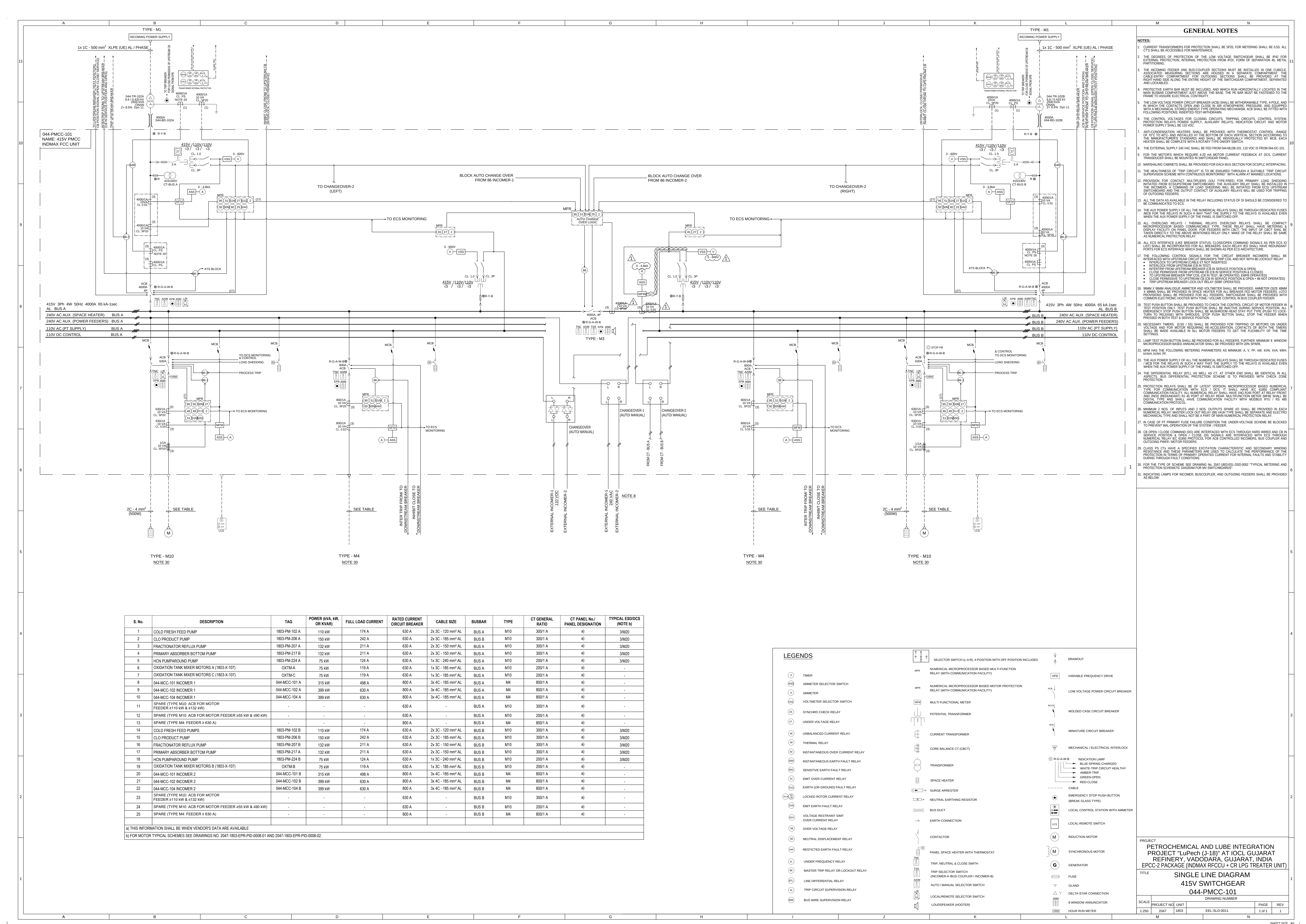
NOTES:

- CURRENT TRANSFORMERS FOR PROTECTION SHALL BE SP20, FOR METERING SHALL BE 0.5S ALL CTs SHALL BE WINDOW (OR TOROIDAL-CORE) TYPE.
- CTs MUST BE INSTALLED IN DELTA CONFIGURATION SAME AS DELTA OF TRANSFORMER. HIGH-SIDE WINDINGS CLASS PS CT SHALL BE USED FOR DIFFERENTIAL PROTECTIONS (87B, 87L, 87T, 87M) AND RESTRICTED EARTH FAULT RELAY (84R).
- THE DEGREES OF PROTECTION OF THE SWITCHGEAR CONFORM WITH IEC 60529 STANDARDS, IP4X FOR THE ENCLOSURE IP20 FOR THE PARTITION BETWEEN COMPARTMENTS.
- THE BUSBAR COMPARTMENT CONTAINS THE MAIN BUSBAR SYSTEM CONNECTED TO THE UPPER ISOLATING CONTACTS OF THE CIRCUIT BREAKER BY MEANS OF BRANCH CONNECTIONS. ALL THE INSTALLATION, OPERATION AND MAINTENANCE OPERATIONS CAN BE CARRIED OUT FROM THE FRONT OF THE UNIT.
- THE EARTHING BUSBAR IS MADE OF ELECTROLYTIC COPPER AND IT RUNS LONGITUDINALLY THROUGHOUT THE SWITCHGEAR, THEREBY GUARANTEEING MAXIMUM PERSONNEL AND INSTALLATION SAFETY.
- THE CIRCUIT-BREAKER SHALL BE WITHDRAWABLE TYPE AND USE VACUUM INTERRUPTERS (VBI) EMBEDDED IN POLES TO EXTINGUISH THE ELECTRIC ARC, AND EQUIPPED WITH A MECHANICAL STORED ENERGY TYPE OPERATING MECHANISM. VCB SHALL BE FITTED WITH FOLLOWING POSITIONS: INSERTED-TEST-WITHDRAWN.
- THE SWITCHGEAR SHALL BE CLASSIFIED FOR IACAFR, 40 KA - 0.5 SEC.
- THE CONTROL VOLTAGES FOR CLOSING CIRCUITS, TRIPPING CIRCUITS, CONTROL SYSTEM, PROTECTION RELAYS, POWER SUPPLY, AUXILIARY RELAYS, INDICATION CIRCUIT AND MOTOR POWER SUPPLY SHALL BE 110VDC.
- ANTI-CONDENSATION HEATERS SHALL BE PROVIDED WITH THERMOSTAT CONTROL - RANGE OF 10°C TO 40°C - AND INSTALLED AT THE BOTTOM OF EACH VERTICAL SECTION ACCORDING TO THE MANUFACTURERS STANDARD AND AS PER PROJECT REQUIREMENT. SHALL BE INDIVIDUALLY PROTECTED BY MCB. EACH HEATER SHALL BE COMPLETE WITH A ROTARY TYPE ON/OFF SWITCH.
- ALL NECESSARY PROTECTION INTERFACE FOR VFD AND VFD CONVERTER TRANSFORMER, IF ANY, SHALL BE PROVIDED IN THE UPSTREAM SWITCHGEAR.
- THE DIFFERENTIAL RELAY (87L) AS WELL AS CT AT OTHER END SHALL BE IDENTICAL IN ALL ASPECTS. BUS DIFFERENTIAL PROTECTION SCHEME IS TO BE PROVIDED WITH CHECK ZONE PROTECTION.
- MARSHALLING CABINETS SHALL BE PROVIDED FOR EACH BUS SECTION FOR DCS PLC INTERFACING.
- EACH RELAY/IED SHALL HAVE REDUNDANT PORTS FOR ECS INTERFACE WHICH SHALL BE SHOWN AS PER ECS ARCHITECTURE. AS WELL AS MOTOR CURRENT'S SIGNAL OF 430 mA SHALL BE REQUIRED FOR DCS, CURRENT TRANSDUCER SHALL BE MOUNTED IN SWITCHGEAR PANEL.
- THE EXTERNAL SUPPLY 240 VAC SHALL BE FED FROM 044-ASB-101, 110 VDC SHALL BE FED FROM 044-DCU-101.
- THE HEALTHINESS OF "TRIP CIRCUIT" IS TO BE ENSURED THROUGH A SUITABLE "TRIP CIRCUIT SUPERVISION SCHEME WITH CONTINUOUS MONITORING" WITH ALARM AT MANNED LOCATIONS.
- PTS SHALL HAVE SEPARATE CORES & WINDING FOR METERING AND PROTECTION AND TERTIARY WINDING TO BE SHOWN IN SLD. PT SHALL BE PROVIDED WITH TERTIARY WINDING LOADED WITH SUITABLE RESISTANCE TO BLOCK FREQUENCY BASED LOAD SHEDDING DURING UNDER VOLTAGE CONDITIONS.
- THE FOLLOWING CONTROL SIGNALS FOR THE CIRCUIT BREAKER INCOMERS SHALL BE INTERFACED WITH UPSTREAM CIRCUIT BREAKER'S TRIP COIL AND NOT WITH 86 LOCKOUT RELAY:
 - INTERLOCK TO UPSTREAM (CABLE NOT INSERTED)
 - INTERLOCK FROM UPSTREAM (CS IN TEST)
 - INTERTIP FROM UPSTREAM BREAKER (CS IN SERVICE POSITION & OPEN)
 - CLOSE PERMISSIVE FROM UPSTREAM CS (CS IN SERVICE POSITION & OPEN)
 - TO UPSTREAM BREAKER TRIP COIL (CS IN TEST, 86 OPERATED, EMPS OPERATED)
 - CLOSE PERMISSIVE TO UPSTREAM CS (CS IN SERVICE POSITION & OPEN - 86 NOT OPERATED)
 - TRIP UPSTREAM BREAKER LOCK-OUT RELAY (80BF OPERATED)
- MFN HAS THE FOLLOWING METERING PARAMETERS AS MINIMUM: A, V, PF, KW, KVAR, KVA, KWH, KVARH, KVArh.
- INDICATING LAMPS FOR INCOMER, BUSCOUPLER AND OUTGOING FEEDERS SHALL BE PROVIDED AS BELOW

LEGENDS



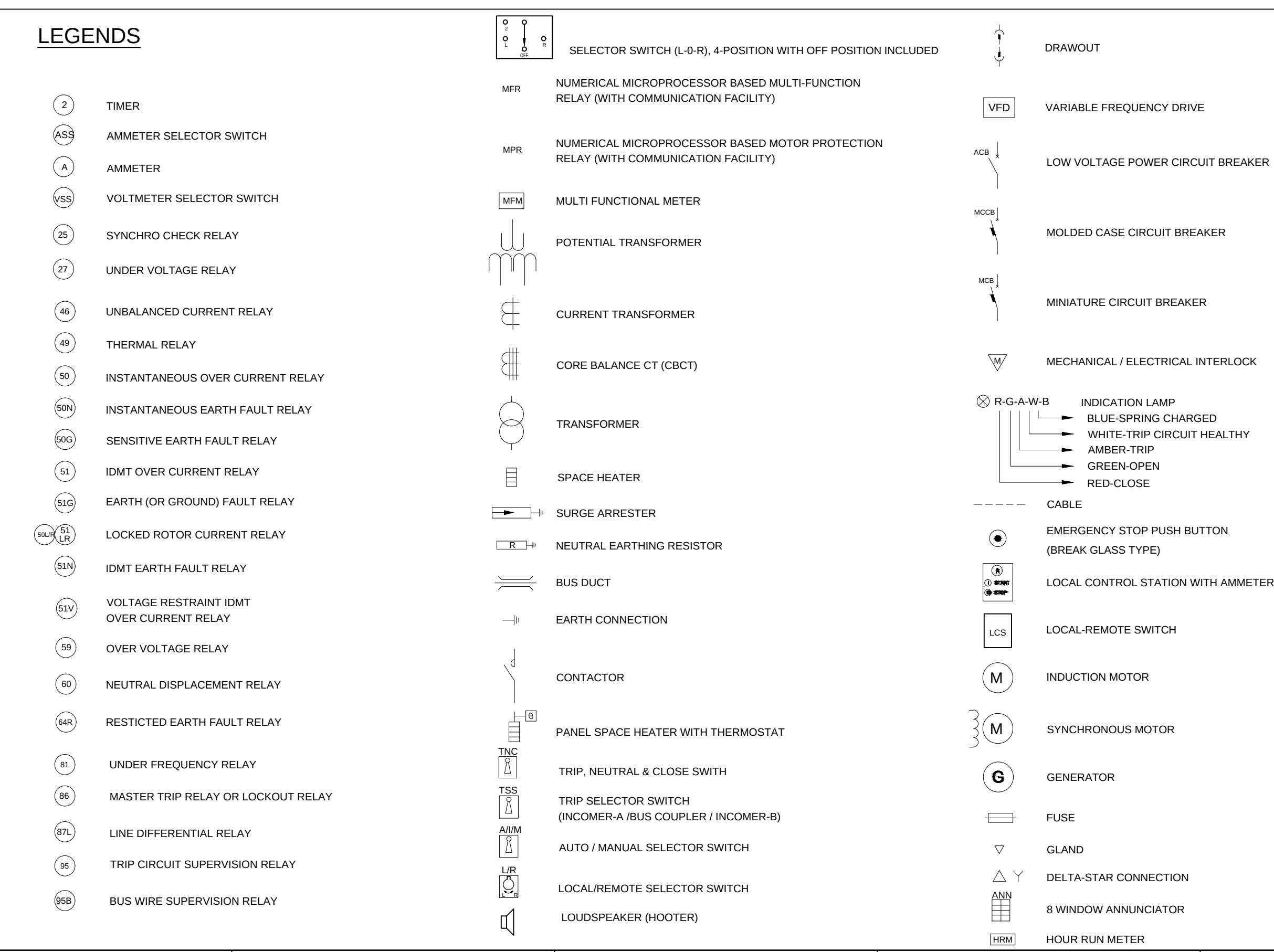
PROJECT PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LuPech (J-18)" AT IOCL GUJARAT REFINERY, VADODARA, GUJARAT, INDIA EPC-2 PACKAGE (INDMAX FCCU + CR LPG TREATER UNIT)				
TITLE SINGLE LINE DIAGRAM 6600V AIS SWITCHGEAR 044-HT6-102				
SCALE	PROJECT NO	UNIT	DRAWING NUMBER	PAGE
1:250	2047	1803	EEL-SLD-0006	1 of 1
M	N			



- ### GENERAL NOTES
- NOTES:
- CURRENT TRANSFORMERS FOR PROTECTION SHALL BE 5P20. FOR METERING SHALL BE 0.1S. ALL CT'S SHALL BE ACCESSIBLE FOR MAINTENANCE.
 - THE DEGREES OF PROTECTION OF THE LOW VOLTAGE SWITCHGEAR SHALL BE IP42 FOR EXTERNAL PROTECTION. INTERNAL PROTECTION FROM IP20 FORM OF SEPARATION AS METAL PARTITIONING.
 - THE INCOMING FEEDER AND BUS COUPLER SECTIONS MUST BE INSTALLED IN ONE CIRCULE ASSOCIATED MEASURING SECTIONS ARE HOUSED IN A SEPARATE COMPARTMENT. THE CABLE ENTRY COMPARTMENT FOR OUTGOING SECTIONS SHALL BE PROVIDED AT THE RIGHT HAND SIDE ALONG THE ENTIRE HEIGHT OF THE SWITCHGEAR COMPARTMENT. SEPARATED AND LOCKABLE.
 - PROTECTIVE EARTH BAR MUST BE INCLUDED, AND WHICH RUN HORIZONTALLY LOCATED IN THE MAIN BUSBAR COMPARTMENT JUST ABOVE THE BASE. THE PE BAR MUST BE FASTENED TO THE FRAME TO ASSURE ELECTRICAL CONTINUITY.
 - THE LOW VOLTAGE POWER CIRCUIT BREAKER (ACB) SHALL BE WITHDRAWABLE TYPE, 4POLE AND IN WHICH THE CONTACTS OPEN AND CLOSE IN AIR ATMOSPHERIC PRESSURE, AND EQUIPPED WITH A MECHANICAL STORED ENERGY TYPE OPERATING MECHANISM. ACB SHALL BE FITTED WITH FOLLOWING POSITION: INSERTED TEST WITHDRAWN.
 - THE CONTROL VOLTAGES FOR CLOSING CIRCUITS, TRIPPING CIRCUITS, CONTROL SYSTEM, PROTECTION RELAYS, POWER SUPPLY, AUXILIARY RELAYS, INDICATION CIRCUIT AND MOTOR POWER SUPPLY SHALL BE 110 VDC.
 - ANTI-CONDENSATION HEATERS SHALL BE PROVIDED WITH THERMOSTAT CONTROL. RANGE OF 10°C TO 40°C AND INSTALLED AT THE BOTTOM OF EACH VERTICAL SECTION (ACCORDING TO THE MANUFACTURER'S STANDARD) AND SHALL BE INDIVIDUALLY PROTECTED BY MCB. EACH HEATER SHALL BE COMPLETE WITH A ROTARY TYPE ON/OFF SWITCH.
 - THE EXTERNAL SUPPLY 240V AC SHALL BE FED FROM 044-MCC-101. 110 VDC IS FROM 044-SC-101.
 - FOR THE MOTORS WHICH REQUIRE 420 mA MOTOR CURRENT FEEDBACK AT DCS, CURRENT TRANSducer SHALL BE MOUNTED IN SWITCHGEAR PANEL.
 - MARSHALLING CABINETS SHALL BE PROVIDED FOR EACH BUS SECTION FOR DCS/PLC INTERFACING.
 - THE HEALTHINESS OF TRIP CIRCUIT IS TO BE ENSURED THROUGH A SUITABLE TRIP CIRCUIT SUPERVISION SCHEME WITH CONTINUOUS MONITORING WITH ALARM AT MANNED LOCATIONS.
 - PROVISION FOR CONTACT MULTIPLEXERS (VIA TYPE-FREE) FOR PRIMARY LOAD SHEDDING INITIATED FROM DCS/PLC SWITCHBOARD. THE AUXILIARY RELAY SHALL BE INSTALLED IN THE INCOMERS. A COMMAND OF LOAD SHEDDING WILL BE INITIATED FROM DCS/PLC SWITCHBOARD AND THE OUTPUT CONTACT OF AUXILIARY RELAYS WILL BE USED FOR TRIPPING OF OUTGOING FEEDERS.
 - ALL THE DATA AS AVAILABLE IN THE RELAY INCLUDING STATUS OF DI SHOULD BE CONSIDERED TO BE COMMUNICATED TO DCS.
 - THE AUX POWER SUPPLY OF ALL THE NUMERICAL RELAYS SHALL BE THROUGH DEDICATED FUSES AND FOR THE RELAYS IN SUCH A WAY THAT THE SUPPLY TO THE RELAYS IS AVAILABLE EVEN WHEN THE AUX POWER SUPPLY OF THE PANEL IS SWITCHED OFF.
 - ALL OVERLOAD RELAYS / THERMAL RELAYS OVERLOAD RELAYS SHALL BE COMPACT MICROPROCESSOR BASED COMMUNICABLE TYPE. THESE RELAY SHALL HAVE METERING A DISPLAY FACILITY ON PANEL DOOR. FOR FEEDERS WITH CBCT, THE INPUT OF CBCT SHALL BE TAKEN DIRECTLY TO THE ABOVE MENTIONED RELAY ONLY. MAKE OF THE RELAY SHALL BE SAME AS NUMERICAL PROTECTION RELAY.
 - ALL ECS INTERFACE LINE BREAKER STATUS, CLOSE/OPEN COMMAND SIGNALS AS PER ECS IO LIST SHALL BE INCORPORATED FOR ALL BREAKERS. EACH RELAY ED SHALL HAVE REDUNDANT PORTS FOR ECS INTERFACE WHICH SHALL BE SHOWN AS PER ECS ARCHITECTURE.
 - THE FOLLOWING CONTROL SIGNALS FOR THE CIRCUIT BREAKER INCOMERS SHALL BE INTERFACED WITH UPSTREAM CIRCUIT BREAKER'S TRIP COIL AND NOT WITH BUS LOCKOUT RELAY:
 - INTERLOCK FROM UPSTREAM BREAKER (CB IN TEST)
 - INTERLOCK FROM UPSTREAM BREAKER (CB IN SERVICE POSITION & OPEN)
 - CLOSE PERMISSIVE FROM UPSTREAM CB (CB IN SERVICE POSITION & CLOSED)
 - TO UPSTREAM BREAKER TRIP COIL (CB IN TEST OR OPERATED, EMERGENCY OPERATED)
 - CLOSE PERMISSIVE TO UPSTREAM CB (CB IN SERVICE POSITION & OPEN & NOT OPERATED)
 - TRIP UPSTREAM BREAKER LOCKOUT RELAY (DSF OPERATED)
 - 90MM X 90MM ANALOGUE AMMETER AND VOLTMETER SHALL BE PROVIDED. AMMETER (SIZE 48MM X 90MM) SHALL BE PROVIDED IN SPACE HEATER FOR ALL BREAKERS. ED MOTOR FEEDERS, LOTO PROVISIONS SHALL BE PROVIDED FOR ALL FEEDERS. SWITCHGEAR SHALL BE PROVIDED WITH COMMERCIAL ELECTRONIC METER WITH TIME / VOLUME CONTROL IN BUS COUPLER FEEDER.
 - TEST PUSH BUTTON SHALL BE PROVIDED TO CHECK THE CONTROL CIRCUIT OF MOTOR FEEDER IN TEST POSITION ONLY. TEST PUSH BUTTON SHALL BE INACTIVE DURING SERVICE POSITION. ALL EMERGENCY STOP PUSH BUTTON SHALL BE MUSHROOM HEAD SIX BUTT PUSH TO LOCK-TURN TO RELEASE) WITH SHROUDS. STOP PUSH BUTTON SHALL STOP THE FEEDER WHEN PRESSED IN BOTH TEST & SERVICE POSITION.
 - NECESSARY TIMERS (0.5S / 5S) SHALL BE PROVIDED FOR TRIPPING OF MOTORS ON UNDER VOLTAGE AND FOR MOTOR REQUIRING RE-ACCELERATION. CONTACTS OF BOTH THE TIMERS SHALL BE MADE AVAILABLE IN ALL MOTOR FEEDERS TO GET THE FLEXIBILITY OF THE TIME SETTINGS.
 - LAMP TEST PUSH BUTTON SHALL BE PROVIDED FOR ALL FEEDERS. FURTHER MINIMUM 8 WINDOW MICROPROCESSOR BASED ANNUNCIATOR SHALL BE PROVIDED WITH 20% SPARE.
 - MFA HAS THE FOLLOWING METERING PARAMETERS AS MINIMUM: A, V, PF, KW, KVA, KVAR, KVARH, KVAH, KVAH/1000, PF.
 - THE AUX POWER SUPPLY OF ALL THE NUMERICAL RELAYS SHALL BE THROUGH DEDICATED FUSES / MCB FOR THE RELAYS IN SUCH A WAY THAT THE SUPPLY TO THE RELAYS IS AVAILABLE EVEN WHEN THE AUX POWER SUPPLY OF THE PANEL IS SWITCHED OFF.
 - THE DIFFERENTIAL RELAY (87L) AS WELL AS CT, AT OTHER END SHALL BE IDENTICAL IN ALL ASPECTS. BUS DIFFERENTIAL PROTECTION SCHEME IS TO PROVIDED WITH CHECK ZONE PROTECTION.
 - PROTECTION RELAYS SHALL BE OF LATEST VERSION. MICROPROCESSOR BASED NUMERICAL TYPE FOR COMMUNICATION WITH ECS / DCS. IT SHALL HAVE ECS (DSF) COMMUNICATION FACILITY. ALL NUMERICAL RELAY SHALL HAVE TWO RS485 PORT AT RELAY FRONT AND 24VDC (REDUNDANT) RS 485 PORT AT RELAY REAR. MULTIFUNCTION METER (MFA) SHALL BE DIGITAL TYPE AND SHALL HAVE COMMUNICATION FACILITY WITH MODBUS RTU / RS 485 COMMUNICATION PROTOCOL.
 - MINIMUM 2 NOS. OF INPUTS AND 2 NOS. OUTPUTS SPARE I/O SHALL BE PROVIDED IN EACH NUMERICAL RELAY. MASTER LOCK OUT RELAY (MLO) VARIETY SHALL BE SEPARATE AND ELECTRO MECHANICAL TYPE AND SHALL NOT BE A PART OF MAIN NUMERICAL PROTECTION RELAY.
 - IN CASE OF PT PRIMARY FUSE FAILURE CONDITION THE UNDER-VOLTAGE SCHEME BE BLOCKED TO PREVENT MAL-OPERATION OF THE SYSTEM FEEDER.
 - CB OPEN / CLOSE COMMAND (DO) ARE INTERFACED WITH ECS THROUGH HARD WIRED AND CB IN SERVICE POSITION & OPEN / CLOSE (DI) SIGNALS ARE INTERFACED WITH ECS THROUGH NUMERICAL RELAY (ED) BUS PROTOCOL. FOR ACB CONTROLLED INCOMERS, BUS COUPLER AND OUTGOING FEEDER MOTOR FEEDERS.
 - CLASS PS ITS HAVE A SPECIFIED EXCITATION CHARACTERISTIC AND SECONDARY WINDING RESISTANCE AND THESE PARAMETERS ARE USED TO CALCULATE THE PERFORMANCE OF THE PROTECTOR IN TERMS OF PRIMARY OPERATED CURRENT FOR INTERNAL FAULTS AND STABILITY DURING THROUGH FAULT CONDITIONS.
 - FOR THE TYPE OF SCHEME SEE DRAWING NO. 2047-1803-EPR-DSI-0002 TYPICAL METERING AND PROTECTION SCHEMATIC DIAGRAM FOR IN SWITCHGEAR.
 - INDICATING LAMPS FOR INCOMER, BUSCOUPLER, AND OUTGOING FEEDERS SHALL BE PROVIDED AS BELOW:

S. No.	DESCRIPTION	TAG	POWER (KVA, KW, OR KVAR)	FULL LOAD CURRENT	RATED CURRENT CIRCUIT BREAKER	CABLE SIZE	BUSBAR	TYPE	CT GENERAL RATIO	CT PANEL No./ PANEL DESIGNATION	TYPICAL ESD/DCS (NOTE B)
1	COLD FRESH FEED PUMP	1803-PM-102 A	110 kW	174 A	630 A	2x 3C - 120 mm ² AL	BUS A	M10	3001 A	a)	3/M20
2	CLO PRODUCT PUMP	1803-PM-206 A	150 kW	242 A	630 A	2x 3C - 185 mm ² AL	BUS B	M10	3001 A	a)	3/M20
3	FRACTIONATOR REFLUX PUMP	1803-PM-207 A	132 kW	211 A	630 A	2x 3C - 150 mm ² AL	BUS A	M10	3001 A	a)	3/M20
4	PRIMARY ABSORBER BOTTOM PUMP	1803-PM-217 B	132 kW	211 A	630 A	2x 3C - 150 mm ² AL	BUS A	M10	3001 A	a)	3/M20
5	HCN PUMP/AROUND PUMP	1803-PM-224 A	75 kW	124 A	630 A	1x 3C - 240 mm ² AL	BUS A	M10	2001 A	a)	3/M20
6	OXIDATION TANK MIXER MOTORS A (1803-X-107)	OXTM-A	75 kW	119 A	630 A	1x 3C - 185 mm ² AL	BUS A	M10	2001 A	a)	3/M20
7	OXIDATION TANK MIXER MOTORS C (1803-X-107)	OXTM-C	75 kW	119 A	630 A	1x 3C - 185 mm ² AL	BUS A	M10	2001 A	a)	-
8	044-MCC-101 INCOMER 1	044-MCC-101 A	315 kW	498 A	800 A	3x 4C - 185 mm ² AL	BUS A	M4	8001 A	a)	-
9	044-MCC-102 INCOMER 1	044-MCC-102 A	399 kW	630 A	800 A	3x 4C - 185 mm ² AL	BUS A	M4	8001 A	a)	-
10	044-MCC-104 INCOMER 1	044-MCC-104 A	399 kW	630 A	800 A	3x 4C - 185 mm ² AL	BUS A	M4	8001 A	a)	-
11	SPARE (TYPE M10: ACB FOR MOTOR FEEDER ≥110 kW & ≤132 kW)	-	-	-	630 A	-	BUS A	M10	3001 A	a)	-
12	SPARE (TYPE M10: ACB FOR MOTOR FEEDER ≥55 kW & ≤90 kW)	-	-	-	630 A	-	BUS A	M10	2001 A	a)	-
13	SPARE (TYPE M4: FEEDER ≥ 630 A)	-	-	-	800 A	-	BUS A	M4	8001 A	a)	-
14	COLD FRESH FEED PUMPS	1803-PM-102 B	110 kW	174 A	630 A	2x 3C - 120 mm ² AL	BUS B	M10	3001 A	a)	3/M20
15	CLO PRODUCT PUMP	1803-PM-206 B	150 kW	242 A	630 A	2x 3C - 185 mm ² AL	BUS A	M10	3001 A	a)	3/M20
16	FRACTIONATOR REFLUX PUMP	1803-PM-207 B	132 kW	211 A	630 A	2x 3C - 150 mm ² AL	BUS B	M10	3001 A	a)	3/M20
17	PRIMARY ABSORBER BOTTOM PUMP	1803-PM-217 A	132 kW	211 A	630 A	2x 3C - 150 mm ² AL	BUS B	M10	3001 A	a)	3/M20
18	HCN PUMP/AROUND PUMP	1803-PM-224 B	75 kW	124 A	630 A	1x 3C - 240 mm ² AL	BUS B	M10	2001 A	a)	3/M20
19	OXIDATION TANK MIXER MOTORS B (1803-X-107)	OXTM-B	75 kW	119 A	630 A	1x 3C - 185 mm ² AL	BUS B	M10	2001 A	a)	-
20	044-MCC-101 INCOMER 2	044-MCC-101 B	315 kW	498 A	800 A	3x 4C - 185 mm ² AL	BUS B	M4	8001 A	a)	-
21	044-MCC-102 INCOMER 2	044-MCC-102 B	399 kW	630 A	800 A	3x 4C - 185 mm ² AL	BUS B	M4	8001 A	a)	-
22	044-MCC-104 INCOMER 2	044-MCC-104 B	399 kW	630 A	800 A	3x 4C - 185 mm ² AL	BUS B	M4	8001 A	a)	-
23	SPARE (TYPE M10: ACB FOR MOTOR FEEDER ≥110 kW & ≤132 kW)	-	-	-	630 A	-	BUS B	M10	3001 A	a)	-
24	SPARE (TYPE M10: ACB FOR MOTOR FEEDER ≥55 kW & ≤90 kW)	-	-	-	630 A	-	BUS B	M10	2001 A	a)	-
25	SPARE (TYPE M4: FEEDER ≥ 630 A)	-	-	-	800 A	-	BUS B	M4	8001 A	a)	-

a) THIS INFORMATION SHALL BE WHEN VENDOR'S DATA ARE AVAILABLE
b) FOR MOTOR TYPICAL SCHEMES SEE DRAWINGS NO. 2047-1803-EPR-PID-0008-01 AND 2047-1803-EPR-PID-0008-02

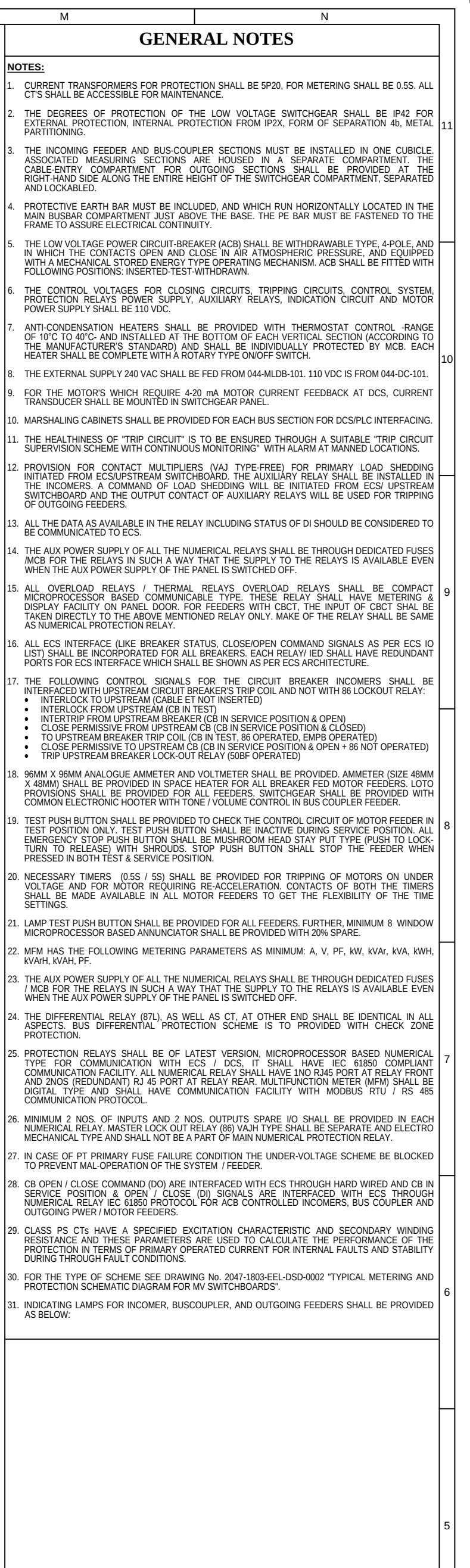


PROJECT
PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LuPech (J-18)" AT IOC GUJARAT REFINERY, VADODARA, GUJARAT, INDIA
EPCC-2 PACKAGE (INDMAX FCCU + CR LPG TREATER UNIT)

TITLE
SINGLE LINE DIAGRAM 415V SWITCHGEAR 044-PMCC-101

SCALE	PROJECT NO	UNIT	PAGE	REV
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a) THIS INFORMATION SHALL BE WHEN VENDOR'S DATA ARE AVAILABLE

7	TIMER
A50	AMMETER SELECTOR SWITCH
50	AMMETER
A50	VOLTMETER SELECTOR SWITCH
25	SYNCHRO CHECK RELAY
17	UNDER VOLTAGE RELAY
46	UNBALANCED CURRENT RELAY
46	THERMAL RELAY
50	INSTANTANEOUS OVER CURRENT
50V	INSTANTANEOUS EARTH FAULT
50C	SENSITIVE EARTH FAULT RELAY
51	IDMT OVER CURRENT RELAY
51C	EARTH (OR GROUND) FAULT RELAY
51C/50	LOCKED ROTOR CURRENT RELAY
51	IDMT EARTH FAULT RELAY
51V	VOLTAGE RESTRAINT IDMT OVER CURRENT RELAY
50	OVER VOLTAGE RELAY
60	NEUTRAL DISPLACEMENT RELAY
60P	RESTRICTED EARTH FAULT RELAY
60	UNDER FREQUENCY RELAY
60	MASTER TRIP RELAY OR LOCKOUT
62	LINE DIFFERENTIAL RELAY
60	TRIP CIRCUIT SUPERVISION RELAY
60	BUS WIRE SUPERVISION RELAY

	SELECTOR SWITCH (I/O-R), 4-POSITION WITH OFF POSITION INCLUDED		DRAWOUT
	NUMERICAL MICROPROCESSOR BASED MULTI-FUNCTION RELAY (WITH COMMUNICATION FACILITY)		VARIABLE FREQUENCY DRIVE
	NUMERICAL MICROPROCESSOR BASED MOTOR PROTECTION RELAY (WITH COMMUNICATION FACILITY)		LOW VOLTAGE POWER CIRCUIT BREAKER
	MULTI-FUNCTIONAL METER		MOLDED CASE CIRCUIT BREAKER
	POTENTIAL TRANSFORMER		MINIATURE CIRCUIT BREAKER
	CURRENT TRANSFORMER		MECHANICAL / ELECTRICAL INTERLOCK
	CORE BALANCE CT (CBCT)		INDICATION LAMP
	TRANSFORMER		BLUE SPRING CHARGED
	SPACE HEATER		WHITE TRIP CIRCUIT HEALTHY
	SURGE ARRESTER		AMBER-TRIP
	NEUTRAL EARTHING RESISTOR		GREEN OPEN
	BUS DUCT		RED-CLOSE
	EARTH CONNECTION		CABLE
	CONTACTOR		EMERGENCY STOP PUSH BUTTON (BREAK GLASS TYPE)
	PANEL SPACE HEATER WITH THERMOSTAT		LOCAL CONTROL STATION WITH AMMETER
	TRIP, NEUTRAL & CLOSE SWITCH		LOCAL-REMOTE SWITCH
	TRIP SELECTOR SWITCH (INCOMER-A / BUS COUPLER / INCOMER-B)		INDUCTION MOTOR
	AUTO / MANUAL SELECTOR SWITCH		SYNCHRONOUS MOTOR
	LOCAL/REMOTE SELECTOR SWITCH		GENERATOR
			FUSE
			GLAND
			DELTA-STAR CONNECTION

1 CURRENT TRANSFORMERS FOR PROTECTION SHALL BE 970. FOR METERING SHALL BE 555. ALL
2 CT'S SHALL BE ACCESSIBLE FOR MAINTENANCE.

3 THE DEGREES OF PROTECTION OF THE LOW VOLTAGE SWITCHGEAR SHALL BE (4)40 FOR
4 THE MAIN BUSBARS, (5)50 FOR THE INTERNAL PROTECTIVE RELAYS, (6)60 FOR SEPARATION AND
5 PARTIAL PARTITIONS.

6 THE INCOMER FEEDER AND BUS-COUPLER SECTIONS MUST BE INSTALLED ON ONE CIRCUIT
7 ASSOCIATED MEASURING DEVICES ARE HOUSED IN A SEPARATE COMPARTMENT. THE
8 INCOMER FEEDER AND BUS-COUPLER SECTIONS MUST BE INSTALLED ON ONE CIRCUIT
9 RIGHT-AND-LEFT ALONG THE ENTIRE HEIGHT OF THE SWITCHGEAR COMPARTMENT. SEPARATED
10 AND LOCATED IN THE SAME COMPARTMENT.

11 PROTECTIVE EARTH BAR MUST INCLUDE AND WASH RUN HORIZONTALLY LOCATED IN THE
12 MAIN BUSBAR COMPARTMENT JUST ABOVE THE WASH. THE PE BAR MUST BE FASTENED TO THE
13 MAIN BUSBAR WITH TWO 10MM DIA. BOLTS.

14 THE LOW VOLTAGE POWER CIRCUIT BREAKER (ACB) SHALL BE WITHDRAWABLE TYPE 4P/6P AND
15 WITH A MECHANICAL STORED ENERGY TYPE OPERATING MECHANISM ACBS SHALL BE FITTED WITH
16 A MECHANICAL LOCKING SYSTEM TO PREVENT UNINTENTIONAL OPERATION.

17 THE CONTROL, VOLTAGE SUPPLY FOR CLOSING CIRCUITS, TRIPPING CIRCUITS, CONTROL, SYSTEM
18 PROTECTION RELAYS, POWER SUPPLY, AUXILIARY RELAYS, INDICATION CIRCUIT AND METERING
19 CIRCUITS SHALL BE LOCATED IN THE SAME COMPARTMENT.

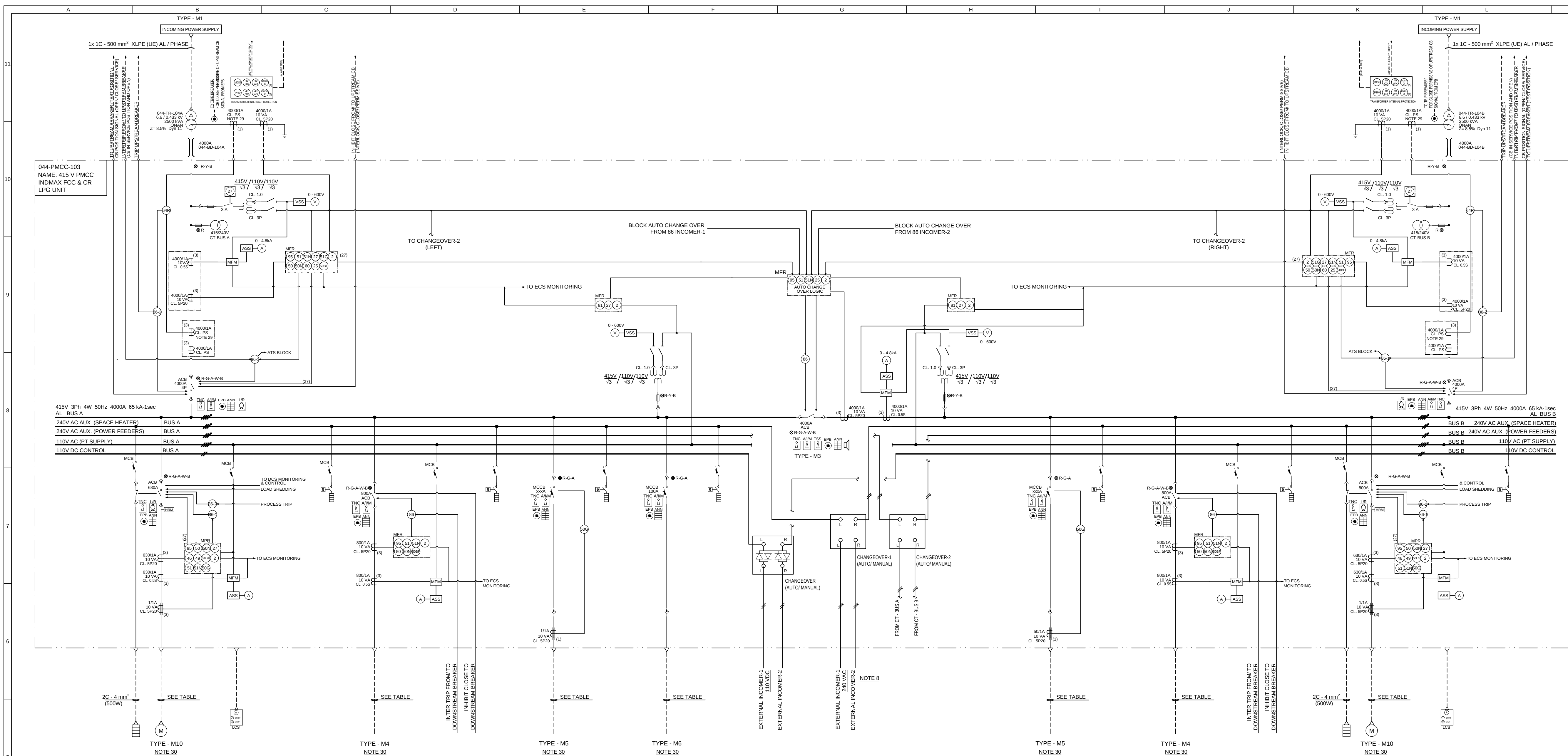
20 ANTI-COMPENSATION HEATERS SHALL BE PROVIDED WITH THERMOSTAT CONTROL, RANGE
21 OF 70°C TO 140°C AND INSTALLED AT THE BOTTOM OF EACH VERTICAL SECTION (ACCORDING TO
22 THE MAINS SUPPLY VOLTAGE). THE HEATERS SHALL BE PROVIDED WITH A 10MM DIA. CABLE
23 HEATER SHALL BE COMPLETE WITH A ROTARY TYPE CIRCUIT SWITCH.

24 FOR THE EXTERIOR WORK WHICH REQUIRE A 240V AC MOTOR CURRENT FEEDBACK (CSF) CURRENT
25 TRANSFORMER SHALL BE MOUNTED IN SWITCHGEAR PANEL.

26 MARSHALLING CABINETS SHALL BE PROVIDED FOR EACH BUS SECTION FOR DCS, CURRENT
27 INTERFACING.

28 THE HEALTHINESS OF "TRIP CIRCUIT" IS TO BE ENSURED THROUGH A "STABLE" TRIP CIRCUIT
29 MONITORING SYSTEM. THE TRIP CIRCUIT SHALL BE PROVIDED WITH A "STABLE" TRIP CIRCUIT
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145 MONITOR

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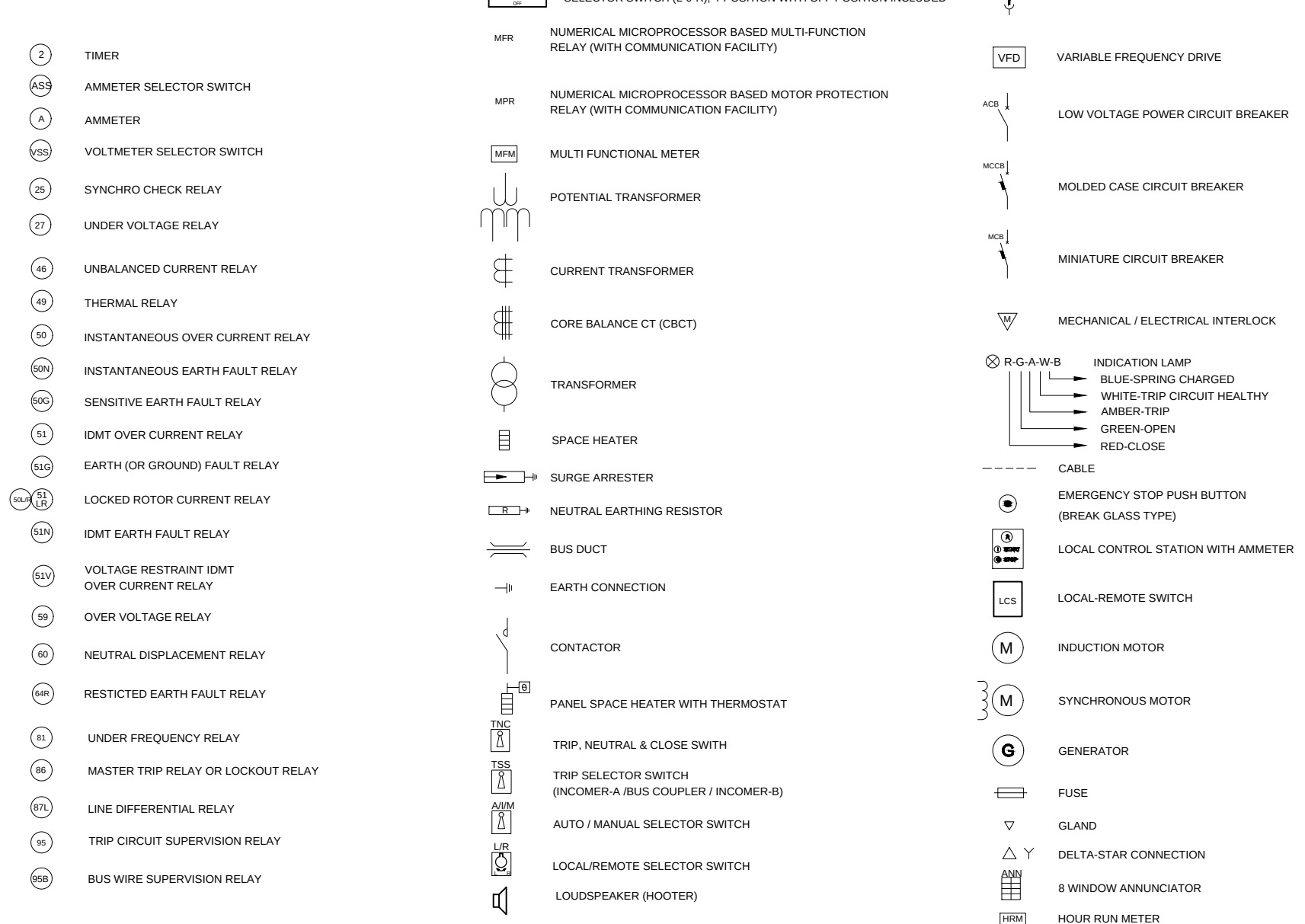


- GENERAL NOTES**
- NOTES:**
- CURRENT TRANSFORMERS FOR PROTECTION SHALL BE SP20, FOR METERING SHALL BE 0.5S. ALL CT'S SHALL BE ACCESSIBLE FOR MAINTENANCE.
 - THE DEGREES OF PROTECTION OF THE LOW VOLTAGE SWITCHGEAR SHALL BE IP42 FOR EXTERNAL PROTECTION, INTERNAL PROTECTION FROM IP2X FORM OF SEPARATION 4S, METAL PARTITIONING.
 - THE INCOMING FEEDER AND BUS-COUPLER SECTIONS MUST BE INSTALLED IN ONE CUBICLE ASSOCIATED MEASURING SECTIONS ARE HOUSED IN A SEPARATE COMPARTMENT. THE CABLE ENTRY COMPARTMENT FOR OUTGOING SECTIONS SHALL BE PROVIDED AT THE RIGHT-HAND SIDE ALONG THE ENTIRE HEIGHT OF THE SWITCHGEAR COMPARTMENT, SEPARATED AND LOCKABLE.
 - PROTECTIVE EARTH BAR MUST BE INCLUDED, AND WHICH RUN HORIZONTALLY LOCATED IN THE MAIN BUSBAR COMPARTMENT JUST ABOVE THE BASE. THE PE BAR MUST BE FASTENED TO THE FRAME TO ASSURE ELECTRICAL CONTINUITY.
 - THE LOW VOLTAGE POWER CIRCUIT BREAKER (ACB) SHALL BE WITHDRAWABLE TYPE 4-POLE AND IN WHICH THE CONTACTS OPEN AND CLOSE IN AIR ATMOSPHERIC PRESSURE, AND EQUIPPED WITH A MECHANICAL STORED ENERGY TYPE TRIPPING MECHANISM. ACB SHALL BE FITTED WITH FOLLOWING POSITIONS: INSERTED-TEST-WITHDRAWN.
 - THE CONTROL VOLTAGES FOR CLOSING CIRCUITS, TRIPPING CIRCUITS, CONTROL SYSTEM PROTECTION RELAYS, POWER SUPPLY, AUXILIARY RELAYS, INDICATION CIRCUIT AND MOTOR POWER SUPPLY SHALL BE 110 VDC.
 - ANTI-CONDENSATION HEATERS SHALL BE PROVIDED WITH THERMOSTAT CONTROL, RANGE OF 10% TO 40% AND INSTALLED AT THE BOTTOM OF EACH VERTICAL SECTION (ACCORDING TO THE MANUFACTURERS STANDARD) AND SHALL BE INDIVIDUALLY PROTECTED BY MCB. EACH HEATER SHALL BE COMPLETE WITH A THERMAL TYPE ON/OFF SWITCH.
 - THE EXTERNAL SUPPLY 240 VAC SHALL BE FED FROM 044-MDB-101. 110 VDC IS FROM 044-DC-101.
 - FOR THE MOTORS WHICH REQUIRE 4.20 mA MOTOR CURRENT FEEDBACK AT DCS, CURRENT TRANSFORMER SHALL BE MOUNTED IN SWITCHGEAR PANEL.
 - MARSHALLING CABINETS SHALL BE PROVIDED FOR EACH BUS SECTION FOR DCS/PLC INTERFACING.
 - THE HEALTHINESS OF 'TRIP CIRCUIT' IS TO BE ENSURED THROUGH A SUITABLE 'TRIP CIRCUIT SUPERVISION SCHEME WITH CONTINUOUS MONITORING' WITH ALARM AT MANNED LOCATIONS.
 - PROVISION FOR CONTACT MULTIPLEX (VA) TYPE-FREED FOR PRIMARY LOAD SHEDDING INITIATED FROM UPS/MAIN SWITCHBOARD. THE AUXILIARY RELAY SHALL BE INSTALLED IN SWITCHBOARD AND THE OUTPUT CONTACT OF AUXILIARY RELAYS WILL BE USED FOR TRIPPING OF OUTGOING BREAKERS.
 - ALL THE DATA AS AVAILABLE IN THE RELAY INCLUDING STATUS OF DI SHOULD BE CONSIDERED TO BE COMMUNICATED TO ECS.
 - THE AUX POWER SUPPLY OF ALL THE NUMERICAL RELAYS SHALL BE THROUGH DEDICATED FUSES AND FOR THE RELAYS IN SUCH A WAY THAT THE SUPPLY TO THE RELAYS IS AVAILABLE EVEN WHEN THE AUX POWER SUPPLY OF THE PANEL IS SWITCHED OFF.
 - ALL OVERLOAD RELAYS / THERMAL RELAYS OVERLOAD RELAYS SHALL BE COMPACT MICROPROCESSOR BASED. INTERLOCKING OF THESE RELAYS SHALL BE THROUGH HARDWIRED INTERLOCKING OF PANEL LOCKS FOR FEEDERS. THE RELAY SHALL BE INSTALLED IN SWITCHBOARD AND THE OUTPUT CONTACT OF AUXILIARY RELAYS WILL BE USED FOR TRIPPING OF OUTGOING BREAKERS.
 - ALL ECS INTERFACE AND BREAKER STATUS CLOSING/OPEN COMMAND SIGNALS AS PER ECS IO LIST SHALL BE INCORPORATED FOR ALL BREAKERS. EACH RELAY ED SHALL HAVE REDUNDANT PORTS FOR ECS INTERFACE WHICH SHALL BE SHOWN AS PER ECS ARCHITECTURE.
 - THE FOLLOWING CONTROL SIGNALS FOR THE CIRCUIT BREAKER INCOMERS SHALL BE INTERFACED WITH UPS/MAIN CIRCUIT BREAKERS TRIP COIL AND NOT WITH 86 LOCKOUT RELAY:
 - INTERLOCK TO UPSTREAM CABLE (ET NOT INSERTED)
 - INTERLOCK FROM UPSTREAM CB IN TEST
 - INTERTRIP FROM UPSTREAM BREAKER (CB IN SERVICE POSITION A OPEN)
 - CLOSE PERMISSIVE FROM UPSTREAM CB (CB IN SERVICE POSITION A CLOSED)
 - TO UPSTREAM BREAKER TRIP COIL (CB IN TEST BE OPERATED, EMPO OPERATED)
 - CLOSE PERMISSIVE TO UPSTREAM CB (CB IN SERVICE POSITION A OPEN + 86 NOT OPERATED)
 - TRIP UPSTREAM BREAKER LOCK OUT RELAY (86B OPERATED)
 - 80MM X 80MM ANALOGUE AMMETER AND VOLTMETER SHALL BE PROVIDED. AMMETER (SIZE 40MM X 40MM) SHALL BE PROVIDED FOR SPACE HEATER FOR ALL BREAKER MOTOR FEEDERS. LOTO PROVISIONS SHALL BE PROVIDED FOR ALL FEEDERS. SWITCHGEAR SHALL BE PROVIDED WITH COMMON ELECTRONIC HOSTER WITH SPOKE VOLUME CONTROL IN BREAKER MOTOR FEEDER.
 - TEST PUSH BUTTON SHALL BE PROVIDED TO CHECK THE CONTROL CIRCUIT OF MOTOR FEEDER IN TEST POSITION ONLY. TEST PUSH BUTTON SHALL BE INACTIVE DURING SERVICE POSITION. ALL EMERGENCY STOP HIGH SIGNAL SHALL BE INACTIVE. EMERGENCY STOP HIGH SIGNAL SHALL BE INACTIVE. EMERGENCY STOP HIGH SIGNAL SHALL BE INACTIVE. EMERGENCY STOP HIGH SIGNAL SHALL BE INACTIVE.
 - NECESSARY TIMERS (0.5S / 1S) SHALL BE PROVIDED FOR TRIPPING OF MOTORS ON UNDER VOLTAGE AND FOR MOTOR REWIND RE-ACCELERATION. CONTACTS OF BOTH THE TIMERS SHALL BE MADE AVAILABLE IN ALL MOTOR FEEDERS TO GET THE FLEXIBILITY OF THE TIME SETTINGS.
 - LAMP TEST PUSH BUTTON SHALL BE PROVIDED FOR ALL FEEDERS. FURTHER, MINIMUM 8 WINDOW MICROPROCESSOR BASED ANNUNCIATOR SHALL BE PROVIDED WITH 20H SPARE.
 - MMH HAS THE FOLLOWING METERING PARAMETERS AS MINIMUM: A, V, PF, KW, KVA, KWH, KVARH, KVAH, PF, PT.
 - THE AUX POWER SUPPLY OF ALL THE NUMERICAL RELAYS SHALL BE THROUGH DEDICATED FUSES AND FOR THE RELAYS IN SUCH A WAY THAT THE SUPPLY TO THE RELAYS IS AVAILABLE EVEN WHEN THE AUX POWER SUPPLY OF THE PANEL IS SWITCHED OFF.
 - THE DIFFERENTIAL RELAY (87A) AS WELL AS CT AT OTHER END SHALL BE IDENTICAL IN ALL ASPECTS. BUS DIFFERENTIAL PROTECTION SCHEME IS TO PROVIDED WITH CHECK 20% PROTECTION.
 - PROTECTION RELAYS SHALL BE OF LATEST VERSION, MICROPROCESSOR BASED NUMERICAL TYPE FOR COMMUNICATION WITH ECS / DCS. IT SHALL HAVE IEC 60890 COMPLIANT COMMUNICATION FACILITY. ALL NUMERICAL RELAY SHALL HAVE AND 24S PORT AT RELAY FRONT AND 24S PORT AT RELAY REAR. MULTIFUNCTION METER (MMH) SHALL BE DIGITAL TYPE AND SHALL HAVE COMMUNICATION FACILITY WITH MODBUS RTU / RS 485 COMMUNICATION PROTOCOL.
 - MINIMUM 2 NOS. OF INPUTS AND 2 NOS. OUTPUTS SPARE IO SHALL BE PROVIDED IN EACH NUMERICAL RELAY. MASTER LOCK OUT RELAY (86) VARIETY TYPE SHALL BE SEPARATE AND ELECTRO MECHANICAL TYPE AND SHALL NOT BE A PART OF MAIN NUMERICAL PROTECTION RELAY.
 - IN CASE OF PT PRIMARY FUSE FAILURE CONDITION THE UNDER-VOLTAGE SCHEME BE BLOCKED TO PREVENT MAL-OPERATION OF THE SYSTEM / FEEDER.
 - CB OPEN / CLOSE COMMAND (DO) ARE INTERFACED WITH ECS THROUGH HARD WIRED AND CB IN SERVICE POSITION A OPEN / CLOSE (DI) SIGNALS ARE INTERFACED WITH ECS THROUGH NUMERICAL RELAY IEC 60890 PROTOCOL FOR ACB CONTROLLED INCOMERS. BUS COUPLER AND OUTGOING PWR/MOTOR FEEDERS.
 - CLASS RS CTs HAVE A SPECIFIED EXCITATION CHARACTERISTIC AND SECONDARY WINDING RESISTANCE AND THESE PARAMETERS ARE USED TO CALCULATE THE PERFORMANCE OF THE PROTECTION IN TERMS OF PRIMARY OPERATED CURRENT FOR INTERNAL FAULTS AND STABILITY DURING THROUGH FAULT CONDITIONS.
 - FOR THE TYPE OF SCHEME SEE DRAWING NO. 2047-1803-ELD-002-0002 'TYPICAL METERING AND PROTECTION SCHEMATIC DIAGRAM FOR MV SWITCHGEAR'.

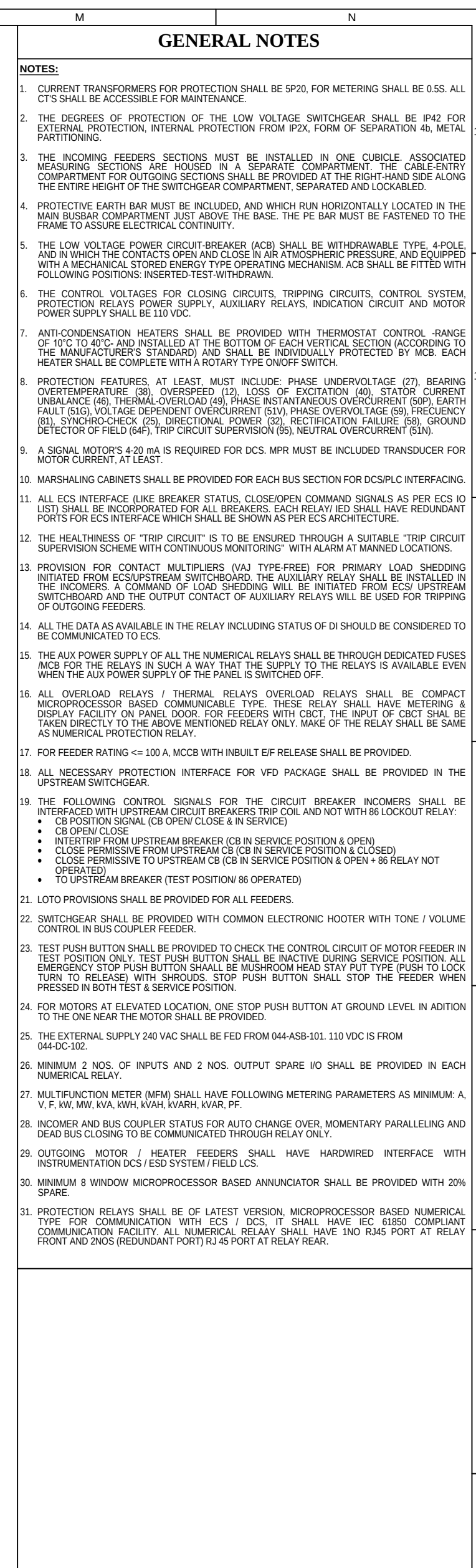
S No	DESCRIPTION	TAG	POWER (KVA, KW, OR KVAR)	FULL LOAD CURRENT	RATED CURRENT CIRCUIT BREAKER	CABLE SIZE	BUSBAR	TYPE	CT GENERAL RATIO	CT PANEL No./ PANEL DESIGNATION	TYPICAL ES/D/CS (NOTE b)
1	LCO PRODUCT PUMP	1803-PM-203 A	55 kW	88 A	630 A	1x 3C - 120 mm ² AL	BUS A	M10	200/1 A	a)	3M/20
2	COMPRESSOR INTERSTAGE LIQUID PUMP	1803-PM-212 B	75 kW	119 A	630 A	1x 3C - 185 mm ² AL	BUS A	M10	200/1 A	a)	3M/20
3	LEAN OIL PUMP	1803-PM-220 A	75 kW	119 A	630 A	1x 3C - 185 mm ² AL	BUS A	M10	200/1 A	a)	3M/20
4	DISTILLATE DRUM LIQUID PUMP	1803-PM-209 B	132 kW	206 A	630 A	2x 3C - 150 mm ² AL	BUS A	M10	300/1 A	a)	3M/20
5	RICH AMINE PUMP	1803-PM-225 A	75 kW	124 A	630 A	1x 3C - 240 mm ² AL	BUS A	M10	200/1 A	a)	3M/20
6	REGENERATED CAUSTIC PUMPS (CR LPG TREATMENT PACKAGE)	1803-X-205-F-006B	90 kW	144 A	630 A	2x 3C - 95 mm ² AL	BUS A	M10	200/1 A	a)	-
7	LPG BOOSTER PUMPS (CR LPG TREATMENT PACKAGE)	1803-X-205-F-010A	125 kW	200 A	630 A	2x 3C - 185 mm ² AL	BUS A	M10	300/1 A	a)	-
8	MAIN LIGHTING TRANSFORMER 0.415 / 0.433 kV (044-MDB-101)	044-TR-107 A	200 KVA	278 A	400 A	1x 4C - 300 mm ² AL	BUS A	M5	-	a)	-
9	044-ASB-101 (WELDINGSOCKETS) INCOMER 1	044-ASB-101 A	182 kW	293 A	800 A	2x 4C - 120 mm ² AL	BUS A	M4	800/1 A	a)	-
10	044-ASB-102 (WELDINGSOCKETS) INCOMER 1	044-ASB-102 A	202 kW	326 A	800 A	2x 4C - 150 mm ² AL	BUS A	M4	800/1 A	a)	-
11	ESS-044 HVAC MCC INCOMER 1	ESS-044-HVAC-1	450 kW	710 A	800 A	3x 4C - 240 mm ² AL	BUS A	M4	800/1 A	a)	-
12	044-MCC-107 INCOMER 1	044-MCC-107 A	399 kW	630 A	800 A	3x 4C - 185 mm ² AL	BUS A	M4	800/1 A	a)	-
13	044-UPS 101 NOM. POWER 100 KVA (DCS/ESD) INCOMER 1 - CHARGER	044-UPS-101 A	100 KVA	158 A	200 A	2x 4C - 185 mm ² AL	BUS A	M5	-	a)	-
14	044-UPS 102 NOM. POWER 25 KVA (TELECOM, CCTV, PAGING & FDAS SYSTEM) INCOMER 1 - CHARGER	044-UPS-102 A	25 KVA	40 A	63 A	1x 4C - 95 mm ² AL	BUS A	M6	-	a)	-
15	044-DC 101 NOM. POWER 50 KVA (SWITCHGEAR CONTROL) INCOMER 1	044-DC-101 A	50 KVA	79 A	100 A	1x 4C - 150 mm ² AL	BUS A	M6	-	a)	-
16	SPARE (TYPE M4: FEEDER ≥ 630 A)	-	-	-	800 A	-	BUS A	M4	800/1 A	a)	-
17	SPARE (TYPE M5: 100 A < FEEDER < 630 A)	-	-	-	400 A	-	BUS A	M5	-	a)	-
18	SPARE (TYPE M5: 100 A < FEEDER < 630 A)	-	-	-	200 A	-	BUS A	M5	-	a)	-
19	SPARE (TYPE M6: FEEDER ≤ 100 A)	-	-	-	100 A	-	BUS A	M6	-	a)	-
20	SPARE (TYPE M6: FEEDER ≤ 100 A)	-	-	-	63 A	-	BUS A	M6	-	a)	-
21	SPARE (TYPE M10: ACB FOR MOTOR FEEDER ≥110 kW & ≤132 kW)	-	-	-	630 A	-	BUS A	M10	-	a)	-
22	SPARE (TYPE M10: ACB FOR MOTOR FEEDER ≥55 kW & ≤90 kW)	-	-	-	630 A	-	BUS A	M10	200/1 A	a)	-
23	LCO PRODUCT PUMP	1803-PM-203 B	55 kW	88 A	630 A	1x 3C - 120 mm ² AL	BUS B	M10	200/1 A	a)	3M/20
24	COMPRESSOR INTERSTAGE LIQUID PUMP	1803-PM-212 A	75 kW	119 A	630 A	1x 3C - 185 mm ² AL	BUS B	M10	200/1 A	a)	3M/20
25	LEAN OIL PUMP	1803-PM-220 B	75 kW	119 A	630 A	1x 3C - 185 mm ² AL	BUS B	M10	200/1 A	a)	3M/20
26	DISTILLATE DRUM LIQUID PUMP	1803-PM-209 A	132 kW	206 A	630 A	2x 3C - 150 mm ² AL	BUS B	M10	300/1 A	a)	3M/20
27	RICH AMINE PUMP	1803-PM-225 B	75 kW	124 A	630 A	1x 3C - 240 mm ² AL	BUS B	M10	200/1 A	a)	3M/20
28	REGENERATED CAUSTIC PUMPS (CR LPG TREATMENT PACKAGE)	1803-X-205-F-006A	90 kW	144 A	630 A	2x 3C - 95 mm ² AL	BUS B	M10	200/1 A	a)	-
29	LPG BOOSTER PUMPS (CR LPG TREATMENT PACKAGE)	1803-X-205-F-010B	125 kW	200 A	630 A	2x 3C - 185 mm ² AL	BUS B	M10	300/1 A	a)	-
30	EMERGENCY LIGHTING TRANSFORMER 415 / 433 V (044-MDB-101)	044-TR-108 A	100 KVA	139 A	400 A	1x 4C - 185 mm ² AL	BUS B	M5	-	a)	-
31	MAIN LIGHTING TRANSFORMER 0.415 / 0.433 kV (044-MDB-101)	044-TR-107 B	200 KVA	278 A	400 A	1x 4C - 300 mm ² AL	BUS B	M5	-	a)	-
32	044-ASB-101 (WELDINGSOCKETS) INCOMER 2	044-ASB-101 B	182 kW	293 A	800 A	2x 4C - 120 mm ² AL	BUS B	M4	800/1 A	a)	-
33	044-ASB-102 (WELDINGSOCKETS) INCOMER 2	044-ASB-102 B	202 kW	326 A	800 A	2x 4C - 150 mm ² AL	BUS B	M4	800/1 A	a)	-
34	ESS-044 HVAC MCC INCOMER 2	ESS-044-HVAC-2	450 kW	710 A	800 A	3x 4C - 240 mm ² AL	BUS B	M4	800/1 A	a)	-
35	044-MCC-107 INCOMER 2	044-MCC-107 B	399 kW	630 A	800 A	3x 4C - 185 mm ² AL	BUS B	M4	800/1 A	a)	-
36	044-UPS 101 NOM. POWER 100 KVA (DCS/ESD) INCOMER 3 - CHARGER	044-UPS-101 C	100 KVA	158 A	200 A	2x 4C - 185 mm ² AL	BUS B	M5	-	a)	-
37	044-UPS 102 NOM. POWER 25 KVA (TELECOM, CCTV, PAGING & FDAS SYSTEM) INCOMER 3 - CHARGER	044-UPS-102 C	25 KVA	40 A	63 A	1x 4C - 95 mm ² AL	BUS B	M6	-	a)	-
38	SPARE (TYPE M4: FEEDER ≥ 630 A)	-	-	-	800 A	-	BUS B	M4	800/1 A	a)	-
39	SPARE (TYPE M5: 100 A < FEEDER < 630 A)	-	-	-	400 A	-	BUS B	M5	-	a)	-
40	SPARE (TYPE M5: 100 A < FEEDER < 630 A)	-	-	-	200 A	-	BUS B	M5	-	a)	-
41	SPARE (TYPE M6: FEEDER ≤ 100 A)	-	-	-	63 A	-	BUS B	M6	-	a)	-
42	SPARE (TYPE M10: ACB FOR MOTOR FEEDER ≥110 kW & ≤132 kW)	-	-	-	630 A	-	BUS B	M10	300/1 A	a)	-
43	SPARE (TYPE M10: ACB FOR MOTOR FEEDER ≥55 kW & ≤90 kW)	-	-	-	630 A	-	BUS B	M10	200/1 A	a)	-

a) THIS INFORMATION SHALL BE WHEN VENDOR'S DATA ARE AVAILABLE

LEGENDS

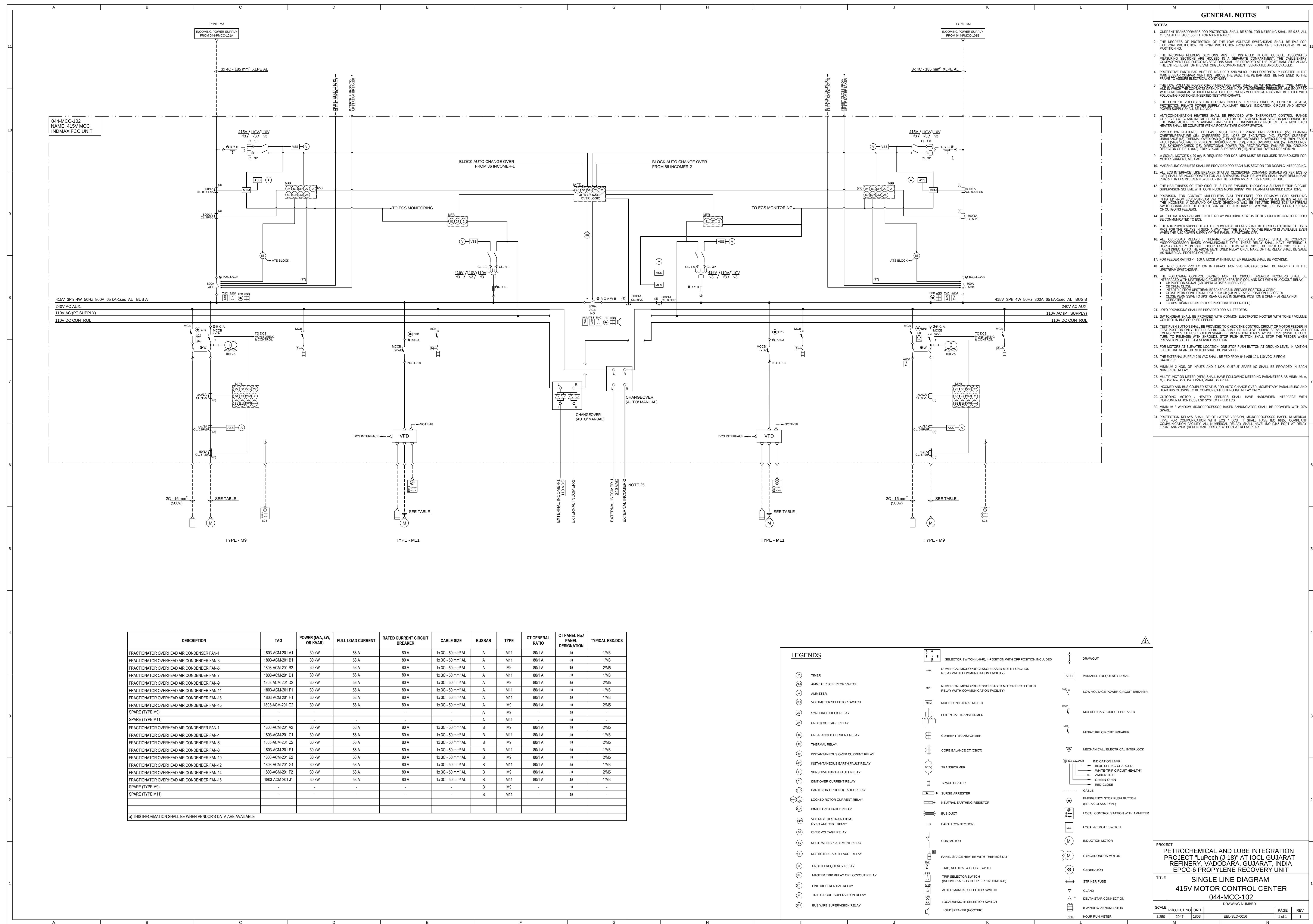


PROJECT				
PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LuPech (J-18)" AT IOCL GUJARAT REFINERY, VADODARA, GUJARAT, INDIA				
EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATMENT UNIT)				
TITLE				
SINGLE LINE DIAGRAM				
044-PMCC-103				
SCALE	PROJECT NO	UNIT	DRAWING NUMBER	PAGE
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LEGENDS		SELECTOR SWITCH (S-O-R), 4-POSITION WITH OFF POSITION INCLUDED	
	TIMER		NUMERICAL MICROPROCESSOR BASED MULTI-FUNCTION RELAY (WITH COMMUNICATION FACILITY)
	AMMETER SELECTOR SWITCH		NUMERICAL MICROPROCESSOR BASED MOTOR PROTECTION RELAY (WITH COMMUNICATION FACILITY)
	AMMETER		MULTI FUNCTIONAL METER
	VOLTMETER SELECTOR SWITCH		POTENTIAL TRANSFORMER
	SYNCHRO CHECK RELAY		CURRENT TRANSFORMER
	UNDER VOLTAGE RELAY		CORE BALANCE CT (CBCT)
	UNBALANCED CURRENT RELAY		TRANSFORMER
	THERMAL RELAY		SPACE HEATER
	INSTANTANEOUS OVER CURRENT RELAY		SURGE ARRESTER
	INSTANTANEOUS EARTH FAULT RELAY		NEUTRAL EARTHING RESISTOR
	SENSITIVE EARTH FAULT RELAY		BUS DUCT
	IDMT OVER CURRENT RELAY		EARTH CONNECTION
	EARTH (OR GROUND) FAULT RELAY		CONTACTOR
	LOCKED ROTOR CURRENT RELAY		PANEL SPACE HEATER WITH THERMOSTAT
	IDMT EARTH FAULT RELAY		TRIP, NEUTRAL & CLOSE SWITCH
	VOLTAGE RESTRAINT IDMT OVER CURRENT RELAY		TRIP SELECTOR SWITCH (INCOMER-A-BUS COUPLER / INCOMER-B)
	OVER VOLTAGE RELAY		AUTO / MANUAL SELECTOR SWITCH
	NEUTRAL DISPLACEMENT RELAY		LOCAL/REMOTE SELECTOR SWITCH
	RESTRICTED EARTH FAULT RELAY		LOUDSPEAKER (NOTIFIER)
	UNDER FREQUENCY RELAY		
	MASTER TRIP RELAY OR LOCKOUT RELAY		
	LINE DIFFERENTIAL RELAY		
	TRIP CIRCUIT SUPERVISION RELAY		
	BUS WIRE SUPERVISION RELAY		
			VARIABLE FREQUENCY DRIVE
			LOW VOLTAGE POWER CIRCUIT BREAKER
			MOLDED CASE CIRCUIT BREAKER
			MINIATURE CIRCUIT BREAKER
			MECHANICAL / ELECTRICAL INTERLOCK
			INDICATION LAMP BLUE SPRING-CHANGED WHITE TRIP CIRCUIT HEALTHY AMBER TRIP GREEN OPEN RED-CLOSE
			CABLE
			EMERGENCY STOP PUSH BUTTON (BREAK GLASS TYPE)
			LOCAL CONTROL STATION WITH AMMETER
			LOCAL-REMOTE SWITCH
			INDUCTION MOTOR
			SYNCHRONOUS MOTOR
			GENERATOR
			STRIKER FUSE
			GLAND
			DELTA-STAR CONNECTION
			8 WINDOW ANNUNCIATOR
			HOURLY RUN METER

PROJECT PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LuPech (J-18)" AT IOCL GUJARAT REFINERY, VADODARA, GUJARAT, INDIA EPPC-6 PROPYLENE RECOVERY UNIT					
TITLE SINGLE LINE DIAGRAM 415V MOTOR CONTROL CENTER 044-MCC-101					
DRAWING NUMBER					
SCALE	PROJECT NO	UNIT	EEL-SLD-0015	PAGE	REV
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S. No.	DESCRIPTION	TAG	POWER (kVA, kW, OR KVAR)	FULL LOAD CURRENT	RATED CURRENT CIRCUIT BREAKER	CABLE SIZE	BUSBAR	TYPE	CT GENERAL RATIO	CT PANEL No./ PANEL DESIGNATION	TYPICAL ESDDCS (NOTE b)
1	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-17	1803-ACM-201 K1	30 kW	46.4 A	100 A	1x 3C - 50 mm ² AL	A	M11	100/1 A	a)	1M3
2	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-19	1803-ACM-201 J2	30 kW	46.4 A	100 A	1x 3C - 50 mm ² AL	A	M9	100/1 A	a)	2M5
3	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-21	1803-ACM-201 M1	30 kW	46.4 A	100 A	1x 3C - 50 mm ² AL	A	M11	100/1 A	a)	1M3
4	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-23	1803-ACM-201 L2	30 kW	46.4 A	100 A	1x 3C - 70 mm ² AL	A	M9	100/1 A	a)	2M5
5	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-25	1803-ACM-201 N1	30 kW	46.4 A	100 A	1x 3C - 70 mm ² AL	A	M11	100/1 A	a)	1M3
6	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-27	1803-ACM-201 N2	30 kW	46.4 A	100 A	1x 3C - 70 mm ² AL	A	M9	100/1 A	a)	2M5
7	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-29	1803-ACM-201 Q1	30 kW	46.4 A	100 A	1x 3C - 70 mm ² AL	A	M11	100/1 A	a)	1M3
8	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-31	1803-ACM-201 Q2	30 kW	46.4 A	100 A	1x 3C - 70 mm ² AL	A	M9	100/1 A	a)	2M5
9	SPARE (TYPE M9: DOL MOTOR STARTER ≥ 30 kW & < 55 kW)	-	-	-	100 A	-	A	M9	100/1 A	a)	-
10	SPARE (TYPE M11: VFD FED MOTOR FEEDER < 55 kW)	-	-	-	100 A	-	A	M11	100/1 A	a)	-
11	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-18	1803-ACM-201 H2	30 kW	46.4 A	100 A	1x 3C - 50 mm ² AL	B	M9	100/1 A	a)	2M5
12	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-20	1803-ACM-201 L1	30 kW	46.4 A	100 A	1x 3C - 50 mm ² AL	B	M11	100/1 A	a)	1M3
13	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-22	1803-ACM-201 K2	30 kW	46.4 A	100 A	1x 3C - 50 mm ² AL	B	M9	100/1 A	a)	2M5
14	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-24	1803-ACM-201 M2	30 kW	46.4 A	100 A	1x 3C - 70 mm ² AL	B	M9	100/1 A	a)	2M5
15	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-26	1803-ACM-201 P1	30 kW	46.4 A	100 A	1x 3C - 70 mm ² AL	B	M11	100/1 A	a)	1M3
16	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-28	1803-ACM-201 P2	30 kW	46.4 A	100 A	1x 3C - 70 mm ² AL	B	M9	100/1 A	a)	2M5
17	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-30	1803-ACM-201 R1	30 kW	46.4 A	100 A	1x 3C - 70 mm ² AL	B	M11	100/1 A	a)	1M3
18	FRACTIONATOR OVERHEAD AIR CONDENSER FAN-32	1803-ACM-201 R2	30 kW	46.4 A	100 A	1x 3C - 70 mm ² AL	B	M9	100/1 A	a)	2M5
19	SPARE (TYPE M9: DOL MOTOR STARTER ≥ 30 kW & < 55 kW)	-	-	-	100 A	-	B	M11	100/1 A	a)	-
20	SPARE (TYPE M11: VFD FED MOTOR FEEDER < 55 kW)	-	-	-	100 A	-	B	M9	100/1 A	a)	-

a) THIS INFORMATION SHALL BE WHEN VENDORS DATA ARE AVAILABLE
b) FOR MOTOR TYPICAL SCHEMES SEE DRAWINGS NO. 2047-1803-EPR-PID-0008-01 AND 2047-1803-EPR-PID-0008-02

LEGENDS



GENERAL NOTES

- CURRENT TRANSFORMERS FOR PROTECTION SHALL BE SP20, FOR METERING SHALL BE 0.5S. ALL CTS SHALL BE ACCESSIBLE FOR MAINTENANCE.
- THE DEGREES OF PROTECTION OF THE LOW VOLTAGE SWITCHGEAR SHALL BE I42 FOR EXTERNAL PROTECTION, INTERNAL PROTECTION FROM PFA FORM OF SEPARATION AS METAL PARTING.
- THE INCOMING FEEDERS SECTIONS MUST BE INSTALLED IN ONE CIRCLE ASSOCIATED MEASURING SECTIONS ARE HOUSED IN A SEPARATE COMPARTMENT. THE CABLEENTRY COMPARTMENT FOR OUTGOING SECTIONS SHALL BE PROVIDED AT THE RIGHT HAND SIDE ALONG THE ENTIRE HEIGHT OF THE SWITCHGEAR COMPARTMENT. SEPARATED AND LOCKABLE.
- PROTECTIVE EARTH BAR MUST BE INCLUDED, AND WHICH RUN HORIZONTALLY LOCATED IN THE MAIN BUSBAR COMPARTMENT JUST ABOVE THE BASE. THE PE BAR MUST BE FASTENED TO THE FRAME TO ASSURE ELECTRICAL CONTINUITY.
- THE LOW VOLTAGE POWER CIRCUIT BREAKER (ACB) SHALL BE WITHDRAWABLE TYPE 4XP/6 AND IN WHICH THE CONTACTS OPEN AND CLOSE IN AIR ATMOSPHERIC PRESSURE, AND EQUIPPED WITH A MECHANICAL STORED ENERGY OPERATING MECHANISM. ACB SHALL BE FITTED WITH FOLLOWING POSITIONS: INSERTED-TEST-WITHDRAWN.
- THE CONTROL VOLTAGES FOR CLOSING CIRCUITS, TRIPPING CIRCUITS, CONTROL SYSTEM PROTECTION RELAYS POWER SUPPLY, AUXILIARY RELAYS, INDICATION CIRCUIT AND MOTOR POWER SUPPLY SHALL BE 110 VDC.
- ANTI-CONDENSATION HEATERS SHALL BE PROVIDED WITH THERMOSTAT CONTROL. RANGE OF 10°C TO 40°C AND INSTALLED AT THE BOTTOM OF EACH VERTICAL SECTION ACCORDING TO THE MANUFACTURER'S STANDARD AND SHALL BE INDIVIDUALLY PROTECTED BY MCB. EACH HEATER SHALL BE COMPLETE WITH A RATED TYPE ON/OFF SWITCH.
- PROTECTION FEATURES, AT LEAST, MUST INCLUDE: PHASE UNDERVOLTAGE (27), BEARING OVERTEMPERATURE (58), OVERSPEED (42), LOSS OF EXCITATION (40), STATOR CURRENT UNBALANCE (46), THERMAL OVERLOAD (48), PHASE INSTANTANEOUS OVERCURRENT (50P), EARTH FAULT (51), VOLTAGE DEPENDENT OVERCURRENT (51V), PHASE OVERVOLTAGE (59), FREQUENCY (61), SYNCHRO-CHECK (2A), DIRECTIONAL POWER (32), RECTIFICATION FAILURE (38), GROUND DETECTOR OF FIELD (45), TRIP CIRCUIT SUPERVISION (56), NEUTRAL OVERCURRENT (50N).
- A SIGNAL MOTOR'S 4-20 mA IS REQUIRED FOR DCS. MPR MUST BE INCLUDED TRANSDUCER FOR MOTOR CURRENT, AT LEAST.
- MARKING CABINETS SHALL BE PROVIDED FOR EACH BUS SECTION FOR DCS/PLC INTERFACE.
- ALL DCS INTERFACE LINE BREAKER STATUS, CLOSURE COMMAND SIGNALS AS PER ECS 10 LIST SHALL BE INCORPORATED FOR ALL BREAKERS. EACH RELAYED SHALL HAVE REDUNDANT POINTS FOR ECS INTERFACE WHICH SHALL BE SHOWN AS PER ECS ARCHITECTURE.
- THE HEALTHINESS OF "TRIP CIRCUIT" IS TO BE ENSURED THROUGH A SUITABLE "TRIP CIRCUIT SUPERVISION SCHEME WITH CONTINUOUS MONITORING" WITH ALARM AT MANNED LOCATIONS.
- PROVISION FOR CONTACT MULTIPLEXERS (VIA TYPE-FREE) FOR PRIMARY LOAD SHEDDING INITIATED FROM ECS/UPSTREAM SWITCHGEAR. THE AUXILIARY RELAY SHALL BE INSTALLED IN THE INCOMER. A COMMAND OF LOAD SHEDDING WILL BE INITIATED FROM ECS/UPSTREAM SWITCHGEAR AND THE OUTPUT CONTACT OF AUXILIARY RELAYS WILL BE USED FOR TRIPPING OF OUTGOING FEEDERS.
- ALL THE DATA IS AVAILABLE IN THE RELAY INCLUDING STATUS OF DI SHOULD BE CONSIDERED TO BE COMMUNICATED TO ECS.
- THE AUX POWER SUPPLY OF ALL THE NUMERICAL RELAYS SHALL BE THROUGH DEDICATED FUSES AND FOR THE RELAYS IN SUCH A WAY THAT THE SUPPLY TO THE RELAYS IS AVAILABLE EVEN WHEN THE AUX POWER SUPPLY OF THE PANEL IS SWITCHED OFF.
- ALL OVERLOAD RELAYS / THERMAL RELAYS OVERLOAD RELAYS SHALL BE COMPACT MICROPROCESSOR BASED COMMUNICABLE TYPE. THESE RELAY SHALL HAVE METERING & DISPLAY FACILITY ON PANEL DOOR. FOR FEEDERS WITH CBCT THE INPUT OF CBCT SHALL BE TAKEN DIRECTLY TO THE ABOVE MENTIONED RELAY ONLY. NONE OF THE RELAY SHALL BE SAME AS NUMERICAL PROTECTION RELAY.
- FOR FEEDER RATING < 100 A, MCCB WITH INBUILT EF RELEASE SHALL BE PROVIDED.
- ALL NECESSARY PROTECTION INTERFACE FOR VFD PACKAGE SHALL BE PROVIDED IN THE UPSTREAM SWITCHGEAR.
- THE FOLLOWING CONTROL SIGNALS FOR THE CIRCUIT BREAKER INCOMERS SHALL BE INTERFACED WITH UPSTREAM CIRCUIT BREAKERS TRIP COIL AND NOT WITH 8S LOCKOUT RELAY:
 - CB OPEN CLOSE
 - INTERTRIP FROM UPSTREAM BREAKER (CB IN SERVICE POSITION & OPEN)
 - CLOSE PERMISSIVE FROM UPSTREAM CB (CB IN SERVICE POSITION & CLOSED)
 - CLOSE PERMISSIVE TO UPSTREAM CB (CB IN SERVICE POSITION & OPEN & 8S RELAY NOT OPERATED)
 - TO UPSTREAM BREAKER (TEST POSITION 8S OPERATED)
- LOTO PROVISIONS SHALL BE PROVIDED FOR ALL FEEDERS.
- SWITCHGEAR SHALL BE PROVIDED WITH COMMON ELECTRONIC HOOTER WITH TONE / VOLUME CONTROL IN BUS COUPLER FEEDER.
- TEST PUSH BUTTON SHALL BE PROVIDED TO CHECK THE CONTROL CIRCUIT OF MOTOR FEEDER IN TEST POSITION ONLY. TEST PUSH BUTTON SHALL BE INACTIVE DURING SERVICE POSITION. ALL EMERGENCY STOP PUSH BUTTON SHALL BE MUSHROOM HEAD STAY PUT TYPE (PUSH TO LOCK, TURN TO RELEASE) WITH SHROUDS. STOP PUSH BUTTON SHALL STOP THE FEEDER WHEN PRESSED IN BOTH TEST & SERVICE POSITION.
- FOR MOTORS AT ELEVATED LOCATION, ONE STOP PUSH BUTTON AT GROUND LEVEL IN ADDITION TO THE ONE NEAR THE MOTOR SHALL BE PROVIDED.
- THE EXTERNAL SUPPLY 240 VAC SHALL BE FED FROM 044-ASB-101. 110 VDC IS FROM 044-DC-102.
- MINIMUM 2 NOS. OF INPUTS AND 2 NOS. OUTPUT SPARE I/O SHALL BE PROVIDED IN EACH NUMERICAL RELAY.
- MULTIFUNCTION METER (MFM) SHALL HAVE FOLLOWING METERING PARAMETERS AS MINIMUM: A, V, F, kW, MW, kVA, kWh, kVAh, kWh, kVAR, kVAR, PF.
- INCOMER AND BUS COUPLER STATUS FOR AUTO CHANGE OVER, MOMENTARY PARALLELING AND DEAD BUS CLOSING TO BE COMMUNICATED THROUGH RELAY ONLY.
- OUTGOING, MOTOR / HEATER FEEDERS SHALL HAVE HARDWIRED INTERFACE WITH INSTRUMENTATION DCS/SYSTEM FIELD LCU.
- MINIMUM 8 WINDOW MICROPROCESSOR BASED ANNUNCIATOR SHALL BE PROVIDED WITH 20% SPARE.
- PROTECTION RELAYS SHALL BE OF LATEST VERSION, MICROPROCESSOR BASED NUMERICAL TYPE FOR COMMUNICATION WITH ECS. IT SHALL HAVE IEC 61850 COMPLIANT COMMUNICATION FACILITY. ALL NUMERICAL RELAY SHALL HAVE 24 RS485 PORT AT RELAY FRONT AND 24VDC REDUNDANT PORT IS 45 PORT AT RELAY REAR.
- FOR THE TYPE OF SCHEME SEE DRAWING NO. 2047-1803-EEL-05D-002 "TYPICAL METERING AND PROTECTION SCHEMATIC DIAGRAM FOR MV SWITCHBOARDS"

PROJECT
PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LuPech (J-18)" AT IOCL GUJARAT REFINERY, VADODARA, GUJARAT, INDIA
EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT)

TITLE
SINGLE LINE DIAGRAM
415V MOTOR CONTROL CENTER
044-MCC-103

SCALE
PROJECT NO. UNIT
1.250 2047 1803 EEL-SLD-0017

DRAWING NUMBER
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S. No.	DESCRIPTION	TAG	POWER (kVA, kW, OR KVAR)	FULL LOAD CURRENT	RATED CURRENT CIRCUIT BREAKER	CABLE SIZE	BUSBAR	TYPE	CT GENERAL RATIO	CT PANEL No./ PANEL DESIGNATION	TYPICAL ESD/DCS (NOTE B)
1	LCO PUMP/ROUND AIR COOLER FAN-1	1803-ACM-202 A1	3.7 kW	5.7 A	32 A	1x 3C - 10 mm ² Cu	A	M8	151 A	a)	2M5
2	DEBUTANIZER OVERHEAD AIR CONDENSER FAN-1	1803-ACM-207 A1	22 kW	34 A	50 A	1x 3C - 95 mm ² AL	A	M8	501 A	a)	2M5
3	DEBUTANIZER OVERHEAD AIR CONDENSER FAN-4	1803-ACM-207 D1	22 kW	34 A	50 A	1x 3C - 95 mm ² AL	A	M8	501 A	a)	2M5
4	DEBUTANIZER OVERHEAD AIR CONDENSER FAN-6	1803-ACM-207 B2	22 kW	34 A	50 A	1x 3C - 95 mm ² AL	A	M8	501 A	a)	2M5
5	DEBUTANIZER OVERHEAD AIR CONDENSER FAN-8	1803-ACM-207 D2	22 kW	34 A	50 A	1x 3C - 95 mm ² AL	A	M8	501 A	a)	2M5
6	CONDENSATE FLASH DRUM AIR COOLER FAN-2	1803-ACM-401 B	3.7 kW	5.7 A	32 A	1x 3C - 4 mm ² Cu	A	M8	151 A	a)	2M5
7	COMPRESSOR INTERSTAGE AIR CONDENSER FAN-1	1803-ACM-204 A1	37 kW	57.2 A	100 A	1x 3C - 95 mm ² AL	A	M9	1001 A	a)	2M5
8	COMPRESSOR INTERSTAGE AIR CONDENSER FAN-3	1803-ACM-204 C1	37 kW	57.2 A	100 A	1x 3C - 95 mm ² AL	A	M9	1001 A	a)	2M5
9	COMPRESSOR INTERSTAGE AIR CONDENSER FAN-5	1803-ACM-204 A2	37 kW	57.2 A	100 A	1x 3C - 95 mm ² AL	A	M9	1001 A	a)	2M5
10	COMPRESSOR INTERSTAGE AIR CONDENSER FAN-7	1803-ACM-204 C2	37 kW	57.2 A	100 A	1x 3C - 95 mm ² AL	A	M9	1001 A	a)	2M5
11	SPARE (TYPE M8: DOL MOTOR STARTER < 30 kW)	-	-	-	32 A	-	A	M8	151 A	a)	-
12	SPARE (TYPE M8: DOL MOTOR STARTER < 30 kW)	-	-	-	50 A	-	A	M8	501 A	a)	-
13	SPARE (TYPE M8: DOL MOTOR STARTER < 30 kW & < 55 kW)	-	-	-	100 A	-	A	M9	1001 A	a)	-
14	LCO PUMP/ROUND AIR COOLER FAN-2	1803-ACM-202 B1	3.7 kW	5.7 A	32 A	1x 3C - 10 mm ² Cu	B	M11	151 A	a)	1M3
15	DEBUTANIZER OVERHEAD AIR CONDENSER FAN-1	1803-ACM-207 B1	22 kW	34 A	50 A	1x 3C - 95 mm ² AL	B	M8	501 A	a)	2M5
16	DEBUTANIZER OVERHEAD AIR CONDENSER FAN-3	1803-ACM-207 C1	22 kW	34 A	50 A	1x 3C - 95 mm ² AL	B	M8	501 A	a)	2M5
17	DEBUTANIZER OVERHEAD AIR CONDENSER FAN-5	1803-ACM-207 A2	22 kW	34 A	50 A	1x 3C - 95 mm ² AL	B	M8	501 A	a)	2M5
18	DEBUTANIZER OVERHEAD AIR CONDENSER FAN-7	1803-ACM-207 C2	22 kW	34 A	50 A	1x 3C - 95 mm ² AL	B	M8	501 A	a)	2M5
19	CONDENSATE FLASH DRUM AIR COOLER FAN-1	1803-ACM-401 A	3.7 kW	5.7 A	32 A	1x 3C - 4 mm ² Cu	B	M8	151 A	a)	2M5
20	COMPRESSOR INTERSTAGE AIR CONDENSER FAN-2	1803-ACM-204 B1	37 kW	57.2 A	100 A	1x 3C - 95 mm ² AL	B	M9	1001 A	a)	2M5
21	COMPRESSOR INTERSTAGE AIR CONDENSER FAN-4	1803-ACM-204 D1	37 kW	57.2 A	100 A	1x 3C - 95 mm ² AL	B	M9	1001 A	a)	2M5
22	COMPRESSOR INTERSTAGE AIR CONDENSER FAN-6	1803-ACM-204 B2	37 kW	57.2 A	100 A	1x 3C - 95 mm ² AL	B	M9	1001 A	a)	2M5
23	COMPRESSOR INTERSTAGE AIR CONDENSER FAN-8	1803-ACM-204 D2	37 kW	57.2 A	100 A	1x 3C - 95 mm ² AL	B	M9	1001 A	a)	2M5
24	SPARE (TYPE M8: DOL MOTOR STARTER < 30 kW)	-	-	-	32 A	-	B	M8	151 A	a)	-
25	SPARE (TYPE M8: DOL MOTOR STARTER < 30 kW)	-	-	-	50 A	-	B	M8	501 A	a)	-
26	SPARE (TYPE M8: DOL MOTOR STARTER > 30 kW & < 55 kW)	-	-	-	100 A	-	B	M9	1001 A	a)	-
27	SPARE (TYPE M11: VFD FED MOTOR FEEDER < 55 kW)	-	-	-	32 A	-	B	M11	151 A	a)	-

a) THIS INFORMATION SHALL BE WHEN VENDORS DATA ARE AVAILABLE
b) FOR MOTOR TYPICAL SCHEMES SEE DRAWINGS NO. 2047-1803-EPR-PID-0008-01 AND 2047-1803-EPR-PID-0008-02.

LEGENDS

2	TIMER		MFR	NUMERICAL MICROPROCESSOR BASED MULTI-FUNCTION RELAY (WITH COMMUNICATION FACILITY)	VFD	VARIABLE FREQUENCY DRIVE
ASB	AMMETER SELECTOR SWITCH		MPR	NUMERICAL MICROPROCESSOR BASED MOTOR PROTECTION RELAY (WITH COMMUNICATION FACILITY)	MCB	LOW VOLTAGE POWER CIRCUIT BREAKER
A	AMMETER				MCB	MOLDED CASE CIRCUIT BREAKER
VS	VOLTMETER SELECTOR SWITCH		MFM	MULTI FUNCTIONAL METER	MCB	MINIATURE CIRCUIT BREAKER
SC	SYNCHRO CHECK RELAY				MECH/ELEC	MECHANICAL / ELECTRICAL INTERLOCK
UR	UNDER VOLTAGE RELAY				R-G-A-W-B	INDICATION LAMP BLUE-SPRING CHARGED WHITE-TRIP CIRCUIT HEALTHY AMBER-TRIP GREEN-OPEN RED-CLOSE
UR	UNBALANCED CURRENT RELAY				—	CABLE
IR	INSTANTANEOUS OVER CURRENT RELAY				—	EMERGENCY STOP PUSH BUTTON (BREAK GLASS TYPE)
IR	INSTANTANEOUS EARTH FAULT RELAY				—	LOCAL CONTROL STATION WITH AMMETER
SR	SENSITIVE EARTH FAULT RELAY				—	LOCAL-REMOTE SWITCH
IR	IDMT OVER CURRENT RELAY				—	INDUCTION MOTOR
IR	EARTH (OR GROUND) FAULT RELAY				—	SYNCHRONOUS MOTOR
IR	LOCKED ROTOR CURRENT RELAY				—	GENERATOR
IR	IDMT EARTH FAULT RELAY				—	FUSE
IR	VOLTAGE RESTRAINT IDMT OVER CURRENT RELAY				—	GLAND
IR	OVER VOLTAGE RELAY				—	DELTA-STAR CONNECTION
IR	NEUTRAL DISPLACEMENT RELAY				—	8 WINDOW ANNUNCIATOR
IR	RESTRICTED EARTH FAULT RELAY				—	—
IR	UNDER FREQUENCY RELAY				—	—
IR	MASTER TRIP RELAY OR LOCKOUT RELAY				—	—
IR	LINE DIFFERENTIAL RELAY				—	—
IR	TRIP CIRCUIT SUPERVISION RELAY				—	—
IR	BUS WIRE SUPERVISION RELAY				—	—

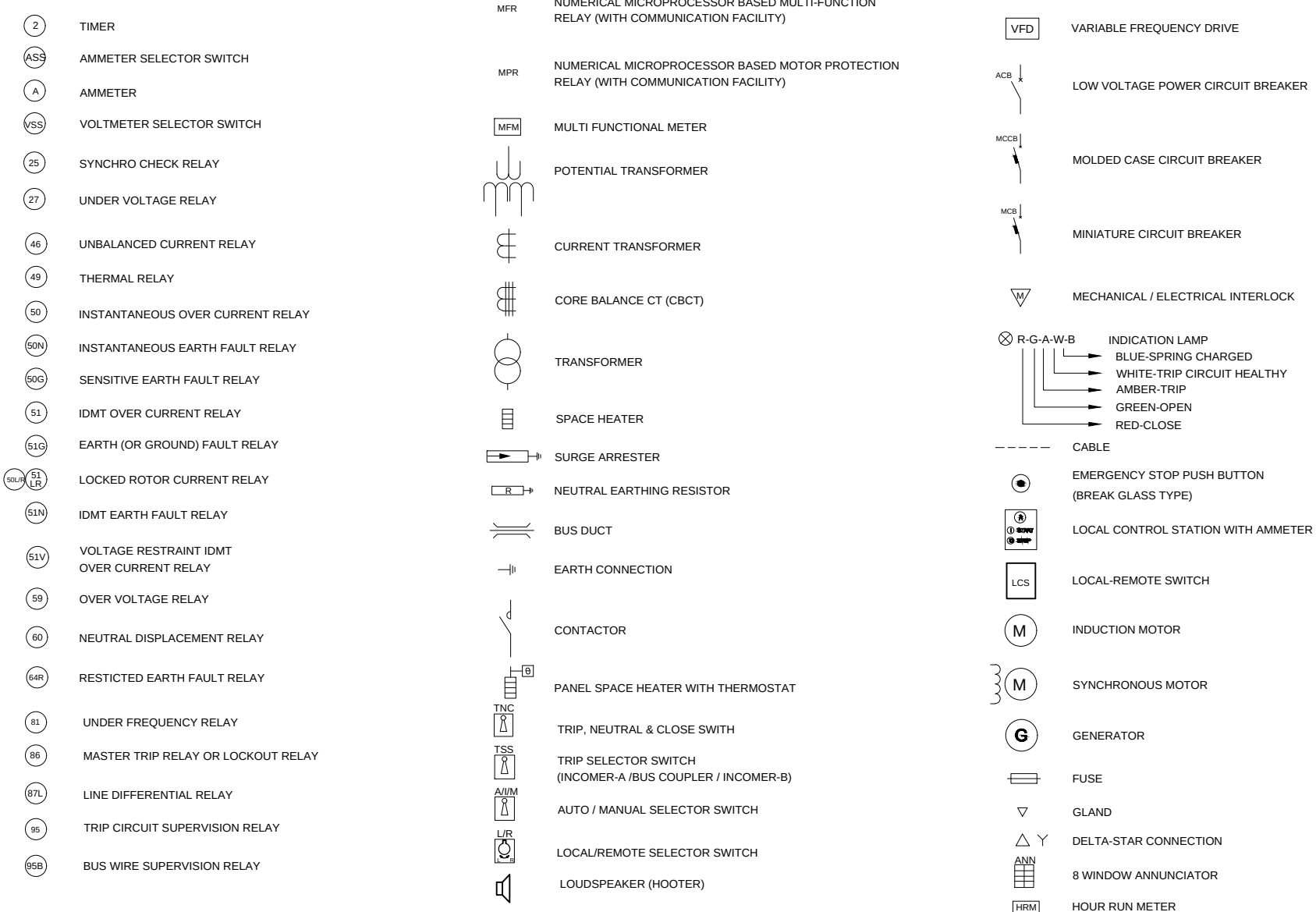
GENERAL NOTES

- CURRENT TRANSFORMERS FOR PROTECTION SHALL BE 5P20, FOR METERING SHALL BE 0.5S. ALL CTS SHALL BE ACCESSIBLE FOR MAINTENANCE.
- THE DEGREE OF PROTECTION OF THE LOW VOLTAGE SWITCHGEAR SHALL BE I42 FOR EXTERNAL PROTECTION, INTERNAL PROTECTION FROM PFA FORM OF SEPARATION AS PER PART 1.
- THE INCOMING FEEDERS SECTIONS MUST BE INSTALLED IN ONE CIRCULE ASSOCIATED MEASURING SECTIONS ARE HOUSED IN A SEPARATE COMPARTMENT. THE CABLE ENTRY COMPARTMENT FOR OUTGOING SECTIONS SHALL BE PROVIDED AT THE RIGHT HAND SIDE ALONG THE ENTIRE HEIGHT OF THE SWITCHGEAR COMPARTMENT. SEPARATED AND LOCKABLE.
- PROTECTIVE EARTH BAR MUST BE INCLUDED, AND WHICH RUN HORIZONTALLY LOCATED IN THE MAIN BUSBAR COMPARTMENT JUST ABOVE THE BASE. THE PE BAR MUST BE FASTENED TO THE FRAME TO ASSURE ELECTRICAL CONTINUITY.
- THE LOW VOLTAGE POWER CIRCUIT BREAKER (ACB) SHALL BE WITHDRAWABLE TYPE (ACB) AND IN WHICH THE CONTACTS OPEN AND CLOSE IN AIR ATMOSPHERE PREARRANGE, AND BE WITH MECHANICAL STORED ENERGY OPERATING MECHANISM. ACB SHALL BE FITTED WITH FOLLOWING POSITIONS: INSERTED-TEST-WITHDRAWN.
- THE CONTROL VOLTAGES FOR CLOSING CIRCUITS, TRIPPING CIRCUITS, CONTROL SYSTEM PROTECTION RELAYS POWER SUPPLY, AUXILIARY RELAYS, INDICATION CIRCUIT AND MOTOR POWER SUPPLY SHALL BE 110 VDC.
- ANTI-CONDENSATION HEATERS SHALL BE PROVIDED WITH THERMOSTAT CONTROL. RANGE OF 10°C TO 40°C AND INSTALLED AT THE BOTTOM OF EACH VERTICAL SECTION (ACCORDING TO THE MANUFACTURER'S STANDARD) AND SHALL BE INDIVIDUALLY PROTECTED BY MCB. EACH HEATER SHALL BE COMPLETE WITH A THERMISTOR TYPE ON/OFF SWITCH.
- PROTECTION FEATURES, AT LEAST, MUST INCLUDE: PHASE UNDERVOLTAGE (27), BEARING OVERTEMPERATURE (58), OVERSPEED (63), LOSS OF EXCITATION (40), STATOR CURRENT UNBALANCE (66), THERMAL OVERLOAD (48), PHASE INSTANTANEOUS OVERCURRENT (50), EARTH FAULT (50), VOLTAGE DEPENDENT OVERCURRENT (51), PHASE OVERVOLTAGE (59), FREQUENCY (61), SYNCHRO-CHECK (26), DIRECTIONAL POWER (32), RECTIFICATION FAILURE (38), GROUND DETECTOR OF FIELD (64), TRIP CIRCUIT SUPERVISION (56), NEUTRAL OVERCURRENT (50).
- A SIGNAL MOTOR'S 4-20 mA IS REQUIRED FOR DCS. MPR MUST BE INCLUDED TRANSDUCER FOR MOTOR CURRENT, AT LEAST.
- MARKING CABLES SHALL BE PROVIDED FOR EACH BUS SECTION FOR DCS/PLC INTERFACING.
- ALL DCS INTERFACE LINE BREAKER STATUS, CLOSURE/COMMAND SIGNALS AS PER ECS 10 LIST SHALL BE INCORPORATED FOR ALL BREAKERS. EACH RELAYED SHALL HAVE REDUNDANT POINTS FOR ECS INTERFACES WHICH SHALL BE SHOWN AS PER ECS ARCHITECTURE.
- THE HEALTHINESS OF "TRIP CIRCUIT" IS TO BE ENSURED THROUGH A SUITABLE "TRIP CIRCUIT SUPERVISION SCHEME WITH CONTINUOUS MONITORING" WITH ALARM AT MANNED LOCATIONS.
- PROVISION FOR CONTACT MULTIPLIERS (VAI TYPE FREE) FOR PRIMARY LOAD SHEDDING INITIATED FROM ECS/UPSTREAM SWITCHGEAR. THE AUXILIARY RELAY SHALL BE INSTALLED IN THE INCOMER. A COMMAND OF LOAD SHEDDING WILL BE INITIATED FROM ECS/UPSTREAM SWITCHGEAR AND THE OUTPUT CONTACT OF AUXILIARY RELAYS WILL BE USED FOR TRIPPING OF OUTGOING FEEDERS.
- ALL THE DATA AVAILABLE IN THE RELAY INCLUDING STATUS OF DI SHOULD BE CONSIDERED TO BE COMMUNICATED TO ECS.
- THE AUX POWER SUPPLY OF ALL THE NUMERICAL RELAYS SHALL BE THROUGH DEDICATED FUSES AND FOR THE RELAYS IN SUCH A WAY THAT THE SUPPLY TO THE RELAYS IS AVAILABLE EVEN WHEN THE AUX POWER SUPPLY OF THE PANEL IS SWITCHED OFF.
- ALL OVERLOAD RELAYS / THERMAL RELAYS OVERLOAD RELAYS SHALL BE COMPACT MICROPROCESSOR BASED COMMUNICABLE TYPE. THESE RELAY SHALL HAVE METERING & DISPLAY FACILITY ON PANEL COOL FOR FEEDERS WITH CBCT. THE INPUT OF CBCT SHALL BE GIVEN DIRECTLY TO THE ABOVE MENTIONED RELAY ONLY. NONE OF THE RELAY SHALL BE SAME AS NUMERICAL PROTECTION RELAY.
- FOR FEEDER RATING < 100 A, MCB WITH INBUILT EF RELEASE SHALL BE PROVIDED.
- ALL NECESSARY PROTECTION INTERFERENCE FOR VFD PACKAGE SHALL BE PROVIDED IN THE UPSTREAM SWITCHGEAR.
- THE FOLLOWING CONTROL SIGNALS FOR THE CIRCUIT BREAKER INCOMERS SHALL BE INTERFACED WITH UPSTREAM CIRCUIT BREAKERS TRIP COIL AND NOT WITH 5S LOCKOUT RELAY.
 - CB OPEN/CLOSE
 - INTERTRIP FROM UPSTREAM BREAKER (CB IN SERVICE POSITION & OPEN)
 - CLOSE PERMISSIVE FROM UPSTREAM CB (CB IN SERVICE POSITION & CLOSED)
 - CLOSE PERMISSIVE TO UPSTREAM CB (CB IN SERVICE POSITION & OPEN & 8S RELAY NOT OPERATED)
 - TO UPSTREAM BREAKER (TEST POSITION 8S OPERATED)
- LOTO PROVISIONS SHALL BE PROVIDED FOR ALL FEEDERS.
- TEST PUSH BUTTON SHALL BE PROVIDED TO CHECK THE CONTROL CIRCUIT OF MOTOR FEEDER IN TEST POSITION ONLY. TEST PUSH BUTTON SHALL BE INACTIVE DURING SERVICE POSITION. ALL EMERGENCY STOP PUSH BUTTON SHALL BE MUSHROOM HEAD STAY PUT TYPE (PUSH TO LOCK, TURN TO RELEASE) WITH SHROUDS. STOP PUSH BUTTON SHALL STOP THE FEEDER WHEN PRESSED IN BOTH TEST & SERVICE POSITION.
- FOR MOTORS AT ELEVATED LOCATION, ONE STOP PUSH BUTTON AT GROUND LEVEL IN ADDITION TO THE ONE NEAR THE MOTOR SHALL BE PROVIDED.
- THE EXTERNAL SUPPLY 240 VAC SHALL BE FED FROM 044-ASB-101. 110 VDC IS FROM 044-DC-102.
- MINIMUM 2 NOS. OF INPUTS AND 2 NOS. OUTPUT SPARE I/O SHALL BE PROVIDED IN EACH NUMERICAL RELAY.
- MULTIFUNCTION METER (MFM) SHALL HAVE FOLLOWING METERING PARAMETERS AS MINIMUM: A, V, F, kW, MW, kVA, kWh, kVAh, kWh, kvarh, kvar, pf.
- INCOMER AND BUS COUPLER STATUS FOR AUTO CHANGE OVER, MOMENTARY PARALLELING AND DEAD BUS CLOSING TO BE COMMUNICATED THROUGH RELAY ONLY.
- OUTGOING, MOTOR / HEATER FEEDERS SHALL HAVE HARDWIRED INTERFACE WITH INSTRUMENTATION 20-50 SYSTEM FIELD LCS.
- MINIMUM 8 WINDOW MICROPROCESSOR BASED ANNUNCIATOR SHALL BE PROVIDED WITH 20% SPARE.
- PROTECTION RELAYS SHALL BE OF LATEST VERSION, MICROPROCESSOR BASED NUMERICAL TYPE FOR COMMUNICATION WITH ECS. IT SHALL HAVE IEC 61850 COMPLIANT COMMUNICATION FACILITY. ALL NUMERICAL RELAY SHALL HAVE 120 R45 PORT AT RELAY FRONT AND 20% REDUNDANT PORT (R45) PORT AT RELAY REAR.
- FOR THE TYPE OF SCHEME SEE DRAWING NO. 2047-1803-EEL-050-002 "TYPICAL METERING AND PROTECTION SCHEMATIC DIAGRAM FOR MV SWITCHGEAR"

PROJECT	PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LuPech (J-18)" AT IOCL GUJARAT REFINERY, VADODARA, GUJARAT, INDIA			
TITLE	SINGLE LINE DIAGRAM 415V MOTOR CONTROL CENTER 044-MCC-104			
SCALE	PROJECT NO	UNIT	PAGE	REV
1:250	2047	1803	EEL-SLD-0018	1 of 1

S. No.	DESCRIPTION	TAG	POWER (KVA, KW, OR KVAR)	FULL LOAD CURRENT	RATED CURRENT CIRCUIT BREAKER	CABLE SIZE	BUSBAR	TYPE	CT GENERAL RATIO	CT PANEL No./ PANEL DESIGNATION	TYPICAL ESD/DCS (NOTE b)
1	HIGH PRESSURE AIR CONDENSER FAN-1	1803-ACM-205 A1	18.5 KW	28.6 A	50 A	1x 3C - 50 mm ² AL	A	M8	50/1 A	a)	2/M5
2	HIGH PRESSURE AIR CONDENSER FAN-3	1803-ACM-205 C1	18.5 KW	28.6 A	50 A	1x 3C - 50 mm ² AL	A	M8	50/1 A	a)	2/M5
3	HIGH PRESSURE AIR CONDENSER FAN-5	1803-ACM-205 E1	18.5 KW	28.6 A	50 A	1x 3C - 50 mm ² AL	A	M8	50/1 A	a)	2/M5
4	HIGH PRESSURE AIR CONDENSER FAN-7	1803-ACM-205 G1	18.5 KW	28.6 A	50 A	1x 3C - 50 mm ² AL	A	M8	50/1 A	a)	2/M5
5	HIGH PRESSURE AIR CONDENSER FAN-9	1803-ACM-205 A2	18.5 KW	28.6 A	50 A	1x 3C - 50 mm ² AL	A	M8	50/1 A	a)	2/M5
6	HIGH PRESSURE AIR CONDENSER FAN-11	1803-ACM-205 C2	18.5 KW	28.6 A	50 A	1x 3C - 50 mm ² AL	A	M8	50/1 A	a)	2/M5
7	HIGH PRESSURE AIR CONDENSER FAN-13	1803-ACM-205 E2	18.5 KW	28.6 A	50 A	1x 3C - 70 mm ² AL	A	M8	50/1 A	a)	2/M5
8	HIGH PRESSURE AIR CONDENSER FAN-15	1803-ACM-205 G2	18.5 KW	28.6 A	50 A	1x 3C - 70 mm ² AL	A	M8	50/1 A	a)	2/M5
9	SPARE (TYPE M8: DOL MOTOR STARTER < 30 KW)	-	-	-	50 A	-	A	M8	50/1 A	a)	-
10	SPARE (TYPE M8: DOL MOTOR STARTER < 30 KW)	-	-	-	50 A	-	A	M8	50/1 A	a)	-
11	HIGH PRESSURE AIR CONDENSER FAN-2	1803-ACM-205 B1	18.5 KW	28.6 A	50 A	1x 3C - 50 mm ² AL	B	M8	50/1 A	a)	2/M5
12	HIGH PRESSURE AIR CONDENSER FAN-4	1803-ACM-205 D1	18.5 KW	28.6 A	50 A	1x 3C - 50 mm ² AL	B	M8	50/1 A	a)	2/M5
13	HIGH PRESSURE AIR CONDENSER FAN-6	1803-ACM-205 F1	18.5 KW	28.6 A	50 A	1x 3C - 50 mm ² AL	B	M8	50/1 A	a)	2/M5
14	HIGH PRESSURE AIR CONDENSER FAN-8	1803-ACM-205 H1	18.5 KW	28.6 A	50 A	1x 3C - 50 mm ² AL	B	M8	50/1 A	a)	2/M5
15	HIGH PRESSURE AIR CONDENSER FAN-10	1803-ACM-205 B2	18.5 KW	28.6 A	50 A	1x 3C - 50 mm ² AL	B	M8	50/1 A	a)	2/M5
16	HIGH PRESSURE AIR CONDENSER FAN-12	1803-ACM-205 D2	18.5 KW	28.6 A	50 A	1x 3C - 70 mm ² AL	B	M8	50/1 A	a)	2/M5
17	HIGH PRESSURE AIR CONDENSER FAN-14	1803-ACM-205 F2	18.5 KW	28.6 A	50 A	1x 3C - 70 mm ² AL	B	M8	50/1 A	a)	2/M5
18	HIGH PRESSURE AIR CONDENSER FAN-16	1803-ACM-205 H2	18.5 KW	28.6 A	50 A	1x 3C - 70 mm ² AL	B	M8	50/1 A	a)	2/M5
19	SPARE (TYPE M8: DOL MOTOR STARTER < 30 KW)	-	-	-	50 A	-	B	M8	50/1 A	a)	-
20	SPARE (TYPE M8: DOL MOTOR STARTER < 30 KW)	-	-	-	50 A	-	B	M8	50/1 A	a)	-
a) THIS INFORMATION SHALL BE WHEN VENDORS DATA ARE AVAILABLE											
b) FOR MOTOR TYPICAL SCHEMES SEE DRAWINGS NO. 2047-1803-EPR-PID-0008-01 AND 2047-1803-EPR-PID-0008-02.											

LEGENDS



GENERAL NOTES

- CURRENT TRANSFORMERS FOR PROTECTION SHALL BE SP20, FOR METERING SHALL BE 0.5S. ALL CTS SHALL BE ACCESSIBLE FOR MAINTENANCE.
- THE DEGREES OF PROTECTION OF THE LOW VOLTAGE SWITCHGEAR SHALL BE R42 FOR EXTERNAL PROTECTION, INTERNAL PROTECTION FROM PFA FORM OF SEPARATION AS PER IEC 60298.
- THE INCOMING FEEDERS SECTIONS MUST BE INSTALLED IN ONE CIRCULE ASSOCIATED MEASURING SECTIONS ARE HOUSED IN A SEPARATE COMPARTMENT. THE CABLE ENTRY COMPARTMENT FOR OUTGOING SECTIONS SHALL BE PROVIDED AT THE RIGHT HAND SIDE ALONG THE ENTIRE HEIGHT OF THE SWITCHGEAR COMPARTMENT. SEPARATED AND LOCKABLE.
- PROTECTIVE EARTH BAR MUST BE INCLUDED, AND WHICH RUN HORIZONTALLY LOCATED IN THE MAIN BUSBAR COMPARTMENT JUST ABOVE THE BASE. THE PE BAR MUST BE FASTENED TO THE FRAME TO ASSURE ELECTRICAL CONTINUITY.
- THE LOW VOLTAGE POWER CIRCUIT BREAKER (ACB) SHALL BE WITHDRAWABLE TYPE AND IN WHICH THE CONTACTS OPEN AND CLOSE IN AIR ATMOSPHERIC PRESSURE, AND BEING WITH A MECHANICAL STORED ENERGY OPERATING MECHANISM. ACB SHALL BE FITTED WITH FOLLOWING POSITIONS: INSERTED-TEST-WITHDRAWN.
- THE CONTROL VOLTAGES FOR CLOSING CIRCUITS, TRIPPING CIRCUITS, CONTROL SYSTEM, PROTECTION RELAYS POWER SUPPLY, AUXILIARY RELAYS, INDICATION CIRCUIT AND MOTOR POWER SUPPLY SHALL BE 110 VDC.
- ANTI-CONDENSATION HEATERS SHALL BE PROVIDED WITH THERMOSTAT CONTROL. RANGE OF 10°C TO 40°C AND INSTALLED AT THE BOTTOM OF EACH VERTICAL SECTION ACCORDING TO THE MANUFACTURER'S STANDARD AND SHALL BE INDIVIDUALLY PROTECTED BY MCB. EACH HEATER SHALL BE COMPLETE WITH A RATED TYPE ON/OFF SWITCH.
- PROTECTION FEATURES, AT LEAST, MUST INCLUDE: PHASE UNDERVOLTAGE (27), BEARING OVERTEMPERATURE (58), OVERSPEED (51), LOSS OF EXCITATION (40), STATOR CURRENT UNBALANCE (68), THERMAL OVERLOAD (48), PHASE INSTANTANEOUS OVERCURRENT (50), EARTH FAULT (51), VOLTAGE DEPENDENT OVERCURRENT (51), PHASE OVERVOLTAGE (59), FREQUENCY (61), SYNCHRO-CHECK (24), RECTIFICATION FAILURE (58), GROUND DETECTOR OF FIELD (48), TRIP CIRCUIT SUPERVISION (50), NEUTRAL OVERCURRENT (50).
- A SIGNAL MOTOR'S 4-20 mA IS REQUIRED FOR DCS. MPR MUST BE INCLUDED TRANSDUCER FOR MOTOR CURRENT, AT LEAST.
- MARKING CABINETS SHALL BE PROVIDED FOR EACH BUS SECTION FOR DCS/PLC INTERFACE.
- ALL DCS INTERFACE LINE BREAKER STATUS, CLOSING COMMAND SIGNALS AS PER IEC 61851 SHALL BE INCORPORATED FOR ALL BREAKERS. EACH RELAYED SHALL HAVE REDUNDANT POINTS FOR DCS INTERFACE WHICH SHALL BE SHOWN AS PER EEC ARCHITECTURE.
- THE HEALTHINESS OF "TRIP CIRCUIT" IS TO BE ENSURED THROUGH A SUITABLE "TRIP CIRCUIT SUPERVISION SCHEME WITH CONTINUOUS MONITORING" WITH ALARM AT MANNED LOCATIONS.
- PROVISION FOR CONTACT MULTIPLIERS (VAI TYPE FREE) FOR PRIMARY LOAD SHEDDING INITIATED FROM ECS/UPSTREAM SWITCHGEAR. THE AUXILIARY RELAY SHALL BE INSTALLED IN THE INCOMER. A COMMAND OF LOAD SHEDDING WILL BE INITIATED FROM ECS/UPSTREAM SWITCHGEAR AND THE OUTPUT CONTACT OF AUXILIARY RELAY WILL BE USED FOR TRIPPING OF OUTGOING FEEDERS.
- ALL THE DATA AVAILABLE IN THE RELAY INCLUDING STATUS OF DI SHOULD BE CONSIDERED TO BE COMMUNICATED TO ECS.
- THE AUX POWER SUPPLY OF ALL THE NUMERICAL RELAYS SHALL BE THROUGH DEDICATED FUSES AND FOR THE RELAYS IN SUCH A WAY THAT THE SUPPLY TO THE RELAYS IS AVAILABLE EVEN WHEN THE AUX POWER SUPPLY OF THE PANEL IS SWITCHED OFF.
- ALL OVERLOAD RELAYS / THERMAL RELAYS OVERLOAD RELAYS SHALL BE COMPACT MICROPROCESSOR BASED COMMUNICABLE TYPE. THESE RELAY SHALL HAVE METERING & DISPLAY FACILITY ON PANEL DOOR FOR FEEDERS WITH CACT THE INPUT OF CACT SHALL BE TAKEN DIRECTLY TO THE ABOVE MENTIONED RELAY ONLY. MAKE OF THE RELAY SHALL BE SAME AS NUMERICAL PROTECTION RELAY.
- FOR FEEDER RATING <= 100 A, MCCB WITH INBUILT EF RELEASE SHALL BE PROVIDED.
- ALL NECESSARY PROTECTION INTERFACE FOR VFD PACKAGE SHALL BE PROVIDED IN THE UPSTREAM SWITCHGEAR.
- THE FOLLOWING CONTROL SIGNALS FOR THE CIRCUIT BREAKER INCOMERS SHALL BE INTERFACED WITH UPSTREAM CIRCUIT BREAKERS TRIP COIL AND NOT WITH BUS LOCKOUT RELAY:
 - CB OPEN CLOSE
 - INTERTRIP FROM UPSTREAM BREAKER (CB IN SERVICE POSITION & OPEN)
 - CLOSE PERMISSIVE FROM UPSTREAM CB (CB IN SERVICE POSITION & CLOSED)
 - CLOSE PERMISSIVE TO UPSTREAM CB (CB IN SERVICE POSITION & OPEN - BUS RELAY NOT OPERATED)
 - TO UPSTREAM BREAKER (TEST POSITION IN OPERATED)
- LOTO PROVISIONS SHALL BE PROVIDED FOR ALL FEEDERS.
- SWITCHGEAR SHALL BE PROVIDED WITH COMMON ELECTRONIC HOOTER WITH TONE / VOLUME CONTROL IN BUS COUPLER FEEDER.
- TEST PUSH BUTTON SHALL BE PROVIDED TO CHECK THE CONTROL CIRCUIT OF MOTOR FEEDER IN TEST POSITION ONLY. TEST PUSH BUTTON SHALL BE INACTIVE DURING SERVICE POSITION. ALL EMERGENCY STOP PUSH BUTTON SHALL BE MUSHROOM HEAD STAY PUT TYPE (PUSH TO LOCK, TURN TO RELEASE) WITH SHROUDS. STOP PUSH BUTTON SHALL STOP THE FEEDER WHEN PRESSED IN BOTH TEST & SERVICE POSITION.
- FOR MOTORS AT ELEVATED LOCATION, ONE STOP PUSH BUTTON AT GROUND LEVEL IN ADDITION TO THE ONE NEAR THE MOTOR SHALL BE PROVIDED.
- THE EXTERNAL SUPPLY 240V AC SHALL BE FED FROM 044-ASB-101. 110 VDC IS FROM 044-DC-102.
- MINIMUM 2 NOS. OF INPUTS AND 2 NOS. OUTPUT SPARE I/O SHALL BE PROVIDED IN EACH NUMERICAL RELAY.
- MULTIFUNCTION METER (MFM) SHALL HAVE FOLLOWING METERING PARAMETERS AS MINIMUM: A, V, F, KW, MW, KVA, KVAR, KVAH, KVAH, KVAR, KVAR, PF.
- INCOMER AND BUS COUPLER STATUS FOR AUTO CHANGE OVER, MOMENTARY PARALLELING AND DEAD BUS CLOSING TO BE COMMUNICATED THROUGH RELAY ONLY.
- OUTGOING, MOTOR / HEATER FEEDERS SHALL HAVE HARDWIRED INTERFACE WITH INSTRUMENTATION DCS/SYSTEM FIELD LCU.
- MINIMUM 8 WINDOW MICROPROCESSOR BASED ANNUNCIATOR SHALL BE PROVIDED WITH 20% SPARE.
- PROTECTION RELAYS SHALL BE OF LATEST VERSION, MICROPROCESSOR BASED NUMERICAL TYPE FOR COMMUNICATION WITH ECS / DCS. IT SHALL HAVE IEC 61850 COMPLIANT COMMUNICATION FACILITY. ALL NUMERICAL RELAY SHALL HAVE 2ND R45 PORT AT RELAY FRONT AND 2ND REDUNDANT PORT (R45) PORT AT RELAY REAR.
- FOR THE TYPE OF SCHEME SEE DRAWING NO. 2047-1803-EEL-050-002 "TYPICAL METERING AND PROTECTION SCHEMATIC DIAGRAM FOR MV SWITCHBOARDS"

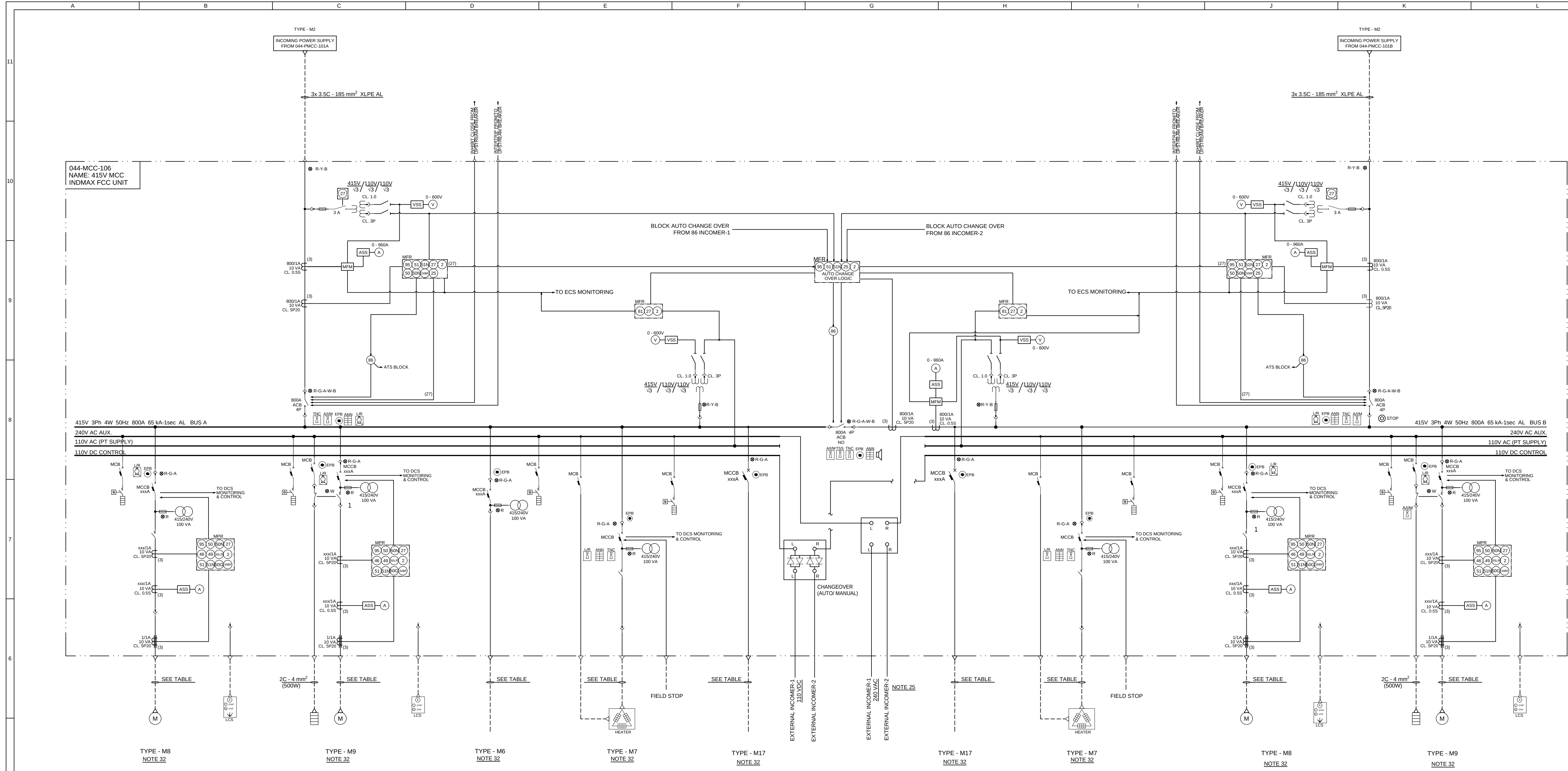
PROJECT
PETROCHEMICAL AND LUBE INTEGRATION
PROJECT "LuPech (J-18)" AT IOCL GUJARAT
REFINERY, VADODARA, GUJARAT, INDIA
EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT)

TITLE
SINGLE LINE DIAGRAM
415V MOTOR CONTROL CENTER
044-MCC-105

SCALE
PROJECT NO. UNIT
1.250 2047 1803 EEL-SLD-0019

DRAWING NUMBER
PAGE
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REV
1



- GENERAL NOTES**
- CURRENT TRANSFORMERS FOR PROTECTION SHALL BE SP20, FOR METERING SHALL BE 0.5S. ALL CTS SHALL BE ACCESSIBLE FOR MAINTENANCE.
 - THE DEGREES OF PROTECTION OF THE LOW VOLTAGE SWITCHGEAR SHALL BE R42 FOR EXTERNAL PROTECTION, INTERNAL PROTECTION FROM PXX FORM OF SEPARATION AS NEPA.
 - THE INCOMING FEEDERS SECTIONS MUST BE INSTALLED IN ONE CIRCLE ASSOCIATED MEASURING SECTIONS ARE HOUSED IN A SEPARATE COMPARTMENT. THE CABLEENTRY COMPARTMENT FOR OUTGOING SECTIONS SHALL BE PROVIDED AT THE RIGHT HAND SIDE ALONG THE ENTIRE HEIGHT OF THE SWITCHGEAR COMPARTMENT. SEPARATED AND LOCKABLE.
 - PROTECTIVE EARTH BAR MUST BE INCLUDED, AND WHICH RUN HORIZONTALLY LOCATED IN THE MAIN BUSBAR COMPARTMENT JUST ABOVE THE BASE. THE PE BAR MUST BE FASTENED TO THE FRAME TO ASSURE ELECTRICAL CONTINUITY.
 - THE LOW VOLTAGE POWER CIRCUIT BREAKER (ACB) SHALL BE WITHDRAWABLE TYPE 415V/110V AND IN WHICH THE CONTACTS OPEN AND CLOSE IN AIR ATMOSPHERIC PRESSURE, AND EQUIPPED WITH MECHANICAL STORED ENERGY OPERATING MECHANISM. ACB SHALL BE FITTED WITH FOLLOWING POSITIONS: INSERTED-TEST-WITHDRAWN.
 - THE CONTROL VOLTAGES FOR CLOSING CIRCUITS, TRIPPING CIRCUITS, CONTROL SYSTEM PROTECTION RELAYS POWER SUPPLY, AUXILIARY RELAYS, INDICATION CIRCUIT AND MOTOR POWER SUPPLY SHALL BE 110 VDC.
 - ANTI-CONDENSATION HEATERS SHALL BE PROVIDED WITH THERMOSTAT CONTROL RANGE OF 10°C TO 40°C AND INSTALLED AT THE BOTTOM OF EACH VERTICAL SECTION ACCORDING TO THE MANUFACTURER'S STANDARD AND SHALL BE INDIVIDUALLY PROTECTED BY MCB. EACH HEATER SHALL BE COMPLETE WITH A RATED TYPE ON/OFF SWITCH.
 - PROTECTION FEATURES, AT LEAST, MUST INCLUDE: PHASE UNDERVOLTAGE (27), BEARING OVERTEMPERATURE (58), OVERSPEED (42), LOSS OF EXCITATION (40), STATOR CURRENT UNBALANCE (66), THERMAL OVERLOAD (49), PHASE INSTANTANEOUS OVERCURRENT (50), EARTH FAULT (51), VOLTAGE DEPENDENT OVERCURRENT (51A), PHASE OVERVOLTAGE (59), FREQUENCY (61), SYNCHRO-CHECK (24), DIRECTIONAL POWER (32), RECTIFICATION FAILURE (38), GROUND DETECTOR OF FIELD (44), TRIP CIRCUIT SUPERVISION (56), NEUTRAL OVERCURRENT (50N).
 - A SIGNAL MOTOR'S 4-20 mA IS REQUIRED FOR DCS. MPR MUST BE INCLUDED TRANSducer FOR MOTOR CURRENT, AT LEAST.
 - MARKING CABINETS SHALL BE PROVIDED FOR EACH BUS SECTION FOR DCS/PLC INTERFACE.
 - ALL DCS INTERFACE LINE BREAKER STATUS, CLOSURE/OPEN COMMAND SIGNALS AS PER ECS ID LIST SHALL BE INCORPORATED FOR ALL BREAKERS. EACH RELAY ED SHALL HAVE REDUNDANT POINTS FOR ECS INTERFACES WHICH SHALL BE SHOWN AS PER ECS ARCHITECTURE.
 - THE HEALTHINESS OF "TRIP CIRCUIT" IS TO BE ENSURED THROUGH A SUITABLE "TRIP CIRCUIT SUPERVISION SCHEME WITH CONTINUOUS MONITORING" WITH ALARM AT MANNED LOCATIONS.
 - PROVISION FOR CONTACT MULTIPLEXERS (VIA TYPE-FREE) FOR PRIMARY LOAD SHEDDING INITIATED FROM ECS/UPSTREAM SWITCHBOARD. THE AUXILIARY RELAY SHALL BE INSTALLED IN THE INCOMERS. A COMMAND OF LOAD SHEDDING WILL BE INITIATED FROM ECS/UPSTREAM SWITCHBOARD AND THE OUTPUT CONTACT OF AUXILIARY RELAYS WILL BE USED FOR TRIPPING OF OUTGOING FEEDERS.
 - ALL THE DATA IS AVAILABLE IN THE RELAY INCLUDING STATUS OF DI SHOULD BE CONSIDERED TO BE COMMUNICATED TO ECS.
 - THE AUX POWER SUPPLY OF ALL THE NUMERICAL RELAYS SHALL BE THROUGH DEDICATED FUSES AND FOR THE RELAYS AS SUCH A WAY THAT THE SUPPLY TO THE RELAYS IS AVAILABLE EVEN WHEN THE AUX POWER SUPPLY OF THE PANEL IS SWITCHED OFF.
 - ALL OVERLOAD RELAYS / THERMAL RELAYS OVERLOAD RELAYS SHALL BE COMPACT MICROPROCESSOR BASED COMMUNICABLE TYPE. THESE RELAY SHALL HAVE METERING & DISPLAY FACILITY ON PANEL DOOR FOR FEEDERS WITH CBCT. THE INPUT OF CBCT SHALL BE GIVEN DIRECTLY TO THE ABOVE MENTIONED RELAY ONLY. NONE OF THE RELAY SHALL BE SAME AS NUMERICAL PROTECTION RELAY.
 - FOR FEEDER RATING <= 100 A, MCCB WITH MANUAL (F) RELEASE SHALL BE PROVIDED.
 - ALL NECESSARY PROTECTION INTERFACE FOR VFD PACKAGE SHALL BE PROVIDED IN THE UPSTREAM SWITCHGEAR.
 - THE FOLLOWING CONTROL SIGNALS FOR THE CIRCUIT BREAKER INCOMERS SHALL BE INTERFACED WITH UPSTREAM CIRCUIT BREAKERS TRIP COIL AND NOT WITH BUS LOCKOUT RELAY.
 - CB OPEN CLOSE
 - INTERTRIP FROM UPSTREAM BREAKER (CB IN SERVICE POSITION & OPEN)
 - CLOSE PERMISSIVE FROM UPSTREAM CB (CB IN SERVICE POSITION & CLOSED)
 - CLOSE PERMISSIVE TO UPSTREAM CB (CB IN SERVICE POSITION & OPEN + BUS RELAY NOT OPERATED)
 - TO UPSTREAM BREAKER (TEST POSITION & OPERATED)
 - LOTO PROVISIONS SHALL BE PROVIDED FOR ALL FEEDERS.
 - SWITCHGEAR SHALL BE PROVIDED WITH COMMON ELECTRONIC HOOTER WITH TONE / VOLUME CONTROL IN BUS COUPLER FEEDER.
 - TEST PUSH BUTTON SHALL BE PROVIDED TO CHECK THE CONTROL CIRCUIT OF MOTOR FEEDER IN TEST POSITION ONLY. TEST PUSH BUTTON SHALL BE INACTIVE DURING SERVICE POSITION. ALL EMERGENCY STOP PUSH BUTTON SHALL BE MUSHROOM HEAD STAY PUT TYPE (PUSH TO LOCK, TURN TO RELEASE) WITH SHROUD. STOP PUSH BUTTON SHALL STOP THE FEEDER WHEN PRESSED IN BOTH TEST & SERVICE POSITION.
 - FOR MOTORS AT ELEVATED LOCATION, ONE STOP PUSH BUTTON AT GROUND LEVEL IN ADDITION TO THE ONE NEAR THE MOTOR SHALL BE PROVIDED.
 - THE EXTERNAL SUPPLY 240 VAC SHALL BE FED FROM 044-ASB-101. 110 VDC IS FROM 044-DC-102.
 - MINIMUM 2 NOS. OF INPUTS AND 2 NOS. OUTPUT SPARE I/O SHALL BE PROVIDED IN EACH NUMERICAL RELAY.
 - MULTIFUNCTION METER (MFR) SHALL HAVE FOLLOWING METERING PARAMETERS AS MINIMUM: A, V, F, KW, MW, KVA, KWH, KVAr, KVAR, KVAR, PF.
 - INCOMER AND BUS COUPLER STATUS FOR AUTO CHANGE OVER, MOMENTARY PARALLELING AND DEAD BUS CLOSING TO BE COMMUNICATED THROUGH RELAY ONLY.
 - OUTGOING, MOTOR / HEATER FEEDERS SHALL HAVE HARDWIRED INTERFACE WITH INSTRUMENTATION DCS/SYSTEM FIELD LICS.
 - MINIMUM 8 WINDOW MICROPROCESSOR BASED ANNUNCIATOR SHALL BE PROVIDED WITH 20% SPARE.
 - PROTECTION RELAYS SHALL BE OF LATEST VERSION, MICROPROCESSOR BASED NUMERICAL TYPE FOR COMMUNICATION WITH ECS. IT SHALL HAVE IEC 61850 COMPLIANT COMMUNICATION FACILITY. ALL NUMERICAL RELAY SHALL HAVE 2ND R42S PORT AT RELAY FRONT AND 2ND REDUNDANT PORT (R42S) AT RELAY REAR.
 - FOR THE TYPE OF SCHEME SEE DRAWING NO. 2047-1803-EEL-050-002 "TYPICAL METERING AND PROTECTION SCHEMATIC DIAGRAM FOR MV SWITCHBOARDS"

S. No.	DESCRIPTION	TAG	POWER (KVA, KW, OR KVAR)	FULL LOAD CURRENT	RATED CURRENT CIRCUIT BREAKER	CABLE SIZE	BUSBAR	TYPE	CT GENERAL RATIO	CT PANEL No./ PANEL DESIGNATION	TYPICAL ESD/DCS (NOTE 5)
1	WASTE HEAT BOILER INLET WHB-101	1803-MOV-2305	3 kW	4.4 A	32 A	1x 3C - 2.5 mm ² CU	BUS A	M17	-	(#)	-
2	HC VAP RCTR OVRHD TO FRACTIONATOR C-201	1803-MOV-4001	3 kW	4.4 A	32 A	1x 3C - 2.5 mm ² CU	BUS A	M17	-	(#)	-
3	WGC 1ST STAGE COMPRESSOR DISCHARGE	1803-MOV-5802	15 kW	22 A	50 A	1x 3C - 16 mm ² CU	BUS A	M17	-	(#)	-
4	WGC 2ND STAGE COMPRESSOR DISCHARGE	1803-MOV-5803	15 kW	22 A	50 A	1x 3C - 16 mm ² CU	BUS A	M17	-	(#)	-
5	PURGE AIR FAN WASTE HEAT BOILER	1803-X-106 A	40 kW	89.6 A	100 A	1x 3C - 95 mm ² AL	BUS A	M9	100/1A	(#)	-
6	SOOT BLOWER POWER PANEL (WASTE HEAT BOILER)	1803-X-106 LRSB	14.5 KVA	22.4 A	50 A	1x 3C - 25 mm ² AL	BUS A	M6	-	(#)	-
7	MOTORISED BY-PASS VALVE FOR MSSV (WASTE HEAT BOILER)	1803-X-106 MOV B	15 kW	23.2 A	50 A	1x 3C - 25 mm ² AL	BUS A	M17	-	(#)	-
8	MAKE-UP WATER BOOSTER PUMP (WET GAS SCRUBBER PACKAGE)	1803-X-107-P002A	22 kW	37 A	50 A	1x 3C - 25 mm ² AL	BUS A	M8	50/1A	(#)	-
9	COAGULANT METERING PUMP (WET GAS SCRUBBER PACKAGE)	1803-X-107-P005A	1.5 kW	2.5 A	32 A	1x 3C - 2.5 mm ² CU	BUS A	M8	15/1A	(#)	-
10	CAUSTIC BOOSTER PUMP (WET GAS SCRUBBER PACKAGE)	1803-X-107-P001A	1.5 kW	2.5 A	32 A	1x 3C - 2.5 mm ² CU	BUS A	M8	15/1A	(#)	-
11	FILTRATE PUMP (WET GAS SCRUBBER PACKAGE)	1803-X-107-P006A	3.7 kW	7 A	32 A	1x 3C - 2.5 mm ² CU	BUS A	M8	15/1A	(#)	-
12	EFFLUENT FILTER SUPPLY PUMP (WET GAS SCRUBBER PACKAGE)	1803-X-107-P007A	22 kW	37 A	50 A	1x 3C - 25 mm ² AL	BUS A	M8	50/1A	(#)	-
13	IGV (INLET GUIDE VANE) MAIN AIR BLOWER 1803-K-101	-	30 kW	46.4 A	63 A	1x 4C - 50 mm ² AL	BUS A	M17	-	(#)	-
14	HEATER 2 (MAIN AIR BLOWER 1803-K-101)	-	30 kW	46.4 A	63 A	1x 4C - 50 mm ² AL	BUS A	M7	-	(#)	-
15	HEATER 1 (WET GAS COMPRESSOR 1803-K-102)	-	30 kW	46.4 A	63 A	1x 4C - 50 mm ² AL	BUS A	M7	-	(#)	-
16	SPARE (TYPE M7: HEATER FEEDER)	-	-	-	63 A	-	BUS A	M8	-	(#)	-
17	SPARE (TYPE M8: DOL MOTOR STARTER < 30 kW)	-	-	-	50 A	-	BUS A	M8	50/1A	(#)	-
18	SPARE (TYPE M8: DOL MOTOR STARTER < 30 kW)	-	-	-	32 A	-	BUS A	M8	15/1A	(#)	-
19	SPARE (TYPE M8: DOL MOTOR STARTER ≥ 30 kW & < 55 kW)	-	-	-	100 A	-	BUS A	M9	100/1A	(#)	-
20	SPARE (TYPE M6: FEEDER ≤ 100 A)	-	-	-	50 A	-	BUS A	M6	-	(#)	-
21	SPARE (TYPE M17: FEEDER ≤ 100 A FIXED)	-	-	-	32 A	-	BUS A	M17	-	(#)	-
22	SPARE (TYPE M17: FEEDER ≤ 100 A FIXED)	-	-	-	50 A	-	BUS A	M17	-	(#)	-
23	SPARE (TYPE M17: FEEDER ≤ 100 A FIXED)	-	-	-	63 A	-	BUS A	M17	-	(#)	-
24	WASTE HEAT BOILER OUTLET WHB-101	1803-MOV-2306	3 kW	4.4 A	32 A	1x 3C - 2.5 mm ² CU	BUS B	M17	-	(#)	-
25	WGC 1ST STAGE COMPRESSOR SUCTION	1803-MOV-5801	15 kW	22 A	50 A	1x 3C - 16 mm ² CU	BUS B	M17	-	(#)	-
26	WGC 2ND STAGE COMPRESSOR SUCTION	1803-MOV-5803	15 kW	22 A	50 A	1x 3C - 16 mm ² CU	BUS B	M17	-	(#)	-
27	PURGE AIR FAN WASTE HEAT BOILER	1803-X-106 B	40 kW	89.6 A	100 A	1x 3C - 95 mm ² AL	BUS B	M9	100/1A	(#)	-
28	MOTORISED MAIN STEAM STOP VALVE (MSSV) WASTE HEAT BOILER	1803-X-106 MOV C	15 kW	23.2 A	50 A	1x 3C - 25 mm ² AL	BUS B	M17	-	(#)	-
29	MOTORISED START UP VENT VALVE (WASTE HEAT BOILER)	1803-X-106 MOV A	15 kW	23.2 A	50 A	1x 3C - 25 mm ² AL	BUS B	M17	-	(#)	-
30	MAKE-UP WATER BOOSTER PUMP (WET GAS SCRUBBER PACKAGE)	1803-X-107-P002B	22 kW	37 A	50 A	1x 3C - 25 mm ² AL	BUS B	M8	50/1A	(#)	-
31	COAGULANT METERING PUMP (WET GAS SCRUBBER PACKAGE)	1803-X-107-P005B	1.5 kW	2.5 A	32 A	1x 3C - 2.5 mm ² CU	BUS B	M8	15/1A	(#)	-
32	CAUSTIC BOOSTER PUMP (WET GAS SCRUBBER PACKAGE)	1803-X-107-P001B	1.5 kW	2.5 A	32 A	1x 3C - 2.5 mm ² CU	BUS B	M8	15/1A	(#)	-
33	FILTRATE PUMP (WET GAS SCRUBBER PACKAGE)	1803-X-107-P006B	3.7 kW	7 A	32 A	1x 3C - 2.5 mm ² CU	BUS B	M8	15/1A	(#)	-
34	EFFLUENT FILTER SUPPLY PUMP (WET GAS SCRUBBER PACKAGE)	1803-X-107-P007B	22 kW	37 A	50 A	1x 3C - 25 mm ² AL	BUS B	M8	50/1A	(#)	-
35	UNIT CONTROL PANEL NON UPS MAIN AIR BLOWER 1803-K-101	-	30 kW	46.4 A	63 A	1x 4C - 50 mm ² AL	BUS B	M17	-	(#)	-
36	HEATER 1 (MAIN AIR BLOWER 1803-K-101)	-	30 kW	46.4 A	63 A	1x 4C - 50 mm ² AL	BUS B	M7	-	(#)	-
37	UNIT CONTROL PANEL NON UPS (WET GAS COMPRESSOR 1803-K-102)	-	30 kW	46.4 A	63 A	1x 4C - 50 mm ² AL	BUS B	M17	-	(#)	-
38	MAIN AIR BLOWER TURNING GEAR MOTOR	-	15 kW	23.2 A	50 A	1x 3C - 16 mm ² CU	BUS B	M8	50/1A	(#)	-
39	SPARE (TYPE M7: HEATER FEEDER)	-	-	-	63 A	-	BUS B	M8	-	(#)	-
40	SPARE (TYPE M8: DOL MOTOR STARTER < 30 kW)	-	-	-	50 A	-	BUS B	M8	50/1A	(#)	-
41	SPARE (TYPE M8: DOL MOTOR STARTER < 30 kW)	-	-	-	32 A	-	BUS B	M8	15/1A	(#)	-
42	SPARE (TYPE M8: DOL MOTOR STARTER ≥ 30 kW & < 55 kW)	-	-	-	100 A	-	BUS B	M9	100/1A	(#)	-
43	SPARE (TYPE M17: FEEDER ≤ 100 A FIXED)	-	-	-	32 A	-	BUS B	M17	-	(#)	-
44	SPARE (TYPE M17: FEEDER ≤ 100 A FIXED)	-	-	-	50 A	-	BUS B	M17	-	(#)	-
45	SPARE (TYPE M17: FEEDER ≤ 100 A FIXED)	-	-	-	63 A	-	BUS B	M17	-	(#)	-

a) THIS INFORMATION SHALL BE WHEN VENDORS DATA ARE AVAILABLE
b) FOR MOTOR TYPICAL SCHEMES SEE DRAWINGS NO. 2047-1803-EPR-PID-0008-01 AND 2047-1803-EPR-PID-0008-02

LEGENDS

- 2

TIMER
- AS

AMMETER SELECTOR SWITCH
- A

AMMETER
- VS

VOLTMETER SELECTOR SWITCH
- CS

SYNCHRO CHECK RELAY
- 27

UNDER VOLTAGE RELAY
- 66

UNBALANCED CURRENT RELAY
- 59

THERMAL RELAY
- 40

INSTANTANEOUS OVER CURRENT RELAY
- 42

INSTANTANEOUS EARTH FAULT RELAY
- 50

SENSITIVE EARTH FAULT RELAY
- 49

IDMT OVER CURRENT RELAY
- 48

EARTH (OR GROUND) FAULT RELAY
- 47

LOCKED ROTOR CURRENT RELAY
- 46

UNDER EARTH FAULT RELAY
- 45

VOLTAGE RESTRAINT IDMT OVER CURRENT RELAY
- 44

OVER VOLTAGE RELAY
- 43

NEUTRAL DISPLACEMENT RELAY
- 42

RESTRICTED EARTH FAULT RELAY
- 41

UNDER FREQUENCY RELAY
- 40

MASTER TRIP RELAY OR LOCKOUT RELAY
- 39

LINE DIFFERENTIAL RELAY
- 38

TRIP CIRCUIT SUPERVISION RELAY
- 37

BUS WIRE SUPERVISION RELAY
- 36

SELECTOR SWITCH (3-OR-4 POSITION WITH OFF POSITION INCLUDED)
- 35

NUMERICAL MICROPROCESSOR BASED MULTI-FUNCTION RELAY (WITH COMMUNICATION FACILITY)
- 34

NUMERICAL MICROPROCESSOR BASED MOTOR PROTECTION RELAY (WITH COMMUNICATION FACILITY)
- 33

POTENTIAL TRANSFORMER
- 32

CURRENT TRANSFORMER
- 31

CORE BALANCE CT (CBCT)
- 30

TRANSFORMER
- 29

SPACE HEATER
- 28

SURGE ARRESTER
- 27

NEUTRAL EARTHING RESISTOR
- 26

BUS DUCT
- 25

EARTH CONNECTION
- 24

CONTACTOR
- 23

PANEL SPACE HEATER WITH THERMOSTAT
- 22

TRIP, NEUTRAL & CLOSE SWITCH
- 21

TRIP SELECTOR SWITCH (INCOMER-A BUS COUPLER / INCOMER-B)
- 20

TRIP CIRCUIT SUPERVISION RELAY
- 19

LOCAL/REMOTE SELECTOR SWITCH
- 18

LOUDSPEAKER (HOOTER)
- 17

DRANOUT
- 16

VARIABLE FREQUENCY DRIVE
- 15

LOW VOLTAGE POWER CIRCUIT BREAKER
- 14

MOLDED CASE CIRCUIT BREAKER
- 13

MINIATURE CIRCUIT BREAKER
- 12

MECHANICAL / ELECTRICAL INTERLOCK
- 11

INDICATION LAMP
BLUE-SPRING CHARGED
WHITE-TRIP CIRCUIT HEALTHY
AMBER-TRIP
GREEN-OPEN
RED-CLOSE
- 10

EMERGENCY STOP PUSH BUTTON (BREAK GLASS TYPE)
- 9

LOCAL CONTROL STATION WITH AMMETER
- 8

LOCAL-REMOTE SWITCH
- 7

INDUCTION MOTOR
- 6

SYNCHRONOUS MOTOR
- 5

GENERATOR
- 4

FUSE
- 3

GLAND
- 2

DELTA-STAR CONNECTION
- 1

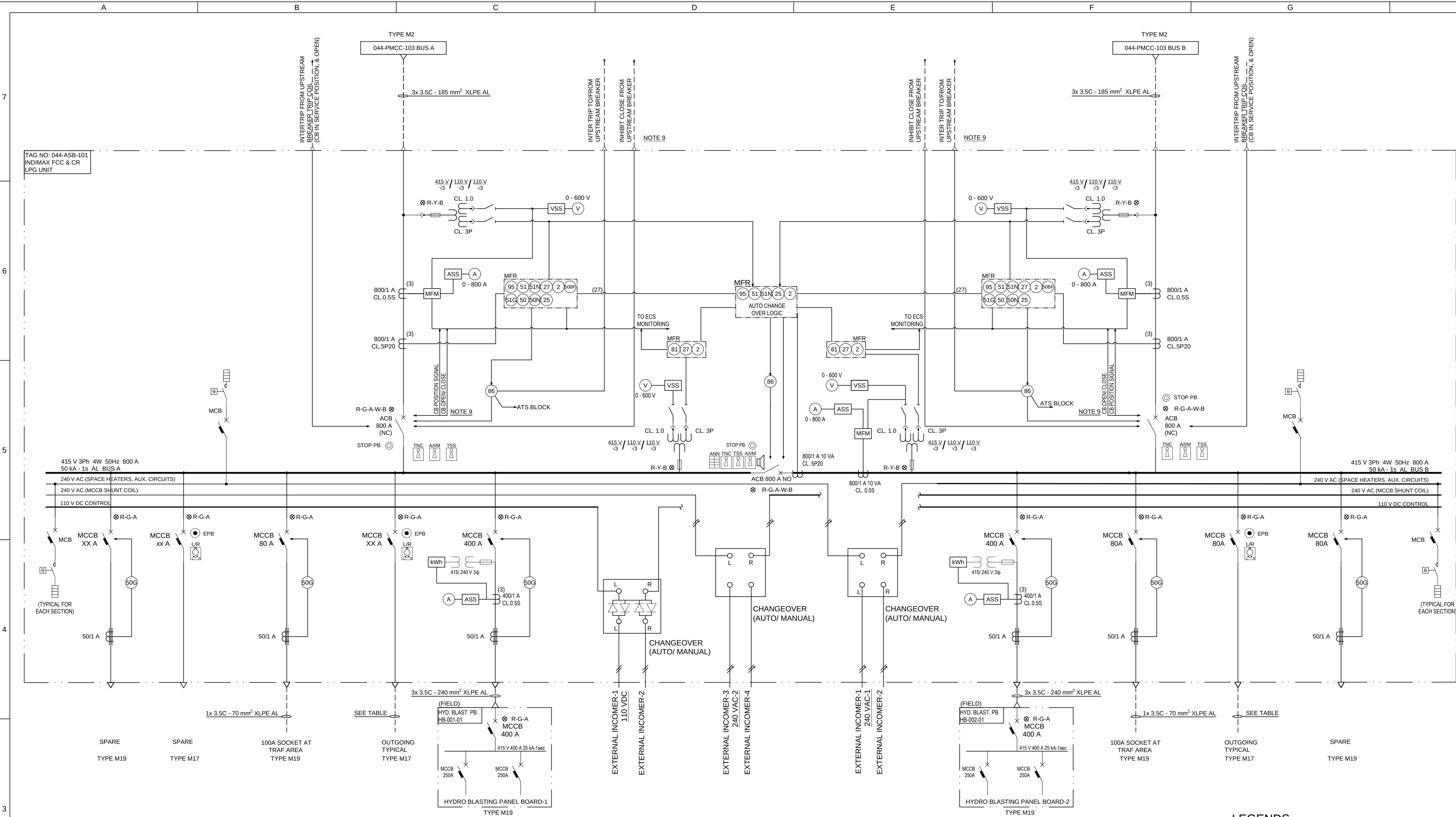
8 WINDOW ANNUNCIATOR
- 0

HOOR HOUR METER

PROJECT
**PETROCHEMICAL AND LUBE INTEGRATION
PROJECT "LuPech (J-18)" AT IOCL GUJARAT
REFINERY, VADODARA, GUJARAT, INDIA
EPC-2 PACKAGE (INDMAX FCCU + CR LPG TREATER UNIT)**

TITLE
**SINGLE LINE DIAGRAM
415V MOTOR CONTROL CENTER
044-MCC-106**

SCALE	PROJECT NO	UNIT	EEL-SLD-0020	PAGE	REV
1:250	2047	1803	EEL-SLD-0020	1 of 1	1



GENERAL NOTES

- NOTES:
- CURRENT TRANSFORMERS FOR PROTECTION SHALL BE 5P20, FOR METERING SHALL BE 0.5S.
 - THE DEGREES OF PROTECTION OF THE LOW VOLTAGE SWITCHGEAR SHALL BE IP42 FOR EXTERNAL PROTECTION, INTERNAL PROTECTION FROM IP2X, FORM OF SEPARATION 4b, METAL PARTITIONING.
 - THE INCOMING FEEDER AND BUS-COUPLER SECTIONS MUST BE INSTALLED IN ONE CUBICLE. ASSOCIATED MEASURING SECTIONS ARE HOUSED IN A SEPARATE COMPARTMENT. THE CABLE-ENTRY COMPARTMENT FOR OUTGOING SECTIONS SHALL BE PROVIDED AT THE RIGHT-HAND SIDE ALONG THE ENTIRE HEIGHT OF THE SWITCHGEAR COMPARTMENT, SEPARATED AND LOCKABLE.
 - PROTECTIVE EARTH BAR MUST BE INCLUDED, AND WHICH RUN HORIZONTALLY LOCATED IN THE MAIN BUSBAR COMPARTMENT JUST ABOVE THE BASE. THE PE BAR MUST BE FASTENED TO THE FRAME TO ASSURE ELECTRICAL CONTINUITY.
 - THE LOW VOLTAGE POWER CIRCUIT-BREAKER (ACB) SHALL BE FIXED TYPE, 4-POLE, AND IN WHICH THE CONTACTS OPEN AND CLOSE IN AIR ATMOSPHERIC PRESSURE, AND EQUIPPED WITH A MECHANICAL STORED ENERGY TYPE OPERATING MECHANISM.
 - THE CONTROL VOLTAGES FOR CLOSING CIRCUITS, TRIPPING CIRCUITS, CONTROL SYSTEM, PROTECTION RELAYS POWER SUPPLY, AUXILIARY RELAYS, INDICATION CIRCUIT SHALL BE 110 VDC.
 - ANTI-CONDENSATION HEATERS SHALL BE PROVIDED WITH THERMOSTAT CONTROL, RANGE OF 10°C TO 40°C AND INSTALLED AT THE BOTTOM OF EACH VERTICAL SECTION, ACCORDING TO THE MANUFACTURER'S STANDARD) AND SHALL BE INDIVIDUALLY PROTECTED BY MCB. EACH HEATER SHALL BE COMPLETE WITH A ROTARY TYPE ON/OFF SWITCH.
 - NORMALLY BOTH THE INCOMERS SHALL BE 'CLOSED' WITH BUSCOUPLER IN 'OPEN' CONDITION, IN CASE OF ANY PROBLEM TO ANY OF THE INCOMER, TRIPPING OF THE AFFECTED INCOMER FOLLOWED BY CLOSING OF BUSCOUPLER SHALL BE DONE MANUALLY.
 - THE FOLLOWING SIGNALS TO BE INCLUDED:
 - CB POSITION SIGNAL (CB OPEN / CLOSE & IN SERVICE) TO ECS
 - CB OPEN / CLOSE FROM ECS
 - INTERTRIP FROM UPSTREAM BREAKER (CB IN SERVICE POSITION & OPEN)
 - CLOSE PERMISSIVE FROM UPSTREAM CB (CB IN SERVICE POSITION & CLOSED)
 - CLOSE PERMISSIVE TO UPSTREAM CB (CB IN SERVICE POSITION & OPEN + 86 RELAY NOT OPERATED)
 - TO UPSTREAM BREAKER (TEST POSITION)
 - A DEDICATED CIRCUIT AT 240 VAC SHALL BE USED FOR MCCB SHUNT COIL. THE EXTERNAL SUPPLIES AT 240 VAC SHALL BE FED FROM 044-MLDB-101. 110 VDC SHALL BE FED FROM 044-DC-102.
 - IN CASE OF PT PRIMARY FUSE FAILURE CONDITION THE UNDER-VOLTAGE SCHEME SHALL BE BLOCKED TO PREVENT MAL-OPERATION OF THE SYSTEM / FEEDER.
 - PROTECTION RELAYS SHALL BE OF LATEST VERSION, MICROPROCESSOR BASED NUMERICAL TYPE FOR COMMUNICATION WITH ECS / DCS, IT SHALL HAVE IEC 61850 COMPLIANT COMMUNICATION FACILITY. ALL NUMERICAL RELAY SHALL HAVE 1NO RJ45 PORT AT RELAY FRONT AND 2NOS (REDUNDANT) RJ 45 PORT AT RELAY REAR. MULTIFUNCTION METERS (MFM) SHALL BE DIGITAL TYPE AND SHALL HAVE COMMUNICATION FACILITY WITH MODBUS RTU / RS 485 COMMUNICATION PROTOCOL. THE REPRESENTATION OF NUMERICAL RELAY IS CONCEPTUAL. THE EXACT DETAILS SHALL BE DEVELOPED BY SWITCHBOARD VENDOR.
 - MULTIFUNCTION METER (MFM) SHALL HAVE FOLLOWING METERING PARAMETERS AS MINIMUM: A, V, F, KW, KVA, KWH, KVAH, KVARH, KVAR, PF.
 - MINIMUM 2 NOS. OF INPUTS AND 2 NOS. OUTPUT SPARE I/O SHALL BE PROVIDED IN EACH NUMERICAL RELAY. MASTER LOCK OUT RELAY (86) VAH TYPE SHALL BE SEPARATE AND ELECTRO MECHANICAL TYPE AND SHALL NOT BE A PART OF MAIN NUMERICAL PROTECTION RELAY.
 - LAMP TEST PUSH BUTTON SHALL BE PROVIDED FOR ALL FEEDERS. MINIMUM 8 WINDOW MICROPROCESSOR BASED ANNUNCIATOR SHALL BE PROVIDED WITH 20% SPARE.
 - 96MM X 96MM ANALOGUE AMMETER AND VOLTMETER SHALL BE PROVIDED. LOTO PROVISIONS SHALL BE PROVIDED FOR ALL FEEDERS. SWITCHBOARD SHALL BE PROVIDED WITH COMMON ELECTRONIC HOOTER WITH TONE / VOLUME CONTROL IN BUS COUPLER FEEDER.

LEGENDS

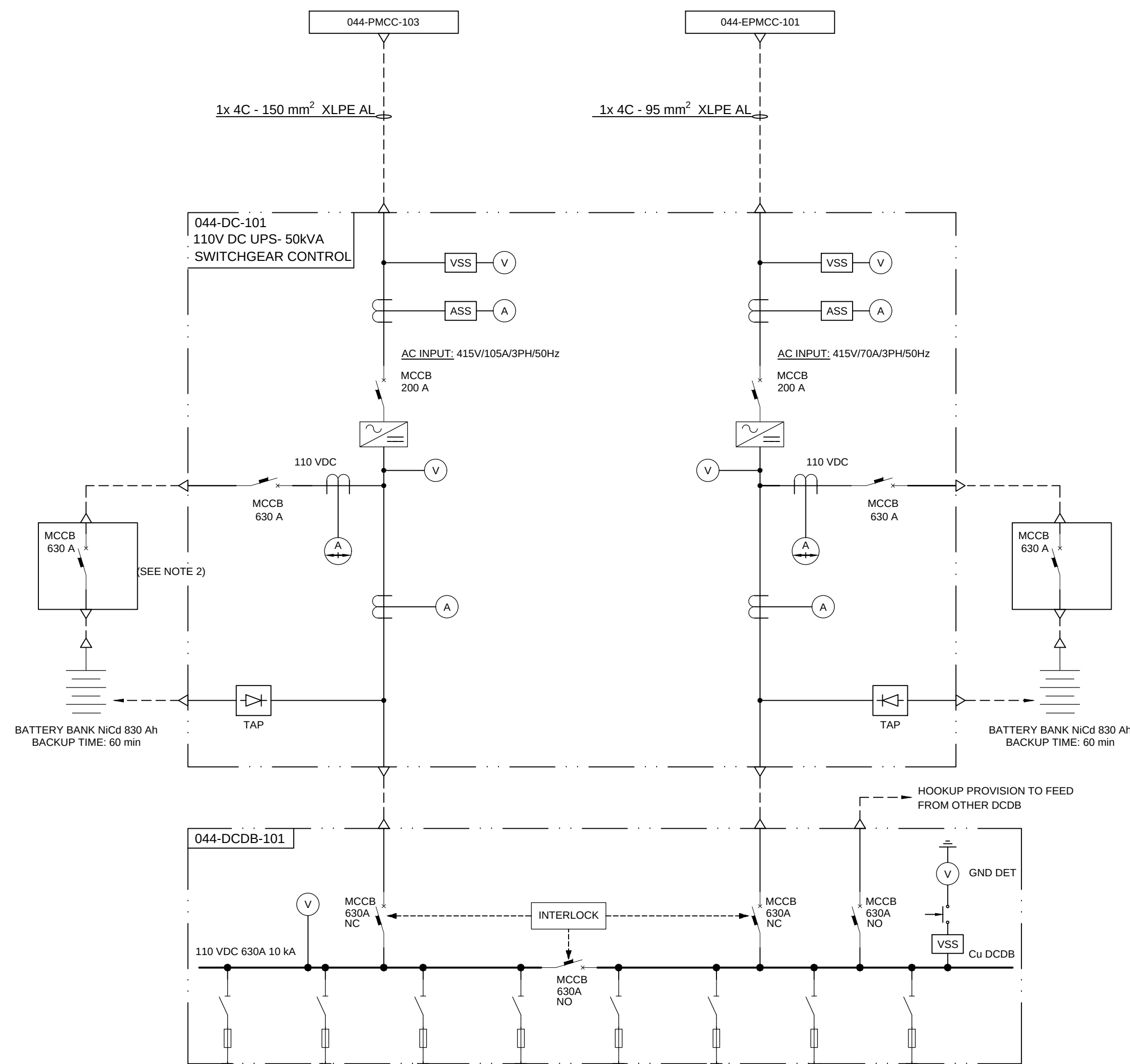
	CABLE GLAND		CURRENT TRANSFORMER
	AMMETER		POTENTIAL TRANSFORMER
	AMMETER SELECTOR SWITCH		UNDER VOLTAGE RELAY
	VOLTMETER		INSTANTANEOUS OVER CURRENT RELAY
	VOLTMETER SELECTOR SWITCH		INSTANTANEOUS EARTH FAULT RELAY
	NUMERICAL MICROPROCESSOR BASED MULTIFUNCTION RELAY		SENSITIVE EARTH FAULT RELAY
	MULTIFUNCTION METER		IDMT OVERCURRENT RELAY
	GROUNDING CONNECTION		EARTH FAULT PROTECTION RELAY
	EMERGENCY STOP PUSH-BUTTON		IDMT EARTH FAULT RELAY
	AIR CIRCUIT BREAKER		HIGH SPEED TRIPPING RELAY
	MOULDED CASE CIRCUIT BREAKER		TRIP CIRCUIT SUPERVISION RELAY
	MINIATURE CIRCUIT BREAKER		TRIP, NEUTRAL & CLOSE SWITCH
	LOUDSPEAKER (HOOTER)		TRIP SELECTOR SWITCH (INCOMMER-A /BUS COUPLER / INCOMMER-B)
	ISOLATOR / DISCONNECT SWITCH		AUTO / MANUAL SELECTOR SWITCH
	CABLE		FUSE
	8 WINDOW ANNUNCIATOR		

S. No.	DESCRIPTION	TAG	POWER (KVA, KW, OR KVAR)	FULL LOAD CURRENT	RATED CURRENT CIRCUIT BREAKER	CABLE SIZE	BUSBAR	TYPE
1	Hydro Blasting RFCC Unit 1	HB-001-01	288.0 KW	401 A	400 A	3 x 3.5C - 240 mm ² XLPE AL	BUS A	M19
2	100A Socket at Transformer Area 1 (044-TR-101A)	100A Socket at Transformer area 1	72.0 KW	100 A	160 A	1 x 3.5C - 70 mm ² XLPE AL	BUS A	M19
3	100A Socket at Transformer Area 3 (044-TR-102A)	100A Socket at Transformer area 3	72.0 KW	100 A	160 A	1 x 3.5C - 70 mm ² XLPE AL	BUS A	M19
4	100A Socket at Transformer Area 5 (044-TR-104A)	100A Socket at Transformer area 5	72.0 KW	100 A	160 A	1 x 3.5C - 70 mm ² XLPE AL	BUS A	M19
5	100A Socket at Transformer Area 7 (044-TR-101B)	100A Socket at Transformer area 7	72.0 KW	100 A	160 A	1 x 3.5C - 70 mm ² XLPE AL	BUS A	M19
6	100A Socket at Transformer Area 9 (044-TR-102B)	100A Socket at Transformer area 9	72.0 KW	100 A	160 A	1 x 3.5C - 70 mm ² XLPE AL	BUS A	M19
7	100A Socket at Transformer Area 11 (044-TR-104B)	100A Socket at Transformer area 11	72.0 KW	100 A	160 A	1 x 3.5C - 70 mm ² XLPE AL	BUS A	M19
8	SUBSTATION LIFT	Substation Lift	10.0 KW	14 A	63 A	1 x 3.5C - 4 mm ² XLPE CU	BUS A	M17
9	DRAIN PUMP 1	Drain Pump 1	10.0 KW	14 A	63 A	1 x 3.5C - 185 mm ² XLPE CU	BUS A	M17
10	1806-X-206 EOT Crane (for Wet Gas Compressor)	1803-X-206	37.0 KW	51 A	80 A	1 x 3.5C - 70 mm ² XLPE AL	BUS A	M17
11	SPARE	-	-	-	63 A	-	BUS A	M17
12	SPARE	-	-	-	80 A	-	BUS A	M17
13	SPARE	-	-	-	160 A	-	BUS A	M19
14	SPARE	-	-	-	400 A	-	BUS A	M19
15	Hydro Blasting RFCC Unit 2	HB-002-01	288.0 KW	401 A	400 A	4 x 3.5C - 240 mm ² XLPE AL	BUS B	M19
16	100A Socket at Transformer Area 2 (044-TR-106A)	100A Socket at Transformer area 2	72.0 KW	100 A	160 A	1 x 3.5C - 70 mm ² XLPE AL	BUS B	M19
17	100A Socket at Transformer Area 4 (044-TR-103A)	100A Socket at Transformer area 4	72.0 KW	100 A	160 A	1 x 3.5C - 70 mm ² XLPE AL	BUS B	M19
18	100A Socket at Transformer Area 6 (044-TR-105A)	100A Socket at Transformer area 6	72.0 KW	100 A	160 A	1 x 3.5C - 70 mm ² XLPE AL	BUS B	M19
19	100A Socket at Transformer Area 8 (044-TR-105B)	100A Socket at Transformer area 8	72.0 KW	100 A	160 A	1 x 3.5C - 70 mm ² XLPE AL	BUS B	M19
20	100A Socket at Transformer Area 10 (044-TR-103B)	100A Socket at Transformer area 10	72.0 KW	100 A	160 A	1 x 3.5C - 70 mm ² XLPE AL	BUS B	M19
21	100A Socket at Transformer Area 12 (044-TR-105C)	100A Socket at Transformer area 12	72.0 KW	100 A	160 A	1 x 3.5C - 70 mm ² XLPE AL	BUS B	M19
22	SUBSTATION LIFT MOTOR	1803-X-702	10.0 KW	14 A	63 A	1 x 3.5C - 4 mm ² XLPE CU	BUS B	M17
23	DRAIN PUMP 2	Drain Pump 2	10.0 KW	14 A	63 A	1 x 3.5C - 4 mm ² XLPE CU	BUS B	M17
24	1806-X-109 EOT Crane (for Main Air Blower)	1803-X-109	15.0 KW	21 A	63 A	1 x 3.5C - 16 mm ² XLPE CU	BUS B	M17
25	SPARE	-	-	-	63 A	-	BUS B	M17
26	SPARE	-	-	-	63 A	-	BUS B	M17
27	SPARE	-	-	-	160 A	-	BUS B	M19
28	SPARE	-	-	-	400 A	-	BUS B	M19

PROJECT PETROCHEMICAL AND LUBE INTEGRATION
PROJECT "LuPech (J-18)" AT IOCL GUJARAT
REFINERY, VADODARA, GUJARAT, INDIA
EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT)

TITLE SINGLE LINE DIAGRAM
415 V SWITCHGEAR
044-ASB-101

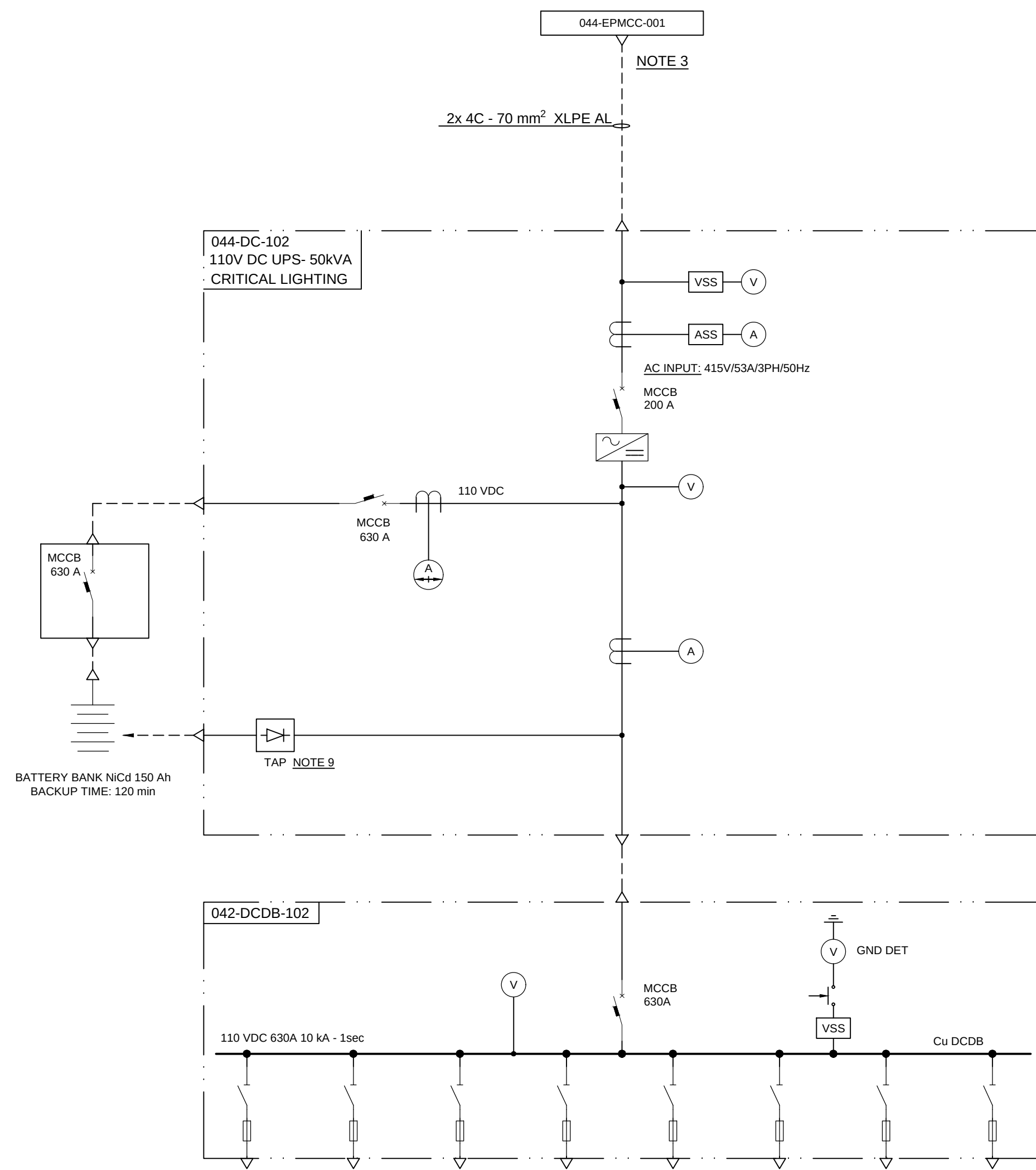
SCALE	DRAWING NUMBER	PROJECT NO	UNIT	PAGE	REV
S/N	2047	1803	EEL-SLD-0022	1 of 1	1



DESCRIPTION	TAG	POWER (KVA, KW, OR KVAR)	FULL LOAD CURRENT	RATED CURRENT CIRCUIT BREAKER	CABLE SIZE (mm ²)
33kV GIS FEEDER-A	044-HT33-101	3.6 Kw	32 A	50 A	-
33kV GIS FEEDER-B	044-HT33-101	3.6 Kw	32 A	50 A	-
11kV SWITCHGEAR FEEDER	044-HT11-101	1.3 Kw	-	20 A	-
6.6kV SWITCHGEAR FEEDER-A	044-HT6-101	13.6 Kw	128 A	150 A	-
6.6kV SWITCHGEAR FEEDER-B	044-HT6-101	13.6 Kw	128 A	150 A	-
6.6kV SWITCHGEAR FEEDER	044-HT6-102	2.8 Kw	26 A	50 A	-
044-PMCC-101 FEEDER-A	044-PMCC-101	7.2 Kw	69 A	80 A	-
044-PMCC-101 FEEDER-B	044-PMCC-101	7.2 Kw	-	80 A	-
044-PMCC-102 FEEDER-A	044-PMCC-102	9 Kw	-	100 A	-
044-PMCC-102 FEEDER-B	044-PMCC-102	9 Kw	81.9 A	100 A	-
044-PMCC-103 FEEDER-A	044-PMCC-103	11.8 Kw	100.2 A	120 A	-
044-PMCC-103 FEEDER-B	044-PMCC-103	11.8 Kw	100.2 A	120 A	-
044-EPMCC-101 FEEDER	044-EPMCC-101	16.2 Kw	146 A	150 A	-
044-MCC-101 FEEDER-A	044-MCC-101	5.8 Kw	52 A	63 A	-
044-MCC-101 FEEDER-B	044-MCC-101	5.8 Kw	52 A	63 A	-
044-MCC-102 FEEDER-A	044-MCC-102	2.6 Kw	25.2 A	50 A	-
044-MCC-102 FEEDER-B	044-MCC-102	2.6 Kw	25.2 A	50 A	-
044-MCC-103 FEEDER-A	044-MCC-103	2.6 Kw	25.2 A	50 A	-
044-MCC-103 FEEDER-B	044-MCC-103	2.6 Kw	25.2 A	50 A	-
044-MCC-104 FEEDER-A	044-MCC-104	3 Kw	27.25 A	50 A	-
044-MCC-104 FEEDER-B	044-MCC-104	3 Kw	27.25 A	50 A	-
044-MCC-105 FEEDER-A	044-MCC-105	2.6 Kw	25.2 A	50 A	-
044-MCC-105 FEEDER-B	044-MCC-105	2.6 Kw	25.2 A	50 A	-
044-MCC-106 FEEDER-A	044-MCC-106	4.3 Kw	40 A	50 A	-
044-MCC-106 FEEDER-B	044-MCC-106	4.3 Kw	40 A	50 A	-
SPARE	-	-	-	-	-
SPARE	-	-	-	-	-
SPARE	-	-	-	-	-

LEGEND		GENERAL NOTES	
	CABLE GLAND	NOTES 1. THE RECTIFIER/ CHARGERS SHALL BE OPERATE, AT LEAST, IN FOUR POSSIBLE MODES: - FLOAT MODE: THIS IS THE NORMAL MODE. CONSTANT-VOLTAGE CHARGE MODE. THE SET POINT SHALL BE ADJUSTABLE BY ±5% OF THE NOMINAL DC VOLTAGE. - AC SUPPLY FAIL MODE: WHEN THE POWER TO THE CHARGER IS INTERRUPTED THE CHARGER STOPS. - CHARGE MODE: AUTOMATICALLY SELECTED WHEN THE AC SUPPLY IS RESTORED. CHARGING OPERATION SHALL BE INCLUDE CONSTANT CURRENT PHASE, AND CONSTANT VOLTAGE PHASE. - BOOST MODE: VERY HIGH CONSTANT VOLTAGE CHARGE, INTENDED FOR USE AT COMMISSIONING TO COMPLETE THE FORMING PROCESS OF THE BATTERY PLATES.	 2. THE AUTONOMY OF SYSTEM DURING A MAIN FAIL SHALL BE 120 MINUTES. THE MINIMUM DISCHARGE VOLTAGE FOR EVERY LOAD CONDITION SHALL NOT BE LOWER THAN 1.05 V/ CELL OF NICKEL-CADMIUM BATTERIES, AND 1.7 V/ CELL OF LEAD-ACID BATTERIES. 3. WHEN THE INPUT VOLTAGE GOES DOWN TO 80% OF RATED VALUE, THE DC OUTPUT VOLTAGE VARIATIONS SHALL BE CONTROLLED TO A VALUE THAT AT LEAST PREVENTS THE INITIATION OF BATTERY DISCHARGE. 4. THE BATTERY BANKS SHALL BE SUPPORT IN A METALLIC RACK STRUCTURE, MADE OF STEEL WITH ACID OR ALKALI RESISTANCE PROTECTION. THE RACKS SHALL, GENERALLY BE REALIZED WITH STEPS, AND TIERS; THE NUMBERS OF STEPS, AND TIERS WILL BE DONE IN ORDER TO FACILITATE MAINTENANCE, AND CONNECTIONS. RACKS SHALL BE SUITABLE TO BE ANCHORED WITH BOLTS TO THE STRUCTURE. 5. THE LOCAL ALARMS TO BE PROVIDED, AT LEAST, ARE: - MAIN POWER SUPPLY FAILURE; - BATTERY CHARGER FAILURE; - DC UNDER VOLTAGE; - DC OVER VOLTAGE; - BATTERY DISCHARGE; - GROUND FAULT ON BATTERY; - BATTERY CHARGER AIR COOLING FAN FAILURE (WHEN FAN IS PROVIDED); - BATTERY IN DISCHARGE OPERATION; - GENERAL ALARM FOR PROTECTION DEVICES INTERVENTION ON THE DISTRIBUTION PANEL.
	AMMETER		
	AMMETER ZERO-CENTRAL		
	VOLTMETER		
	INDICATING LAMPS		
	CABLE		
	MOLDED CASE CIRCUIT BREAKER		
	MINIATURE CIRCUIT BREAKER		
	DRAW OUT FEATURE		
	FUSE		
	INVERTER		
	RECTIFIER		
	STATIC SWITCH		
	DISCONNECTING SWITCH		
	TRANSFORMER		
	TRANSFORMER WITH VARIABLE COUPLING		
	BATTERY BANK		
	MANUAL TRANSFER SWITCH		
	CURRENT TRANSFORMER FOR METERING CL.0.5FS5		
	GROUND DETECTOR (VOLTMETER)		

PROJECT				
PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LuPech (J-18)" AT IOCL GUJARAT REFINERY, VADODARA, GUJARAT, INDIA EPCC-2 PACKAGE (INDMAX FCCU + CR LPG TREATER UNIT)				
TITLE				
SINGLE LINE DIAGRAM				
110 V DC CHARGER				
044-DC-101				
DRAWING NUMBER				
SCALE	PROJECT NO	UNIT	PAGE	REV
S/C	2047	1803	EEL-SLD-0026	1 of 1 B



DESCRIPTION	TAG	POWER (KVA, kW, OR KVAR)	FULL LOAD CURRENT	RATED CURRENT CIRCUIT BREAKER	CABLE SIZE (mm²)
PROCESS AREA CLDB-1	-	1 KVA	9.09 A	10 A	-
PROCESS AREA CLDB-2	-	1 KVA	9.09 A	10 A	-
PROCESS AREA CLDB-3	-	1 KVA	9.09 A	10 A	-
SUBSTATION CLDB-1	-	1 KVA	9.09 A	10 A	-
SUBSTATION CLDB-2	-	1 KVA	9.09 A	10 A	-
CONTROL ROOM CLDB-1	-	1 KVA	9.09 A	10 A	-
SPARE	-	-	-	-	-
SPARE	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-

LEGEND	
	CABLE GLAND
	AMMETER
	AMMETER ZERO-CENTRAL
	VOLTMETER
	INDICATING LAMPS
	CABLE
	MOLDED CASE CIRCUIT BREAKER
	MINIATURE CIRCUIT BREAKER
	DRAW OUT FEATURE
	FUSE
	INVERTER
	RECTIFIER
	STATIC SWITCH
	DISCONNECTING SWITCH
	TRANSFORMER
	TRANSFORMER WITH VARIABLE COUPLING
	BATTERY BANK
	MANUAL TRANSFER SWITCH
	CURRENT TRANSFORMER FOR METERING CL.0.5FS5
	GROUND DETECTOR (VOLTMETER)

GENERAL NOTES

NOTES

1.

THE RECTIFIER/ CHARGERS SHALL BE OPERATE, AT LEAST, IN FOUR POSSIBLE MODES:

- FLOAT MODE: THIS IS THE NORMAL MODE. CONSTANT-VOLTAGE CHARGE MODE. THE SET POINT SHALL BE ADJUSTABLE BY ±5% OF THE NOMINAL DC VOLTAGE.
- AC SUPPLY FAIL MODE: WHEN THE POWER TO THE CHARGER IS INTERRUPTED THE CHARGER STOPS.
- CHARGE MODE: AUTOMATICALLY SELECTED WHEN THE AC SUPPLY IS RESTORED. CHARGING OPERATION SHALL BE INCLUDE CONSTANT CURRENT PHASE, AND CONSTANT VOLTAGE PHASE.
- BOOST MODE: VERY HIGH CONSTANT VOLTAGE CHARGE. INTENDED FOR USE AT COMMISSIONING TO COMPLETE THE FORMING PROCESS OF THE BATTERY PLATES.

2.

THE AUTONOMY/ OF SYSTEM DURING A MAIN FAIL SHALL BE 120 MINUTES. THE MINIMUM DISCHARGE VOLTAGE FOR EVERY LOAD CONDITION SHALL NOT BE LOWER THAN: 1.05 V/ CELL OF NICKEL-CADMIUM BATTERIES, AND 1.7 V/ CELL OF LEAD-ACID BATTERIES.

3.

WHEN THE INPUT VOLTAGE GOES DOWN TO 80% OF RATED VALUE, THE DC OUTPUT VOLTAGE VARIATIONS SHALL BE CONTROLLED TO A VALUE THAT AT LEAST PREVENTS THE INITIATION OF BATTERY DISCHARGE.

4.

THE BATTERY BANKS SHALL BE SUPPORT IN A METALLIC RACK STRUCTURE, MADE OF STEEL WITH ACID OR ALKALI RESISTANCE PROTECTION. THE RACKS SHALL, GENERALLY, BE REALIZED WITH STEPS, AND TIERS; THE NUMBERS OF STEPS, AND TIERS WILL BE DONE IN ORDER TO FACILITATE MAINTENANCE, AND CONNECTIONS. RACKS SHALL BE SUITABLE TO BE ANCHORED WITH BOLTS TO THE STRUCTURE.

5.

THE LOCAL ALARMS TO BE PROVIDED, AT LEAST, ARE:

- MAIN POWER SUPPLY FAILURE;
- BATTERY CHARGER FAILURE;
- DC UNDER VOLTAGE;
- DC OVER VOLTAGE;
- BATTERY DISCHARGE;
- GROUND FAULT ON BATTERY;
- BATTERY CHARGER AIR COOLING FAN FAILURE (WHEN FAN IS PROVIDED);
- BATTERY IN DISCHARGE OPERATION;
- GENERAL ALARM FOR PROTECTION DEVICES INTERVENTION ON THE DISTRIBUTION PANEL.

6.

THE FOLLOWING VISUAL SIGNALS FOR BATTERY CHARGER SHALL BE PROVIDED:

- MAINS SUPPLY HEALTHY;
- BATTERY UNDER FLOATING CHARGE;
- BATTERY UNDER RECHARGING;
- BATTERY UNDER INITIAL CHARGE;
- CHARGER FAULT.

7.

THE FOLLOWING VISUAL SIGNALS FOR DC DISTRIBUTION BOARD SHALL BE PROVIDED:

- DC POWER ON;
- OUTGOING FEEDER ON (FOR EACH OUTGOING FEEDER).

8.

THE BATTERY CHARGER SHALL BE SUPPLIED IN FREESTANDING ENCLOSURES AND IN A SEPARATE CUBICLE FROM DC THE DISTRIBUTION BOARD WHICH SHALL BE HOUSED IN ANOTHER CUBICLE. EACH VERTICAL SECTION SHALL BE PROVIDED WITH A SPACE HEATER TO PREVENT CONDENSATION, THE POWER SUPPLY TO AUXILIARY EQUIPMENT (SUCH AS PANEL LIGHTING, FANS, SPACE HEATERS, ETC.) SHALL BE SUPPLIED FROM SWITCHBOARD OF AUXILIARY SUPPLY, 240 VAC.

9.

BATTERY CHARGERS SHALL BE PROVIDED WITH TAP CELL CONNECTION TO TAKE CARE OF INTERRUPTION OF FLOAT CHARGER WHEN OTHER CHARGER IS BEING USED TO BOOST CHARGE THE BATTERY BANK.

PROJECT

PETROCHEMICAL AND LUBE INTEGRATION
PROJECT "LuPech (J-18)" AT IOCL GUJARAT
REFINERY, VADODARA, GUJARAT, INDIA
EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT)

TITLE

SINGLE LINE DIAGRAM
110 V DC CHARGER
044-DC-102

SCALE

PROJECT NO

UNIT

DRAWING NUMBER

PAGE

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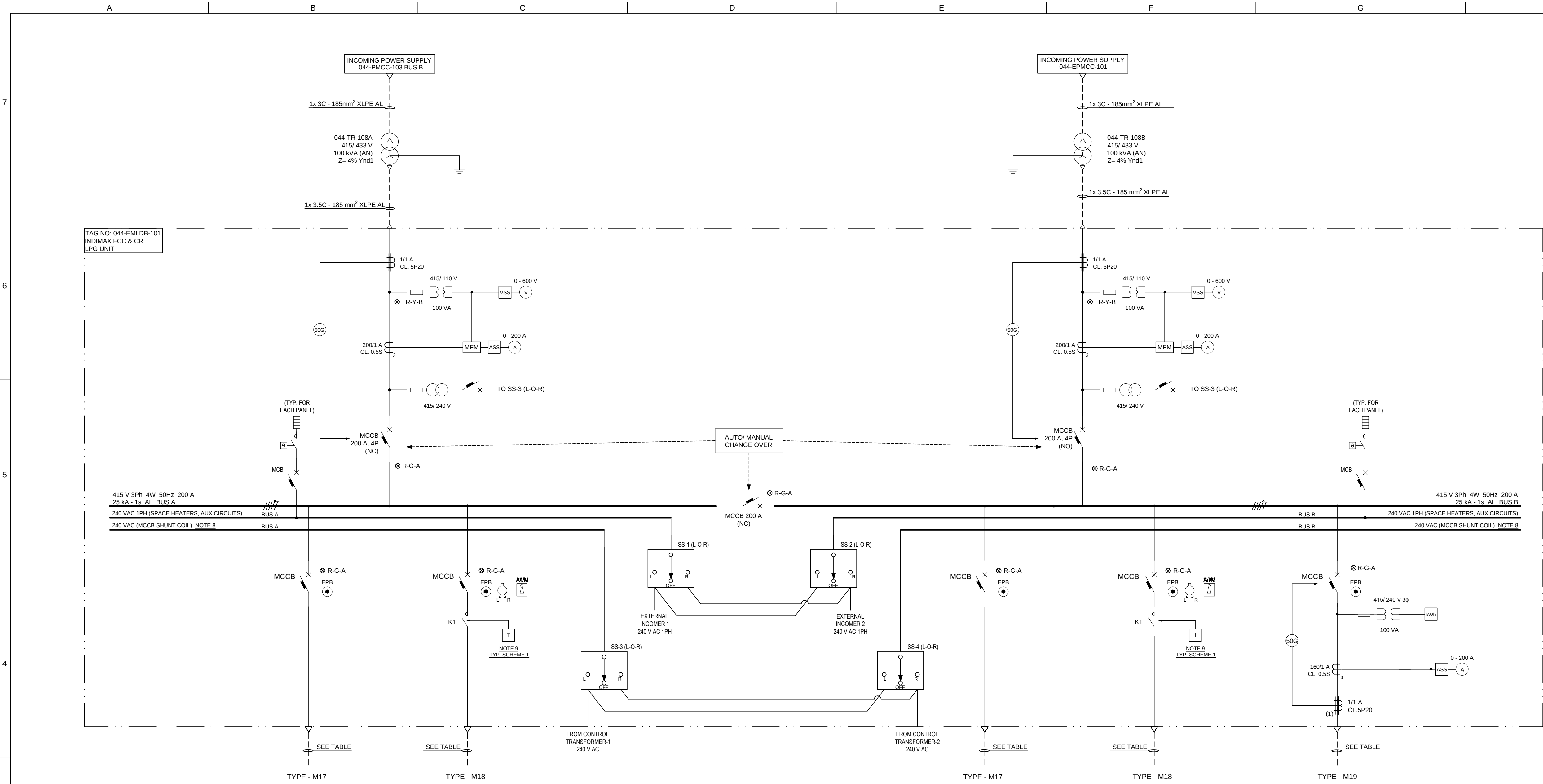
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1803

EEL-SLD-0027

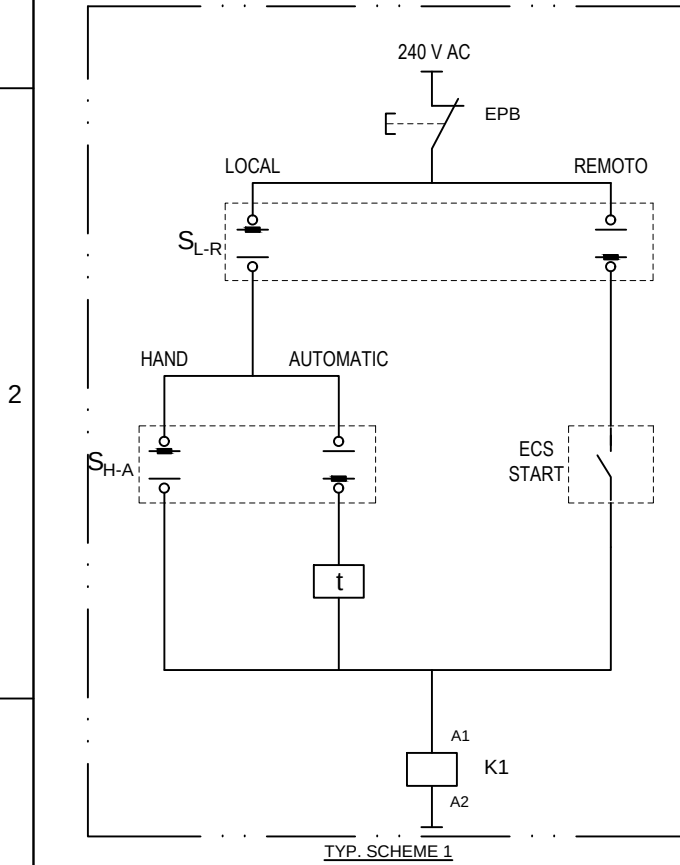
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GENERAL NOTES

- NOTES:
- CURRENT TRANSFORMERS FOR PROTECTION SHALL BE 5P20, FOR METERING SHALL BE 0.5S.
 - THE DEGREES OF PROTECTION OF THE LOW VOLTAGE SWITCHGEAR SHALL BE IP42 FOR EXTERNAL PROTECTION, INTERNAL PROTECTION FROM IP2X, FORM OF SEPARATION 4b, METAL PARTITIONING.
 - PROTECTIVE EARTH BAR MUST BE INCLUDED, AND WHICH RUN HORIZONTALLY LOCATED IN THE MAIN BUSBAR COMPARTMENT JUST ABOVE THE BASE. THE PE BAR MUST BE FASTENED TO THE FRAME TO ASSURE ELECTRICAL CONTINUITY.
 - THE CONTROL VOLTAGES FOR CLOSING CIRCUITS, TRIPPING CIRCUITS, CONTROL SYSTEM, PROTECTION RELAYS POWER SUPPLY, AUXILIARY RELAYS, INDICATION CIRCUIT AND MOTOR POWER SUPPLY SHALL BE 110 VDC.
 - ANTI-CONDENSATION HEATERS SHALL BE PROVIDED WITH THERMOSTAT CONTROL -RANGE OF 10°C TO 40°C- AND INSTALLED AT THE BOTTOM OF EACH VERTICAL SECTION (ACCORDING TO THE MANUFACTURER'S STANDARD) AND SHALL BE INDIVIDUALLY PROTECTED BY MCB. EACH HEATER SHALL BE COMPLETE WITH A ROTARY TYPE ON/OFF SWITCH.
 - FOR EMLDB, ONE OF THE INCOMER SHALL BE FED FROM NORMAL PMCC AND THE OTHER INCOMER SHALL BE FED FROM EPMCC. UNDER NORMAL RUNNING CONDITION, INCOMER FROM PMCC AND BUS COUPLER SHALL BE CLOSED WITH THE INCOMER FROM PMCC IN OPEN CONDITION. UPON FAILURE OF NORMAL SUPPLY FROM PMCC, THE INCOMER FROM EPMCC SHALL BE CLOSED AUTOMATICALLY TO FEED THE ENTIRE LOAD.
 - THE MCCB FOR INCOMING, BUSCOUPLER, AND OUTGOING UNITS SHALL BE 4-POLE.
 - A DEDICATED CIRCUIT AT 240 VAC SHALL BE USED FOR MCCB SHUNT COIL.
 - THE LIGHTING CONTROL SHALL HAVE LOCAL AND REMOTE SELECTION AT THE ELECTRICAL SWITCHBOARD. IN REMOTE MODE, THE LIGHTING WILL BE CONTROLLED CENTRALLY THROUGH ECS. IN LOCAL MODE, THE AUTO / MANUAL MODE SHALL BE THERE FOR TIMER / MANUAL CONTROL. AUXILIARY RELAYS AS REQUIRED FOR REMOTE SWITCHING ON / OFF OF LIGHTING SYSTEM SHALL BE PROVIDED.
 - PROTECTION RELAYS SHALL BE OF LATEST VERSION, MICROPROCESSOR BASED NUMERICAL TYPE FOR COMMUNICATION WITH ECS / DCS. IT SHALL HAVE IEC 61850 COMPLIANT COMMUNICATION FACILITY. ALL NUMERICAL RELAY SHALL HAVE 1NO RJ45 PORT AT RELAY FRONT AND 2NOS (REDUNDANT) RJ 45 PORT AT RELAY REAR. MULTIFUNCTION METERS (MFM) SHALL BE DIGITAL TYPE AND SHALL HAVE COMMUNICATION FACILITY WITH MODBUS RTU / RS 485 COMMUNICATION PROTOCOL. THE REPRESENTATION OF NUMERICAL RELAY IS CONCEPTUAL. THE EXACT DETAILS SHALL BE DEVELOPED BY SWITCHBOARD VENDOR.
 - MULTIFUNCTION METER (MFM) SHALL BE DIGITAL TYPE AND SHALL HAVE COMMUNICATION FACILITY WITH MODBUS RTU / RS 485 COMMUNICATION PROTOCOL. MFM SHALL HAVE FOLLOWING METERING PARAMETERS AS MINIMUM: A, V, F, KW, KVA, KWH, KVARH, KVAR, PF.
 - LAMP TEST PUSH BUTTON SHALL BE PROVIDED FOR ALL FEEDERS. MINIMUM 8 WINDOW MICROPROCESSOR BASED ANNUNCIATOR SHALL BE PROVIDED WITH 20% SPARE.
 - 96MM X 96MM ANALOGUE AMMETER AND VOLTMETER SHALL BE PROVIDED. LOTO PROVISIONS SHALL BE PROVIDED FOR ALL FEEDERS. SWITCHBOARD SHALL BE PROVIDED WITH COMMON ELECTRONIC HOOTER WITH TONE / VOLUME CONTROL IN BUS COUPLER FEEDER.
 - LIGHTING CONTROL SCHEME SHALL BE DESIGNED TO TRIP THE ENTIRE LIGHTING SYSTEM IN CASE OF "AIR RAID WARNING". LIGHTING SYSTEM SHALL HAVE CONTROL TO ENABLE / DISABLE THE LIGHTING OF ENTIRE UNIT INCLUDING SUBSTATION AND PLANT LIGHTING. THE SIGNALS SHALL BE INTERFACED TO CGP-1 AS PART OF ECS SYSTEM.
 - IN EMLDB, UNDER VOLTAGE RELAY CONTACTS OF BOTH THE EMERGENCY BUS SECTIONS WIRED IN PARALLEL WHICH SHALL BE USED TO SWITCH ON THE DC LIGHTING CIRCUIT.



DESCRIPTION	TAG	RATING POWER (kW or kVA)	FULL LOAD CURRENT	RATED CURRENT CIRCUIT BREAKER	CABLE SIZE/ MATERIAL	BUSBAR	TYPE
EMERGENCY INDOOR LIGHTING DISTRIBUTION BOARD (SS-044 GROUND FLOOR)	044-ELDB-104	2 kW	3 A	16 A	1x 4C - 2.5 mm² XLPE Cu	A	M17
EMERGENCY INDOOR LIGHTING DISTRIBUTION BOARD (SS-044 SECOND FLOOR)	044-ELDB-106	2 kW	3 A	16 A	1x 4C - 2.5 mm² XLPE Cu	A	M17
EMERGENCY INDOOR LIGHTING DISTRIBUTION BOARD (CONTROL ROOM)	044-ELDB-103	2 kW	3 A	16 A	1x 4C - 2.5 mm² XLPE Cu	A	M17
EMERGENCY OUTDOOR LIGHTING DISTRIBUTION BOARD (DELUGE HOUSE)	044-ELDB-107	2 kW	3 A	16 A	1x 4C - 2.5 mm² XLPE Cu	A	M18
EMERGENCY OUTDOOR LIGHTING DISTRIBUTION BOARD (RECIRCULATION PUMPS)	044-ELDB-109	2 kW	3 A	16 A	1x 4C - 2.5 mm² XLPE Cu	A	M18
EMERGENCY OUTDOOR LIGHTING DISTRIBUTION BOARD (REACTOR & REGENERATOR AREA)	044-ELDB-111	2 kW	3 A	16 A	1x 4C - 2.5 mm² XLPE Cu	A	M18
EMERGENCY OUTDOOR LIGHTING DISTRIBUTION BOARD (FLUE GAS WH BOILER AREA)	044-ELDB-113	2 kW	3 A	16 A	1x 4C - 2.5 mm² XLPE Cu	A	M18
EMERGENCY OUTDOOR LIGHTING DISTRIBUTION BOARD (PIPERACK - EAST)	044-ELDB-115	2 kW	3 A	16 A	1x 4C - 2.5 mm² XLPE Cu	A	M18
SPARE	-	-	-	16 A	-	A	M17
SPARE	-	-	-	16 A	-	A	M18
EMERGENCY INDOOR LIGHTING DISTRIBUTION BOARD (SS-044 FIRST FLOOR)	044-ELDB-105	2 kW	3 A	16 A	1x 4C - 2.5 mm² XLPE Cu	B	M17
EMERGENCY INDOOR LIGHTING DISTRIBUTION BOARD (SS-044 THIRD FLOOR)	044-ELDB-101	2 kW	3 A	16 A	1x 4C - 2.5 mm² XLPE Cu	B	M17
EMERGENCY OUTDOOR LIGHTING DISTRIBUTION BOARD (LAYDOWN AREA)	044-ELDB-102	2 kW	3 A	16 A	1x 4C - 2.5 mm² XLPE Cu	B	M18
EMERGENCY OUTDOOR LIGHTING DISTRIBUTION BOARD (LPG TREATER UNIT)	044-ELDB-108	2 kW	3 A	16 A	1x 4C - 2.5 mm² XLPE Cu	B	M18
EMERGENCY OUTDOOR LIGHTING DISTRIBUTION BOARD (DEETHENIZER AND DEBUTANIZER AREA)	044-ELDB-110	2 kW	3 A	16 A	1x 4C - 2.5 mm² XLPE Cu	B	M18
EMERGENCY OUTDOOR LIGHTING DISTRIBUTION BOARD (WET GAS SCRUBBER AREA)	044-ELDB-112	2 kW	3 A	16 A	1x 4C - 2.5 mm² XLPE Cu	B	M18
EMERGENCY OUTDOOR LIGHTING DISTRIBUTION BOARD (PIPERACK - WEST)	044-ELDB-114	2 kW	3 A	16 A	1x 4C - 2.5 mm² XLPE Cu	B	M18
SECURITY GATE HOUSE INCOMER 2	044-MLDB-102 B	50 kW	79 A	160A	3x 3.5C - 300 mm² XLPE AL	B	M5
SPARE	-	-	-	16 A	-	B	M17
SPARE	-	-	-	16 A	-	B	M18
SPARE	-	-	-	160 A	-	B	M5

LEGEND

	CABLE GLAND		TRIP, NEUTRAL & CLOSE SWITCH
	AMMETER		TRIP SELECTOR SWITCH (INCOMER-A /BUS COUPLER / INCOMER-B)
	AMMETER SELECTOR SWITCH		AUTO / MANUAL SELECTOR SWITCH
	VOLTMETER		8 WINDOW ANNUNCIATOR
	VOLTMETER SELECTOR SWITCH		EMERGENCY STOP PUS BUTTON (BREAK GLASS TYPE)
	NUMERICAL MICROPROCESSOR BASED MULTIFUNCTION RELAY		CONTROL LOCAL AND REMOTE SELECTOR
	MULTIFUNCTION METER		PUSHBUTTON ON/ PUSHBUTTON OFF
	GROUNDING CONNECTION		TIMER
	CABLE		TIMER
	MOULDED CASE CIRCUIT BREAKER		SYNCHRO CHECK RELAY
	MINIATURE CIRCUIT BREAKER		UNDER VOLTAGE RELAY
	ISOLATOR / DISCONNECT SWITCH		IDMT OVERCURRENT RELAY
	HEATER ELEMENT		IDMT EARTH FAULT RELAY
	CONTACTOR		HIGH SPEED TRIPPING RELAY
	CURRENT TRANSFORMER		TRIP CIRCUIT SUPERVISION RELAY
	POTENTIAL TRANSFORMER 3φ		SENSITIVE EARTH FAULT RELAY
	CORE BALANCE CT (CBCT)		

PROJECT		PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LuPech (J-18)" AT IOCL GUJARAT REFINERY, VADODARA, GUJARAT, INDIA			
		EPCC-2 PACKAGE (INDMAX RFCCU+CR LPG TREATER UNIT)			
TITLE		SINGLE LINE DIAGRAM 415 V SWITCHGEAR 044-EMLDB-101			
SCALE	DRAWING NUMBER		PAGE	REV	
	PROJECT NO	UNIT			
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GROUNDING INSTALLATION STANDARDS

PROJECT									
PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LuPech (J-18)" AT IOCL GUJARAT REFINERY, VADODARA, GUJARAT, INDIA EPCC-2 RFCC UNIT									
TITLE									
GROUNDING INSTALLATION STANDARDS									
SCALE	DRAWING NUMBER								
	PROJECT NO	UNIT	2047-1803-EEL-DST-0003					PAGE	REV
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7	GENERAL NOTES : 1. EARTHING SHALL BE DONE IN ACCORDANCE WITH THE REQUIREMENTS LAID DOWN IN IS:3043, ENGINEERING DESIGN BASIS FOR ELECTRICAL (DOC. NO:077154C-000-JSD-1600-001_E), JOB SPECIFICATION FOR ELECTRICAL INSTALLATION (DOC. NO:077154C-000-JSD-1600-003). 2. WHEREVER G.I. IS MENTIONED IN THE NOTES & STANDARDS, THIS INDICATES THAT HOT DIP GALVANIZED MILD STEEL TO BE USED FOR EARTHING. 3. MAIN GROUNDING GRID SHALL BE INSTALLED AT A MINIMUM DEPTH OF 500MM (AS PER LAYOUTS) FROM FINISHED GRADE LEVEL. 4. CLEAN EARTHING GRID SHALL BE LAID 500MM AWAY FROM MAIN ELECTRICAL EARTHING GRID. ALSO CLEAN EARTHING GRID SHALL NOT BE CONNECTED WITH ELECTRICAL MAIN GRID. 5. ALL MEDIUM AND HIGH VOLTAGE EQUIPMENT (ABOVE 250V) SHALL BE EARTHED BY TWO SEPARATE AND DISTINCT CONNECTIONS WTH EARTH. 6. ALL LIGHTING FIXTURES/CONVENIENCE SOCKET OUTLET/LIGHTING JUNCTION BOX SHALL BE EARTHED THROUGH THE THIRD CORE OF THE FEEDING CABLE OR THIRD WIRE OF THE FEEDING CIRCUIT AS PER INDIVIDUAL LIGHTING LAYOUT DRAWING. 7. METALLIC SHEATHS, SCREENS AND ARMOUR OF ALL MULTICORE CABLES SHALL BE EARTHED AT BOTH EQUIPMENT AND SWITCHGEAR ENDS. SHEATH AND ARMOUR OF SINGLE CORE CABLES SHALL BE EARTHED AT SWITCHGEAR END ONLY. 8. ALL PROCESS PIPELINES SHALL BE BONDED AND EARTHED AT THE ENTRY AND EXIT POINTS OF BATTERY LIMIT OF PROCESS AREA. 9. IN HAZARDOUS AREAS ALL PROCESS EQUIPMENT SHALL BE CONNECTED TO THE MAIN EARTH GRID AT TWO PLACES. 10. THE FLANGES OF THE PIPE LINES CARRYING HAZARDOUS LIQUID SHALL LOOPED BONDED TOGETHER IN ORDER TO PREVENT ACCUMULATION OF STATIC CHARGE & MAINTAIN CONTINUITY OF EARTHING. 11. FOR EQUIPMENT EARTHING, INDIVIDUAL EARTH CONNECTIONS SHALL BE TAPPED FROM NEAREST MAIN EARTHING GRID/EARTH PLATE AS PER LAYOUT DRAWING. THE SIZE OF THE GROUNDING CONDUCTOR FOR THE EQUIPMENT SHALL BE AS PER EQUIPMENT INSTALLATION/LAYOUT. 12. FOR EARTHING LAYOUT OF INDIVIDUAL PLANT, SUBSTATION ETC. REFER TO THE RESPECTIVE EARTHING LAYOUT DRAWINGS. 13. ALL JOINTS BELOW GRADE SHALL BE WELDED & SHALL BE SUITABLY PROTECTED BY BITUMEN (2 COATS) IMPREGNATED HESSIAN TAPE. 14. EARTH STRIP LAID ABOVE GROUND SHALL BE WELDED ACROSS STRAIGHT THROUGH JOINTS & JOINTS SHALL BE SUITABLY PROTECTED BY GIVING TWO COATS OF BITUMEN TO AVOID OXIDATION AND INSULATION FILM FORMATION OF THE STRIP SURFACE. 15. ALL OIL & GAS HEADER PIPE LINES SHALL BE DISTINCTLY EARTHED AT 2 LOCATIONS. 16. THE MASS OF THE ZINC COATING SHALL BE 720GM/M², & AVERAGE THICKNESS SHALL BE 100 MICRONS FOR GALVANIZED ITEMS. 17. ALL DAMAGE TO GALVANIZED SURFACES SHALL BE POLISHED GOOD WITH ZINC RICH PAINT. 18. ALL EARTH CONNECTIONS SHOULD BE VISIBLE FOR INSPECTION TO THE EXTENT POSSIBLE. 19. MAIN EARTH GRID SHALL BE SUPPLIED AND LAID BY ELECTRICAL CONTRACTOR. 20. LIGHTNING PROTECTION SHALL BE DONE IN ACCORDANCE WITH THE REQUIREMENTS LAID DOWN IN IS/IEC:62305 AND ENGINEERING DESIGN BASIS FOR ELECTRICAL 077154C-000-JSD-1600-001_E. SELF-CONDUCTING STRUCTURES HAVING METAL THICKNESS OF MORE THAN 4.8mm MAY NOT REQUIRE LIGHTNING PROTECTION WITH AERIAL ROD AND DOWN CONDUCTORS. THEY SHALL HOWEVER BE CONNECTED TO THE EARTHING SYSTEM ATLEAST AT TWO POINTS AT THE BASE. 21. SEPARATE EARTH PITS SHALL BE PROVIDED FOR EACH DOWN CONDUCTOR OF LIGHTNING PROTECTION. 22. EARTH DISPATCHER REQUIREMENT SHALL BE SUITABLY DECIDED AT SITE BASED ON NUMBER OF TAPPING CONNECTION FOR THE RESPECTIVE EQUIPMENT. 23. DEDICATED EARTHING SYSTEM FOR PLANT INSTRUMENT, DCS, PLC AND OTHER ELECTRONIC INSTRUMENTS, DATA CONCENTRATOR AS PER INSTRUMENTATION DESIGN PHILOSOPHY. 24. SEPARATE EARTH PITS WITH REDUNDANT EARTH BUS SHALL BE PROVIDED FOR THE SYSTEM EARTH, SHIELD/FRAME/POWER EARTH GRID. GRID EARTH RESISTANCE SHALL BE LESS THAN 1 OHM FOR SYSTEM EARTH AND LESS THAN 5 OHM FOR SHIELD/FRAME/POWER EARTH.								PROJECT PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LuPech (J-18)" AT IOCL GUJARAT REFINERY, VADODARA, GUJARAT, INDIA EPCC-2 RFCC UNIT TITLE GROUNDING INSTALLATION STANDARDS GENERAL NOTES <table><tr><td>SCALE</td><td colspan="4">DRAWING NUMBER</td><td>PAGE</td><td>REV</td></tr><tr><td>N.T.S</td><td>PROJECT NO</td><td>UNIT</td><td colspan="2">2047-1803-EEL-DST-0003</td><td>2 OF 14</td><td>A</td></tr><tr><td></td><td>2047</td><td>1803</td><td>EEL</td><td>DST</td><td>0003</td><td></td></tr></table>	SCALE	DRAWING NUMBER				PAGE	REV	N.T.S	PROJECT NO	UNIT	2047-1803-EEL-DST-0003		2 OF 14	A		2047	1803	EEL	DST	0003		7
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LEGEND :

- : 100X12mm GI STRIP FOR MAIN EARTH GRID
- : 75X10mm GI STRIP (UNDER GROUND)
- : 75X10mm GI STRIP (ABOVE GROUND)
- : 50X6mm GI STRIP FOR LIGHTNING PROTECTION
- : 40X5 GI STRIP
- : 16MM DIA. GI WIRE ROPE FOR EQUIPMENT EARTH
- : 10MM DIA. GI WIRE ROPE FOR EQUIPMENT EARTH
- : 4MM DIA.(8 SWG) GI WIRE ROPE FOR EQUIPMENT EARTH

- : 400X75X10MM EARTHING BAR
- IE - INSTRUMENT EARTH BAR (COPPER)
- PE - PLANT / SAFETY EARTH BAR (COPPER)
- IS - INSTRUMENT IS EARTH BAR (COPPER)

- : EARTHING CONNECTION (BOLTED /REMOVABLE)
- : EARTHING CONNECTION (WELDED)
- : EARTH ELECTRODE
- : INDICATE EARTH PIT FOR NEUTRAL EARTHING
- : INDICATE EARTH PIT FOR LIGHTNING PROTECTION
- : INSTRUMENTATION EARTH PIT

- : EARTH ELECTRODE

- : EARTH BAR IN TEST CHAMBER

- : EARTHING CABLE GOING UP
- : EARTHING CABLE COMING DOWN

- : HV MOTOR
- : MV MOTOR

- : LOCAL DISTRIBUTION PANEL
- NORMAL LIGHTING PANEL (LP)
- EMERGENCY LIGHTING PANEL (ELP)
- SMALL POWER PANEL (SPP)

- : EMERGENCY STOP PB
- : LOCAL CONTROL STATION
- : LOCAL CONTROL STATION WITH AMMETER

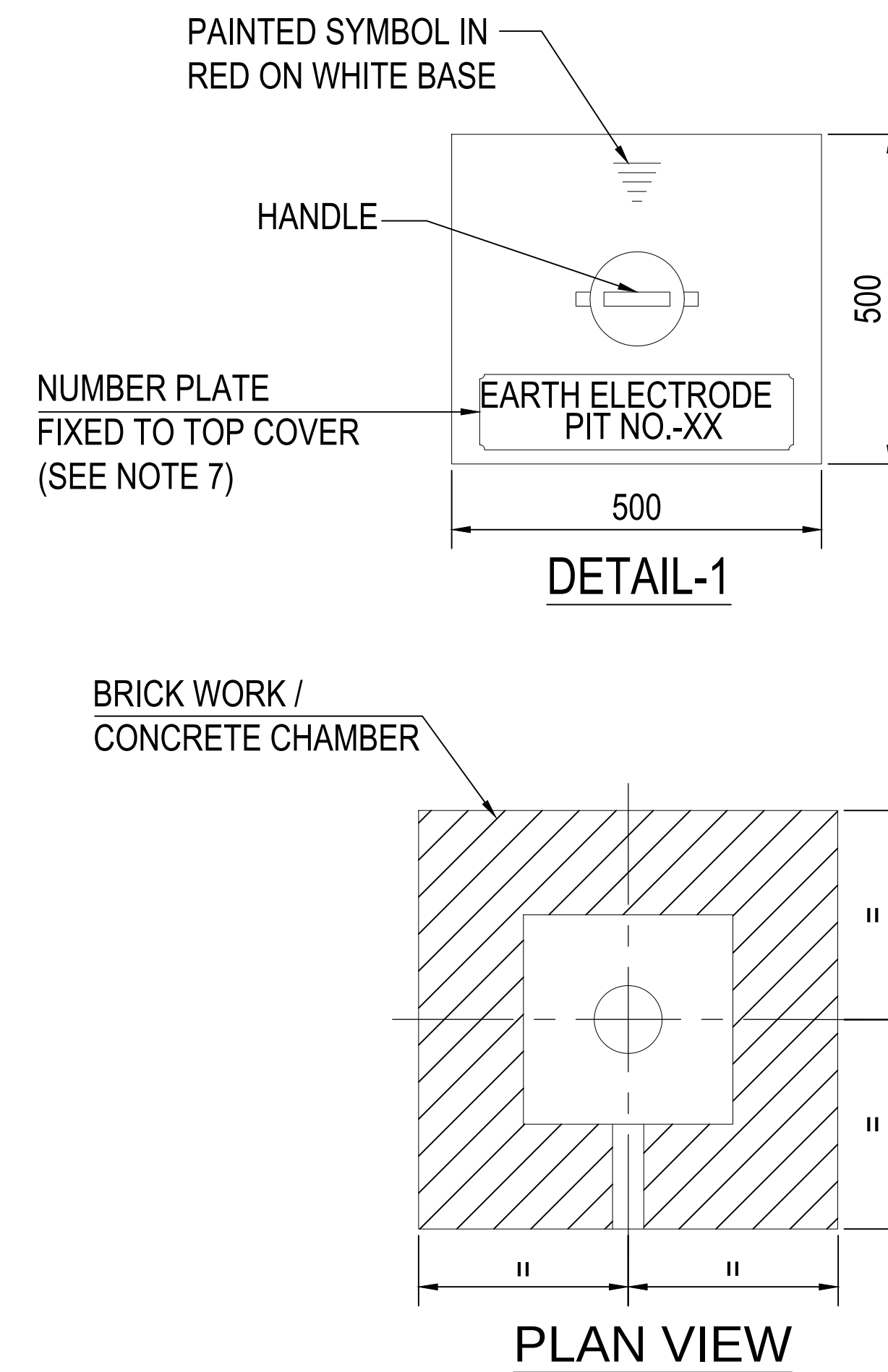
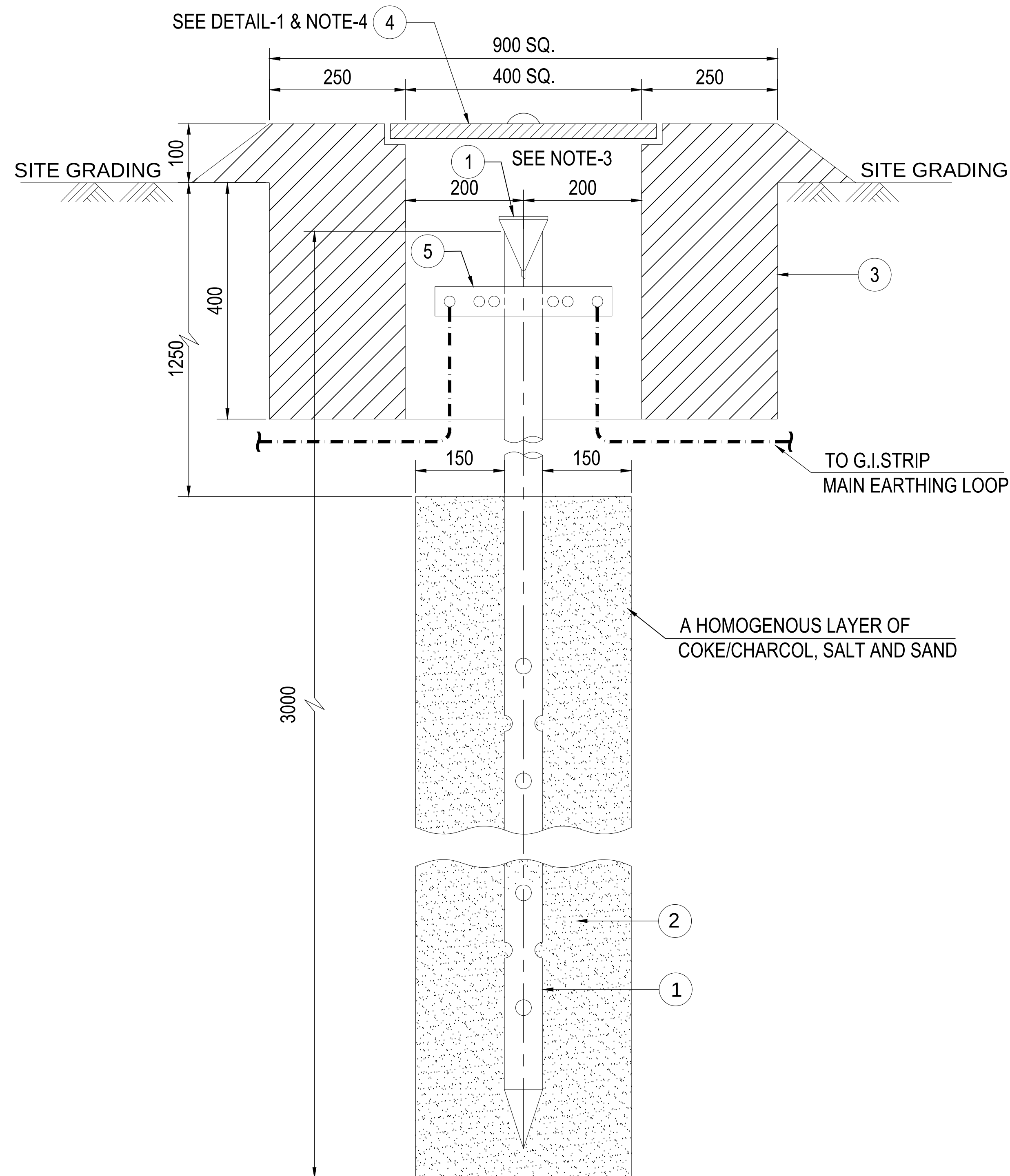
- : WELDING OUTLET (63A)
- : HYDRO BLASTING OUTLET (250A)
- : POWER JUNCTION BOX
- : MOUNTING STANDARD
- : 100A RECEPTACLE

PROJECT									
PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LuPech (J-18)" AT IOCL GUJARAT REFINERY, VADODARA, GUJARAT, INDIA EPCC-2 RFCC UNIT									
TITLE									
GROUNDING INSTALLATION STANDARDS LEGEND									
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EQUIPMENT EARTHING SCHEDULE:

TYPE OF EQUIPMENT	EARTHING CONDUCTOR SIZES
MOTOR UP TO 3.7KW	8 SWG SOLID G.I.WIRE
MOTOR ABOVE 5.5KW UP TO 30KW & WELDING RECEPTACLE	10 MM (3/8") DIA G.I WIRE ROPE
MOTOR ABOVE 30KW INCLUDING HV MOTORS	16 MM (5/8") DIA G.I WIRE ROPE / 40 x 5 MM GI STRIP
BUILDING COLUMNS	50 X 6 MM GI STRIP
STORAGE TANKS (VERTICAL & HORIZONTAL)	50 X 6 MM GI STRIP
LOADING RACKS	50 X 6 MM GI STRIP
VESSELS & HEAT EXCHANGERS	50 X 6 MM GI STRIP
SMALL EQUIPMENTS & INSTRUMENTS	8 SWG SOLID G.I.WIRE
LIGHTING / POWER PANEL/ INSTRUMENT PANEL	10 MM (3/8") DIA G.I WIRE ROPE
MAIN EARTH BUS / INTERCONNECTION / POWER TRANSFORMER	75x10mm GI EARTH STRIP
HV SWITCHGEAR / HV VFD / MCC PANEL/ SOFT STARTER PANEL/ THYRISTOR CONTROL PANEL	65x8mm GI EARTH STRIP
PMCC / EPMCC PANEL	50x6mm GI EARTH STRIP
CAPACITOR BANK PANEL	40x5mm GI EARTH STRIP
ASB PANEL / DCDB PANEL / BATTERY CHARGER PANEL MLDB / EMLDB / APFC PANEL / AMF PANEL/ HEAT TRACING PANEL /	50 X 6 MM GI STRIP
SOLAR PANEL ECS PANEL	40x5mm GI EARTH STRIP
HV SUBSTATIONS	120x10mm GI EARTH STRIP
PUSHBUTTON STATIONS	8 SWG SOLID G.I.WIRE
STREET LIGHT POLES	10 MM (3/8") DIA G.I WIRE ROPE
LIGHTING TRANSFORMER	16 MM (5/8") DIA G.I WIRE ROPE
PIPE RACK	50 X 6 MM GI STRIP
BONDING OF PIPE	10 MM (3/8") DIA G.I WIRE ROPE
LIGHTNING PROTECTION	50 X 6 MM GI STRIP

PROJECT PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LuPech (J-18)" AT IOCL GUJARAT REFINERY, VADODARA, GUJARAT, INDIA EPCC-2 RFCC UNIT					
TITLE GROUNDING INSTALLATION STANDARDS EQUIPMENT EARTHING SCHEDULE					
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STANDARD
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SYMBOL

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NOTES:

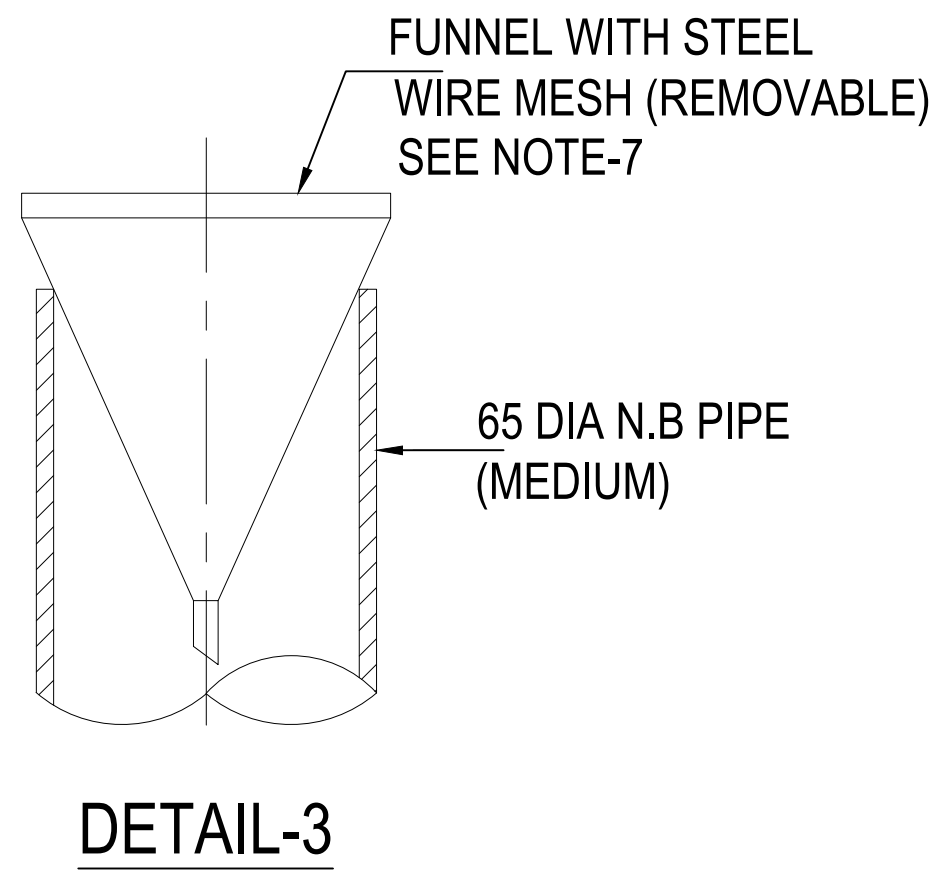
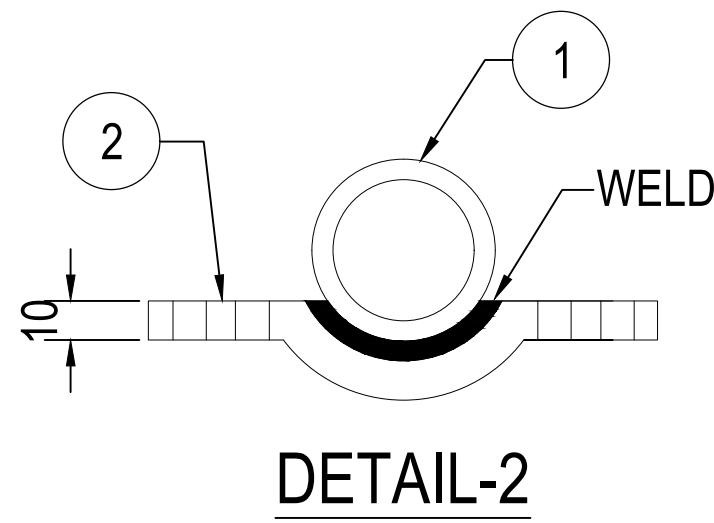
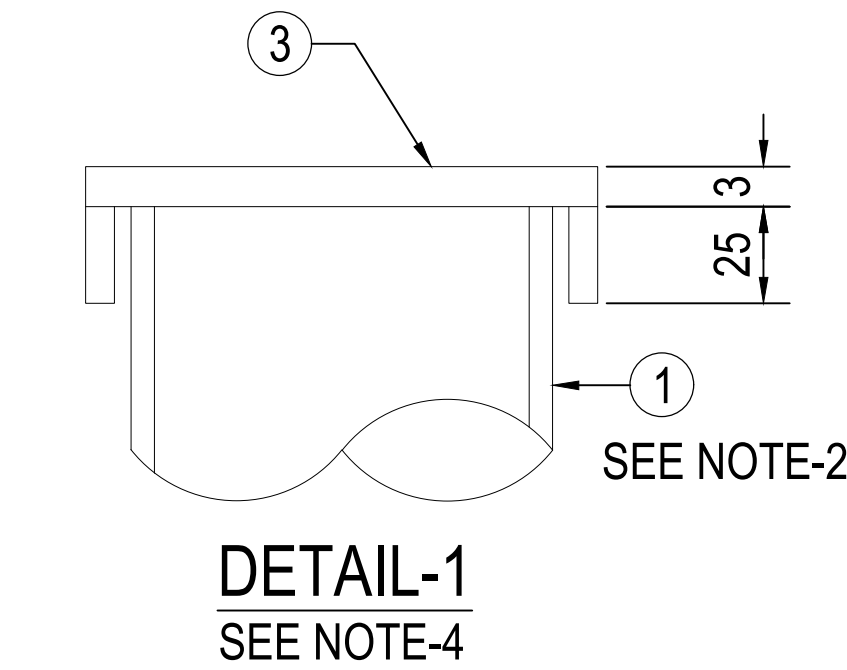
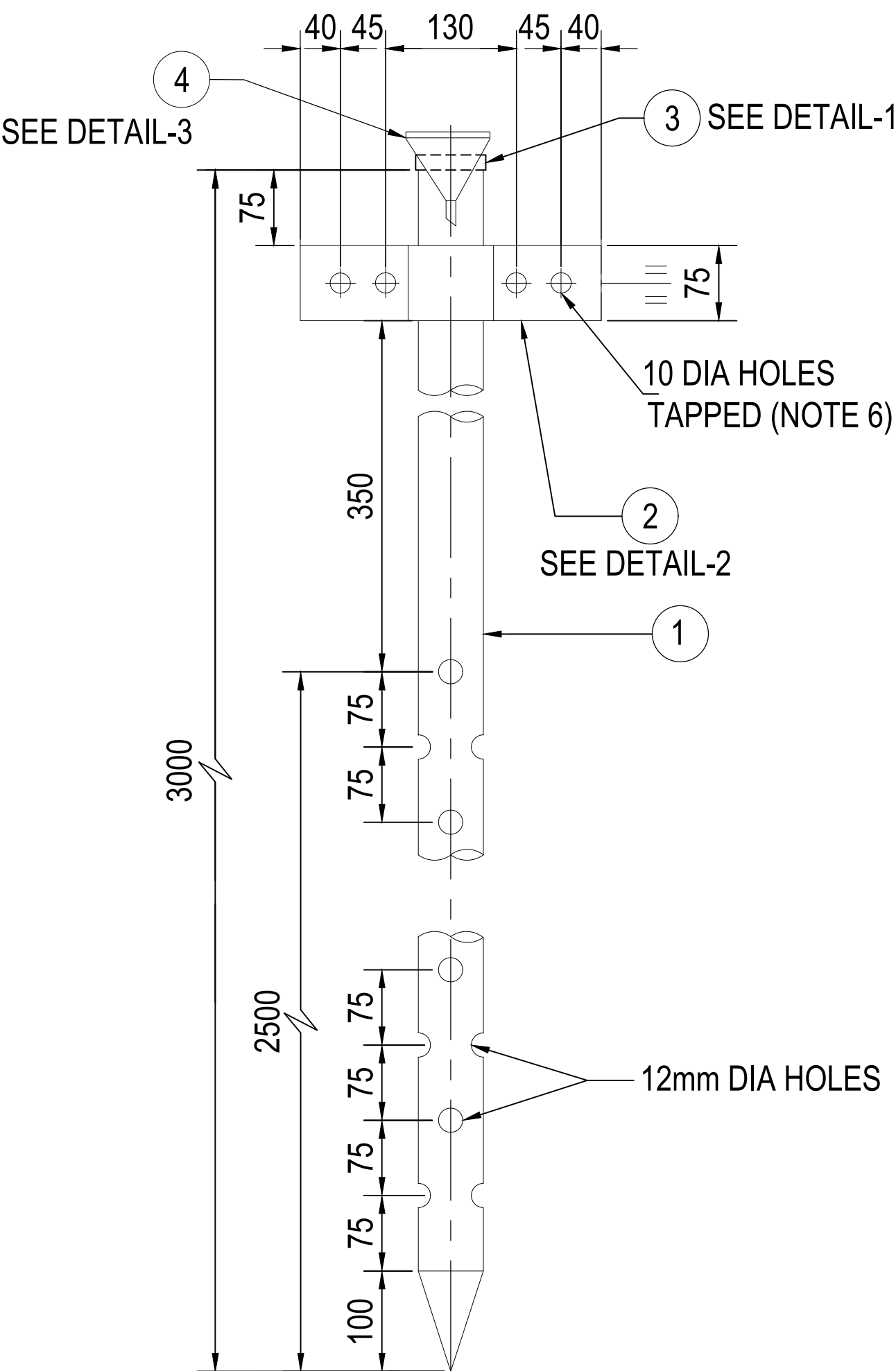
1. ALL DIMENSIONS ARE IN MM.
2. BRICK WORK SHALL BE DONE AFTER COMPACTING THE NEARBY SOIL.
3. AFTER REMOVAL OF CAP, OWNER SHALL BE ABLE TO POUR WATER THROUGH THE FUNNEL WITH STEEL WIRE MESH.
4. COLOR CODING & PAINTING OF COVER SHALL BE AS PER OISD NORMS.
5. ALL DAMAGE TO GALVANIZED SURFACES SHALL BE MADE GOOD WITH ZINC RICH PAINT.
6. IN CASE OF PAVED AREA, TOP OF PIT SHALL BE FLUSHED WITH F.F.L., WHEREAS IN UNPAVED AREA, TOP OF PIT SHALL BE PROJECTED 100MM ABOVE F.G.L.
7. ALL EARTH PITS SHALL BE MARKED WITH EARTH PIT NUMBER FOR EASY IDENTIFICATION. IN ADDITION, METALLIC TAG IS ALSO TO BE FASTENED WITH THE EARTH ELECTRODE INSIDE THE PIT AS A PERMANENT IDENTIFICATION.

ITEM	COMPONENT DESCRIPTION	QUANTITY
1	ELECTRICAL EARTH ELECTRODE ASSEMBLY, 65mm DIA, G.I. N.B 3M LENGTH (AS PER STD E02)	1
2	A HOMOGENOUS MIXTURE OF COKE/CHARCOL, SALT AND SAND	AS. REQ'D
3	MASSIONARY WORK OF BRICK WITH CEMENT MOTAR & PLASTER FINISH BOTH INNER & OUTER SURFACE OF BRICK WORK	AS. REQ'D
4	500X500X25 MM THK. HEAVY DUTY CAST IRON COVER HINGED TO FRAME	1
5	75X10x300 MM LONG M.S. PLATE BEND TO SHAPE AND WELDED	1

PROJECT
PETROCHEMICAL AND LUBE INTEGRATION
PROJECT "LuPech (J-18)" AT IOCL GUJARAT
REFINERY, VADODARA, GUJARAT, INDIA
EPCC-2 RFCC UNIT

TITLE	TYPICAL INSTALLATION OF EARTH ELECTRODE IN TEST PIT

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NOTES:

- ALL DIMENSIONS ARE IN MM.
- THE PIPE ASSEMBLY SHALL BE HOT DIP GALVANISED AFTER FABRICATION, IN CASE OF G.I.
- MINIMUM GALVANISATION THICKNESS SHALL BE AVERAGE 100 MICRON AND MINIMUM MASS SHALL BE 720 gm/sq.m.
- GI COVER CAP SHALL BE PLACED OVER THE EARTH ELECTRODE AFTER REMOVING THE FUNNEL FROM THE TOP.
- ALL DAMAGE TO GALVANIZED SURFACES SHALL BE MADE GOOD WITH ZINC RICH PAINT.
- ALL SUITABLE HARDWARE LIKE BOLT, LOCK NUT, SPRING & PLAIN WASHER REQUIRED FOR CONNECTION SHALL BE SUPPLIED BY ELECTRICAL CONTRACTOR.
- ELECTRICAL CONTRACTOR TO SUPPLY 25% OF THE TOTAL G.I. COVER CAP BEING SUPPLIED.

ITEM	COMPONENT DESCRIPTION	QUANTITY
1	65 MM DIA N.B. MEDIUM G.I. PIPE	1
2	75X10x300 MM LONG M.S. PLATE BEND TO SHAPE AND WELDED	1
3	REMOVABLE G.I. COVER CAP SUITABLE FOR 65mm DIA PIPE	1
4	FUNNEL WITH WIRE MESH	1

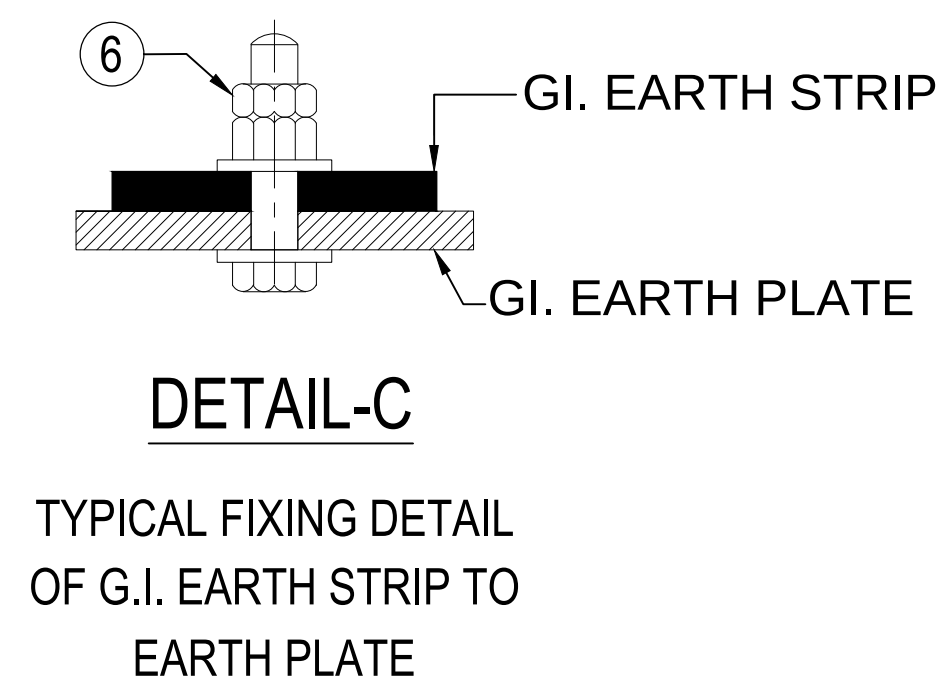
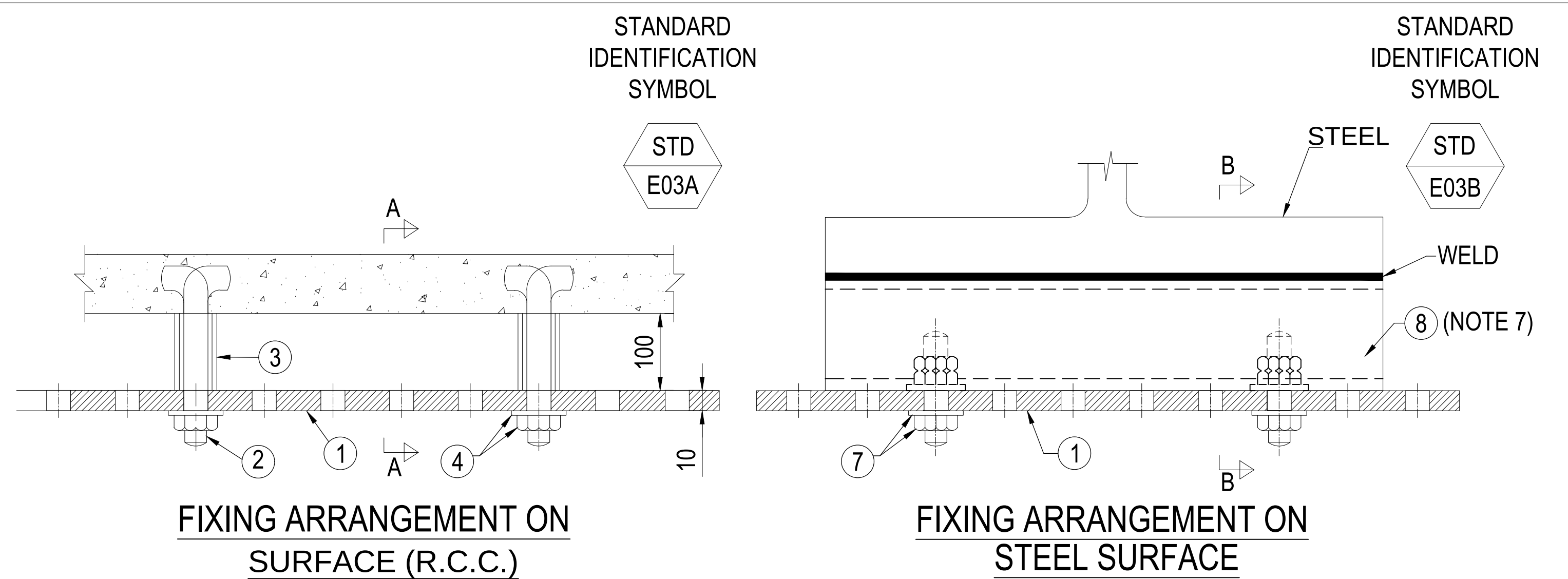
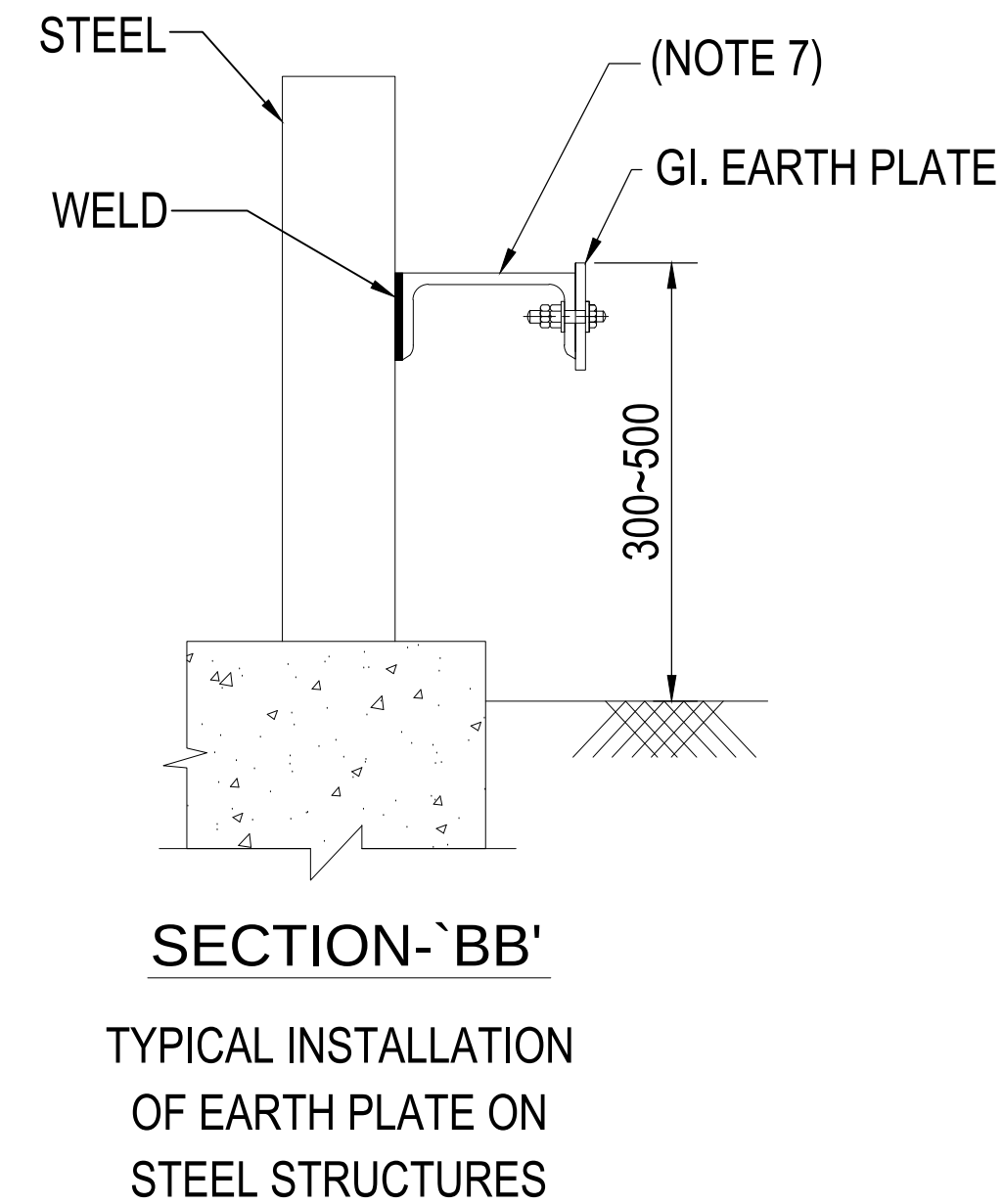
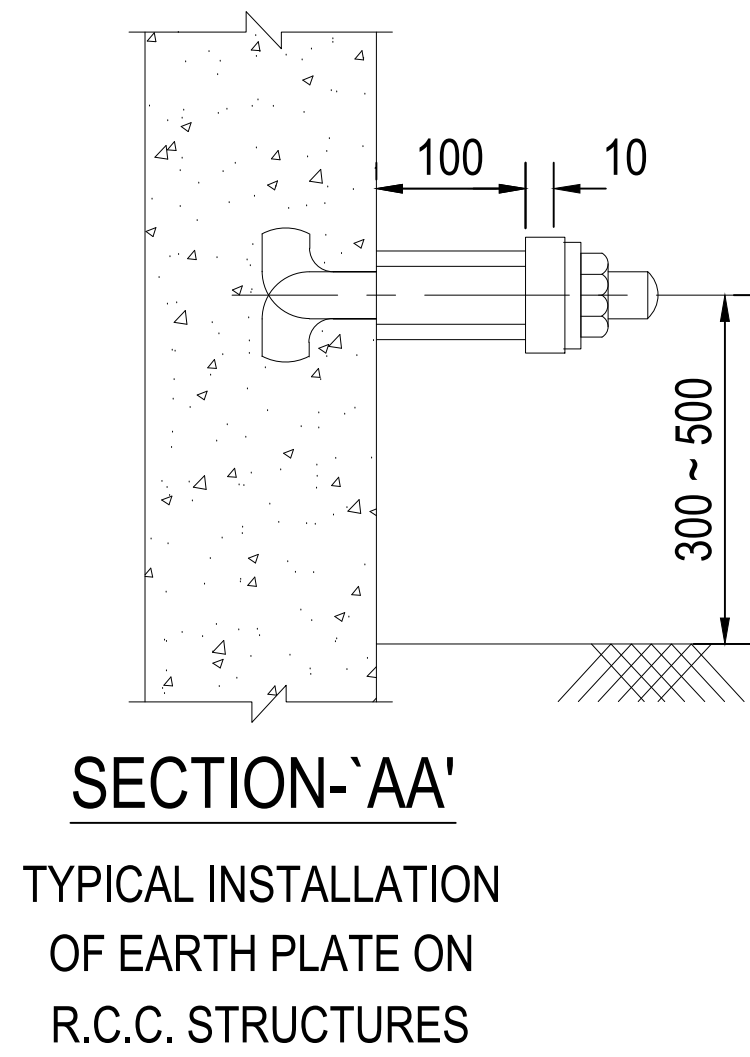
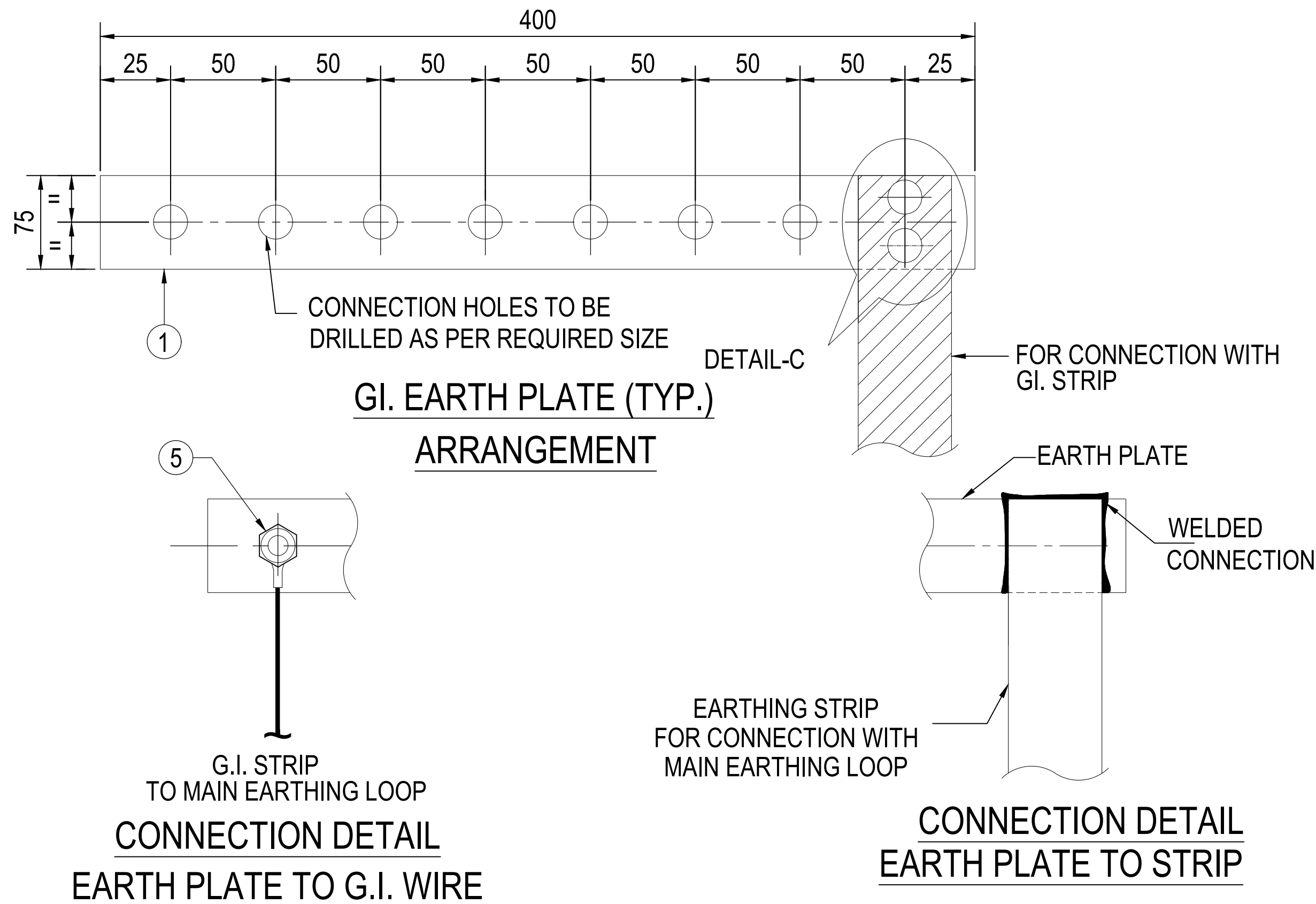
STANDARD
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PROJECT
PETROCHEMICAL AND LUBE INTEGRATION
PROJECT "LuPech (J-18)" AT IOCL GUJARAT
REFINERY, VADODARA, GUJARAT, INDIA
EPCC-2 RFCC UNIT

TITLE
TYPICAL INSTALLATION OF EARTH ELECTRODE
FOR EARTHING SYSTEM

SCALE		DRAWING NUMBER				PAGE		REV
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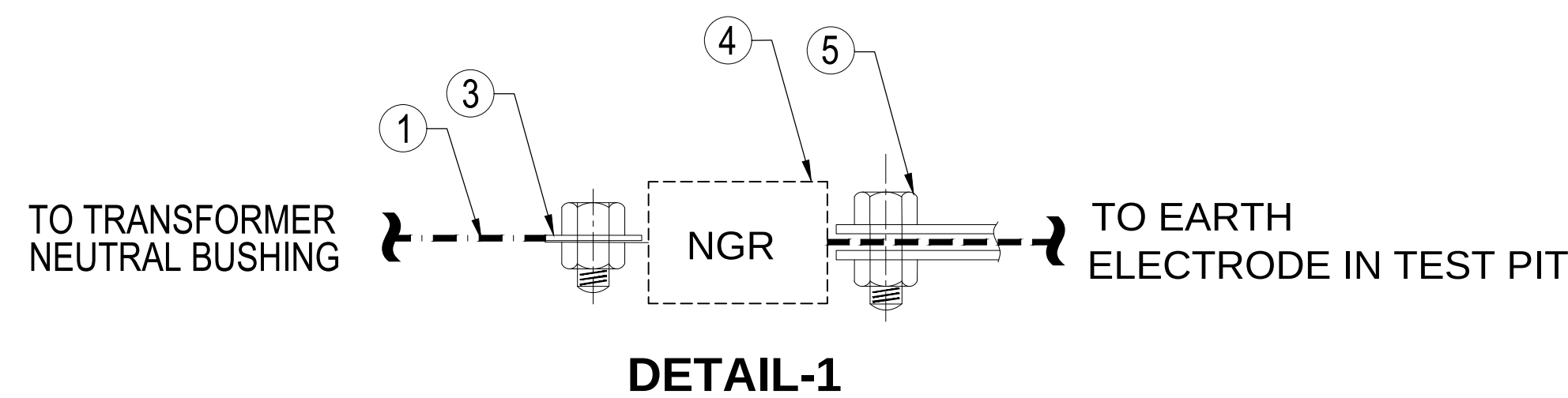
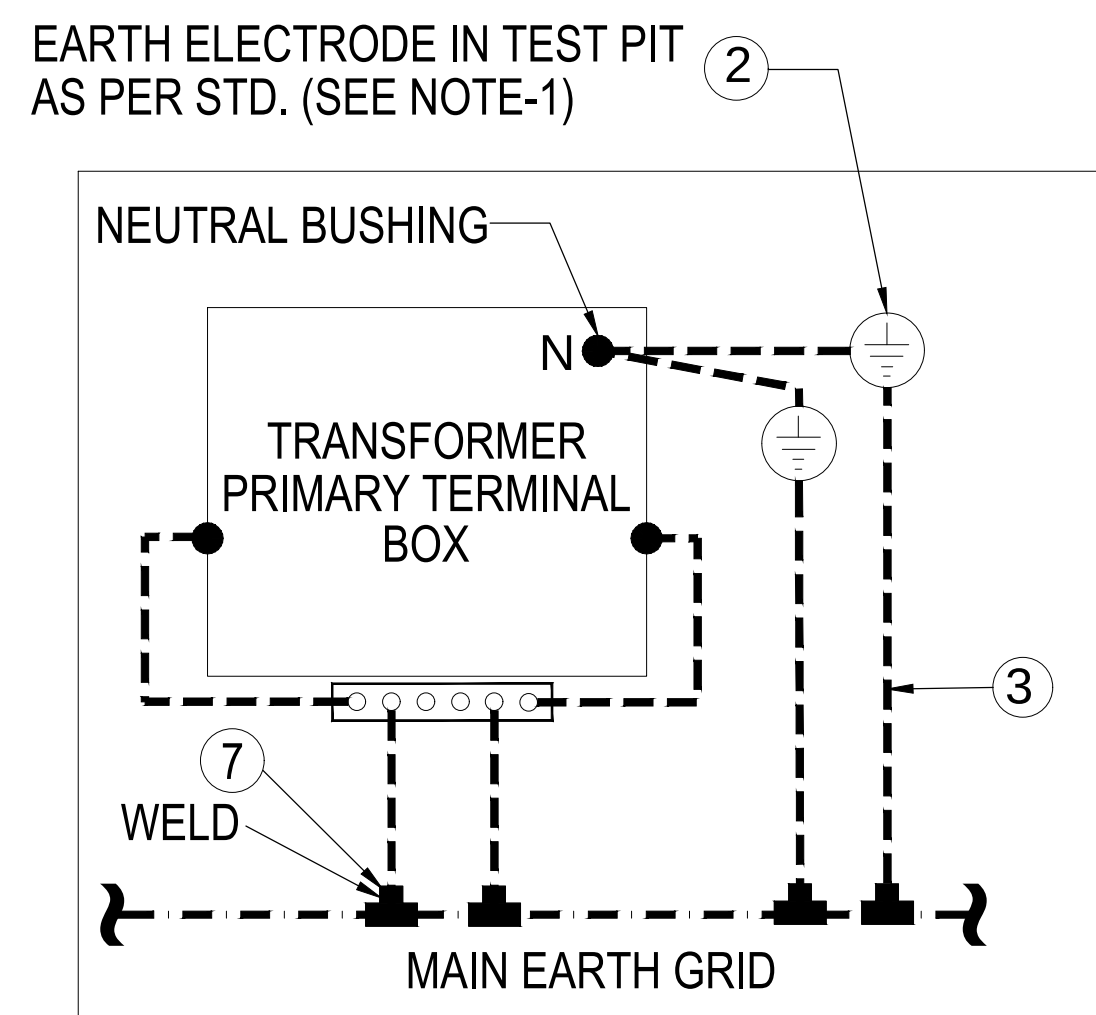
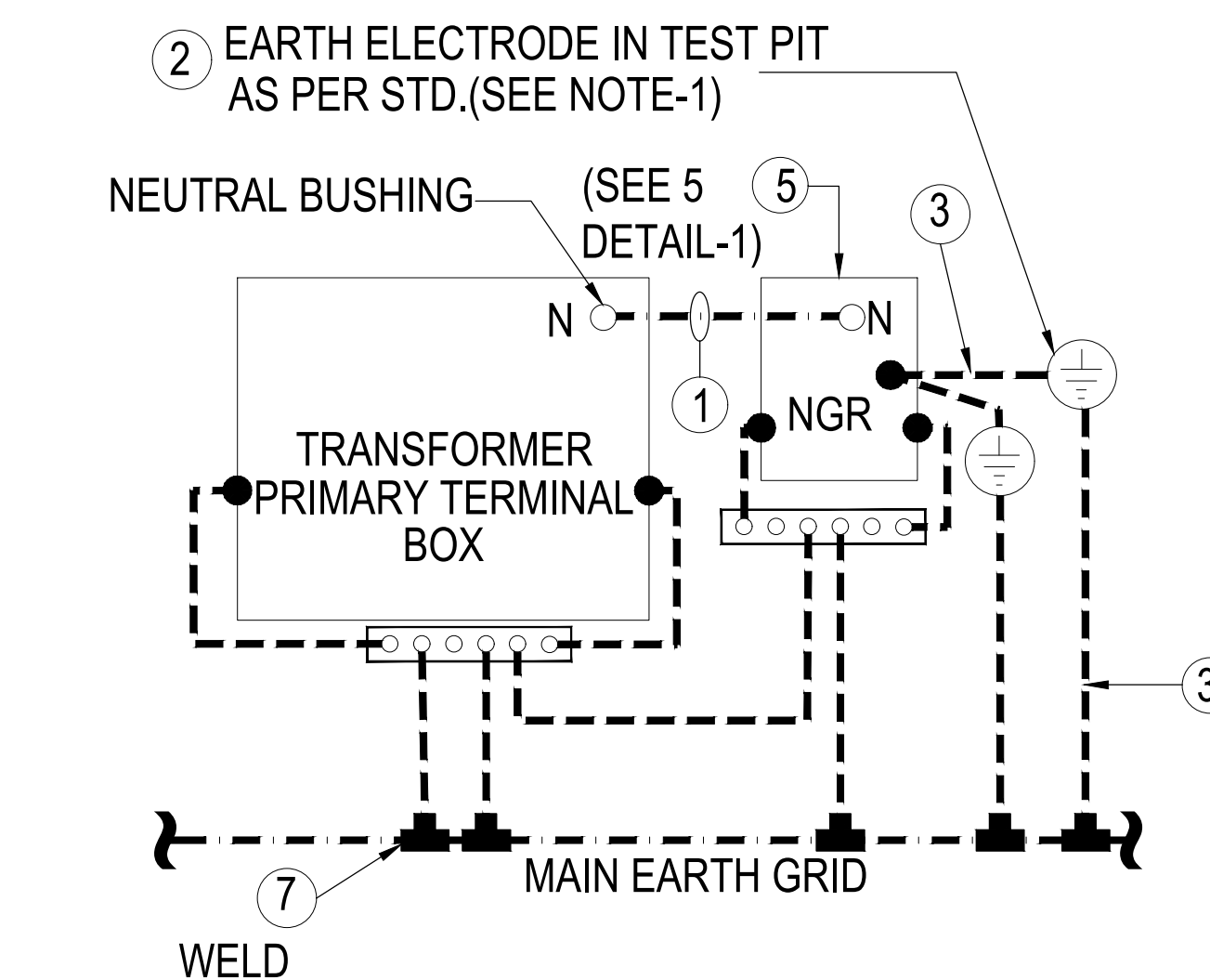
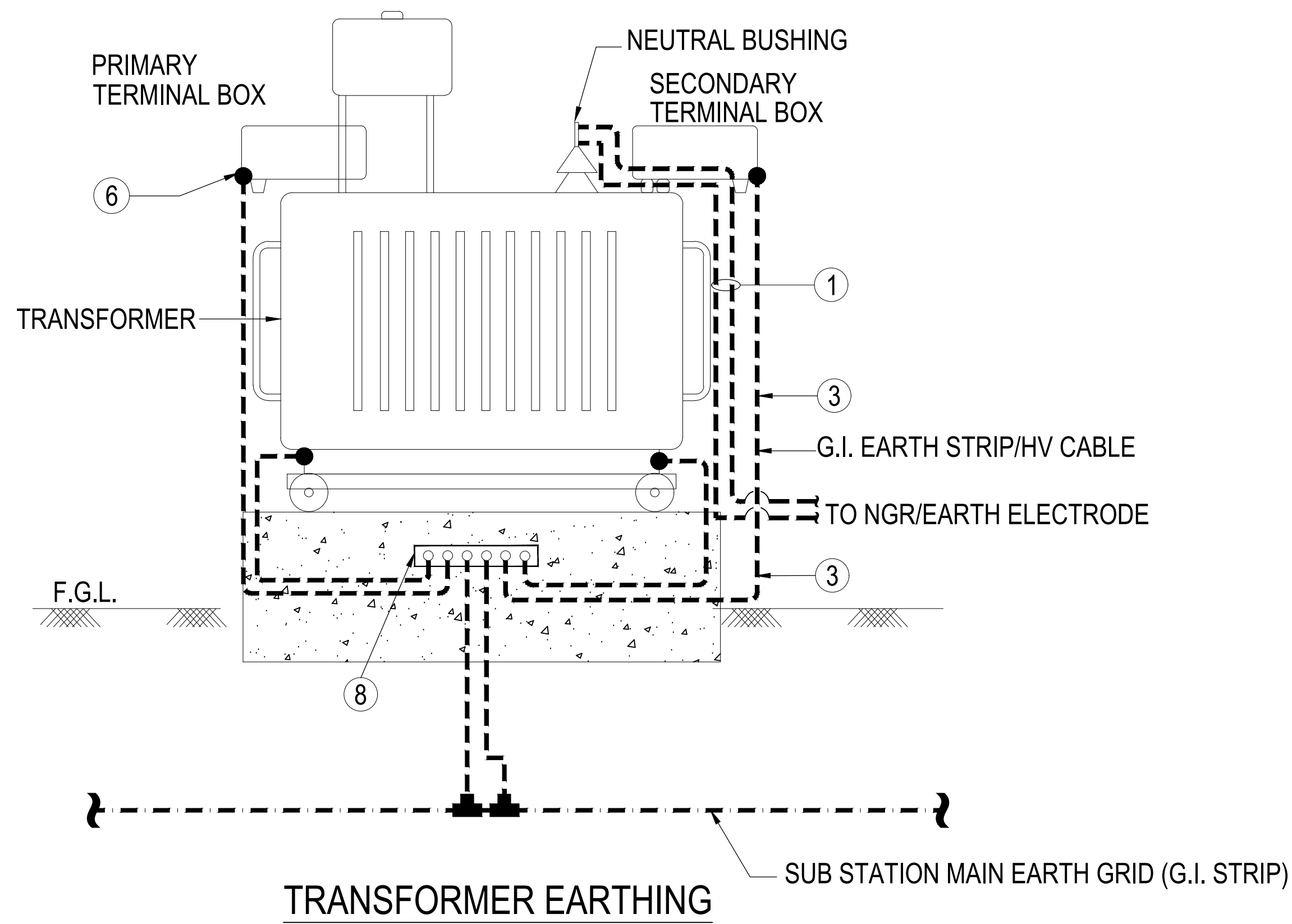
1. ALL DIMENSIONS ARE IN MM.
2. WHERE FIRE PROOFING OF STEEL STRUCTURES ARE ENCOUNTERED LENGTH OF CARBON STEEL BOLT SHALL BE INCREASED FOR FIXING EARTH PLATE.
3. ALL CABLE CONNECTION WITH EARTH PLATE SHALL BE MADE WITH G.I. (AS PER EARTH PLATE MATERIAL) BOLT, NUT, SPRING, AND PLAIN WASHERS.
4. CONNECTION BETWEEN EARTH PLATE AND EARTHING STRIP SHALL BE MADE BY WELDING GENERALLY. HOWEVER BOLTING CAN BE USED IN SPECIFIC CASES.
5. ALL DAMAGE TO GALVANIZED SURFACES SHALL BE MADE GOOD WITH ZINC RICH PAINT.
6. ALL SUITABLE HARDWARE LIKE BOLT, LOCK NUT, SPRING & PLAIN WASHER REQUIRED FOR CONNECTION SHALL BE SUPPLIED BY ELECTRICAL CONTRACTOR.
7. ISMC 100 IS USE FOR NON FIREPROOF STRUCTURE AND ISMC 150 IS USE FOR FIREPROOF STRUCTURE.

ITEM	COMPONENT DESCRIPTION	QUANTITY	
		E03A	E03B
1	G.I. EARTH PLATE (400x75x10 MM THK.)	1	1
2	G.I. ANCHOR BOLT SUITABLE FOR EARTH PLATE FIXING	2	-
3	12 MM DIA G.I. SPACING PIPE (TYP.)	2	-
4	G.I. NUT, SPRING & PLAIN WASHERS (TYP.)	AS. REQ'D	AS. REQ'D
5	5 CABLE LUGS AL./Cu AS PER CABLE/WIRE SIZE	AS. REQ'D	AS. REQ'D
6	8 MM DIA G.I. LOCK NUT, BOLT & WASHER	AS. REQ'D	AS. REQ'D
7	10 MM DIA G.I. LOCK NUT, BOLT & WASHER	AS. REQ'D	AS. REQ'D
8	ISMC 100/150	-	350mm

PROJECT
PETROCHEMICAL AND LUBE INTEGRATION
PROJECT "LuPech (J-18)" AT IOCL GUJARAT
REFINERY, VADODARA, GUJARAT, INDIA
EPCC-2 RFCC UNIT

TITLE
TYPICAL EARTH PLATE
AND FIXING DETAILS

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ITEM	COMPONENT DESCRIPTION	QUANTITY
1	100x12 MM G.I. EARTH STRIP (FOR NGR SUITABLE CABLE SHALL BE USED.	20m
2	EARTH ELECTRODE IN TEST PIT AS PER STD.	2
3	CABLE LUG SUIT TO INSULATED CABLE	AS. REQ'D
4	NEUTRAL GROUNDING RESISTOR	1
5	10MM DIA BRASS BOLT WITH LOCK NUT & WASHER	AS. REQ'D
6	10MM DIA BRASS STUD WITH NUT & LOCK NUT	AS. REQ'D
7	TWO COATS OF BITUMEN IMPREGNATED HESSIAN TAPE	AS. REQ'D
8	G.I. PLATE AS PER STANDARD	1

NOTES:

- EARTH ELECTRODE IN TEST PITS SHALL BE SO LOCATED THAT DISTANCE BETWEEN TWO PITS SHALL BE MINIMUM 2L (LENGTH OF ELECTRODE) METER.
- ALL DAMAGE TO GALVANIZED SURFACES SHALL BE MADE GOOD WITH ZINC RICH PAINT.
- ALL ASSOCIATED METALLIC NON CURRENT CARRYING EQUIPMENT i.e. CONDUITS, BUS DUCTS, AUXILIARY PANELS, SHALL BE BONDED/EARTHED.
- ALL SUITABLE HARDWARE LIKE BOLT, LOCK NUT, SPRING & PLAIN WASHER REQUIRED FOR CONNECTION SHALL BE SUPPLIED BY ELECTRICAL CONTRACTOR.

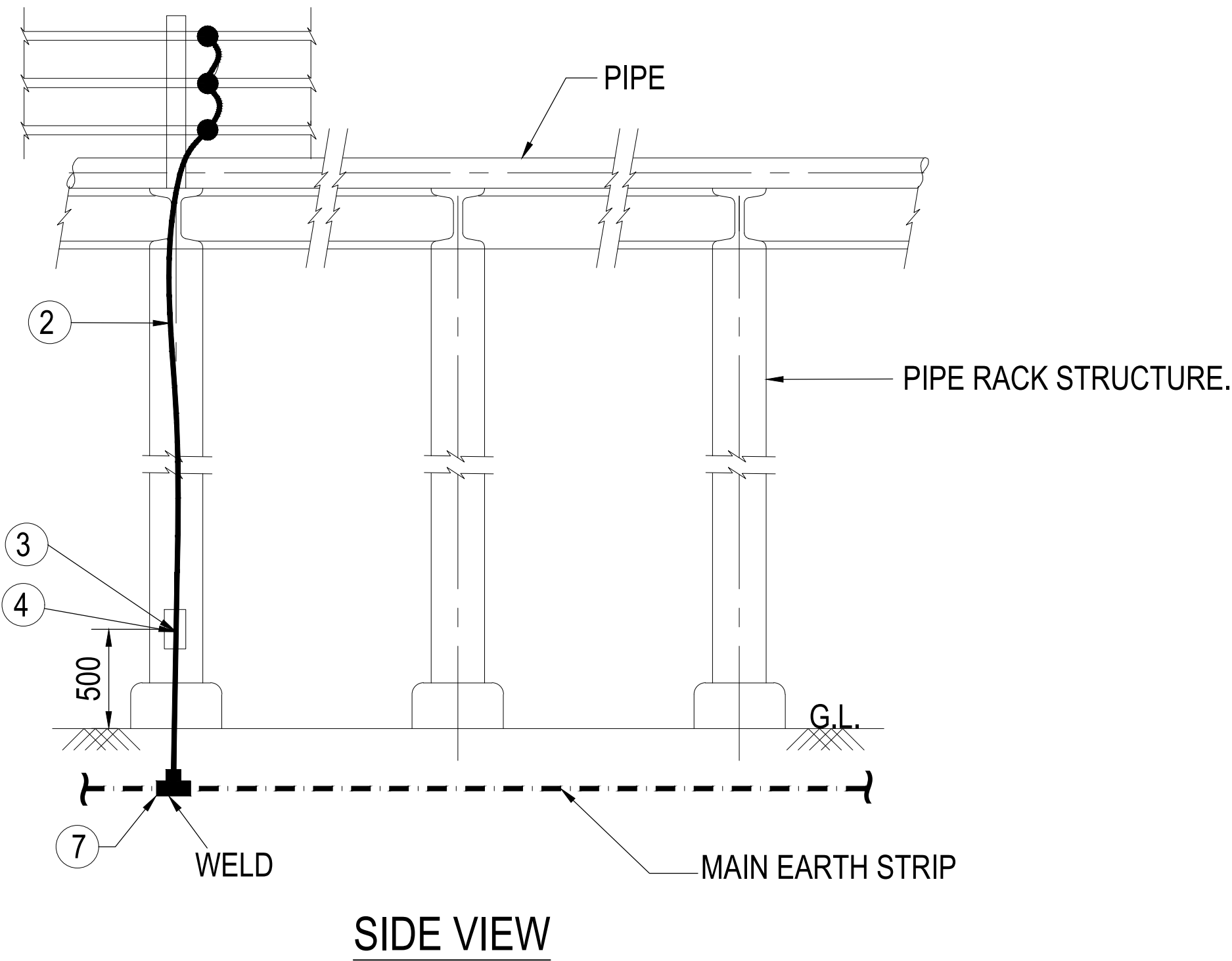
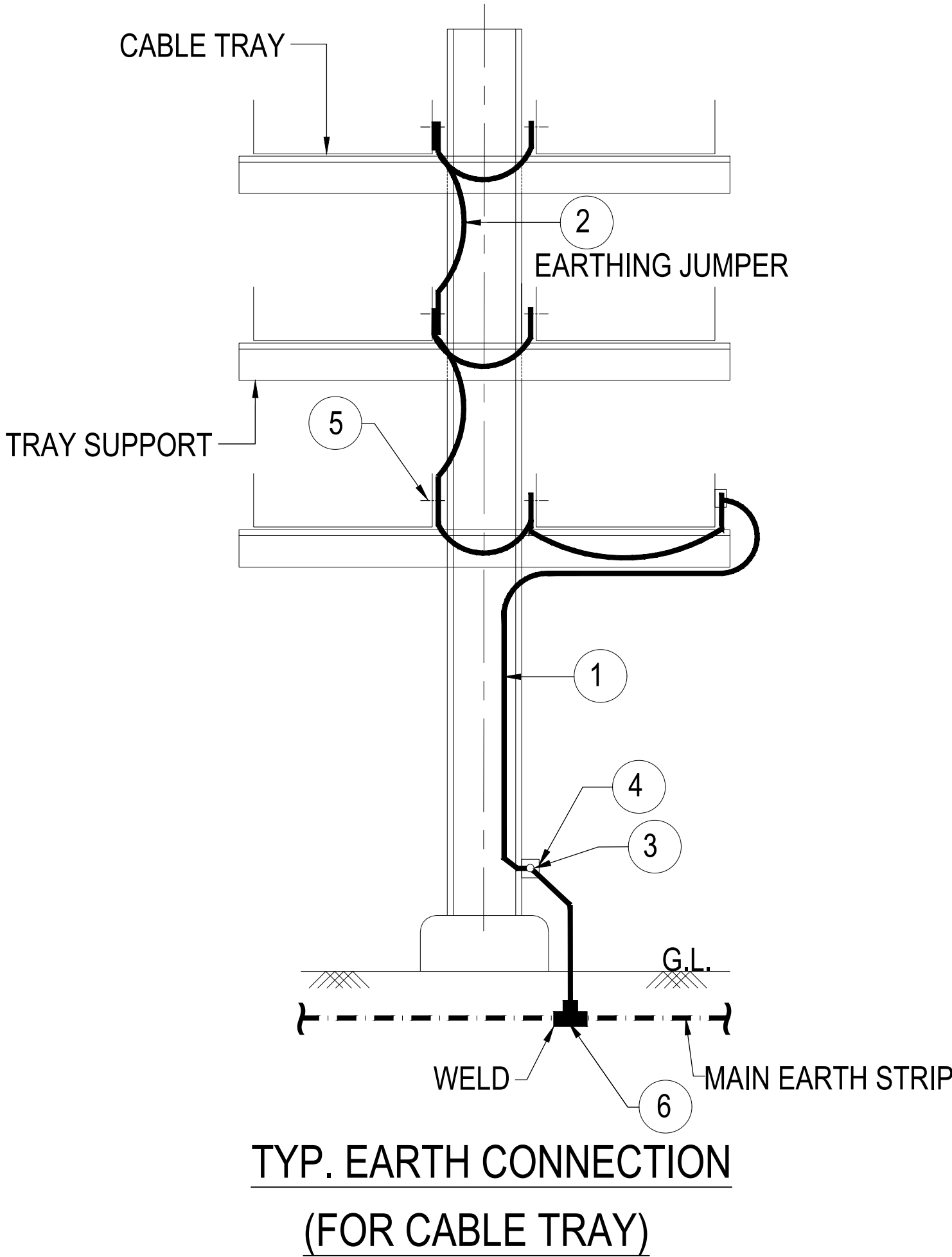
STANDARD
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PROJECT
PETROCHEMICAL AND LUBE INTEGRATION
PROJECT "LuPech (J-18)" AT IOCL GUJARAT
REFINERY, VADODARA, GUJARAT, INDIA
EPCC-2 RFCC UNIT

TITLE
TYPICAL ARRANGEMENT FOR
TRANSFORMER EARTHING

SCALE	DRAWING NUMBER	PROJECT NO	UNIT	2047-1803-EEL-DST-0003	PAGE	REV
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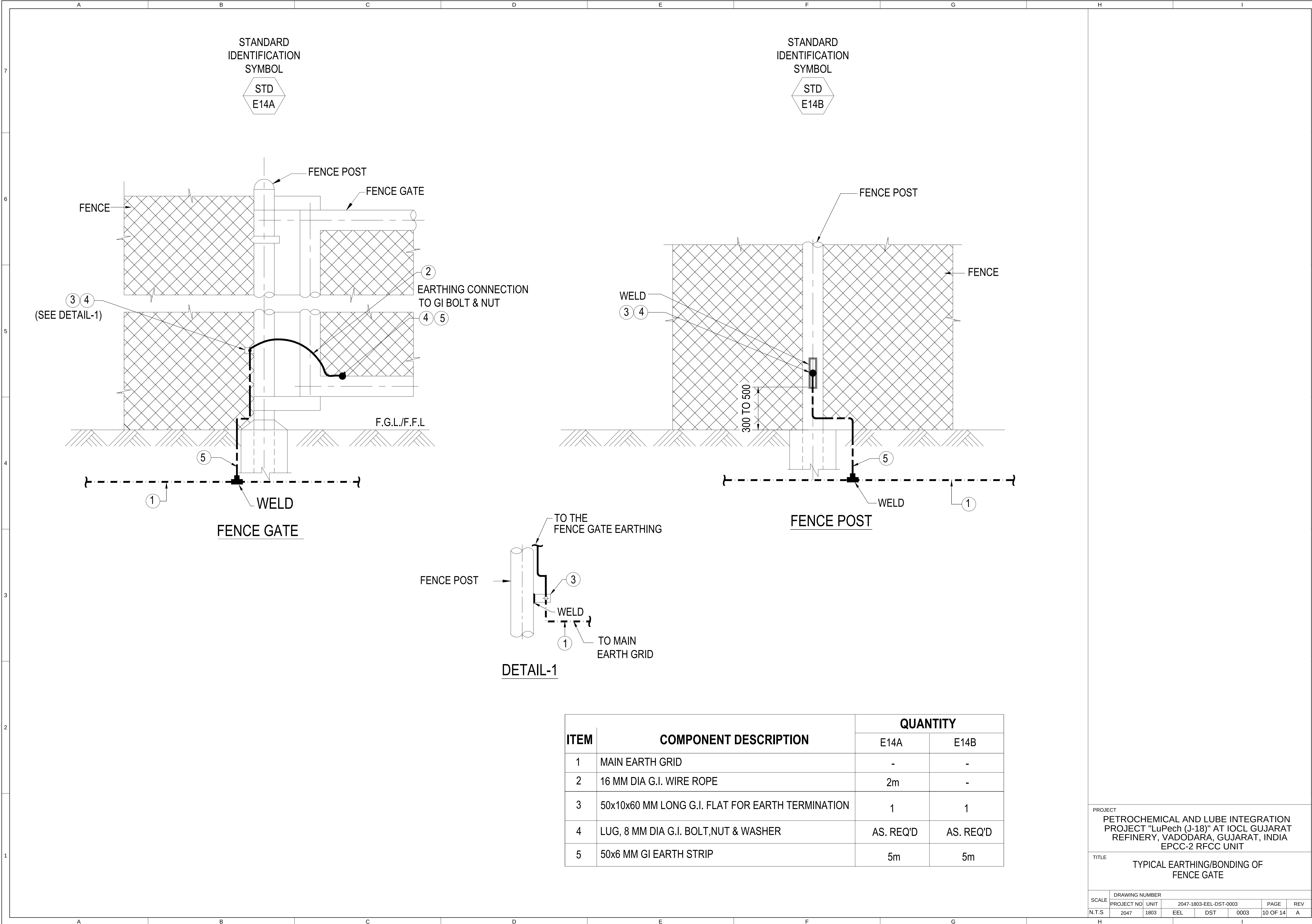
1. THE EARTHING CONDUCTOR SHALL RUN ALONG ONE OF THE CABLE TRAYS ALONG A CABLE ROUTE.
2. THE EARTHING CONDUCTOR SHALL BE SUITABLY CLEATED AND ELECTRICALLY BONDED TO ALL THE OTHER CABLE TRAYS ON THE SAME CABLE ROUTE AT A REGULAR INTERVAL OF 20 METER AND AT BOTH ENDS. THE EARTHING CONDUCTOR SHALL BE CONNECTED TO THE EARTH GRID AT EVERY 20m INTERVAL.
3. CABLE TRAY JOINTS FIXED WITH SPLICE PLATE BY NUT, BOLT & WASHERS, SHALL BE TIGHTENED TO FULL EXTENT TO ACHIEVE THE EARTH CONTINUITY BETWEEN CABLE TRAY JOINTS.
4. ALL DAMAGE TO GALVANIZED SURFACES SHALL BE MADE GOOD WITH ZINC RICH PAINT.

ITEM	COMPONENT DESCRIPTION	QUANTITY
1	50x6 MM GI EARTH STRIP	15m
2	16MM DIA G.I. WIRE ROPE	5m
3	50x10x60 MM LONG G.I. FLAT FOR EARTH TERMINATION	1
4	8MM DIA 25 LONG BOLT,NUT AND TWO SPRING WASHERS.	AS. REQ'D
5	LUG, 8MM DIA G.I. NUT BOLT & WASHER	AS. REQ'D
6	TWO COATS OF BITUMEN IMPREGNATED HESSIAN TAPE	AS. REQ'D

PROJECT
PETROCHEMICAL AND LUBE INTEGRATION
PROJECT "LuPech (J-18)" AT IOCL GUJARAT
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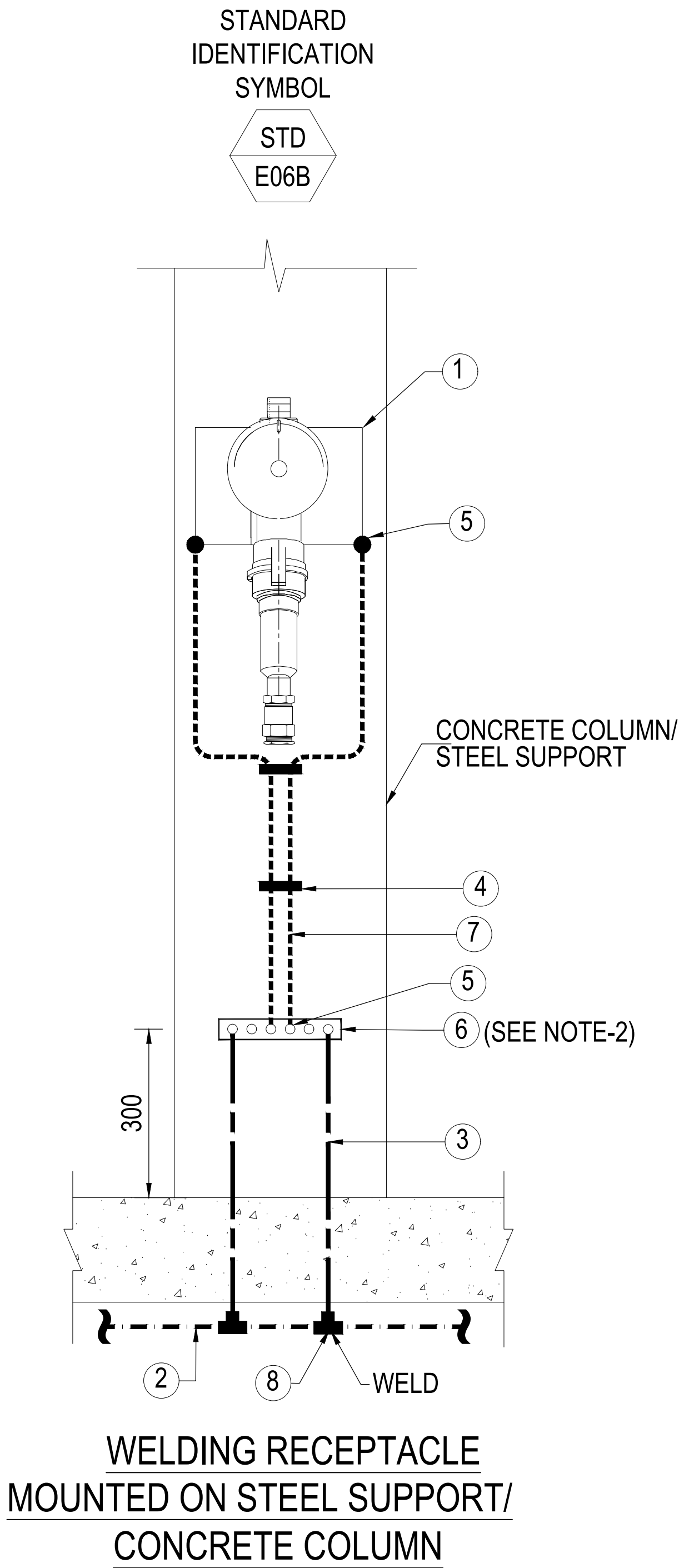
TITLE
TYPICAL EARTHING OF
CABLE TRAY

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ITEM	COMPONENT DESCRIPTION	QUANTITY	
		E14A	E14B
1	MAIN EARTH GRID	-	-
2	16 MM DIA G.I. WIRE ROPE	2m	-
3	50x10x60 MM LONG G.I. FLAT FOR EARTH TERMINATION	1	1
4	LUG, 8 MM DIA G.I. BOLT,NUT & WASHER	AS. REQ'D	AS. REQ'D
5	50x6 MM GI EARTH STRIP	5m	5m

PROJECT					
PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LuPech (J-18)" AT IOCL GUJARAT REFINERY, VADODARA, GUJARAT, INDIA EPCC-2 RFCC UNIT					
TITLE					
TYPICAL EARTHING/BONDING OF FENCE GATE					
DRAWING NUMBER					
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				A	A



NOTES:

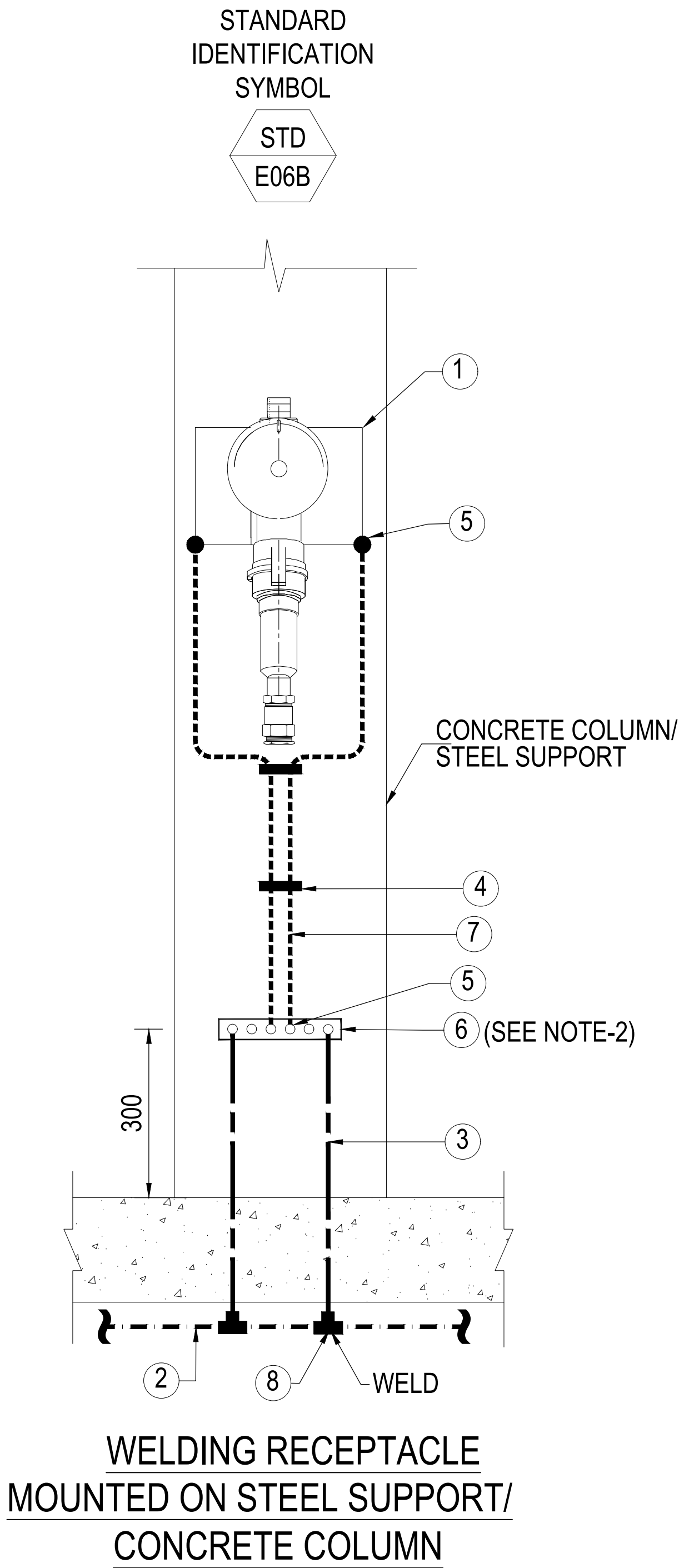
- ALL DAMAGE TO GALVANIZED SURFACES SHALL BE MADE GOOD WITH ZINC RICH PAINT.
- FOR INSTALLATION OF EARTH PLATE REFER STD E03.

ITEM	COMPONENT DESCRIPTION	QUANTITY	
		E06A	E06B
1	LOCAL PANEL/JUNCTION BOX/WELDING RECEPTACLE	1	1
2	MAIN EARTH GRID	-	-
3	50x6 MM G.I. EARTH STRIP	10m	10m
4	G.I CLAMP WITH FIXING SCREW	2	2
5	LUG, GI NUT, BOLT & WASHER FOR CONNECTION OF CABLE	AS. REQ'D	AS. REQ'D
6	G.I. EARTH PLATE AS PER STANDARD	1	1
7	10 MM (3/8") DIA G.I WIRE ROPE	5m	5m
8	TWO COATS OF BITUMEN IMPREGNATED HESSIAN TAPE	AS. REQ'D	AS. REQ'D

PROJECT
PETROCHEMICAL AND LUBE INTEGRATION
PROJECT "LuPech (J-18)" AT IOCL GUJARAT
REFINERY, VADODARA, GUJARAT, INDIA
EPCC-2 RFCC UNIT

TITLE
TYPICAL EARTH CONNECTION FOR LOCAL PANEL/POWER
JUNCTION BOX/WELDING RECEPTACLE

SCALE	DRAWING NUMBER						PAGE	REV
	PROJECT NO	UNIT	2047-1803-EEL-DST-0003					
N.T.S	2047	1803	EEL	DST	0003	11 OF 14	A	



NOTES:

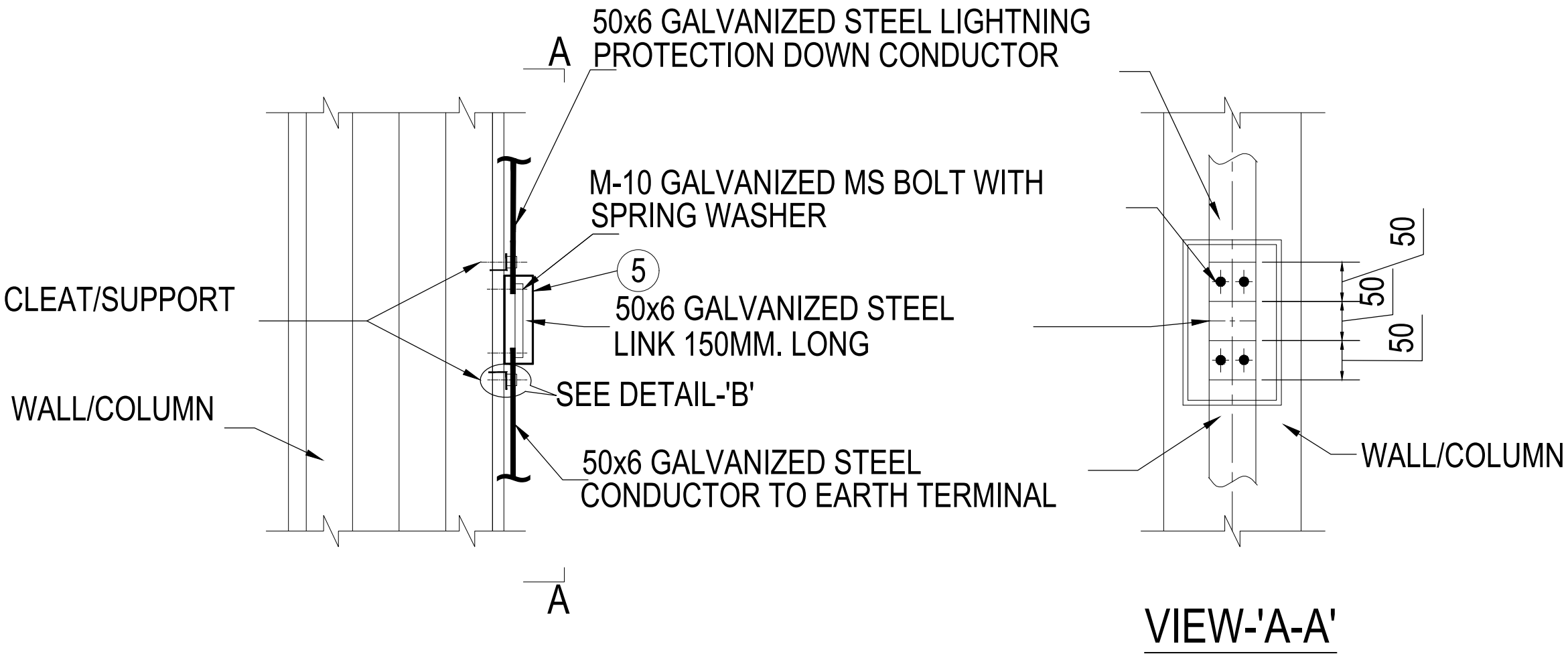
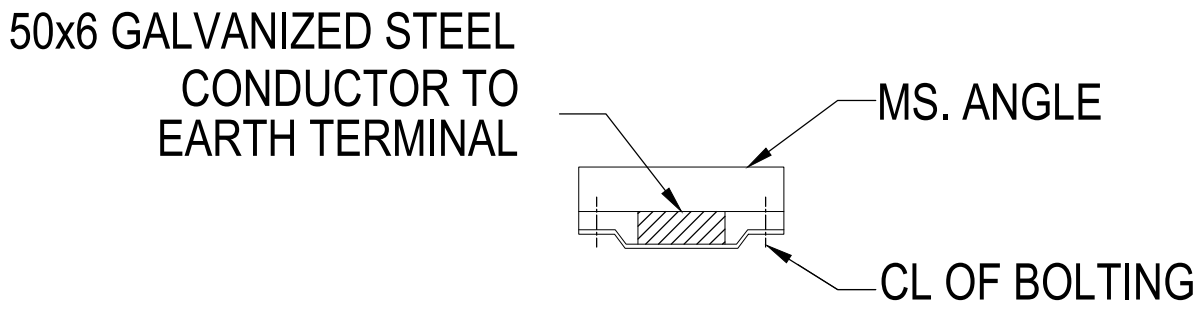
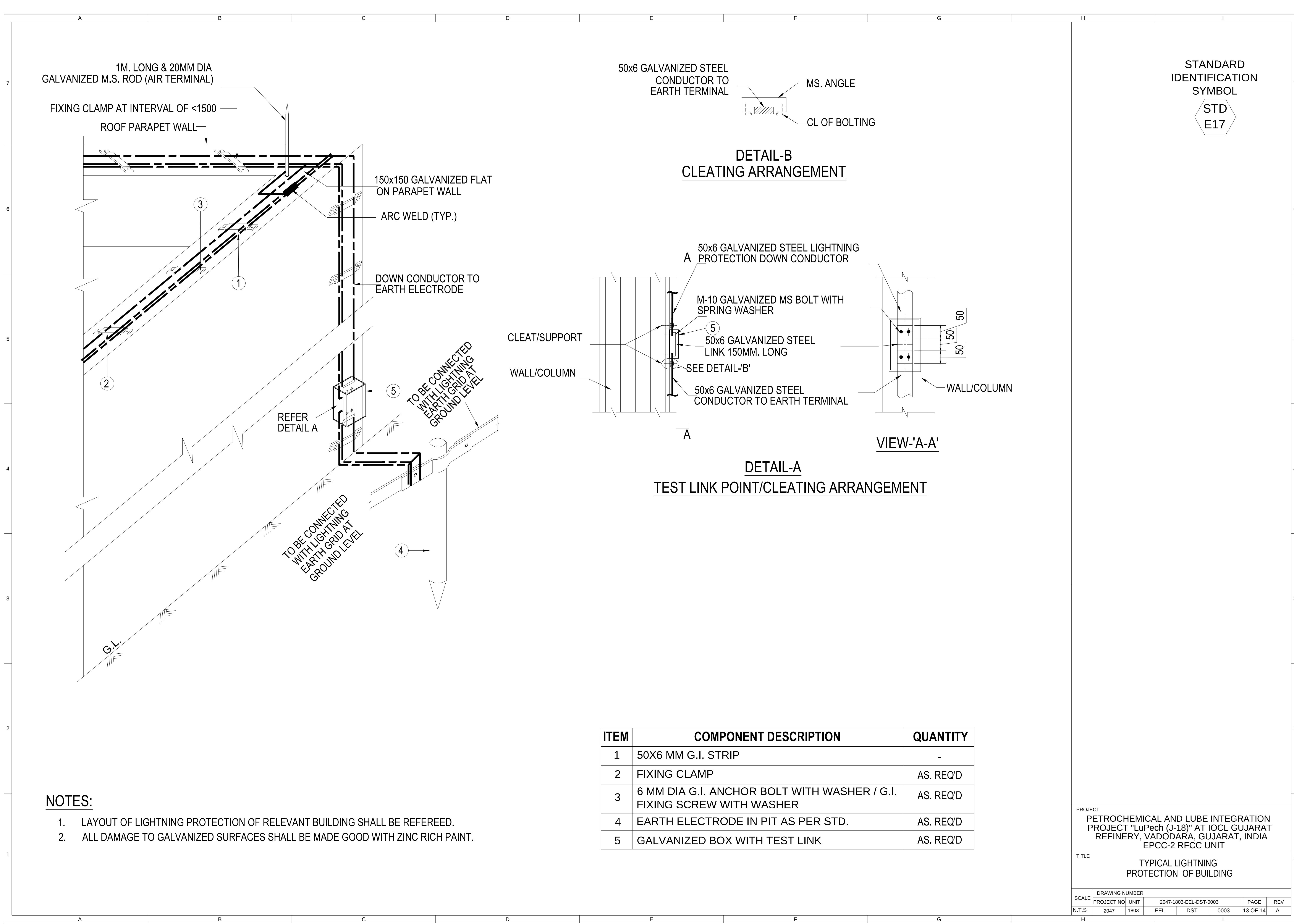
- ALL DAMAGE TO GALVANIZED SURFACES SHALL BE MADE GOOD WITH ZINC RICH PAINT.
- FOR INSTALLATION OF EARTH PLATE REFER STD E03.

ITEM	COMPONENT DESCRIPTION	QUANTITY	
		E06A	E06B
1	LOCAL PANEL/JUNCTION BOX/WELDING RECEPTACLE	1	1
2	MAIN EARTH GRID	-	-
3	50x6 MM G.I. EARTH STRIP	10m	10m
4	G.I CLAMP WITH FIXING SCREW	2	2
5	LUG, GI NUT, BOLT & WASHER FOR CONNECTION OF CABLE	AS. REQ'D	AS. REQ'D
6	G.I. EARTH PLATE AS PER STANDARD	1	1
7	10 MM (3/8") DIA G.I WIRE ROPE	5m	5m
8	TWO COATS OF BITUMEN IMPREGNATED HESSIAN TAPE	AS. REQ'D	AS. REQ'D

PROJECT
PETROCHEMICAL AND LUBE INTEGRATION
PROJECT "LuPech (J-18)" AT IOCL GUJARAT
REFINERY, VADODARA, GUJARAT, INDIA
EPCC-2 RFCC UNIT

TITLE
TYPICAL EARTH CONNECTION FOR LOCAL PANEL/POWER
JUNCTION BOX/WELDING RECEPTACLE

SCALE	DRAWING NUMBER						PAGE	REV
	PROJECT NO	UNIT	2047-1803-EEL-DST-0003					
N.T.S	2047	1803	EEL	DST	0003	11 OF 14	A	



STANDARD
IDENTIFICATION
SYMBOL

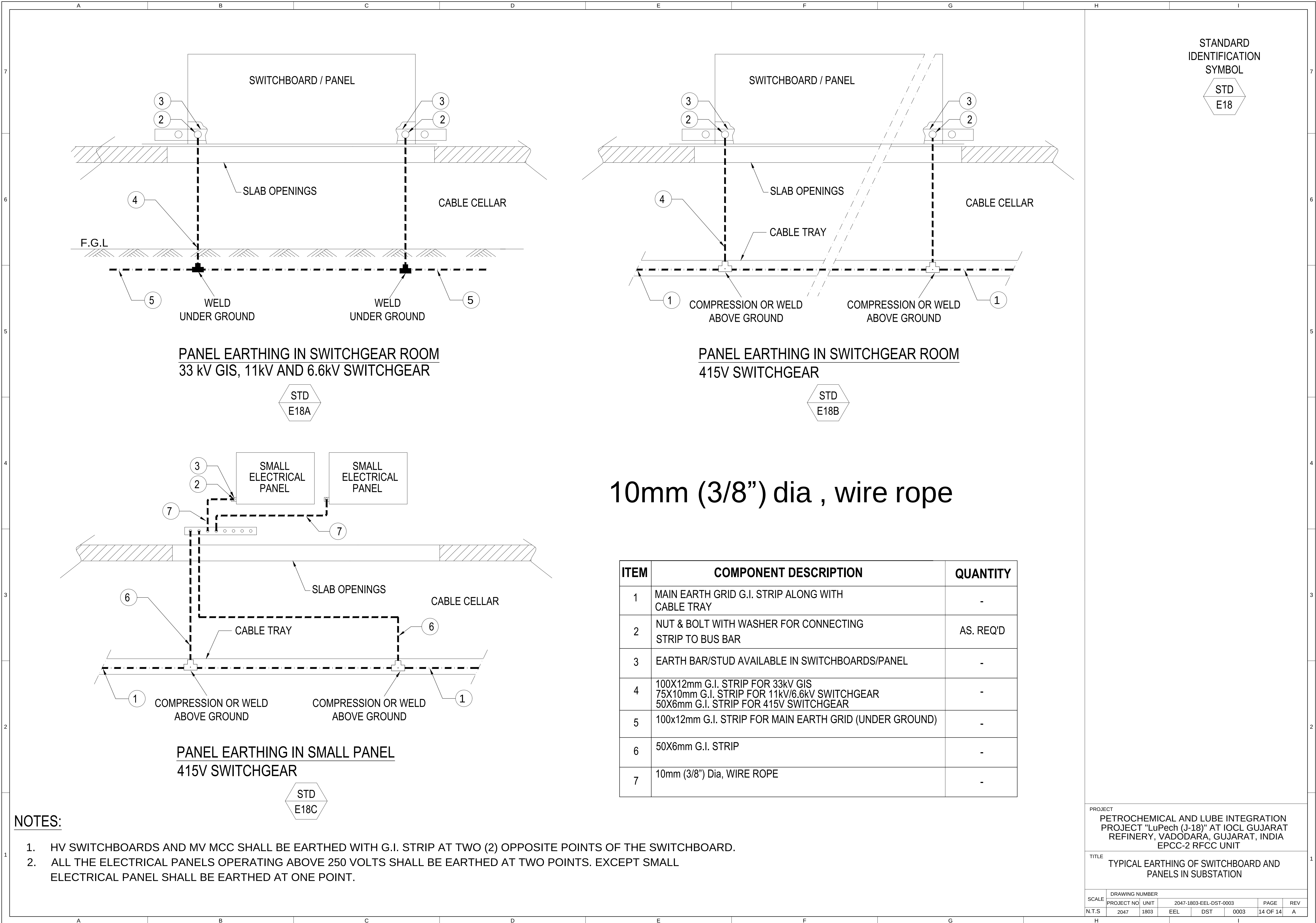
STD
E17

NOTES:

- LAYOUT OF LIGHTNING PROTECTION OF RELEVANT BUILDING SHALL BE REFEREED.
- ALL DAMAGE TO GALVANIZED SURFACES SHALL BE MADE GOOD WITH ZINC RICH PAINT.

ITEM	COMPONENT DESCRIPTION	QUANTITY
1	50X6 MM G.I. STRIP	-
2	FIXING CLAMP	AS. REQ'D
3	6 MM DIA G.I. ANCHOR BOLT WITH WASHER / G.I. FIXING SCREW WITH WASHER	AS. REQ'D
4	EARTH ELECTRODE IN PIT AS PER STD.	AS. REQ'D
5	GALVANIZED BOX WITH TEST LINK	AS. REQ'D

PROJECT					
PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LuPech (J-18)" AT IOCL GUJARAT REFINERY, VADODARA, GUJARAT, INDIA EPCC-2 RFCC UNIT					
TITLE					
TYPICAL LIGHTNING PROTECTION OF BUILDING					
DRAWING NUMBER					
SCALE	PROJECT NO	UNIT	2047-1803-EEL-DST-0003		PAGE
N.T.S	2047	1803	EEL	DST	0003
				13 OF 14	REV
				A	



STANDARD
IDENTIFICATION
SYMBOL

STD
E18

PANEL EARTHING IN SWITCHGEAR ROOM
33 kV GIS, 11kV AND 6.6kV SWITCHGEAR

STD
E18A

PANEL EARTHING IN SWITCHGEAR ROOM
415V SWITCHGEAR

STD
E18B

PANEL EARTHING IN SMALL PANEL
415V SWITCHGEAR

STD
E18C

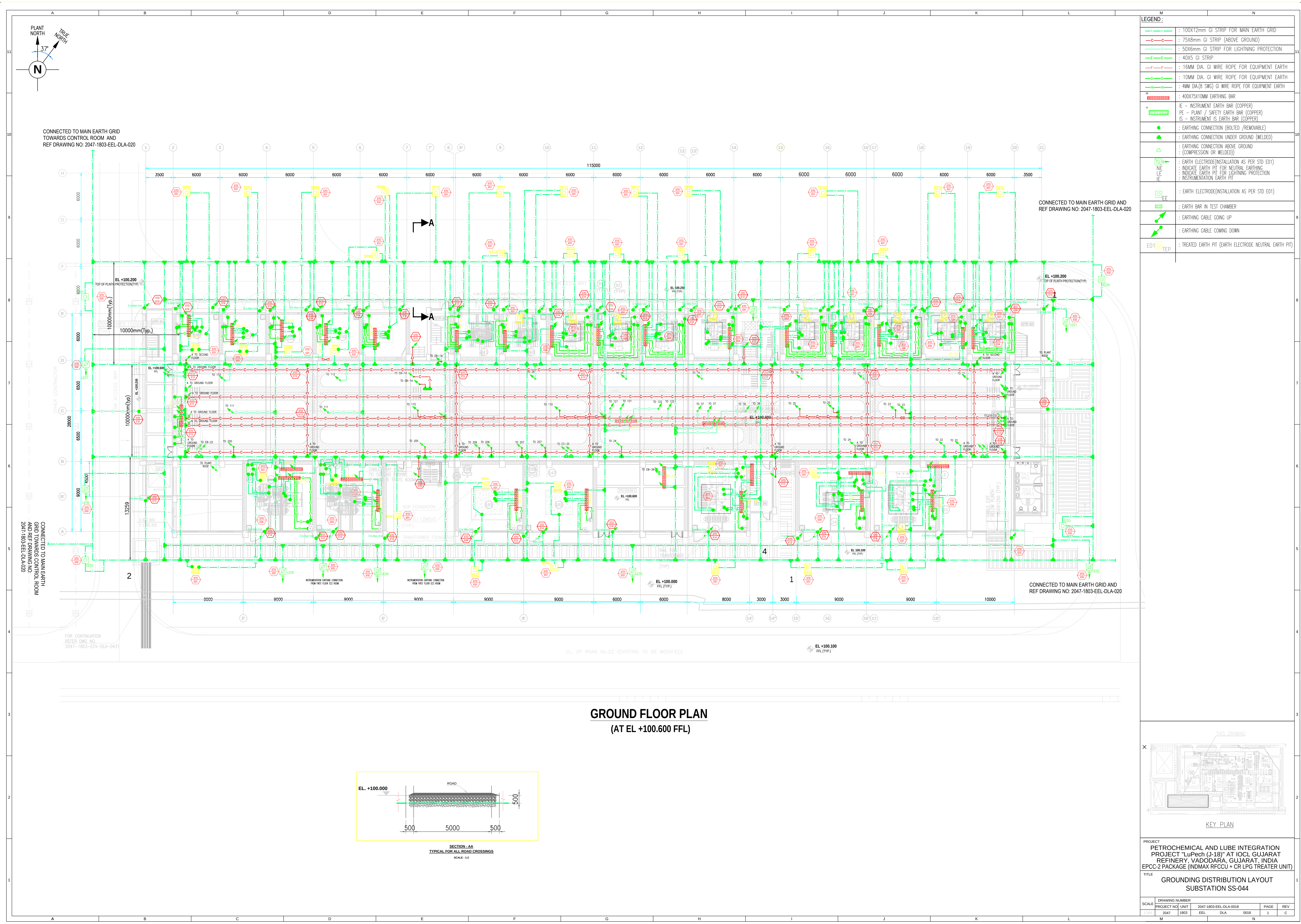
10mm (3/8") dia , wire rope

ITEM	COMPONENT DESCRIPTION	QUANTITY
1	MAIN EARTH GRID G.I. STRIP ALONG WITH CABLE TRAY	-
2	NUT & BOLT WITH WASHER FOR CONNECTING STRIP TO BUS BAR	AS. REQ'D
3	EARTH BAR/STUD AVAILABLE IN SWITCHBOARDS/PANEL	-
4	100X12mm G.I. STRIP FOR 33kV GIS 75X10mm G.I. STRIP FOR 11kV/6.6kV SWITCHGEAR 50X6mm G.I. STRIP FOR 415V SWITCHGEAR	-
5	100x12mm G.I. STRIP FOR MAIN EARTH GRID (UNDER GROUND)	-
6	50X6mm G.I. STRIP	-
7	10mm (3/8") Dia, WIRE ROPE	-

NOTES:

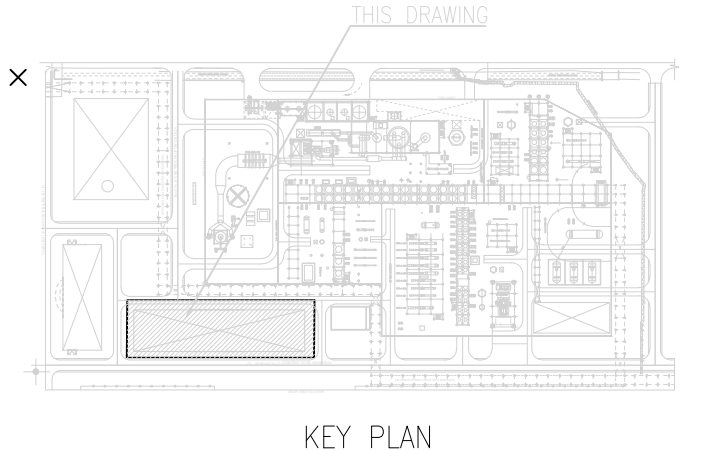
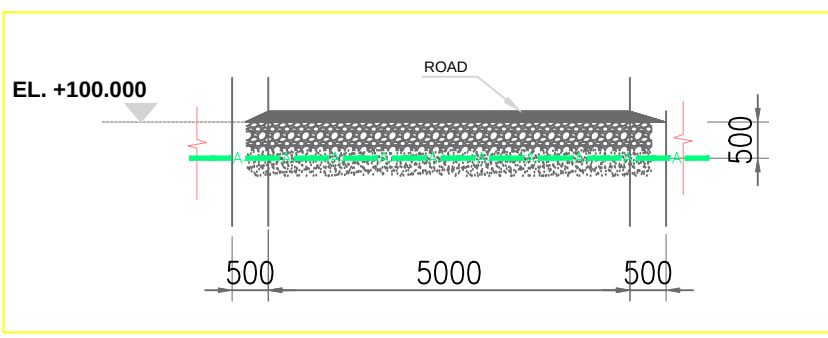
1. HV SWITCHBOARDS AND MV MCC SHALL BE EARTHED WITH G.I. STRIP AT TWO (2) OPPOSITE POINTS OF THE SWITCHBOARD.
2. ALL THE ELECTRICAL PANELS OPERATING ABOVE 250 VOLTS SHALL BE EARTHED AT TWO POINTS. EXCEPT SMALL ELECTRICAL PANEL SHALL BE EARTHED AT ONE POINT.

PROJECT PETROCHEMICAL AND LUBE INTEGRATION PROJECT "LuPech (J-18)" AT IOCL GUJARAT REFINERY, VADODARA, GUJARAT, INDIA EPCC-2 RFCC UNIT					
TITLE TYPICAL EARTHING OF SWITCHBOARD AND PANELS IN SUBSTATION					
DRAWING NUMBER 2047-1803-EEL-DST-0003					
SCALE N.T.S	PROJECT NO 2047	UNIT 1803	EEL	DST	0003
PAGE 14 OF 14				REV A	



LEGEND :	
	: 100X12mm GI STRIP FOR MAIN EARTH GRID
	: 75X8mm GI STRIP (ABOVE GROUND)
	: 50X6mm GI STRIP FOR LIGHTNING PROTECTION
	: 40X5 GI STRIP
	: 16MM DIA. GI WIRE ROPE FOR EQUIPMENT EARTH
	: 10MM DIA. GI WIRE ROPE FOR EQUIPMENT EARTH
	: 4MM DIA.(8 SWG) GI WIRE ROPE FOR EQUIPMENT EARTH
	: 400X75X10MM EARTHING BAR
	: IE - INSTRUMENT EARTH BAR (COPPER)
	: PE - PLANT / SAFETY EARTH BAR (COPPER)
	: IS - INSTRUMENT IS EARTH BAR (COPPER)
	: EARTHING CONNECTION (BOLTED /REMOVABLE)
	: EARTHING CONNECTION UNDER GROUND (WELDED)
	: EARTHING CONNECTION ABOVE GROUND (COMPRESSION OR WELDED)
	: EARTH ELECTRODE(INSTALLATION AS PER STD E01)
	: INDICATE EARTH PIT FOR NEUTRAL EARTHING
	: INDICATE EARTH PIT FOR LIGHTNING PROTECTION
	: INSTRUMENTATION EARTH PIT
	: EARTH ELECTRODE(INSTALLATION AS PER STD E01)
	: EARTH BAR IN TEST CHAMBER
	: EARTHING CABLE GOING UP
	: EARTHING CABLE COMING DOWN
	: TREATED EARTH PIT (EARTH ELECTRODE NEUTRAL EARTH PIT)

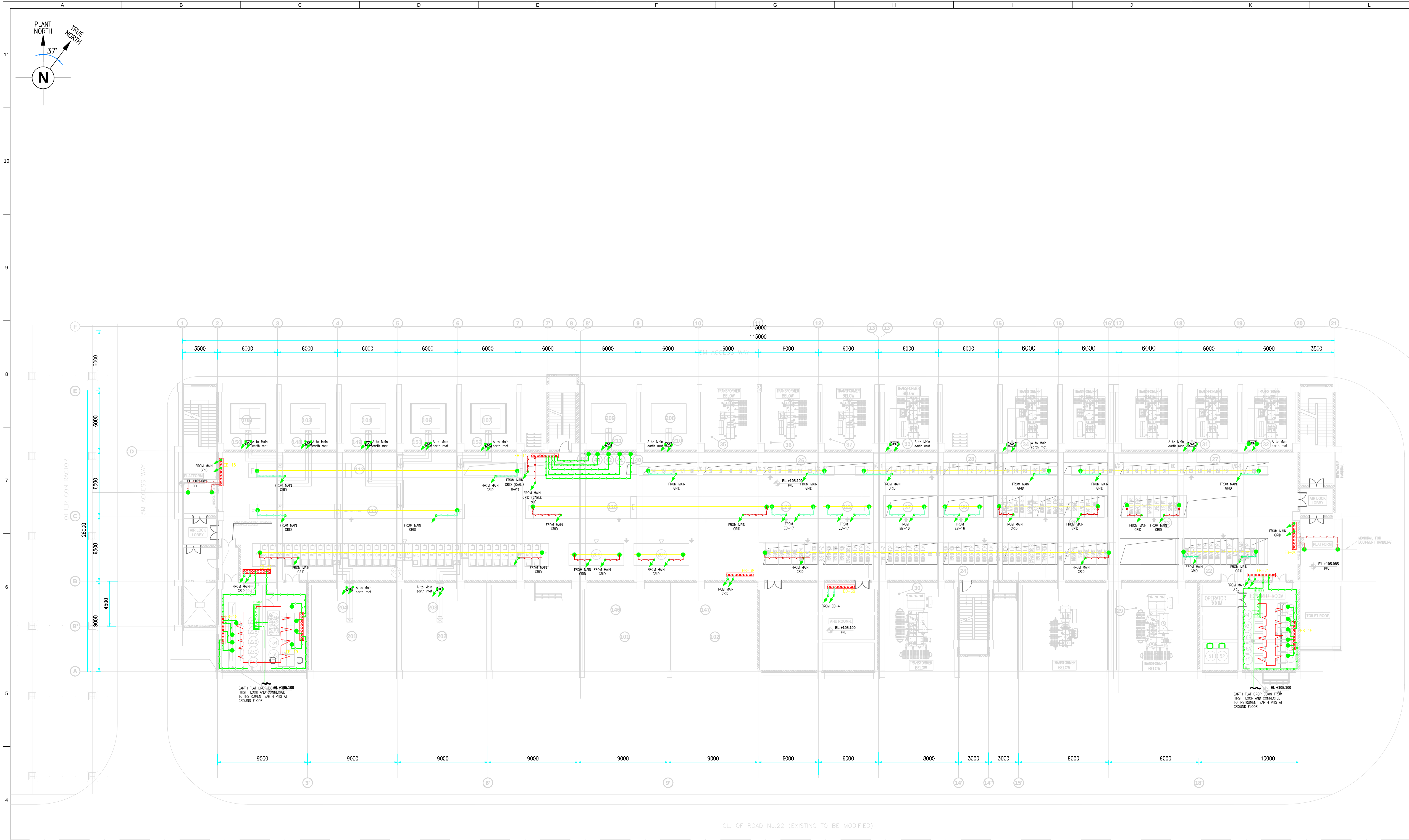
GROUND FLOOR PLAN
(AT EL +100.600 FFL)



PROJECT
PETROCHEMICAL AND LUBE INTEGRATION
PROJECT "LuPech (J-18)" AT IOCL GUJARAT
REFINERY, VADODARA, GUJARAT, INDIA
EPC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT)

TITLE
GROUNDING DISTRIBUTION LAYOUT
SUBSTATION SS-044

DRAWING NUMBER	
PROJECT NO	2047-1803-EEL-DLA-0018
UNIT	EEL DLA 0018
PAGE	1
REV	C



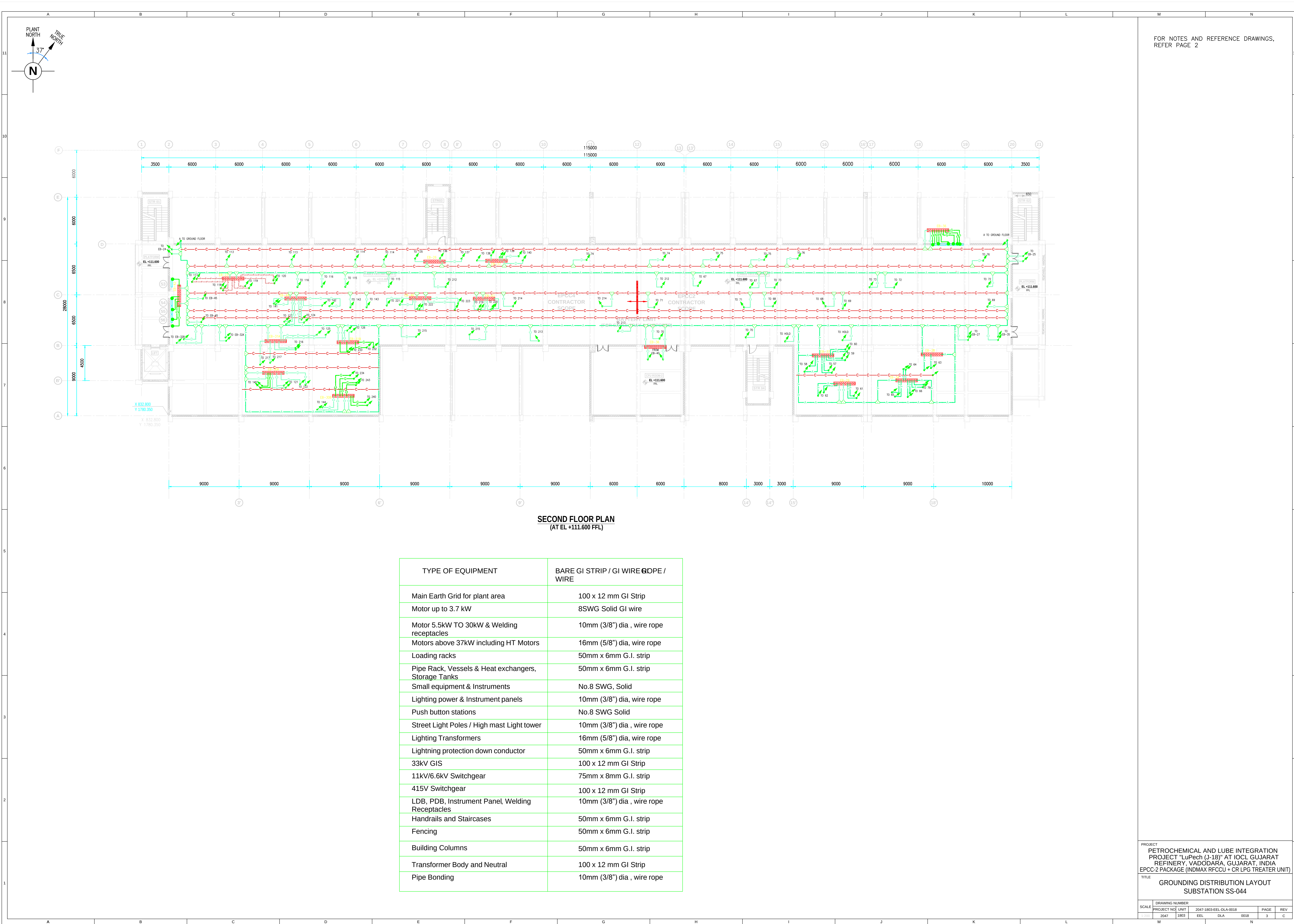
FIRST FLOOR PLAN
(AT EL +105.100 FFL)

- GENERAL NOTES:
- UNLESS OTHERWISE STATED ALL DIMENSIONS ARE IN MILLIMETERS, ELEVATIONS AND CO-ORDINATES ARE IN METERS.
 - EARTH CONDUCTOR WILL PROVIDED ALONG ONE OF THE CABLE TRAY AND WILL BE SUITABLY CLEATED / WELDED. THE EARTHING CONDUCTOR ELECTRICALLY BONDED TO ALL THE OTHER CABLE TRAYS AS PER ELECTRICAL STANDARDS.
 - EARTHING WILL DONE IN ACCORDANCE WITH THE REQUIREMENTS LAID DOWN IN IS 3043, ENGINEERING DESIGN BASIS FOR ELECTRICAL.
 - WHEREVER GI IS MENTIONED IN THE NOTES & STANDARDS, THIS INDICATES THAT HOT DIP GALVANIZED MILD STEEL TO BE USED FOR EARTHING.
 - MAIN GROUNDING GRID WILL INSTALLED AT A MINIMUM DEPTH OF 500MM(AS PER LAYOUTS) FROM FINISHED GRADE LEVEL.
 - MAIN EARTH GRID WILL BE INSTALLED WITH THE SPAN OF 10x10METER AS A MESH FORMATION.
 - THE EXTERNAL RING OF EARTH ELECTRODES SHOULD BE BURIED AT A DEPTH OF AT LEAST 0.7m BUT NOT CLOSER THAN 1.0M TO THE BUILDING WALLS.
 - CLEAN EARTHING GRID WILL LAID 500MM AWAY FROM MAIN ELECTRICAL EARTHING GRID, ALSO CLEAN NEARTHING GRID SHALL NOT BE CONNECTED WITH ELECTRICAL MAIN GRID.
 - ALL MEDIUM AND HIGH VOLTAGE EQUIPMENT (ABOVE 250V) WILL EARTHED BY TWO SEPARATE AND DISTINCT CONNECTIONS WITH EARTH.
 - ALL LIGHTING FIXTURES/CONVENIENCE SOCKET OUTLET/LIGHTING JUNCTION BOX WILL EARTHED THROUGH THE THIRD CORE OF THE FEEDING CABLE OR THIRD WIRE OF THE FEEDING CIRCUIT AS PER INDIVIDUAL LIGHTING LAYOUT DRAWING.
 - METALLIC SHEATHS, SCREENS AND ARMOUR OF ALL MULTICORE CABLES WILL EARTHED AT BOTH EQUIPMENT AND SWITCHGEAR ENDS. SHAFT AND ARMOUR OF SINGLE CORE CABLES SHALL BE EARTHED AT SWITCHGEAR END ONLY.
 - ALL PROCESS PIPELINES WILL BONDED AND EARTHED AT THE ENTRY AND EXIT POINTS OF BATTERY UNIT OF PROCESS AREA.
 - IN HAZARDOUS AREAS ALL PROCESS EQUIPMENT SHALL BE CONNECTED TO THE MAIN EARTH GRID AT TWO PLACES.
 - CATHODIC PROTECTED PIPELINES OR EQUIPMENT WILL EARTHED AS PER CATHODIC PROTECTION GUIDELINES & DRAWING.
 - FOR EQUIPMENT EARTHING, INDIVIDUAL EARTH CONNECTIONS WILL TAPPED FROM NEAREST MAIN EARTHING GRID/EARTH PLATE AS PER LAYOUT DRAWING. THE SIZE OF THE GROUNDING CONDUCTOR FOR THE EQUIPMENT SHALL BE AS PER EQUIPMENT INSTALLATION/LAYOUT.
 - FOR EARTHING LAYOUT OF INDIVIDUAL PLANT, SUBSTATION ETC. REFER TO THE RESPECTIVE EARTHING LAYOUT DRAWINGS.
 - ALL JOINTS BELOW GRADE WILL WELDED & SHALL BE SUITABLY PROTECTED BY BITUMENT (2 COATS) IMPREGNATED HESSIAN TAPE.
 - EARTH STRIP LAID ABOVE GROUND WILL WELDED ACROSS STRAIGHT THROUGH JOINTS & JOINTS SHALL BE SUITABLY PROTECTED BY GIVING TWO COATS OF BITUMENT TO AVOID OXIDATION AND INSULATION FILM FORMATION OF THE STRIP SURFACE.
 - THE MASS OF THE ZINC COATING WILL 720GM/M² & AVERAGE THICKNESS SHALL BE 100 MICRONS FOR GALVANISED ITEMS.
 - ALL DAMAGE TO GALVANIZED SURFACES SHALL BE POLISHED GOOD WITH ZINC RICH PAINT.
 - LIGHTING PROTECTION WILL DONE IN ACCORDANCE WITH THE REQUIREMENTS LAID DOWN IN IS/IEC 62305 AND ENGINEERING DESIGN BASIS FOR ELECTRICAL 077154C-000-JSD-1600-001. SELF CONDUCTING STRUCTURES HAVING METAL THICKNESS OF MORE THAN 4.8MM MAY NOT REQUIRE LIGHTING PROTECTION WITH AERIAL ROD AND DOWN CONDUCTORS. THEY SHALL HOWEVER BE CONNECTED TO THE EARTHING. SYSTEM AT LEAST AT TOW POINTS AT THE BASE.
 - FOR ALL PACKAGE LOADS, INDIVIDUAL MOTOR LOADS AND EARTHING WILL BE SHOWN AFTER RECEIVING PLAN DATA FROM VENDOR.
 - THE EARTHING SYSTEM OF NEW VDU & AHU-V REVAMP UNIT SUBSTATION EQUIPMENT LIKE TRANSFORMERS, SWITCHBOARDS ETC SHALL BE INTERCONNECTED WITH THE UNDERGROUND MAIN EARTH GRID BY RESPECTIVE UNIT CONTRACTOR THROUGH NECESSARY EARTH DISPATCHERS PROVIDED BY MEIL.
- NOTE: 1. AHU AND CFU ROOM EQUIPMENT UNDER HOLD AND PROVIDED EARTH BARS. AFTER FINALIZATION OF EQUIPMENT DETAILS ALL EQUIPMENTS TO BE CONNECTED TO EARTH BAR AS PER EARTHING STANDARDS.
2. REFER LIGHTNING PROTECTION LAYOUT DRAWING NO: 2047-1803-EEL-DLA-0024 FOR LIGHTING PITS AND CONNECTION DETAILS

PROJECT
PETROCHEMICAL AND LUBE INTEGRATION
PROJECT "LuPech (J-18)" AT IOCL GUJARAT
REFINERY, VADODARA, GUJARAT, INDIA
EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT)

TITLE
GROUNDING DISTRIBUTION LAYOUT
SUBSTATION SS-044

SCALE	DRAWING NUMBER	PROJECT NO	UNIT	2047-1803-EEL-DLA-0018	PAGE	REV
1:200	MAT	1803	EEL	DLA	0018	2
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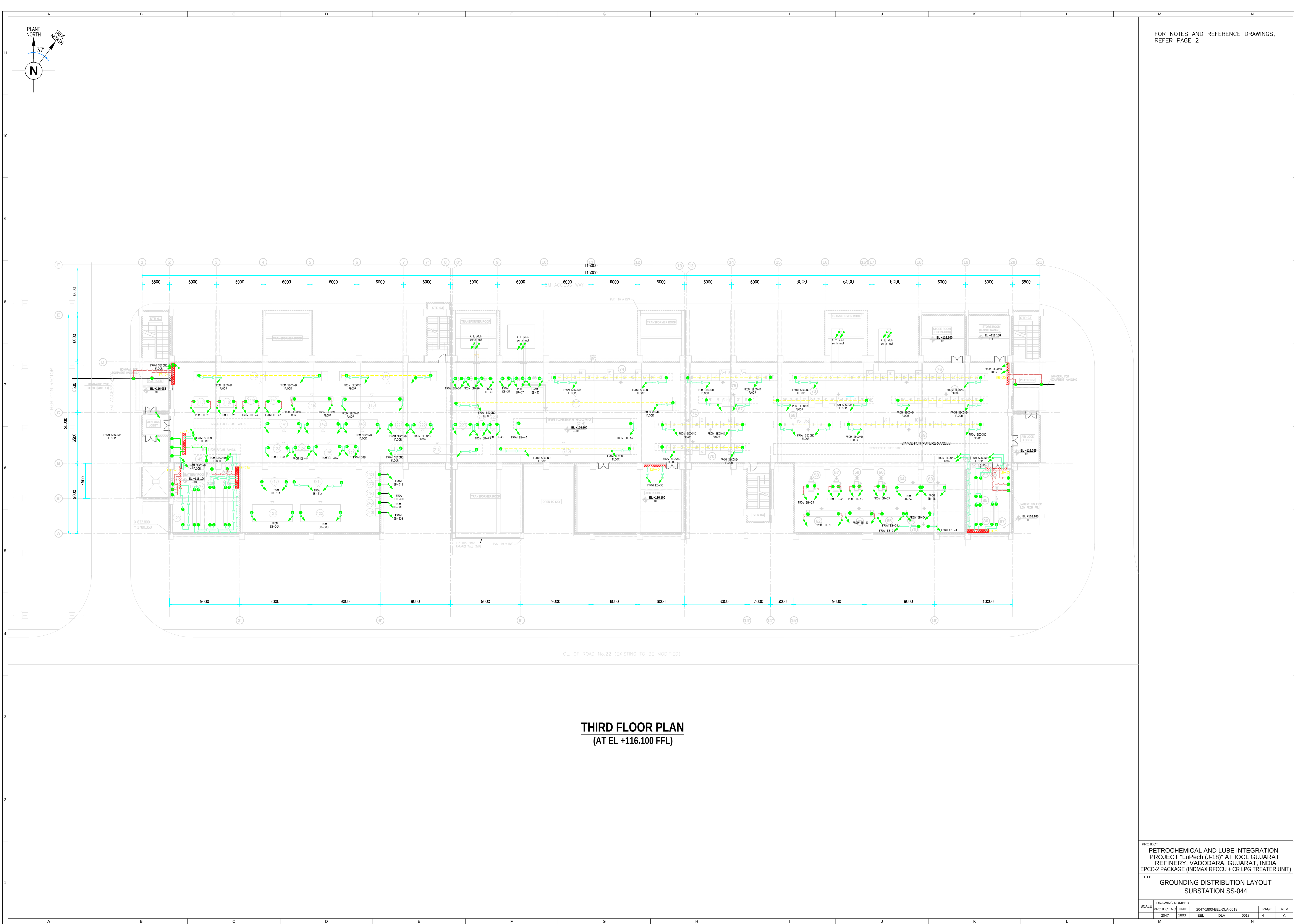
FOR NOTES AND REFERENCE DRAWINGS,
REFER PAGE 2

SECOND FLOOR PLAN
(AT EL +111.600 FFL)

TYPE OF EQUIPMENT	BARE GI STRIP / GI WIRE / WIRE ROPE
Main Earth Grid for plant area	100 x 12 mm GI Strip
Motor up to 3.7 kW	8SWG Solid GI wire
Motor 5.5kW TO 30kW & Welding receptacles	10mm (3/8") dia , wire rope
Motors above 37kW including HT Motors	16mm (5/8") dia, wire rope
Loading racks	50mm x 6mm G.I. strip
Pipe Rack, Vessels & Heat exchangers, Storage Tanks	50mm x 6mm G.I. strip
Small equipment & Instruments	No.8 SWG, Solid
Lighting power & Instrument panels	10mm (3/8") dia, wire rope
Push button stations	No.8 SWG Solid
Street Light Poles / High mast Light tower	10mm (3/8") dia , wire rope
Lighting Transformers	16mm (5/8") dia, wire rope
Lightning protection down conductor	50mm x 6mm G.I. strip
33kV GIS	100 x 12 mm GI Strip
11kV/6.6kV Switchgear	75mm x 8mm G.I. strip
415V Switchgear	100 x 12 mm GI Strip
LDB, PDB, Instrument Panel, Welding Receptacles	10mm (3/8") dia , wire rope
Handrails and Staircases	50mm x 6mm G.I. strip
Fencing	50mm x 6mm G.I. strip
Building Columns	50mm x 6mm G.I. strip
Transformer Body and Neutral	100 x 12 mm GI Strip
Pipe Bonding	10mm (3/8") dia , wire rope

PROJECT
PETROCHEMICAL AND LUBE INTEGRATION
PROJECT "LuPech (J-18)" AT IOCL GUJARAT
REFINERY, VADODARA, GUJARAT, INDIA
EPC-C-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT)
TITLE
GROUNDING DISTRIBUTION LAYOUT
SUBSTATION SS-044

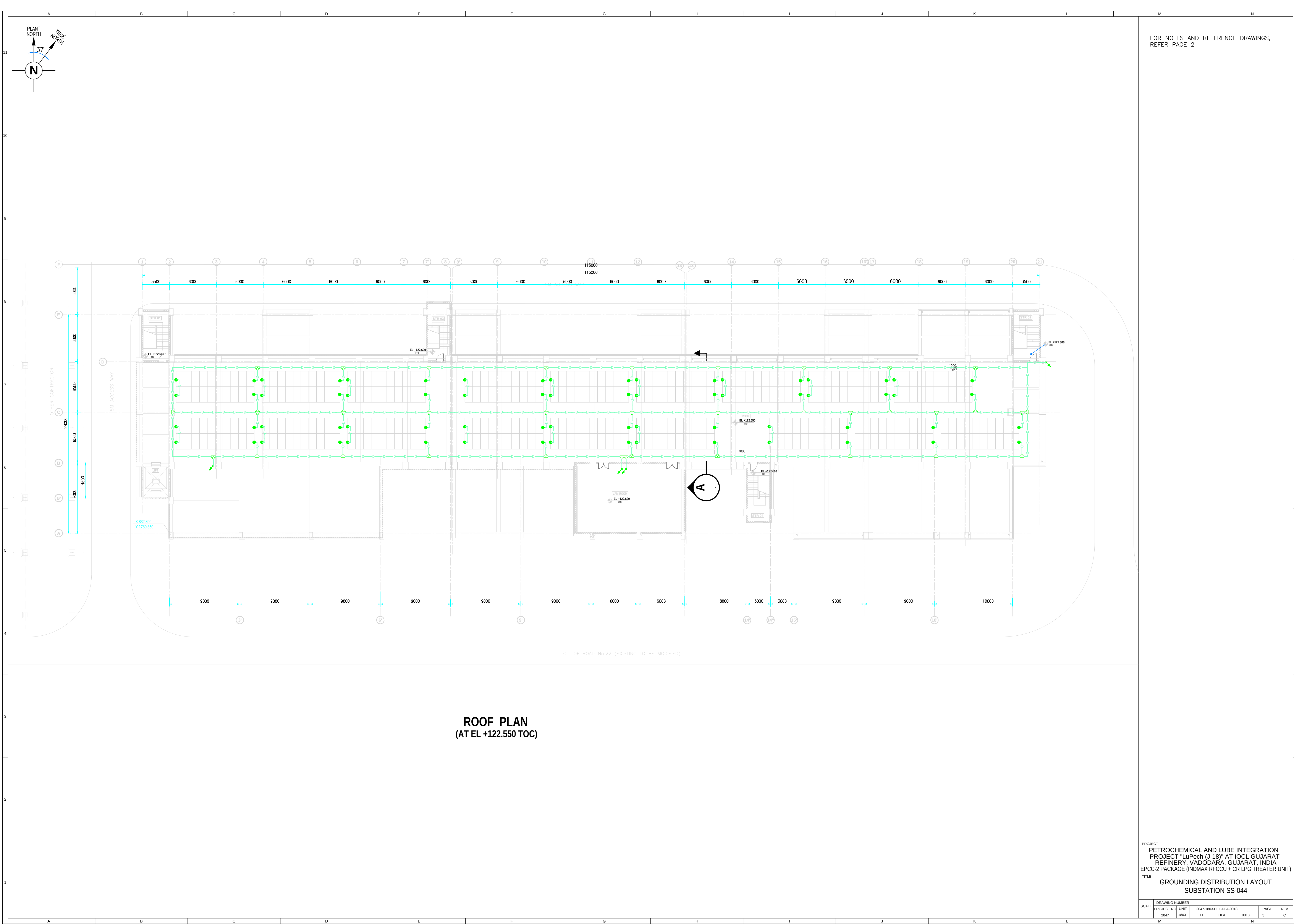
SCALE	DRAWING NUMBER						
	PROJECT NO	UNIT	2047-1803-EEL-DLA-0018		PAGE	REV	
1:200	2047	1803	EEL	DLA	0018	3	C



THIRD FLOOR PLAN
(AT EL +116.100 FFL)

FOR NOTES AND REFERENCE DRAWINGS,
REFER PAGE 2

PROJECT				
PETROCHEMICAL AND LUBE INTEGRATION				
PROJECT "LuPech (J-18)" AT IOCL GUJARAT				
REFINERY, VADODARA, GUJARAT, INDIA				
EPCC-2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT)				
TITLE				
GROUNDING DISTRIBUTION LAYOUT				
SUBSTATION SS-044				
SCALE				
DRAWING NUMBER				
PROJECT NO	UNIT	2047-1803-EEL-DLA-0018	PAGE	REV
2047	1803	EEL DLA 0018	4	C
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FOR NOTES AND REFERENCE DRAWINGS,
REFER PAGE 2

ROOF PLAN
(AT EL +122.550 TOC)

PROJECT				
PETROCHEMICAL AND LUBE INTEGRATION				
PROJECT "LuPech (J-18)" AT IOCL GUJARAT				
REFINERY, VADODARA, GUJARAT, INDIA				
EPCC2 PACKAGE (INDMAX RFCCU + CR LPG TREATER UNIT)				
TITLE				
GROUNDING DISTRIBUTION LAYOUT				
SUBSTATION SS-044				
SCALE				
DRAWING NUMBER		PAGE		REV
PROJECT NO	UNIT	2047-1803-EEL-DLA-0018	5	C
2047	1803	EEL	DLA	0018
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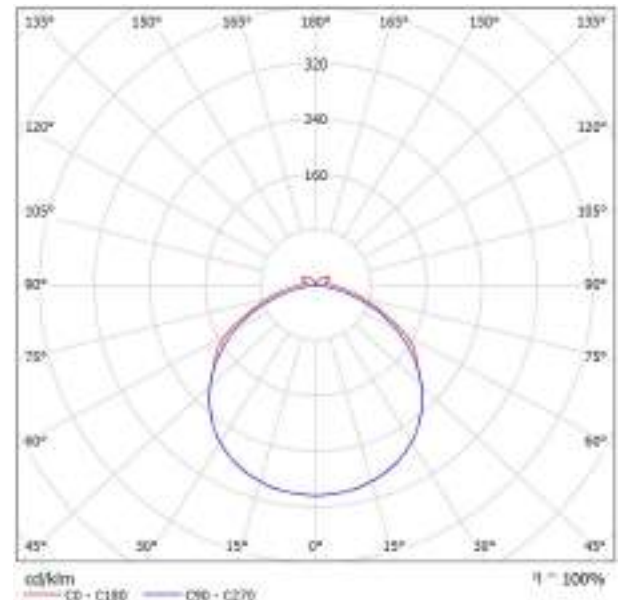
Substation - Ground Floor

Date: 10.04.2023
Operator:

Operator
Telephone
Fax
e-Mail

PHILIPS WT470C L1600 1 xLED64S/840 O / Luminaire Data Sheet

Luminous emittance 1:



Luminaire classification according to CIE: 94
CIE flux code: 45 77 94 94 100

Excelente calidad de la luz con alta eficiencia PacificLED gen4 es una luminaria LED estanca, fiable y de alta eficiencia que ofrece una excelente calidad de luz con una distribución de luz uniforme sin franjas ni artefactos de color visibles. La gama proporciona una construcción modular que permite una actualización y mantenimiento sencillos. El nuevo sistema óptico brinda iluminación sin distorsiones con una orientación visual mejorada, lo que la hace especialmente idónea para la industria en general, los almacenes y los aparcamientos. La gama también ofrece la opción de diversas ópticas para garantizar un sistema de iluminación optimizado para una amplia variedad de aplicaciones. Para aplicaciones industriales, PacificLED gen4 dispone de una arquitectura de producto abierta con acceso a la bandeja portaequipos sin necesidad de herramientas y un innovador diseño con conector integrado para una instalación rápida y sencilla. El anclaje de montaje a techo de una sola pieza garantiza que no haya pequeños componentes sueltos, lo que podría afectar al proceso de producción.

Luminous emittance 1:

Glare Evaluation According to UGR											
UG Rating	70	70	30	30	30	70	70	30	30	30	30
UG Rating	90	90	30	30	30	90	90	30	30	30	30
UG Rating	20	20	20	20	20	20	20	20	20	20	20
Room Size h	Viewing direction at right angles to lamp axis					Viewing direction parallel to lamp axis					
2H	2H	20.5	20.7	20.8	21.1	21.4	20.3	21.4	20.8	21.8	22.3
	4H	20.6	21.8	21.1	21.2	22.6	21.5	22.6	21.9	22.9	23.3
	4H	21.1	22.1	21.5	22.6	23.6	21.9	22.9	22.3	23.3	23.8
	8H	21.4	22.4	21.8	22.8	23.3	22.8	23.8	22.5	23.4	23.9
	12H	21.5	22.5	22.8	22.9	23.4	22.8	23.8	22.5	23.4	23.9
4H	2H	21.6	22.5	22.1	23.0	23.4	23.8	23.8	22.5	23.4	23.8
	2H	20.1	21.1	20.8	21.5	22.6	20.6	21.7	21.1	22.1	22.5
	4H	21.4	22.1	21.5	22.6	23.7	22.1	23.6	22.8	23.3	23.8
	4H	22.0	22.8	22.5	23.2	23.8	22.6	23.4	22.1	23.8	24.4
	8H	22.5	23.2	23.6	23.7	24.2	23.8	23.5	23.4	24.8	24.4
6H	2H	22.8	23.3	23.2	23.8	24.4	23.8	23.8	23.4	24.8	24.4
	12H	23.0	23.4	23.3	23.6	24.5	23.9	23.5	23.4	24.8	24.4
	4H	22.3	22.9	23.8	23.4	23.8	22.8	23.4	22.3	23.8	24.3
	8H	22.8	23.4	23.4	23.8	24.8	23.1	23.7	23.7	24.7	24.8
	8H	23.1	23.6	23.7	24.2	24.8	23.2	23.7	23.8	24.2	24.8
12H	23.4	23.8	24.3	24.4	25.8	23.2	23.7	23.8	24.2	24.8	
	4H	22.2	22.8	22.8	23.3	23.9	22.8	23.4	22.3	23.8	24.3
	8H	22.9	23.4	23.3	23.6	24.3	23.2	23.7	23.8	24.2	24.8
8H	23.2	23.6	23.8	24.2	24.8	23.2	23.7	23.9	24.3	24.8	
Variation of the observer position for the luminaire distance h											
h = 1.0H	+0.2 / -0.2					+0.1 / -0.1					
h = 1.5H	+0.2 / -0.2					+0.2 / -0.2					
h = 2.0H	+0.5 / -0.5					+0.5 / -0.5					
Standard Value	UGR					UGR					
Correction	UGR					UGR					
Summed	UGR					UGR					
Corrected Glare Index referring to 4000lx Solid Luminaire Flux											

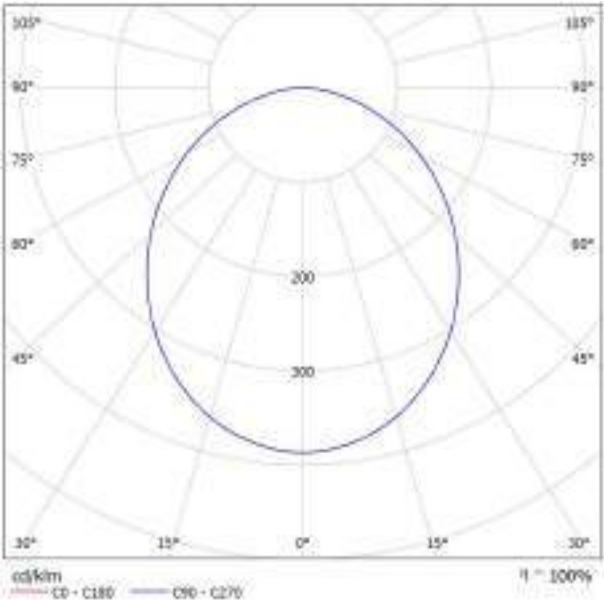


Operator
Telephone
Fax
e-Mail

Philips SM251C LED20S-6500 PSU WH / Luminaire Data Sheet

Luminous emittance 1:

See our luminaire catalog for an image of the luminaire.



Luminaire classification according to CIE: 100
CIE flux code: 49 80 96 100 100

Luminous emittance 1:

Glare Evaluation According to UGR											
Ceiling	70	70	30	30	30	70	70	30	30	30	
Walls	80	80	30	30	30	80	80	30	30	30	
Floor	20	20	20	20	20	20	20	20	20	20	
Room Size lx · t	Viewing direction at right angles to lamp axis					Viewing direction parallel to lamp axis					
2H	2H	22.8	24.8	23.6	24.3	24.6	22.8	24.8	23.3	24.3	24.8
	2H	24.0	25.2	24.4	25.1	25.1	24.0	25.2	24.4	25.1	25.1
	4H	24.5	25.6	24.8	25.6	26.2	24.5	25.6	24.9	25.6	26.2
	6H	24.8	25.9	25.2	26.2	26.5	24.8	25.9	25.2	26.2	26.5
	8H	24.9	25.9	25.3	26.2	26.5	24.9	25.9	25.3	26.2	26.5
4H	12H	24.9	25.9	25.3	26.2	26.5	24.9	25.9	25.3	26.2	26.5
	2H	23.1	24.5	22.7	24.3	25.6	23.1	24.5	22.7	24.3	25.6
	2H	24.0	25.2	24.4	25.1	26.4	24.0	25.2	24.4	25.1	26.4
	4H	25.4	26.3	25.6	26.6	27.8	25.4	26.3	25.6	26.6	27.8
	6H	25.8	26.6	26.0	26.6	27.3	25.8	26.6	26.0	26.6	27.3
6H	8H	25.9	26.6	26.4	27.0	27.4	25.9	26.6	26.4	27.0	27.4
	12H	26.0	26.6	26.4	27.0	27.5	26.0	26.6	26.4	27.0	27.5
	4H	25.6	26.3	26.1	26.7	27.1	25.6	26.3	26.1	26.7	27.1
	6H	26.2	26.7	26.6	27.1	27.8	26.2	26.7	26.6	27.1	27.8
	8H	26.3	26.8	26.8	27.3	27.7	26.3	26.8	26.8	27.3	27.7
12H	12H	26.4	26.8	26.8	27.3	27.8	26.4	26.8	26.8	27.3	27.8
	4H	25.7	26.3	26.1	26.7	27.1	25.7	26.3	26.1	26.7	27.1
	6H	26.2	26.7	26.7	27.1	27.8	26.2	26.7	26.7	27.1	27.8
	8H	26.4	26.8	26.8	27.3	27.8	26.4	26.8	26.8	27.3	27.8
	Variation of the observer position for the luminance distance S										
S = 1.0H	+3.1 / -6.2					+0.1 / -6.2					
S = 1.5H	+3.2 / -6.5					+0.2 / -6.5					
S = 2.0H	+3.5 / -6.9					+0.5 / -6.9					
Standard Error	8000					8000					
Correction Summed	8.2					8.2					
Corrected Glare Index referring to 3000lx Solid Luminous Flux											

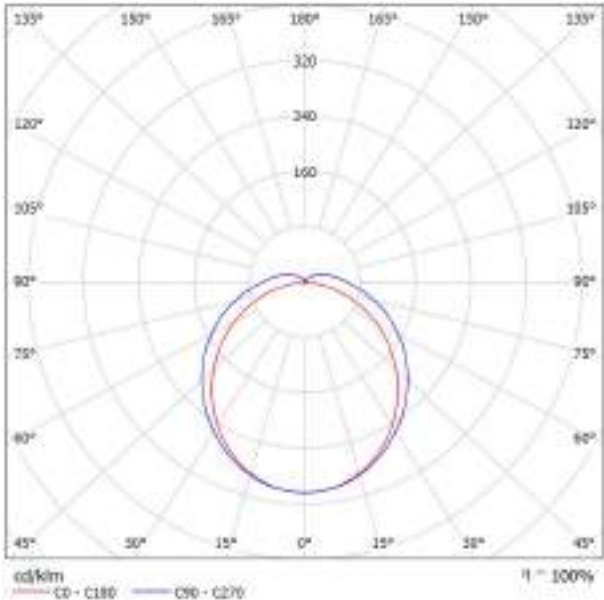


Operator
Telephone
Fax
e-Mail

Philips BN308C LED60S-6500 L120 PSU WH / Luminaire Data Sheet

Luminous emittance 1:

See our luminaire catalog for an image of the luminaire.



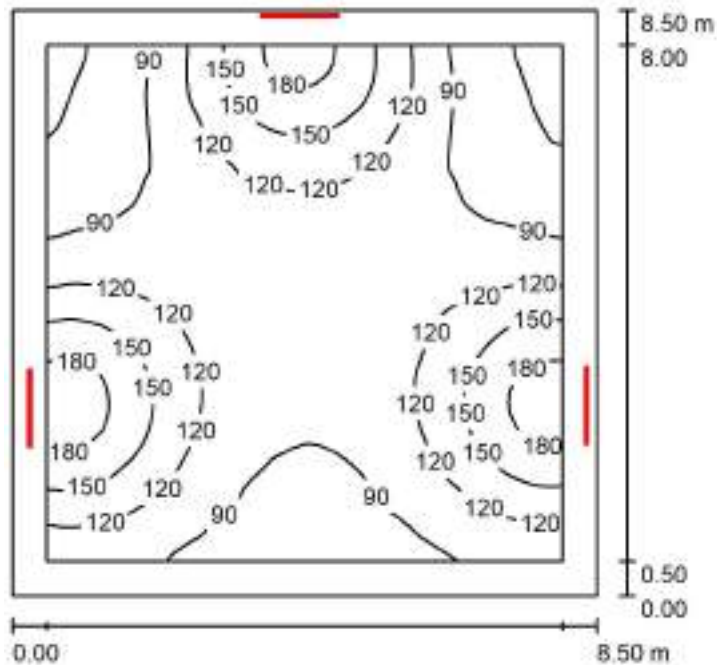
Luminaire classification according to CIE: 93
CIE flux code: 43 73 91 93 100

Luminous emittance 1:

Glare Evaluation According to UGR											
		70	70	30	30	30	70	70	30	30	30
Celing		90	90	90	90	90	90	90	90	90	90
Walls		20	20	20	20	20	20	20	20	20	20
Floor		20	20	20	20	20	20	20	20	20	20
Room Size		Viewing direction at right angles to lamp axis					Viewing direction parallel to lamp axis				
S	T										
2H	2H	22.4	24.7	23.8	25.0	25.4	21.6	24.8	24.0	25.1	25.6
	3H	24.0	26.0	25.2	26.4	26.8	23.4	26.6	25.8	27.0	27.4
	4H	25.4	28.4	27.6	29.0	29.4	25.1	28.4	27.6	27.8	28.2
	5H	25.8	28.8	28.0	29.2	29.6	25.5	28.8	27.5	28.5	28.9
	12H	25.9	28.9	28.1	29.3	29.7	25.6	28.9	27.9	28.3	28.7
4H	2H	24.0	26.0	25.2	26.4	26.8	24.2	26.2	25.4	25.7	26.2
	3H	25.7	27.6	26.8	27.2	27.6	26.2	27.2	26.4	26.7	27.2
	4H	26.4	27.2	26.6	27.2	27.6	27.0	27.0	26.2	26.5	27.0
	5H	26.8	27.6	27.0	27.4	27.8	27.4	27.4	26.6	26.9	27.4
	12H	27.1	27.7	27.1	27.5	27.9	27.7	27.7	26.9	27.2	27.7
6H	2H	25.8	27.5	27.0	27.4	27.8	27.6	27.6	26.8	27.1	27.6
	3H	27.8	28.6	28.0	28.4	28.8	28.7	28.7	27.9	28.2	28.7
	4H	27.7	28.2	27.6	28.0	28.4	28.3	28.3	27.5	27.8	28.3
	5H	27.9	28.3	27.7	28.1	28.5	28.5	28.5	27.7	28.0	28.5
	12H	27.9	28.3	27.7	28.1	28.5	28.5	28.5	27.7	28.0	28.5
12H	2H	26.9	27.5	27.1	27.6	28.0	27.8	27.8	26.9	27.1	27.6
	3H	27.8	28.1	28.0	28.1	28.2	28.0	28.1	27.8	27.9	28.0
	5H	27.9	28.4	28.5	28.6	28.8	28.5	28.6	28.1	28.2	28.3
Variation of the observer position for the luminaire distance 3											
S = 1.0H		+0.1 / -6.1					+0.1 / -6.1				
S = 1.5H		+0.2 / -6.3					+0.2 / -6.3				
S = 2.0H		+0.4 / -6.8					+0.3 / -6.8				
Standard Value		8000					8000				
Correction Summed		30.4					12.9				
Corrected Glare Index referring to 5000lx Solid Luminous Flux											

Operator
Telephone
Fax
e-Mail

044-TR-201 typical / Summary



Height of Room: 11.000 m, Mounting Height: 3.800 m, Light loss factor: 0.80

Values in Lux, Scale 1:110

Surface	ρ [%]	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0
Workplane	/	113	48	197	0.428
Floor	20	97	48	127	0.496
Ceiling	70	17	14	19	0.832
Walls (4)	50	41	12	3321	/

Workplane:

Height: 1.000 m
Grid: 128 x 128 Points
Boundary Zone: 0.500 m

Luminaire Parts List

No.	Pieces	Designation (Correction Factor)	Φ (Luminaire) [lm]	Φ (Lamps) [lm]	P [W]
1	3	Philips BN308C LED60S-6500 L120 PSU WH (1.000)	5702	5700	45.5
Total:			17105	17100	136.5

Specific connected load: $1.89 \text{ W/m}^2 = 1.67 \text{ W/m}^2/100 \text{ lx}$ (Ground area: 72.25 m^2)



Operator
Telephone
Fax
e-Mail

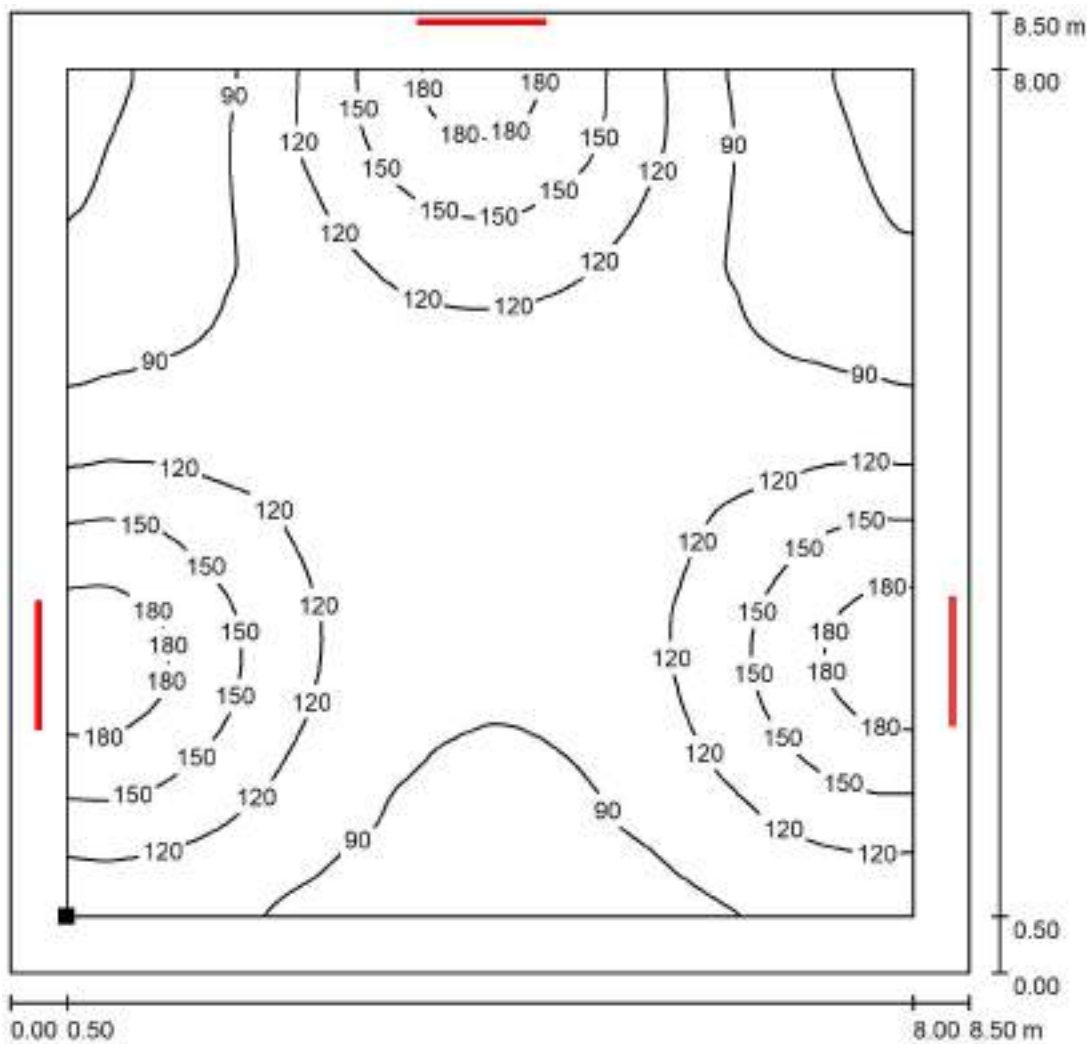
044-TR-201 typical / 3D Rendering





Operator
Telephone
Fax
e-Mail

044-TR-201 typical / Workplane / Isolines (E)



Values in Lux, Scale 1 : 67

Position of surface in room:
Working plane with 0.500 m
Boundary Zone
Marked point:
(27.819 m, 24.276 m, 1.000 m)

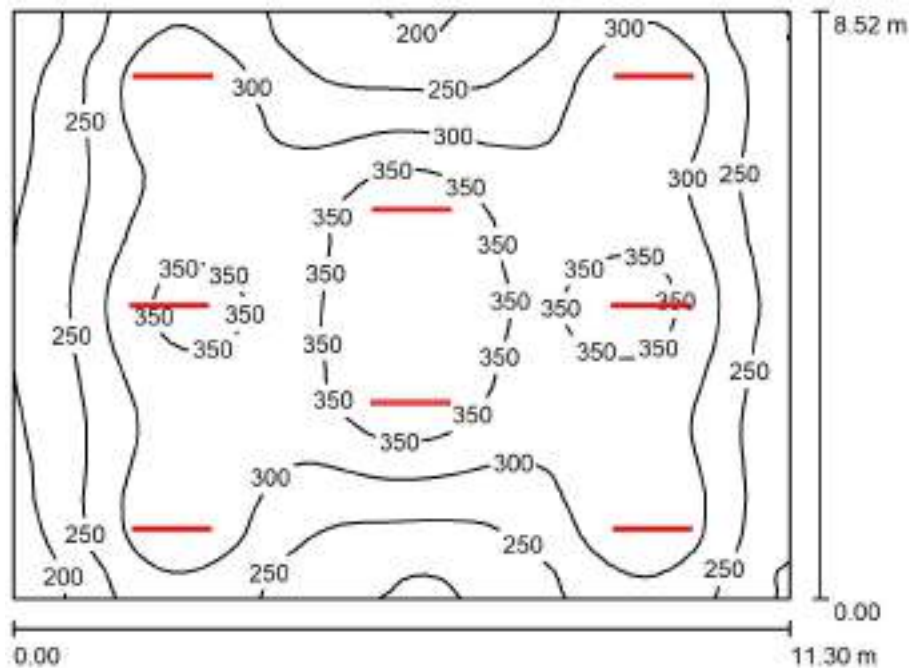


Grid: 128 x 128 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0	E_{min} / E_{max}
113	48	197	0.428	0.246

Operator
Telephone
Fax
e-Mail

CFU Room / Summary



Height of Room: 3.500 m, Mounting Height: 3.500 m, Light loss factor: 0.80

Values in Lux, Scale 1:110

Surface	ρ [%]	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0
Workplane	/	295	167	393	0.567
Floor	20	264	164	333	0.622
Ceiling	70	101	54	9190	0.533
Walls (4)	50	183	95	559	/

Workplane:

Height: 0.850 m
Grid: 64 x 64 Points
Boundary Zone: 0.000 m

Luminaire Parts List

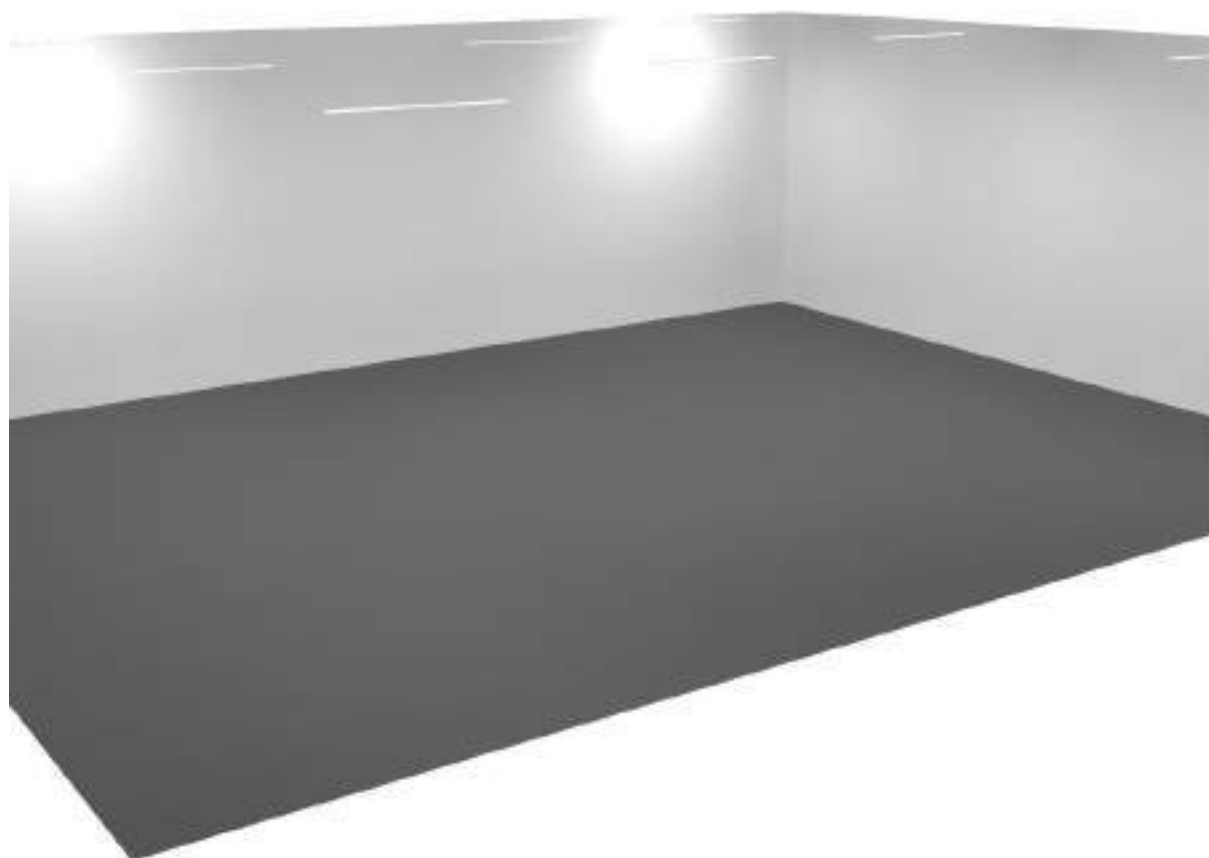
No.	Pieces	Designation (Correction Factor)	Φ (Luminaire) [lm]	Φ (Lamps) [lm]	P [W]
1	8	Philips BN308C LED60S-6500 L120 PSU WH (1.000)	5702	5700	45.5
Total:			45613	45600	364.1

Specific connected load: $3.78 \text{ W/m}^2 = 1.28 \text{ W/m}^2/100 \text{ lx}$ (Ground area: 96.31 m^2)



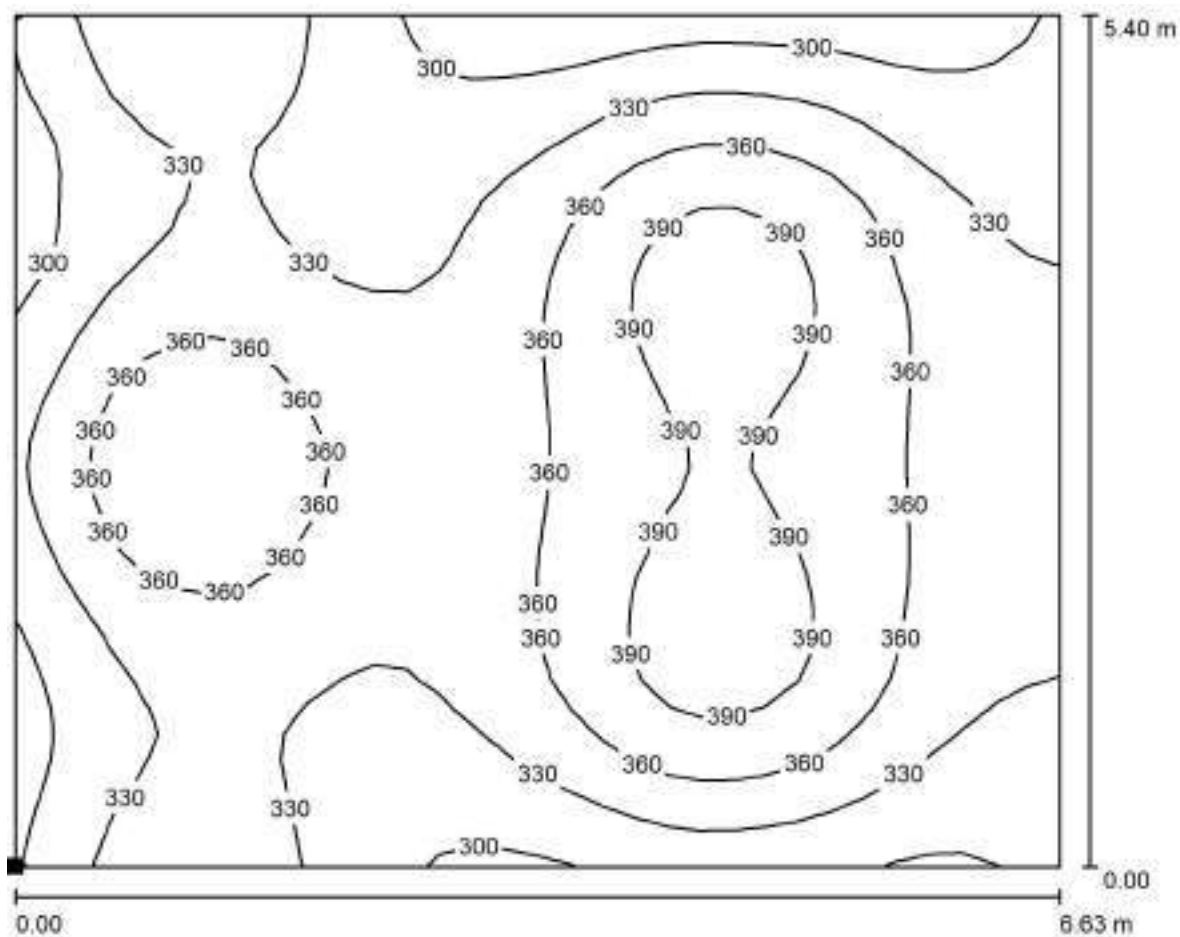
Operator
Telephone
Fax
e-Mail

CFU Room / 3D Rendering



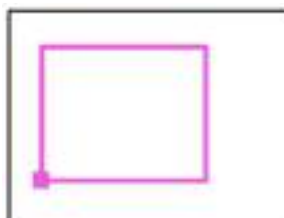
Operator
Telephone
Fax
e-Mail

CFU Room / Calculation Surface / Isolines (E, Perpendicular)



Values in Lux, Scale 1 : 48

Position of surface in room:
Marked point:
(73.632 m, 25.456 m, 1.000 m)



Grid: 32 x 32 Points

E_{av} [lx]
345

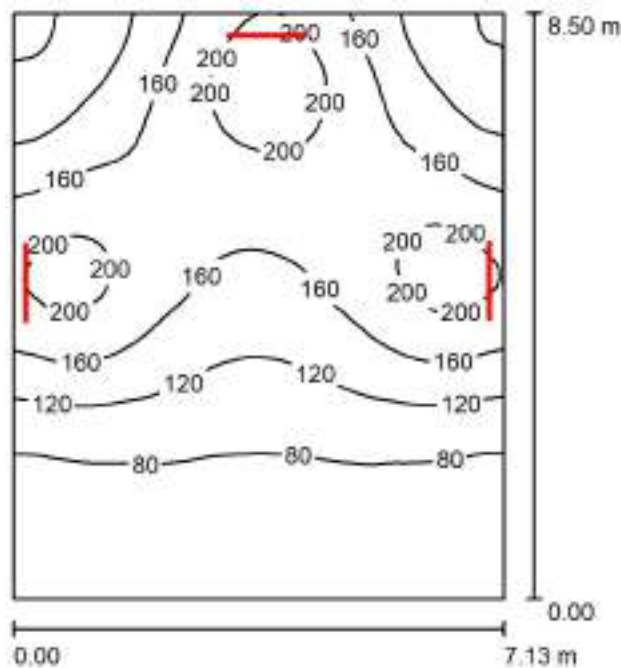
E_{min} [lx]
281

E_{max} [lx]
408

u_0
0.815

E_{min} / E_{max}
0.689

Operator
Telephone
Fax
e-Mail

044-TR-106A / Summary

Height of Room: 11.000 m, Light loss factor: 0.80

Values in Lux, Scale 1:110

Surface	ρ [%]	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0
Workplane	/	131	42	225	0.322
Floor	20	114	48	163	0.423
Ceiling	70	18	15	20	0.853
Walls (4)	50	46	13	1671	/

Workplane:

Height: 1.000 m
Grid: 64 x 64 Points
Boundary Zone: 0.000 m

Luminaire Parts List

No.	Pieces	Designation (Correction Factor)	Φ (Luminaire) [lm]	Φ (Lamps) [lm]	P [W]
1	3	Philips BN308C LED60S-6500 L120 PSU WH (1.000)	5702	5700	45.5
Total:			17105	17100	136.5

Specific connected load: $2.25 \text{ W/m}^2 = 1.72 \text{ W/m}^2/100 \text{ lx}$ (Ground area: 60.61 m^2)



Operator
Telephone
Fax
e-Mail

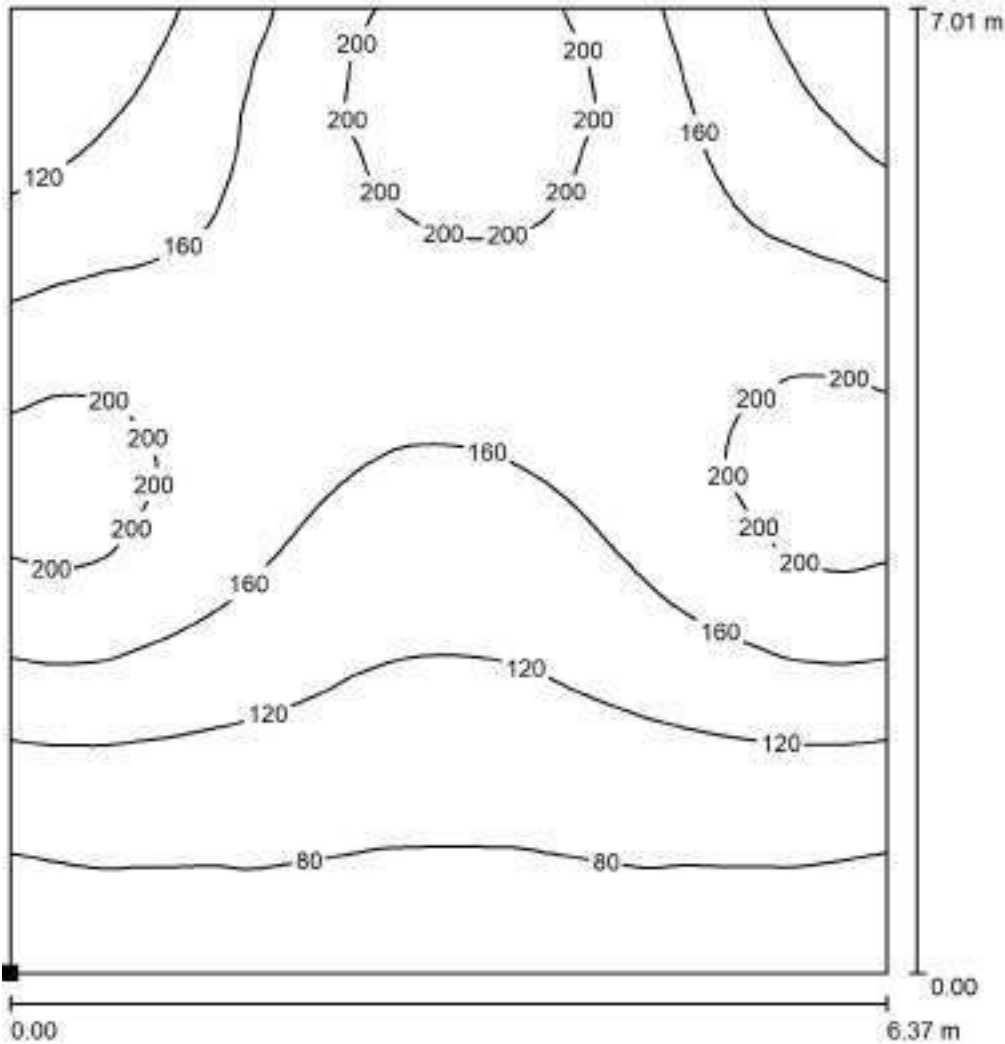
044-TR-106A / 3D Rendering





Operator
Telephone
Fax
e-Mail

044-TR-106A / Calculation Surface / Isolines (E, Perpendicular)



Values in Lux, Scale 1 : 55

Position of surface in room:
Marked point:
(84.927 m, 24.914 m, 1.000 m)

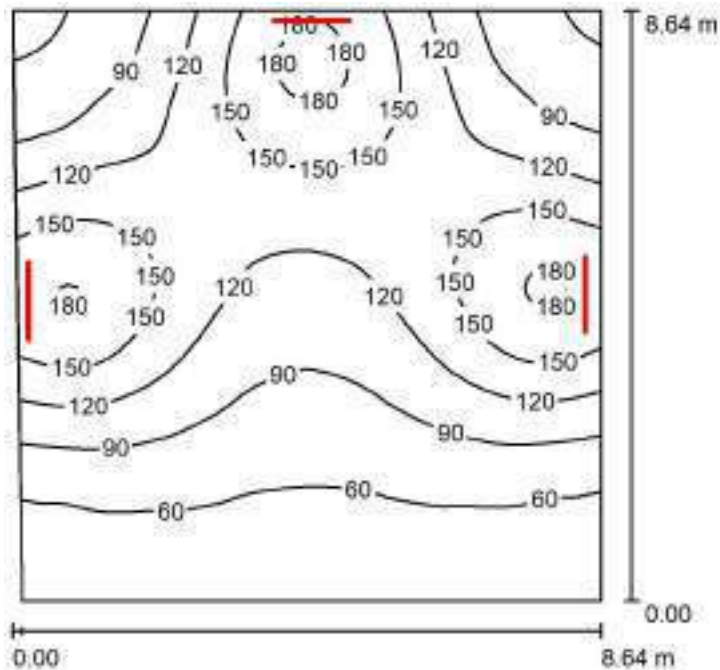


Grid: 64 x 64 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
146	58	228	0.400	0.257

Operator
Telephone
Fax
e-Mail

044-TR-101 typical / Summary



Height of Room: 11.000 m, Light loss factor: 0.80

Values in Lux, Scale 1:111

Surface	ρ [%]	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0
Workplane	/	108	40	189	0.374
Floor	20	97	44	140	0.451
Ceiling	70	17	14	19	0.828
Walls (4)	50	40	11	2037	/

Workplane:

Height: 0.850 m
Grid: 64 x 64 Points
Boundary Zone: 0.000 m

Luminaire Parts List

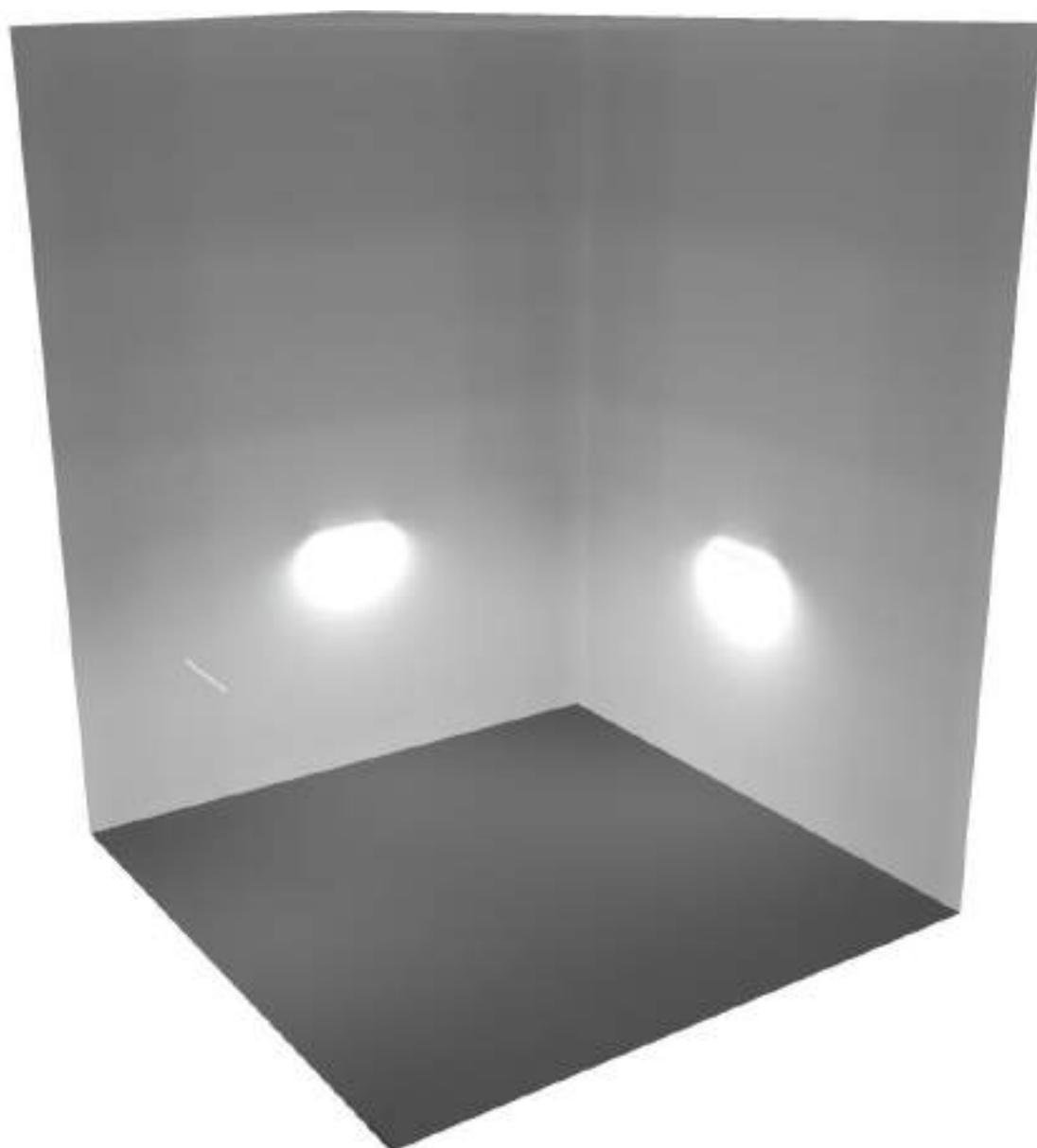
No.	Pieces	Designation (Correction Factor)	Φ (Luminaire) [lm]	Φ (Lamps) [lm]	P [W]
1	3	Philips BN308C LED60S-6500 L120 PSU WH (1.000)	5702	5700	45.5
Total:			17105	17100	136.5

Specific connected load: $1.84 \text{ W/m}^2 = 1.71 \text{ W/m}^2/100 \text{ lx}$ (Ground area: 74.11 m^2)



Operator
Telephone
Fax
e-Mail

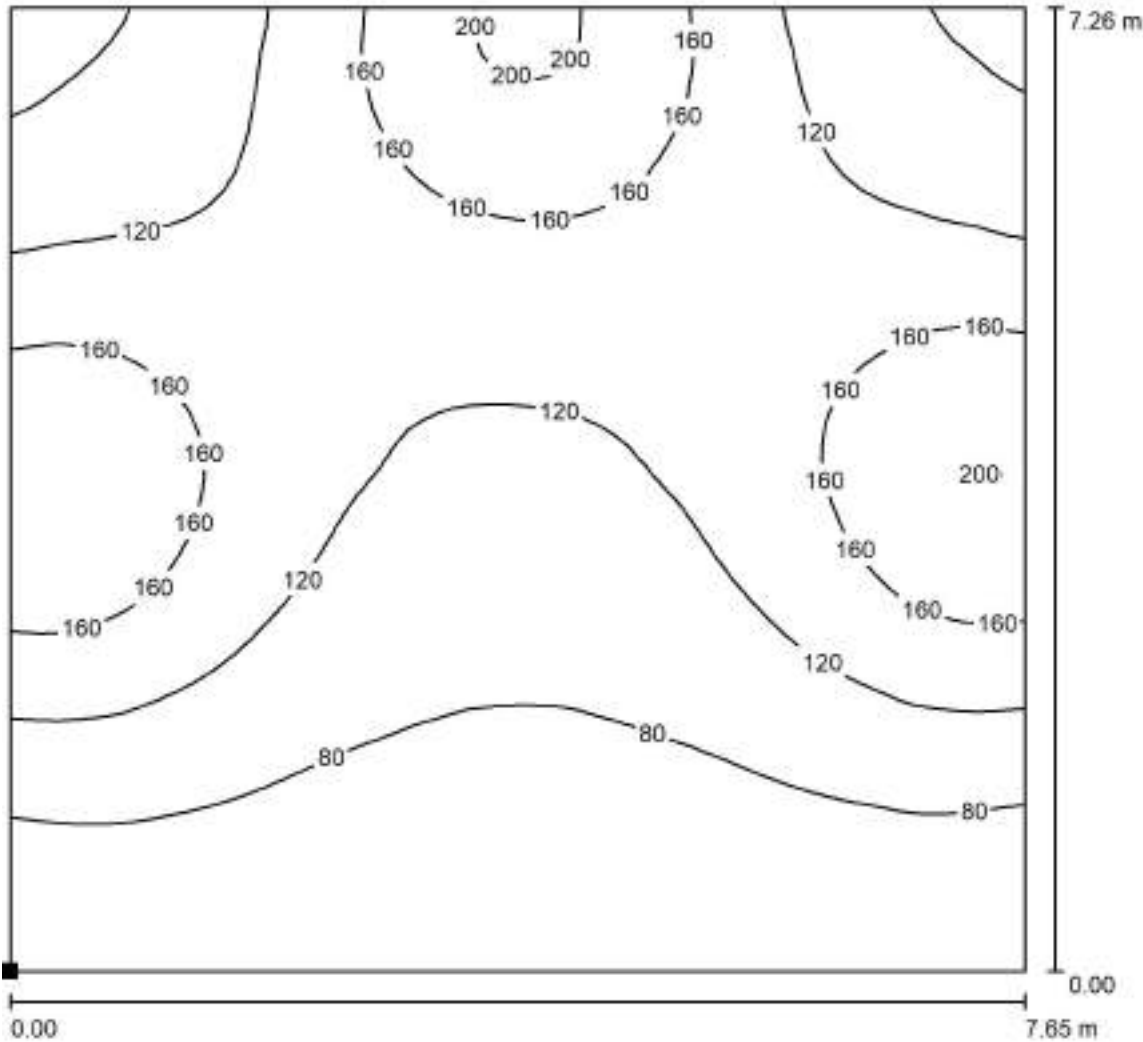
044-TR-101 typical / 3D Rendering





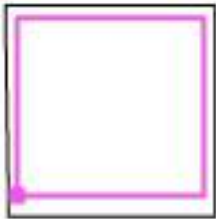
Operator
Telephone
Fax
e-Mail

044-TR-101 typical / Calculation Surface / Isolines (E, Perpendicular)



Values in Lux, Scale 1 : 57

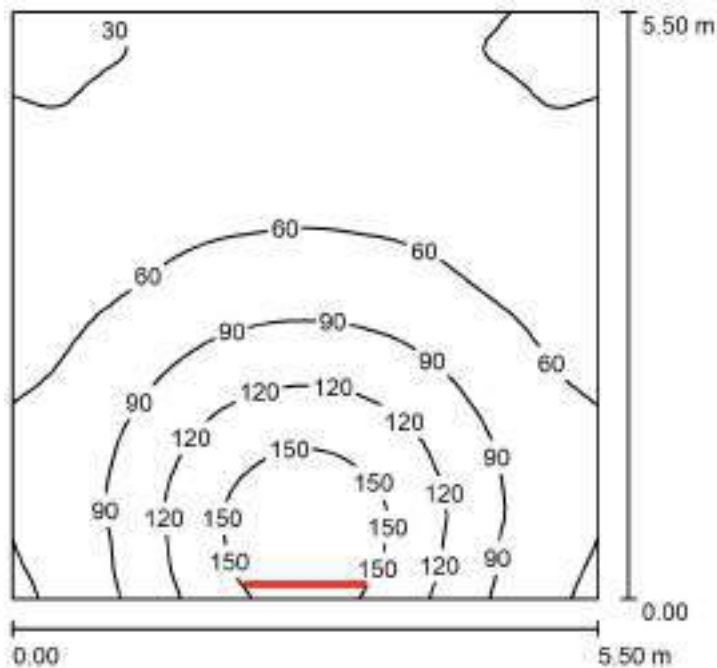
Position of surface in room:
Marked point:
(98.684 m, 24.616 m, 1.000 m)



Grid: 64 x 64 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
118	49	207	0.417	0.238

Operator
Telephone
Fax
e-Mail

044-TR-110/111/202 typical / Summary

Height of Room: 11.000 m, Mounting Height: 3.800 m, Light loss factor: 0.80

Values in Lux, Scale 1:71

Surface	ρ [%]	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0
Workplane	/	72	26	172	0.360
Floor	20	59	29	100	0.489
Ceiling	70	7.10	5.84	8.17	0.822
Walls (4)	50	25	4.69	2285	/

Workplane:

Height: 1.000 m
Grid: 64 x 64 Points
Boundary Zone: 0.000 m

Luminaire Parts List

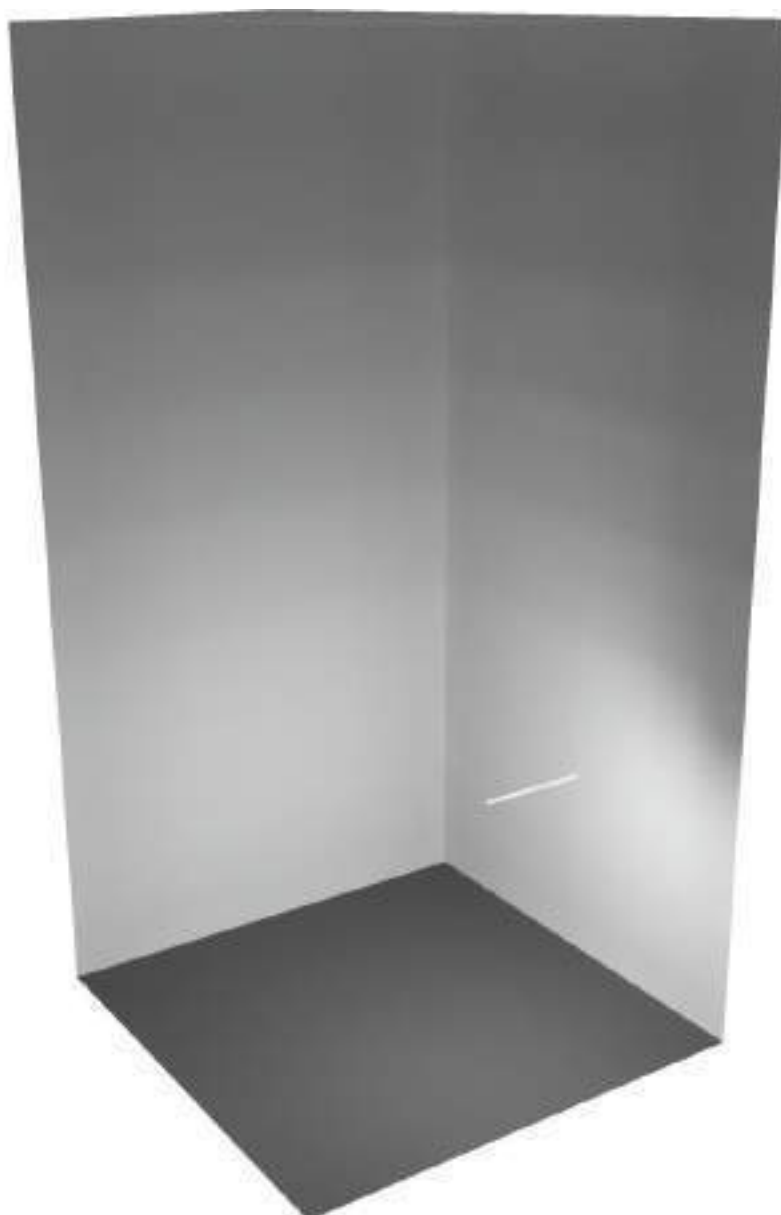
No.	Pieces	Designation (Correction Factor)	Φ (Luminaire) [lm]	Φ (Lamps) [lm]	P [W]
1	1	Philips BN308C LED60S-6500 L120 PSU WH (1.000)	5702	5700	45.5
Total:			5702	5700	45.5

Specific connected load: $1.50 \text{ W/m}^2 = 2.08 \text{ W/m}^2/100 \text{ lx}$ (Ground area: 30.25 m^2)



Operator
Telephone
Fax
e-Mail

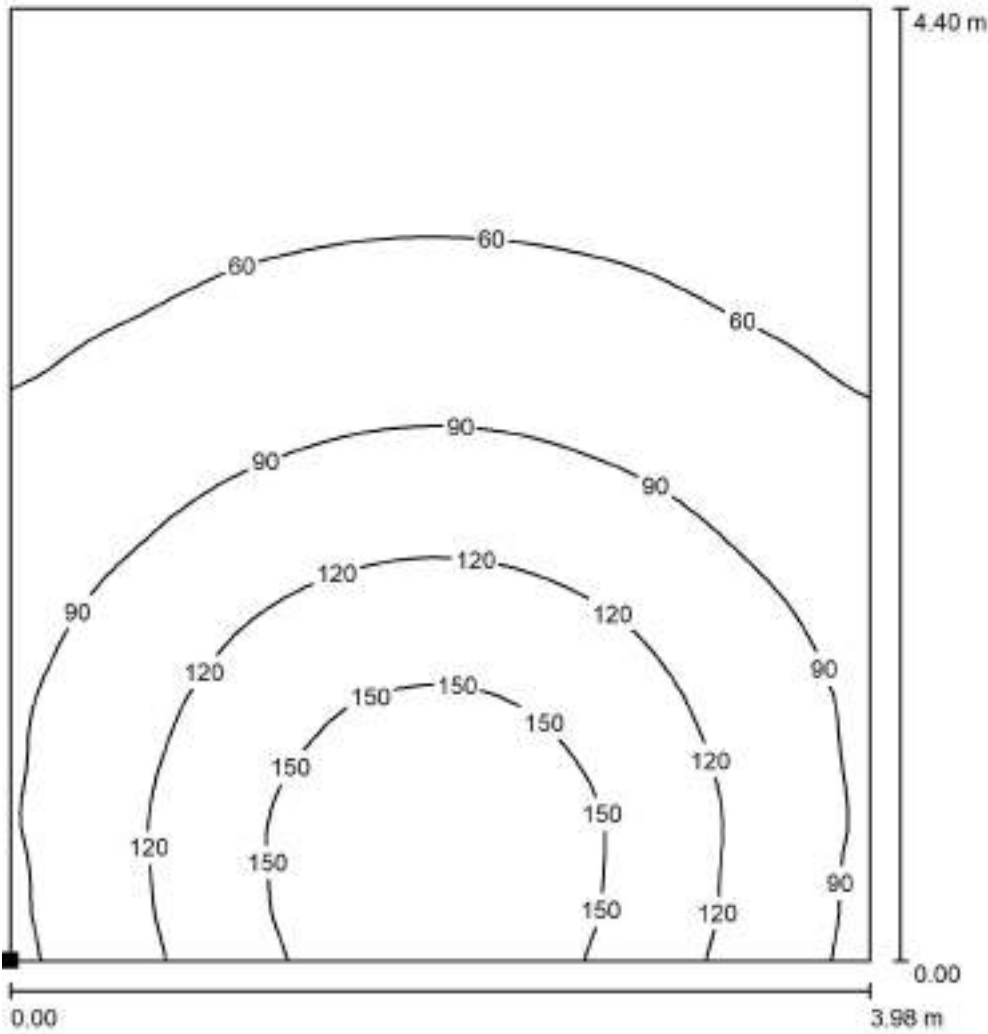
044-TR-110/111/202 typical / 3D Rendering





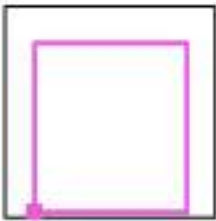
Operator
Telephone
Fax
e-Mail

044-TR-110/111/202 typical / Calculation Surface / Isolines (E, Perpendicular)



Position of surface in room:
Marked point:
(19.098 m, 46.176 m, 1.000 m)

Values in Lux, Scale 1 : 35

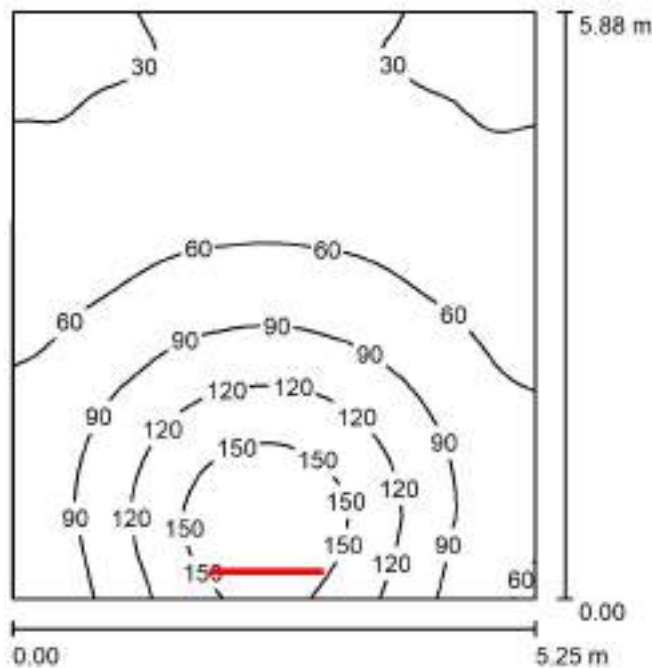


Grid: 64 x 64 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0	E_{min} / E_{max}
90	36	172	0.401	0.210

Operator
Telephone
Fax
e-Mail

044-TR-102/103/104/105 typical / Summary



Height of Room: 11.000 m, Mounting Height: 3.800 m, Light loss factor: 0.80

Values in Lux, Scale 1:76

Surface	ρ [%]	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0
Workplane	/	73	24	174	0.334
Floor	20	59	28	102	0.467
Ceiling	70	6.98	5.71	8.14	0.818
Walls (4)	50	25	4.56	1049	/

Workplane:

Height: 1.000 m
Grid: 64 x 64 Points
Boundary Zone: 0.000 m

Luminaire Parts List

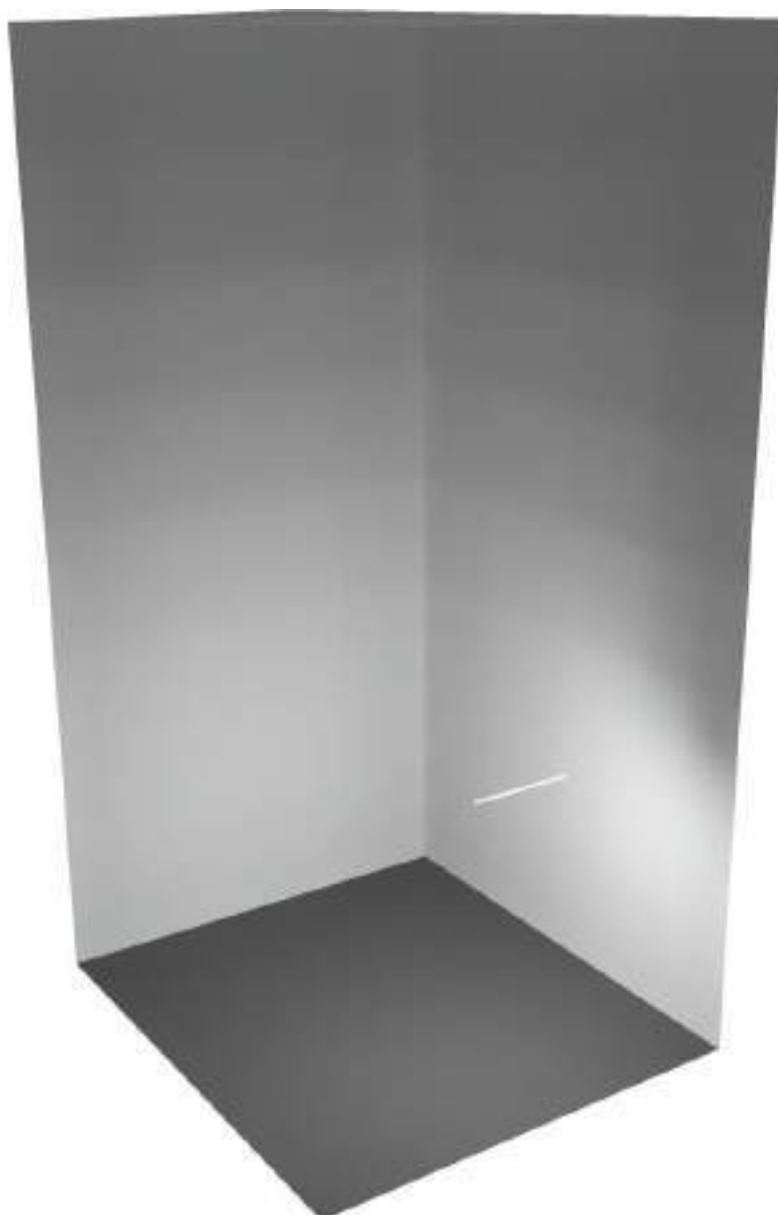
No.	Pieces	Designation (Correction Factor)	Φ (Luminaire) [lm]	Φ (Lamps) [lm]	P [W]
1	1	Philips BN308C LED60S-6500 L120 PSU WH (1.000)	5702	5700	45.5
Total:			5702	5700	45.5

Specific connected load: $1.48 \text{ W/m}^2 = 2.03 \text{ W/m}^2/100 \text{ lx}$ (Ground area: 30.85 m^2)



Operator
Telephone
Fax
e-Mail

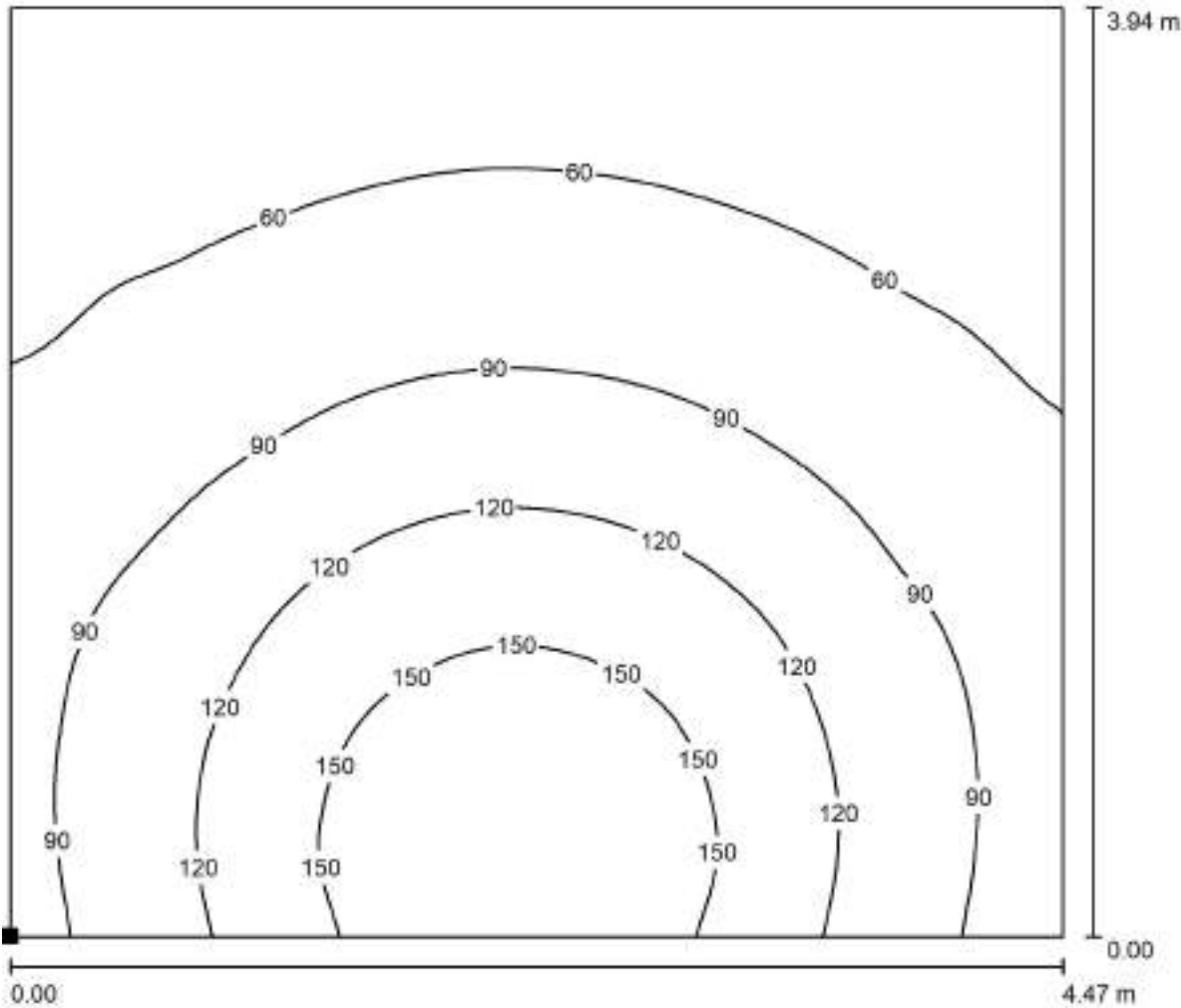
044-TR-102/103/104/105 typical / 3D Rendering





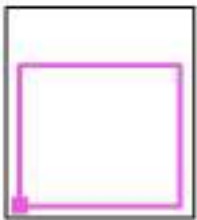
Operator
Telephone
Fax
e-Mail

044-TR-102/103/104/105 typical / Calculation Surface / Isolines (E, Perpendicular)



Values in Lux, Scale 1 : 32

Position of surface in room:
Marked point:
(84.962 m, 46.217 m, 1.000 m)

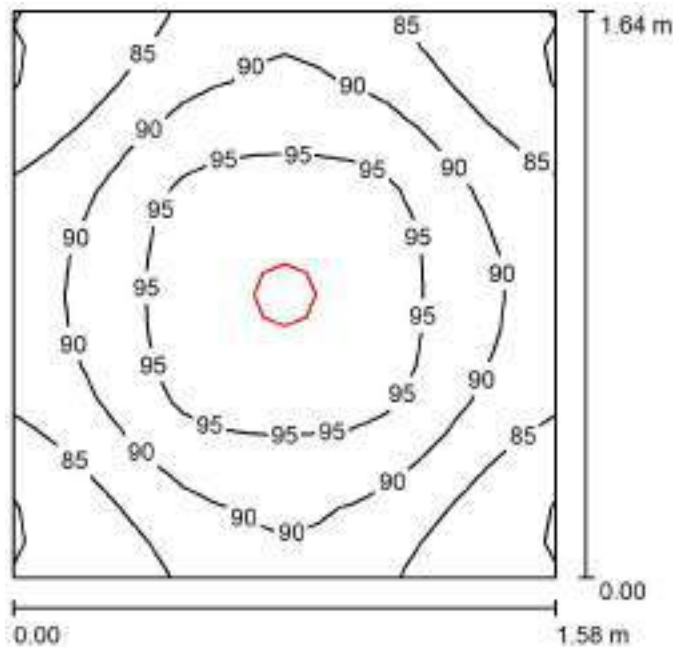


Grid: 64 x 64 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
92	37	175	0.407	0.212

Operator
Telephone
Fax
e-Mail

WC typical / Summary



Height of Room: 4.300 m, Mounting Height: 4.300 m, Light loss factor: 0.80

Values in Lux, Scale 1:22

Surface	ρ [%]	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0
Workplane	/	90	79	99	0.875
Floor	20	55	52	58	0.937
Ceiling	70	76	52	85	0.681
Walls (4)	50	103	22	326	/

Workplane:

Height: 1.000 m
Grid: 16 x 16 Points
Boundary Zone: 0.000 m

Luminaire Parts List

No.	Pieces	Designation (Correction Factor)	Φ (Luminaire) [lm]	Φ (Lamps) [lm]	P [W]
1	1	Philips SM251C LED20S-6500 PSU WH (1.000)	2012	2010	17.9
Total:			2012	2010	17.9

Specific connected load: $6.91 \text{ W/m}^2 = 7.67 \text{ W/m}^2/100 \text{ lx}$ (Ground area: 2.60 m^2)



Operator
Telephone
Fax
e-Mail

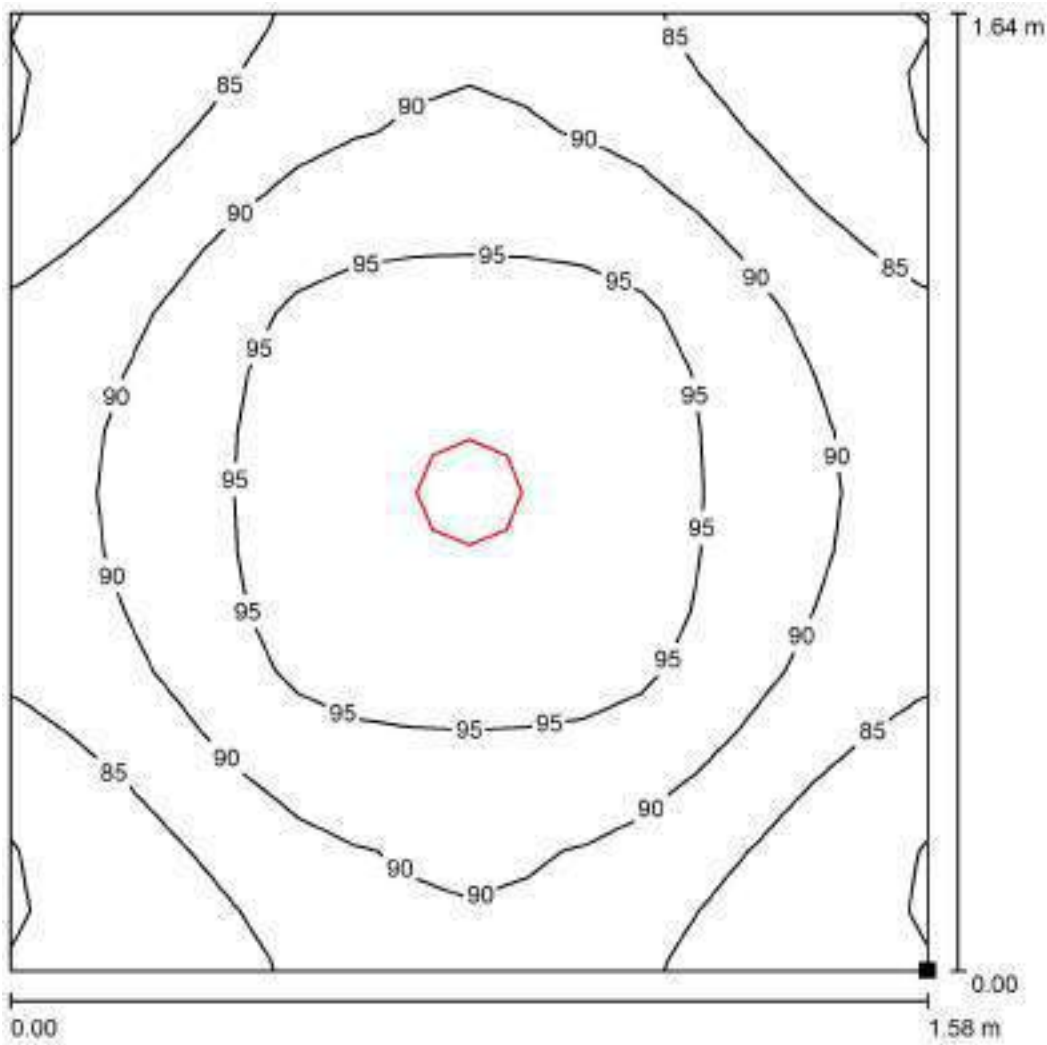
WC typical / 3D Rendering





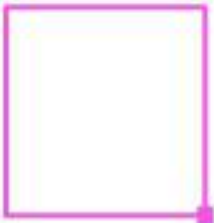
Operator
Telephone
Fax
e-Mail

WC typical / Workplane / Isolines (E)



Values in Lux, Scale 1 : 13

Position of surface in room:
Marked point:
(129.320 m, 26.161 m, 1.000 m)

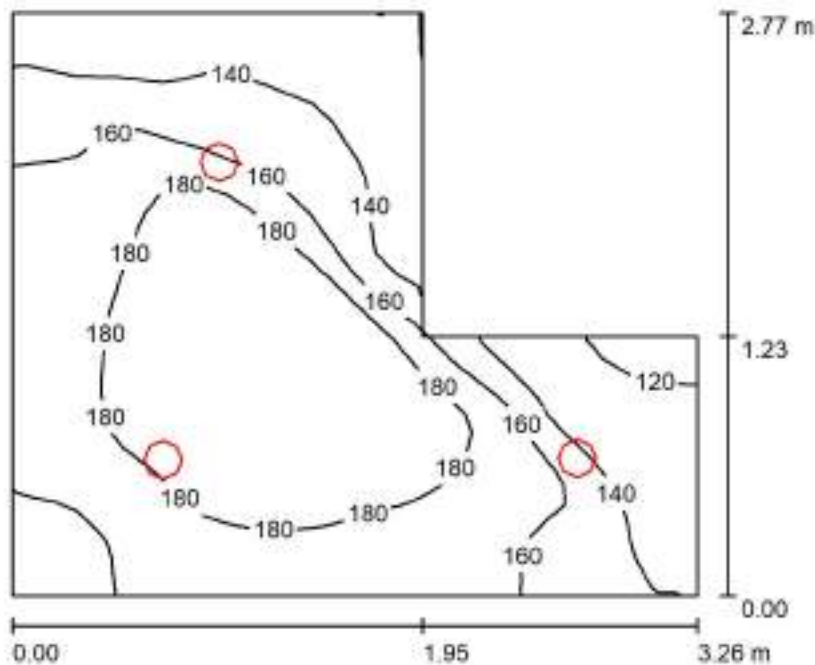


Grid: 16 x 16 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0	E_{min} / E_{max}
90	79	99	0.875	0.796

Operator
Telephone
Fax
e-Mail

Toilet typical / Summary



Height of Room: 4.300 m, Mounting Height: 4.300 m, Light loss factor: 0.80

Values in Lux, Scale 1:36

Surface	ρ [%]	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	$u0$
Workplane	/	163	109	200	0.666
Floor	20	120	91	143	0.754
Ceiling	70	95	59	180	0.623
Walls (6)	50	151	37	582	/

Workplane:

Height: 0.850 m
Grid: 32 x 32 Points
Boundary Zone: 0.000 m

Luminaire Parts List

No.	Pieces	Designation (Correction Factor)	Φ (Luminaire) [lm]	Φ (Lamps) [lm]	P [W]
1	3	Philips SM251C LED20S-6500 PSU WH (1.000)	2012	2010	17.9
Total:			6036	6030	53.8

Specific connected load: $7.66 \text{ W/m}^2 = 4.68 \text{ W/m}^2/100 \text{ lx}$ (Ground area: 7.03 m^2)



Operator
Telephone
Fax
e-Mail

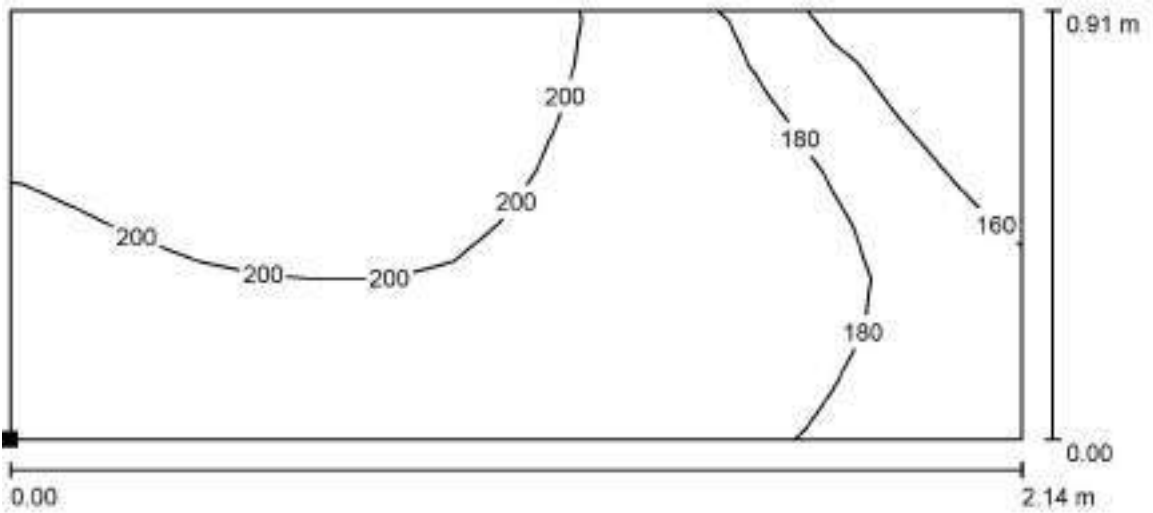
Toilet typical / 3D Rendering





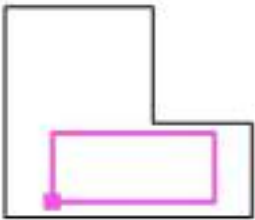
Operator
Telephone
Fax
e-Mail

Toilet typical / Calculation Surface 1 / Isolines (E, Perpendicular)



Values in Lux, Scale 1 : 16

Position of surface in room:
Marked point:
(126.678 m, 29.975 m, 1.000 m)



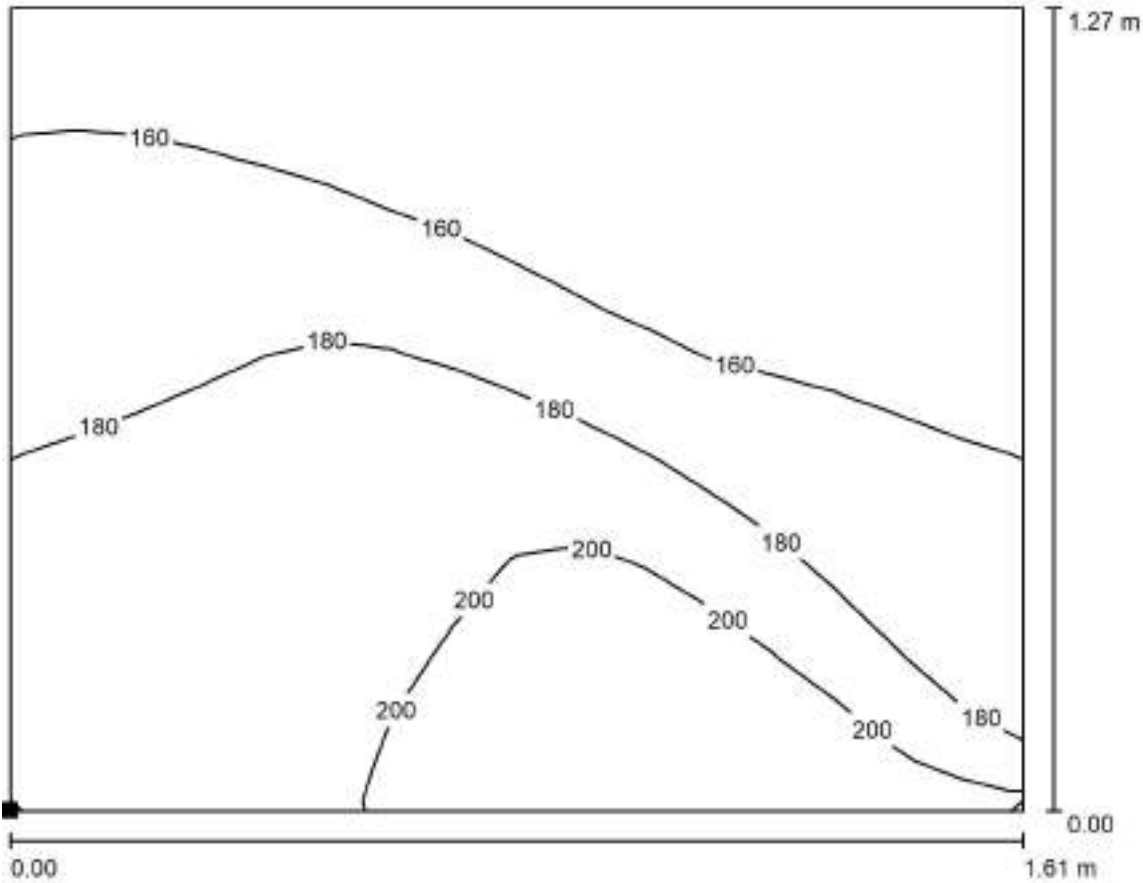
Grid: 16 x 8 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	$u0$	E_{min} / E_{max}
191	150	210	0.786	0.715



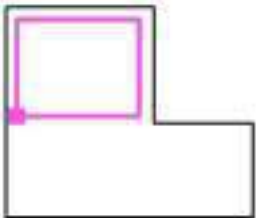
Operator
Telephone
Fax
e-Mail

Toilet typical / Calculation Surface 2 / Isolines (E, Perpendicular)



Values in Lux, Scale 1 : 12

Position of surface in room:
Marked point:
(126.199 m, 31.100 m, 1.000 m)

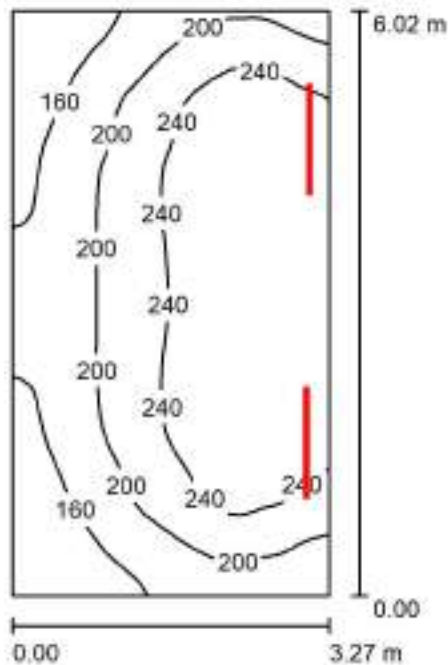


Grid: 16 x 16 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0	E_{min} / E_{max}
174	141	207	0.809	0.682

Operator
Telephone
Fax
e-Mail

Stairs typical / Summary



Height of Room: 4.000 m, Mounting Height: 3.500 m, Light loss factor: 0.80

Values in Lux, Scale 1:78

Surface	ρ [%]	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0
Workplane	/	214	120	284	0.563
Floor	20	172	114	207	0.665
Ceiling	70	109	53	256	0.490
Walls (4)	50	153	51	1554	/

Workplane:

Height: 0.850 m
Grid: 32 x 64 Points
Boundary Zone: 0.000 m

Luminaire Parts List

No.	Pieces	Designation (Correction Factor)	Φ (Luminaire) [lm]	Φ (Lamps) [lm]	P [W]
1	2	Philips BN308C LED60S-6500 L120 PSU WH (1.000)	5702	5700	45.5
Total:			11403	11400	91.0

Specific connected load: $4.62 \text{ W/m}^2 = 2.17 \text{ W/m}^2/100 \text{ lx}$ (Ground area: 19.69 m^2)



Operator
Telephone
Fax
e-Mail

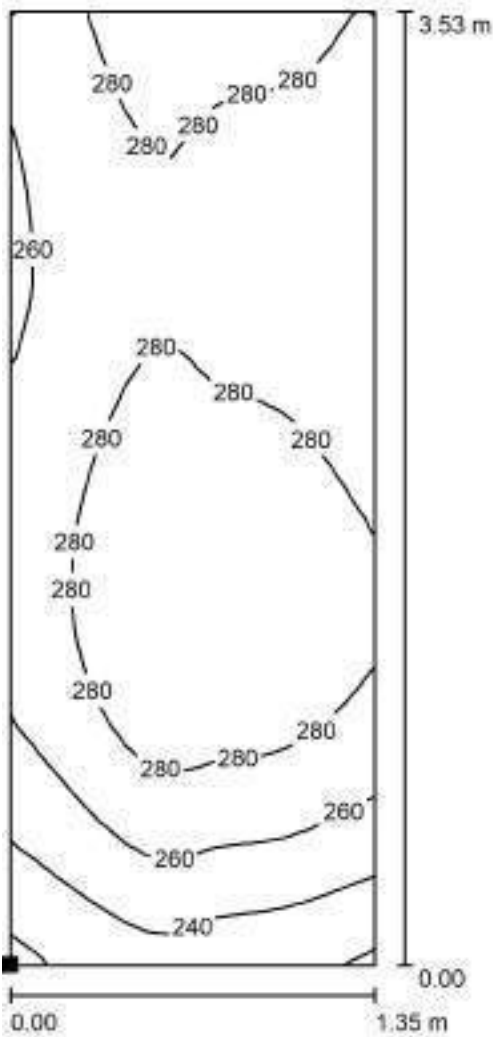
Stairs typical / 3D Rendering



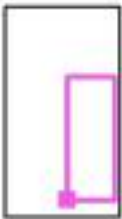


Operator
Telephone
Fax
e-Mail

Stairs typical / Calculation Surface / Isolines (E, Perpendicular)



Position of surface in room:
Marked point:
(16.322 m, 46.524 m, 1.000 m)



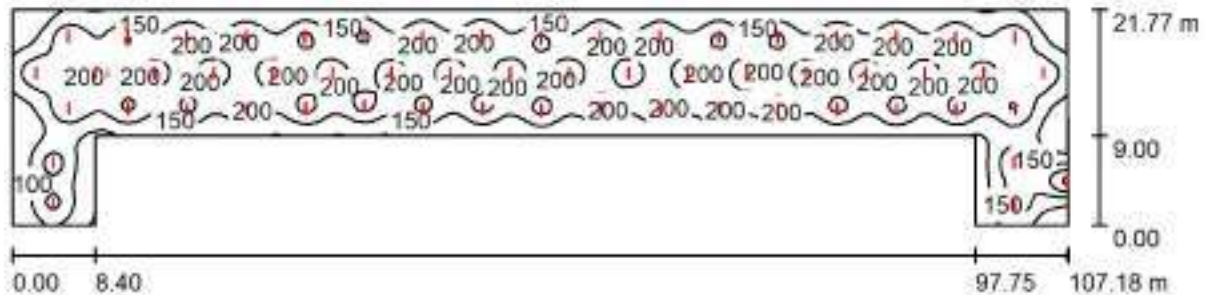
Values in Lux, Scale 1 : 28

Grid: 16 x 32 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0	E_{min} / E_{max}
272	217	301	0.795	0.719

Operator
Telephone
Fax
e-Mail

Cable cellar / Summary



Height of Room: 4.300 m, Light loss factor: 0.80

Values in Lux, Scale 1:767

Surface	ρ [%]	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0
Workplane	/	161	48	258	0.295
Floor	20	152	52	198	0.345
Ceiling	70	47	19	8088	0.405
Walls (8)	50	85	30	3882	/

Workplane:

Height: 1.000 m
Grid: 128 x 128 Points
Boundary Zone: 0.000 m

Luminaire Parts List

No.	Pieces	Designation (Correction Factor)	Φ (Luminaire) [lm]	Φ (Lamps) [lm]	P [W]
1	57	Philips BN308C LED60S-6500 L120 PSU WH (1.000)	5702	5700	45.5
Total:			324991	324900	2594.1

Specific connected load: $1.70 \text{ W/m}^2 = 1.05 \text{ W/m}^2/100 \text{ lx}$ (Ground area: 1527.70 m^2)



Operator
Telephone
Fax
e-Mail

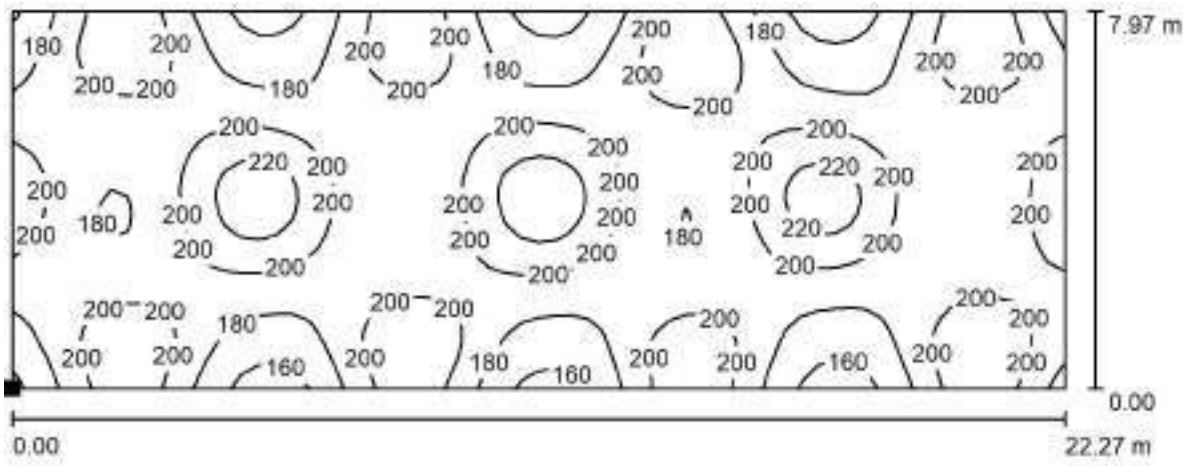
Cable cellar / 3D Rendering





Operator
Telephone
Fax
e-Mail

Cable cellar / Calculation Surface / Isolines (E, Perpendicular)



Values in Lux, Scale 1 : 160

Position of surface in room:
Marked point:
(57.719 m, 35.166 m, 1.000 m)



Grid: 64 x 32 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
193	150	236	0.775	0.633

Substation- First floor

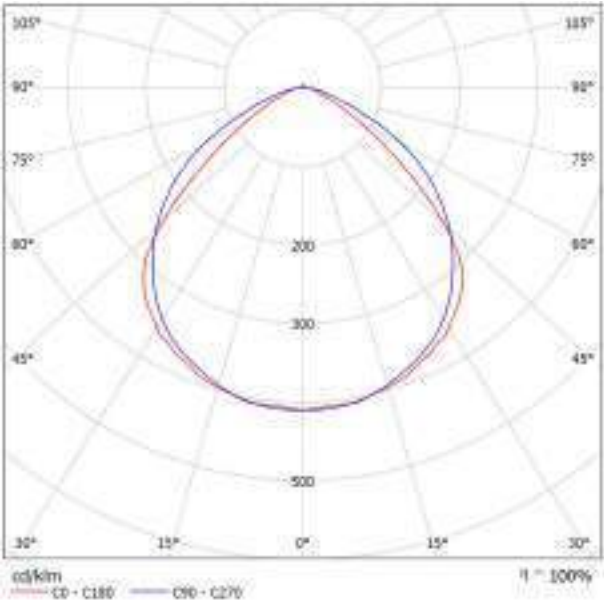
Date: 09.02.2023
Operator:



Operator
Telephone
Fax
e-Mail

PHILIPS RC136B PSU W60L60 1 x28S_34S_40S/830 NOC / Luminaire Data Sheet

Luminous emittance 1:



Luminaire classification according to CIE: 99
CIE flux code: 56 88 98 99 100

CoreLine empotrable: diseño elegante y fácil instalación La luminaria CoreLine empotrable de la familia CoreLine LED puede emplearse para sustituir punto a punto las luminarias de fluorescencia en aplicaciones generales de iluminación. El proceso de selección, instalación y mantenimiento muy sencillo.

Luminous emittance 1:

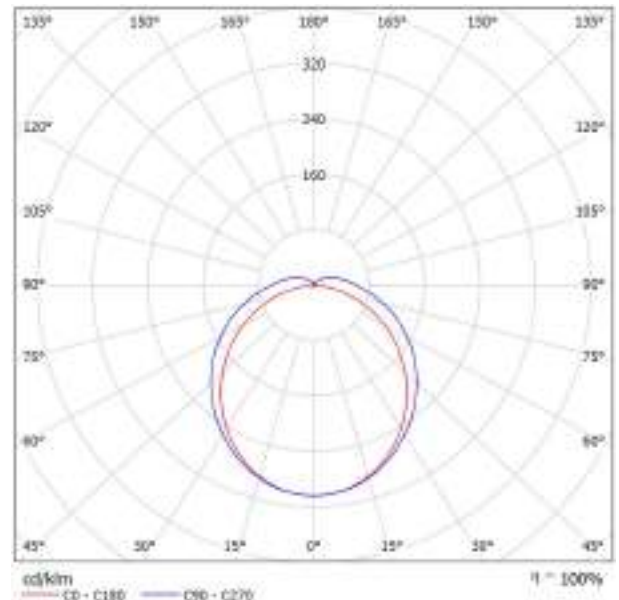
Glare Evaluation According to UGR												
Ceiling		70	70	30	30	30	70	70	30	30	30	30
Walls		90	90	90	90	90	90	90	90	90	90	90
Floor		20	20	20	20	20	20	20	20	20	20	20
Room Size h t		Viewing direction at right angles to lamp axis					Viewing direction parallel to lamp axis					
3H	3H	20.9	22.9	21.2	21.3	21.6	22.4	22.8	22.9	24.8	24.3	24.3
	3H	21.1	22.1	21.4	21.4	21.7	22.1	22.4	22.5	24.8	24.3	24.3
	4H	21.1	22.1	21.4	21.4	21.7	22.1	22.4	22.5	24.8	24.3	24.3
	5H	21.1	22.5	21.5	21.3	21.6	22.6	24.5	24.0	24.9	25.1	25.1
	12H	21.1	22.8	21.5	21.3	21.6	22.7	24.5	24.0	24.9	25.1	25.1
4H	3H	21.1	21.8	21.5	21.3	21.6	22.7	24.5	24.1	24.9	25.1	25.1
	3H	21.2	22.2	21.6	21.5	21.6	22.8	22.7	22.1	24.8	24.3	24.3
	3H	21.6	22.4	21.5	21.7	21.1	22.6	24.9	22.9	24.7	25.1	25.1
	4H	21.6	22.4	22.2	22.7	21.1	22.6	24.6	24.2	24.9	25.1	25.1
	5H	21.7	22.3	22.1	22.7	21.1	24.8	24.6	24.4	25.8	25.4	25.4
5H	3H	21.7	22.3	22.2	22.7	21.1	24.1	24.7	24.5	25.1	25.5	25.5
	3H	21.7	22.3	22.2	22.7	21.1	24.1	24.7	24.6	25.1	25.5	25.5
	4H	21.7	22.3	22.1	22.7	21.1	22.6	24.4	24.2	24.8	25.1	25.1
	4H	21.8	22.3	22.3	22.7	21.2	24.6	24.5	24.5	25.8	25.4	25.4
	5H	21.9	22.3	22.4	22.6	21.2	24.2	24.6	24.6	25.8	25.6	25.6
12H	3H	21.7	22.2	22.2	22.7	21.1	22.6	24.3	24.2	24.7	25.2	25.2
	3H	21.8	22.3	22.3	22.7	21.2	24.6	24.4	24.3	24.8	25.4	25.4
	3H	21.9	22.3	22.4	22.7	21.3	24.1	24.5	24.6	25.8	25.5	25.5
	Variation of the observer position for the luminance distance, h											
	h = 1.0H		+0.6 / -0.9					+0.3 / -0.3				
h = 1.5H		+1.2 / -0.5					+0.6 / -0.9					
h = 2.0H		+2.4 / -0.9					+1.6 / -1.2					
Standard Error		0.002					0.003					
Correction Summed		4.2					6.7					
Corrected Glare Index referring to 4000lx Solid Luminous Flux												

Operator
Telephone
Fax
e-Mail

Philips BN308C LED60S-6500 L120 PSU WH / Luminaire Data Sheet

Luminous emittance 1:

See our luminaire catalog for an image of the luminaire.



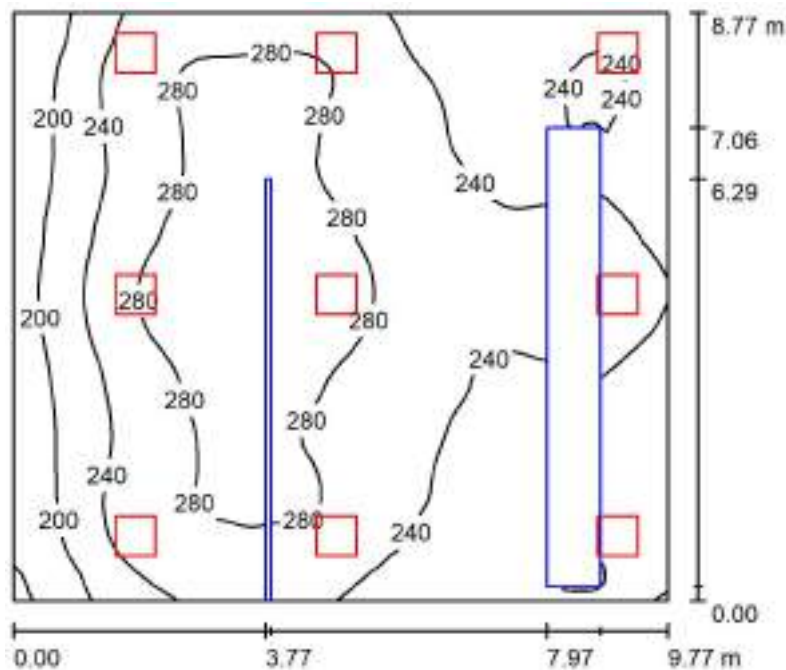
Luminaire classification according to CIE: 93
CIE flux code: 43 73 91 93 100

Luminous emittance 1:

Glare Evaluation According to UGR											
Room Size x y		70	70	30	30	30	70	70	30	30	30
Ceiling		90	90	90	90	90	90	90	90	90	90
Walls		90	90	90	90	90	90	90	90	90	90
Floor		20	20	20	20	20	20	20	20	20	20
		Viewing direction at right angles to lamp axis					Viewing direction parallel to lamp axis				
2H	2H	22.4	24.7	23.8	25.0	25.4	21.6	24.8	24.0	25.1	25.6
	4H	24.0	26.0	25.7	26.4	26.8	22.4	26.6	25.8	27.0	27.4
	6H	24.4	26.5	26.5	26.9	27.4	26.1	27.4	26.7	27.8	28.1
	8H	25.0	26.6	26.2	27.2	27.7	27.1	26.1	27.5	26.5	26.8
	9H	25.9	26.8	26.3	27.3	27.8	27.5	26.4	27.9	26.9	26.4
4H	12H	25.9	26.8	26.4	27.3	27.8	27.8	26.8	26.3	26.3	26.7
	2H	24.0	25.3	24.5	25.6	26.8	24.2	25.3	24.7	25.7	26.2
	2H	25.7	26.6	26.2	27.1	27.8	26.2	27.2	26.7	27.8	28.1
	4H	26.4	27.2	26.6	27.7	28.2	27.3	26.1	27.8	26.4	26.1
	6H	26.8	27.8	27.4	28.1	28.7	28.2	26.6	28.8	26.9	26.1
6H	8H	27.0	27.7	27.8	28.2	28.8	28.7	26.4	28.2	26.9	26.8
	12H	27.1	27.7	27.7	28.3	28.8	28.2	26.8	28.7	26.3	26.8
	4H	26.8	27.5	27.3	28.0	28.6	27.6	26.3	28.1	26.8	26.3
	6H	27.8	28.6	28.6	29.6	29.2	28.7	26.3	29.3	26.8	26.8
	8H	27.7	28.2	28.1	29.6	29.4	28.3	26.8	28.9	26.4	26.1
12H	12H	27.9	28.3	28.5	29.6	29.8	30.0	30.4	28.6	26.8	26.7
	6H	26.9	27.5	27.4	28.0	28.8	27.8	26.2	28.1	26.7	26.3
	8H	27.6	28.1	28.2	28.7	29.3	28.8	26.2	28.4	26.8	26.4
9H	27.9	28.4	28.5	29.0	29.8	29.5	26.5	28.1	26.5	26.2	
Variation of the observer position for the luminaire distance 3											
S = 1.0H		+3.1 / -6.1					+0.1 / -6.1				
S = 1.5H		+0.2 / -6.2					+0.2 / -6.2				
S = 2.0H		+0.4 / -6.8					+0.3 / -6.5				
Standard Value		8008					8008				
Correction		30.4					12.9				
Corrected Glare Index referring to 5000lx Solid Luminous Flux											

Operator
Telephone
Fax
e-Mail

ECS RTU Room / Summary



Height of Room: 4.200 m, Mounting Height: 4.200 m, Light loss factor: 0.80

Values in Lux, Scale 1:113

Surface	ρ [%]	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0
Workplane	/	250	153	304	0.614
Floor	20	224	147	268	0.658
Ceiling	70	60	41	418	0.674
Walls (4)	50	146	48	1124	/

Workplane:

Height: 1.000 m
Grid: 64 x 64 Points
Boundary Zone: 0.000 m

Luminaire Parts List

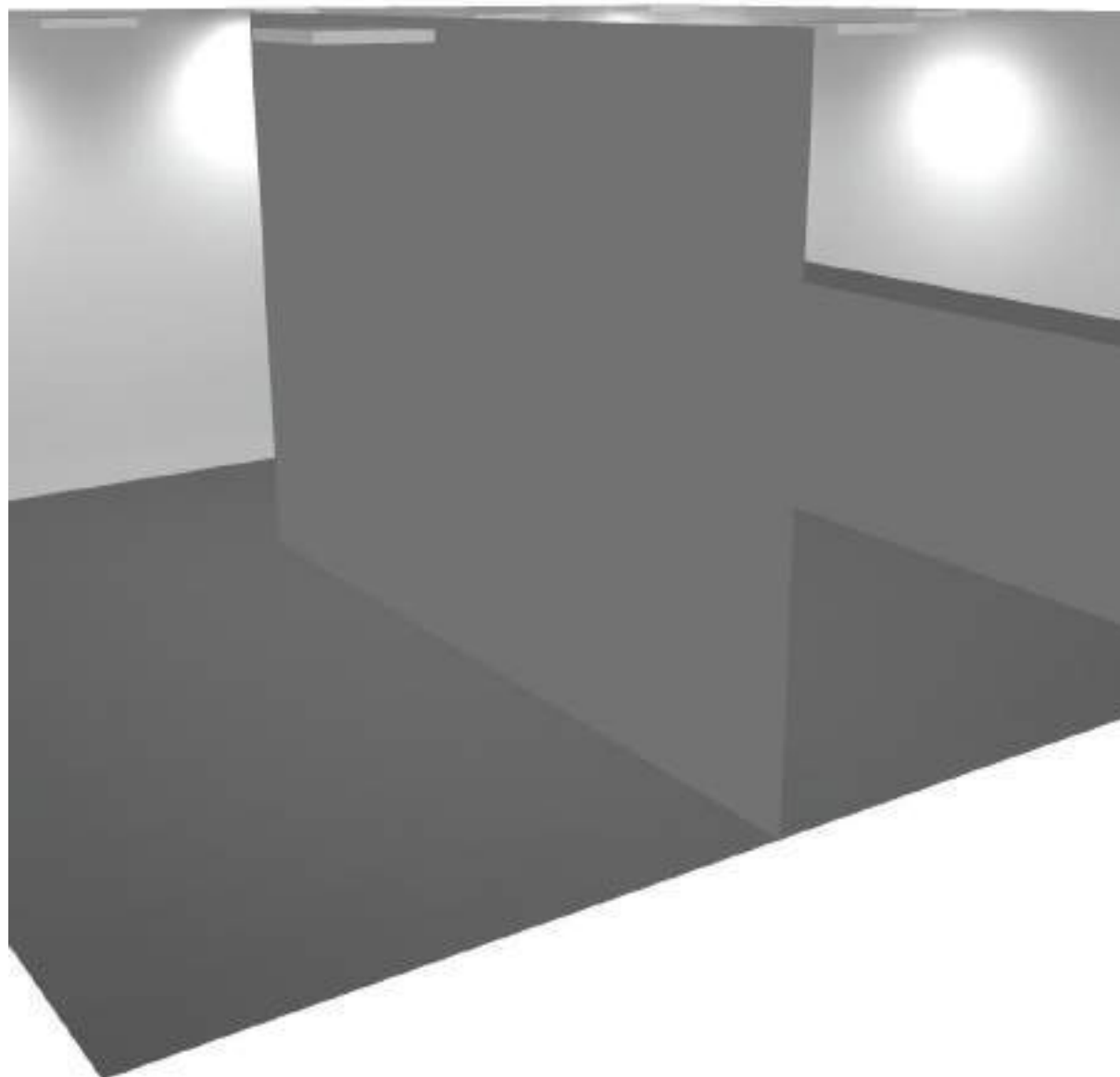
No.	Pieces	Designation (Correction Factor)	Φ (Luminaire) [lm]	Φ (Lamps) [lm]	P [W]
1	9	PHILIPS RC136B PSU W60L60 1 x28S_34S_40S/830 NOC (1.000)	4000	4000	31.0
Total:			36000	36000	279.0

Specific connected load: $3.26 \text{ W/m}^2 = 1.30 \text{ W/m}^2/100 \text{ lx}$ (Ground area: 85.68 m^2)



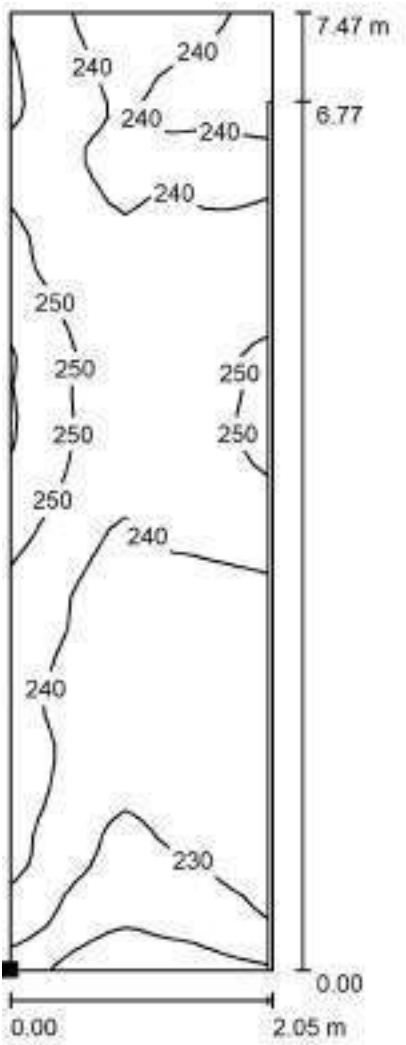
Operator
Telephone
Fax
e-Mail

ECS RTU Room / 3D Rendering

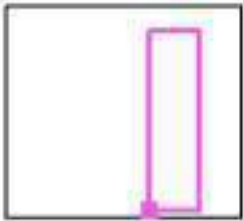


Operator
Telephone
Fax
e-Mail

ECS RTU Room / Calculation Surface 1 / Isolines (E, Perpendicular)



Position of surface in room:
Marked point:
(301.757 m, 66.450 m, 1.000 m)



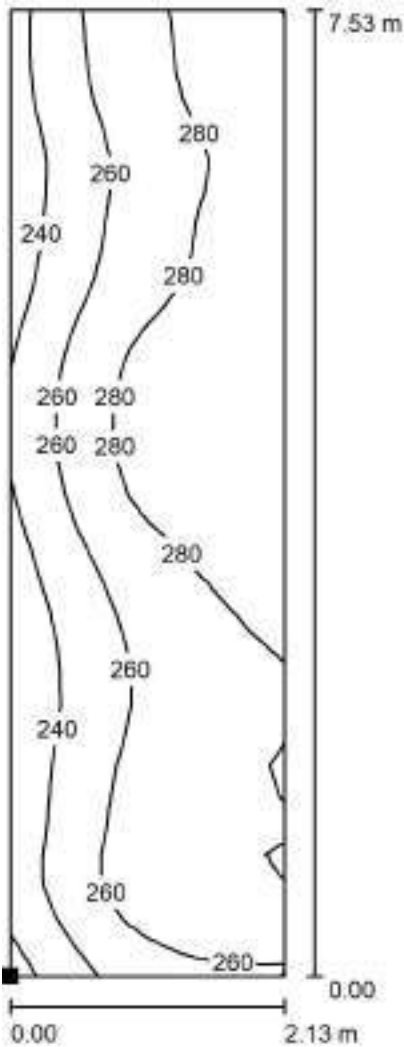
Values in Lux, Scale 1 : 59

Grid: 16 x 64 Points

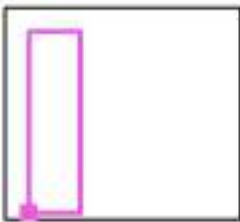
E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
240	211	261	0.881	0.810

Operator
Telephone
Fax
e-Mail

ECS RTU Room / Calculation Surface 2 / Isolines (E, Perpendicular)



Position of surface in room:
Marked point:
(296.805 m, 66.429 m, 1.000 m)



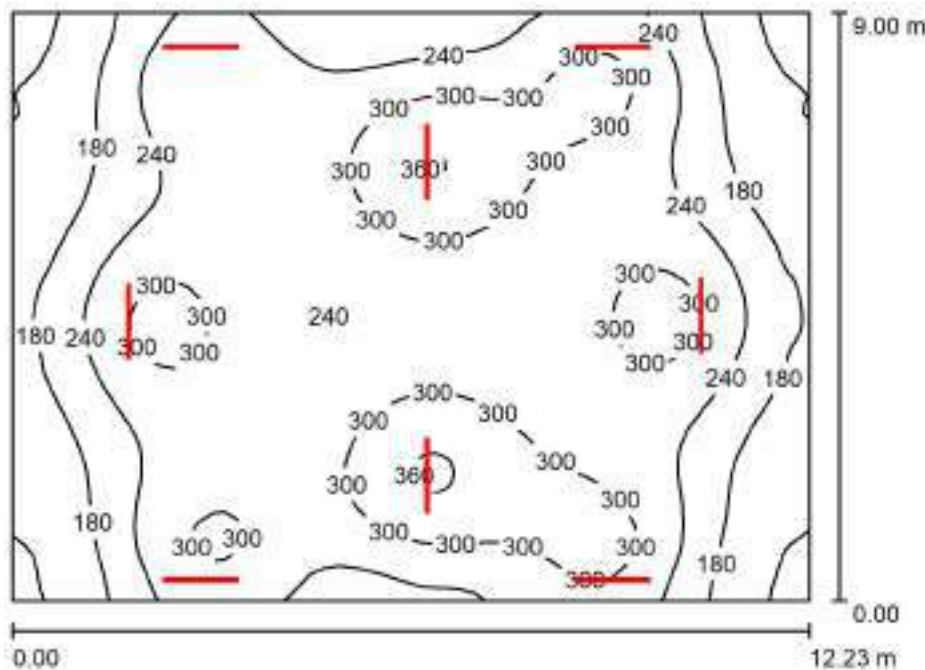
Values in Lux, Scale 1 : 59

Grid: 16 x 32 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0	E_{min} / E_{max}
267	214	299	0.801	0.716

Operator
Telephone
Fax
e-Mail

AHU Room / Summary



Height of Room: 6.300 m, Light loss factor: 0.80

Values in Lux, Scale 1:116

Surface	ρ [%]	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	$u0$
Workplane	/	249	104	370	0.417
Floor	20	222	113	284	0.511
Ceiling	70	61	41	77	0.670
Walls (4)	50	110	45	964	/

Workplane:

Height: 1.000 m
Grid: 64 x 64 Points
Boundary Zone: 0.000 m

Luminaire Parts List

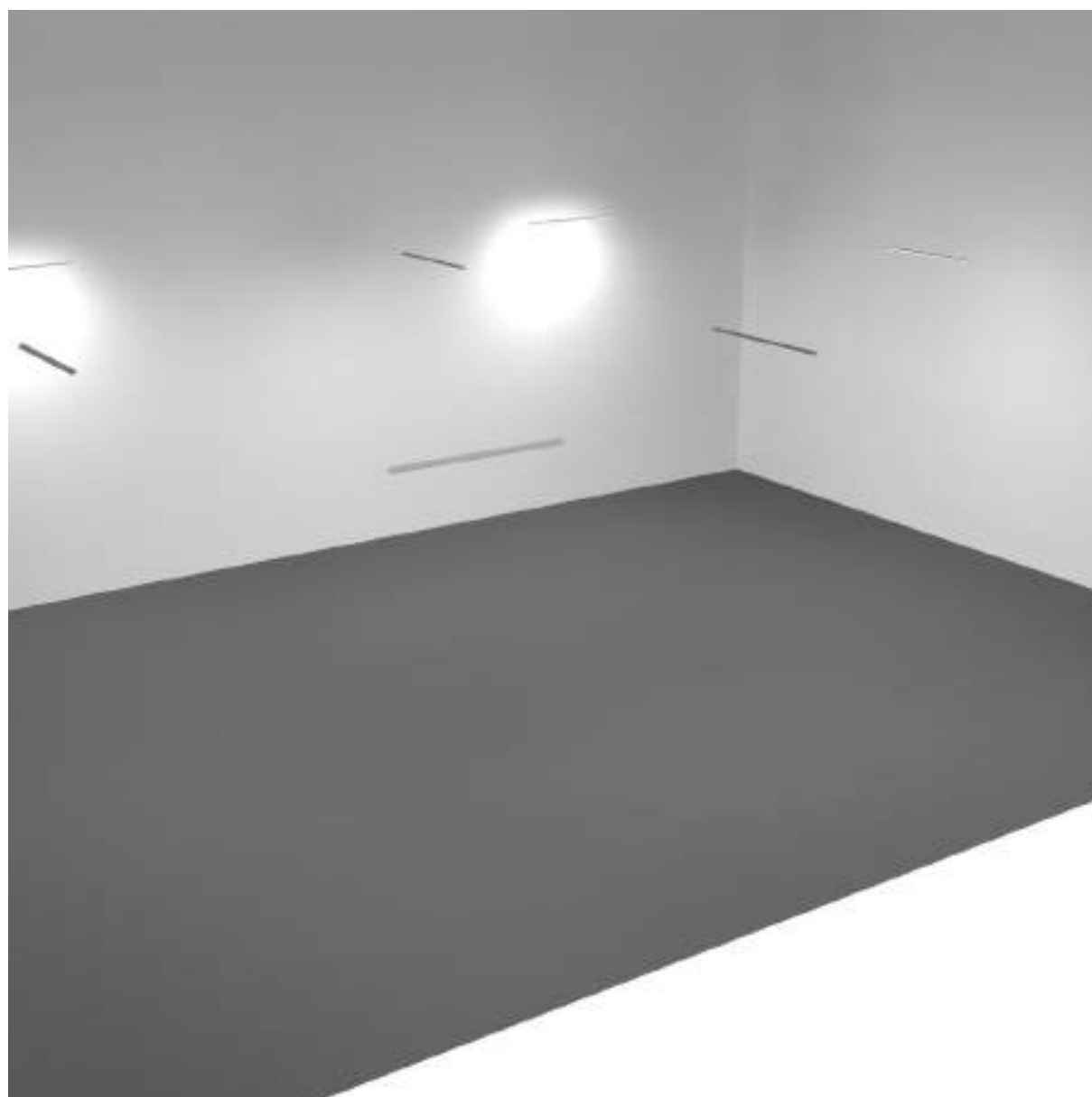
No.	Pieces	Designation (Correction Factor)	Φ (Luminaire) [lm]	Φ (Lamps) [lm]	P [W]
1	8	Philips BN308C LED60S-6500 L120 PSU WH (1.000)	5702	5700	45.5
Total:			45613	45600	364.1

Specific connected load: $3.31 \text{ W/m}^2 = 1.33 \text{ W/m}^2/100 \text{ lx}$ (Ground area: 110.07 m^2)



Operator
Telephone
Fax
e-Mail

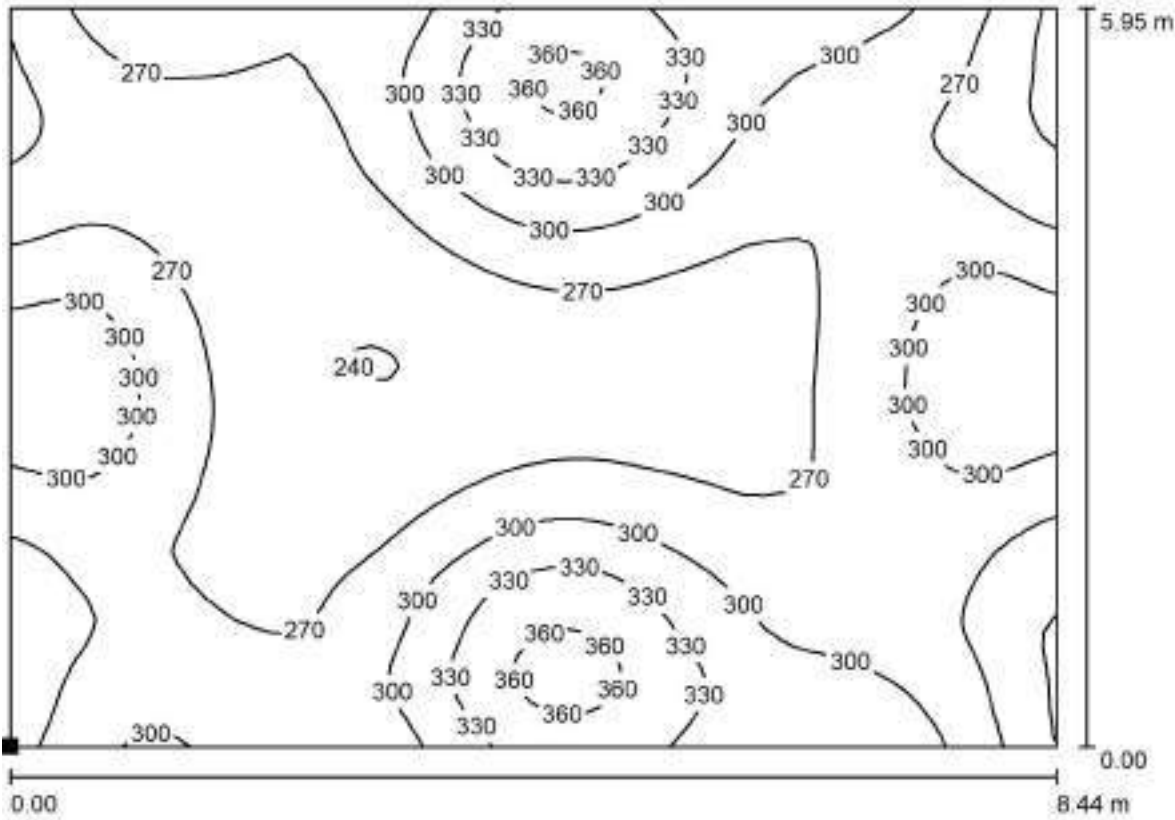
AHU Room / 3D Rendering





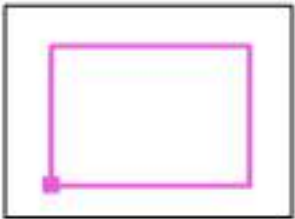
Operator
Telephone
Fax
e-Mail

AHU Room / Calculation Surface / Isolines (E, Perpendicular)



Values in Lux, Scale 1 : 61

Position of surface in room:
Marked point:
(253.557 m, 67.502 m, 1.000 m)

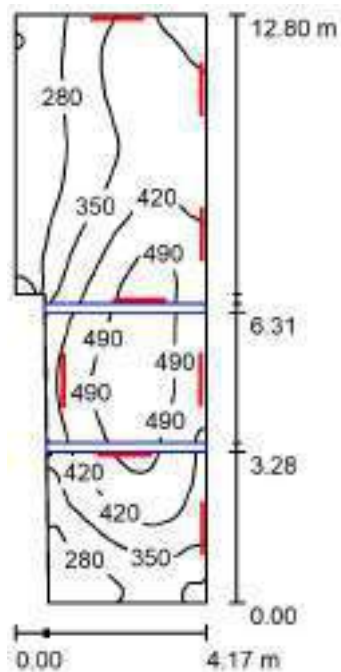


Grid: 64 x 64 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0	E_{min} / E_{max}
284	231	372	0.813	0.622

Operator
Telephone
Fax
e-Mail

Platform 1st floor typical 1 / Summary



Height of Room: 6.300 m, Light loss factor: 0.80

Values in Lux, Scale 1:165

Surface	ρ [%]	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0
Workplane	/	380	180	527	0.472
Floor	20	316	182	414	0.576
Ceiling	70	104	73	122	0.696
Walls (6)	50	209	66	3657	/

Workplane:

Height: 1.000 m
Grid: 128 x 128 Points
Boundary Zone: 0.000 m

Luminaire Parts List

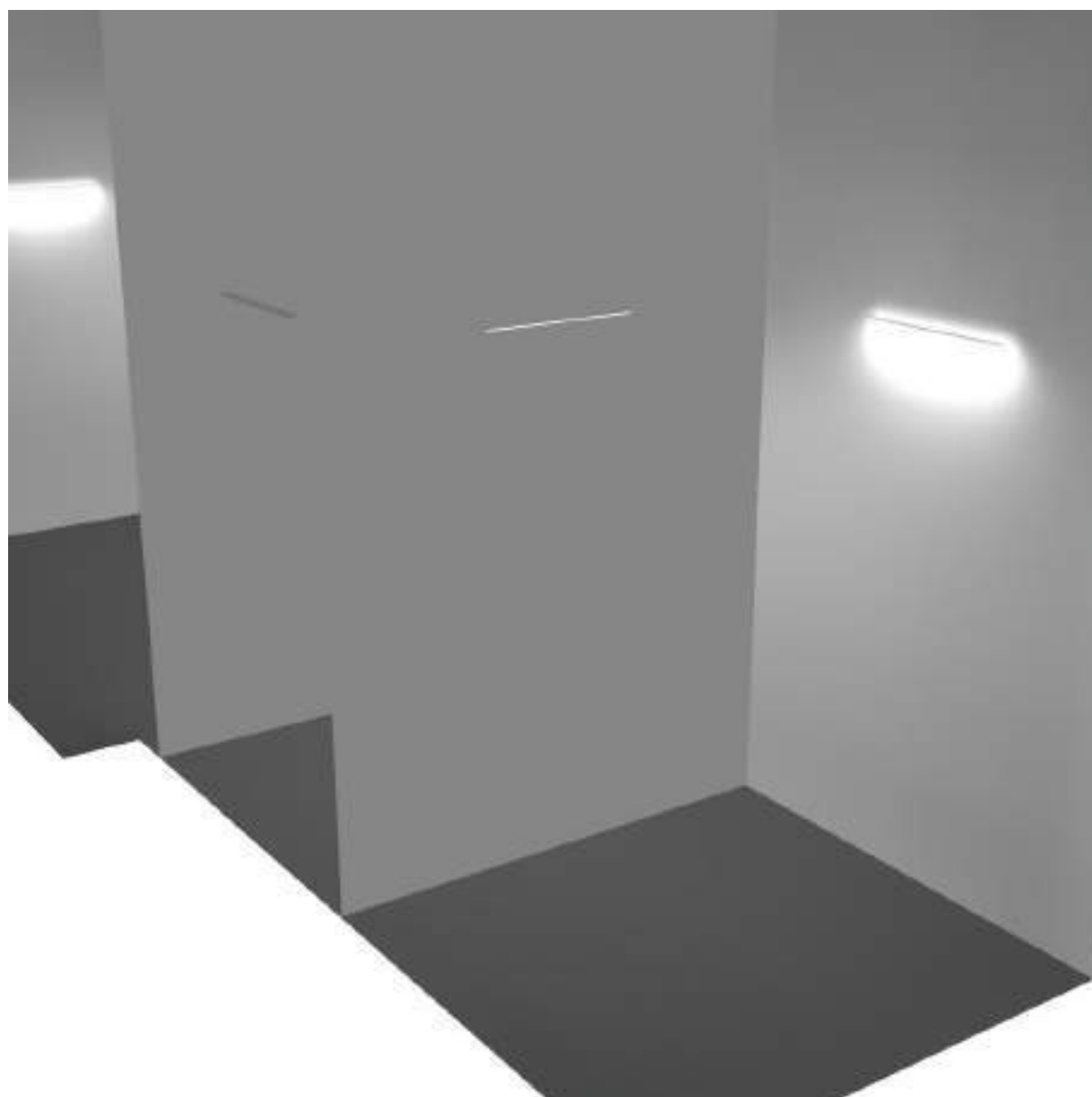
No.	Pieces	Designation (Correction Factor)	Φ (Luminaire) [lm]	Φ (Lamps) [lm]	P [W]
1	8	Philips BN308C LED60S-6500 L120 PSU WH (1.000)	5702	5700	45.5
Total:			45613	45600	364.1

Specific connected load: $7.46 \text{ W/m}^2 = 1.96 \text{ W/m}^2/100 \text{ lx}$ (Ground area: 48.81 m^2)



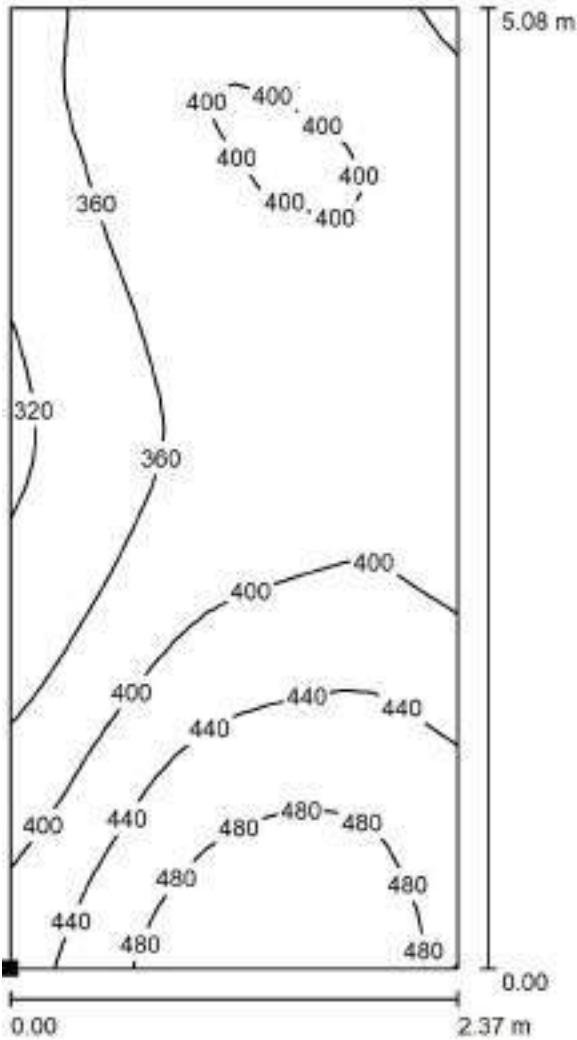
Operator
Telephone
Fax
e-Mail

Platform 1st floor typical 1 / 3D Rendering



Operator
Telephone
Fax
e-Mail

Platform 1st floor typical 1 / Calculation Surface 1 / Isolines (E, Perpendicular)



Position of surface in room:
Marked point:
(194.990 m, 82.190 m, 1.000 m)



Values in Lux, Scale 1 : 40

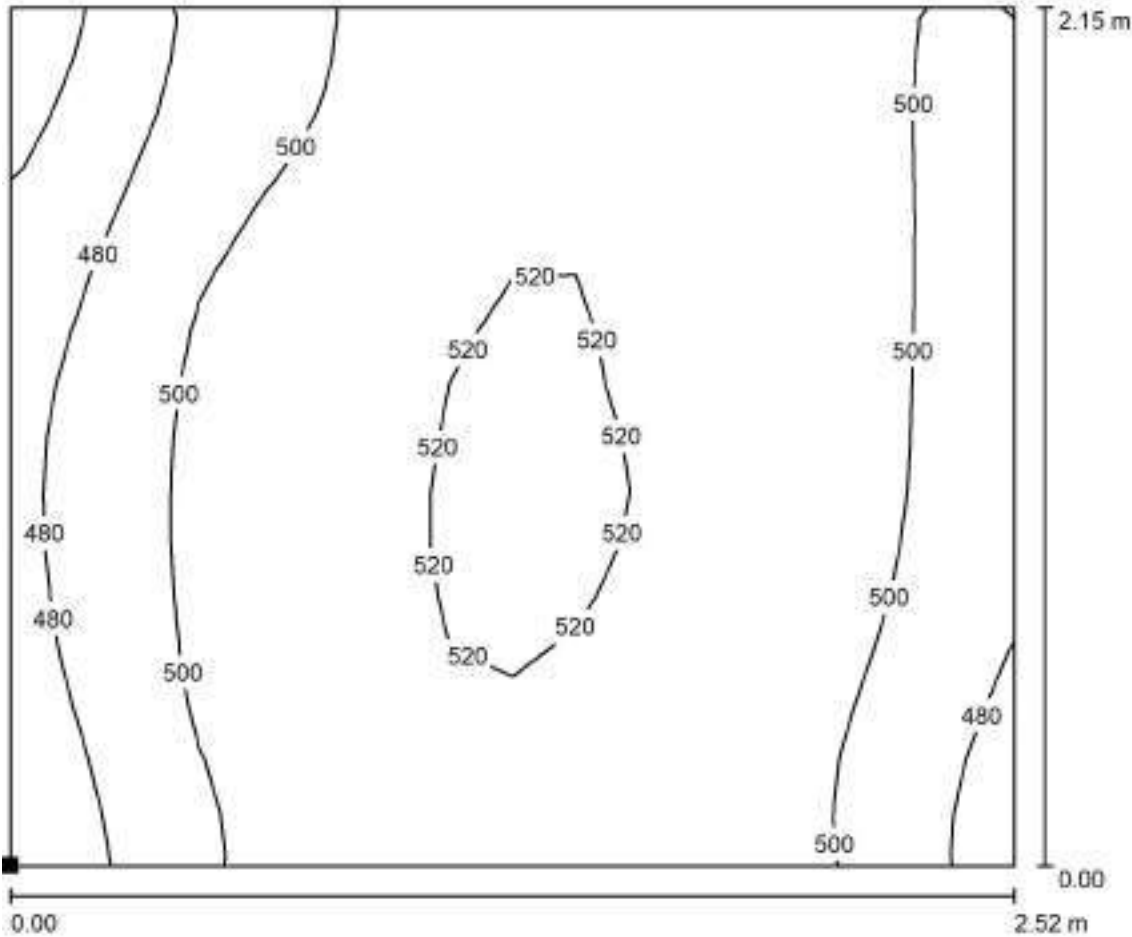
Grid: 16 x 32 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0	E_{min} / E_{max}
401	313	511	0.781	0.613



Operator
Telephone
Fax
e-Mail

Platform 1st floor typical 1 / Calculation Surface 2 / Isolines (E, Perpendicular)



Values in Lux, Scale 1 : 19

Position of surface in room:
Marked point:
(194.662 m, 79.008 m, 1.000 m)



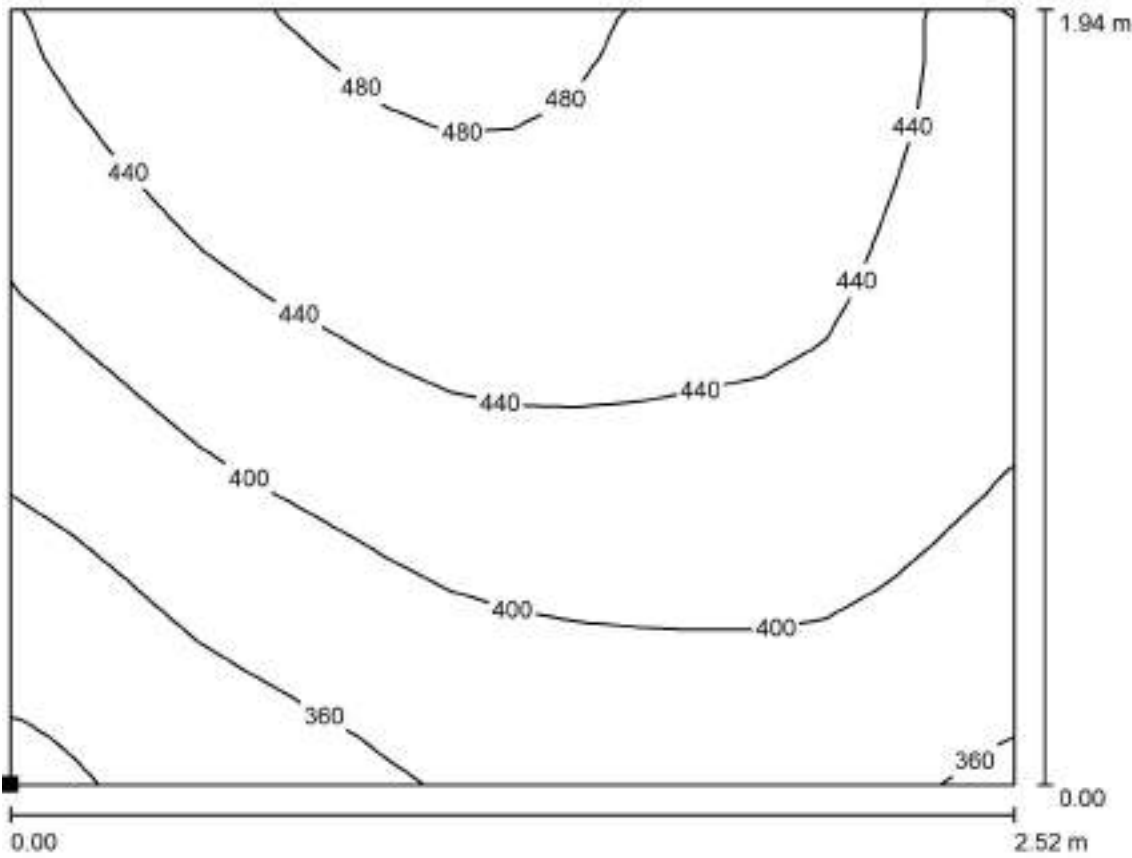
Grid: 16 x 16 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0	E_{min} / E_{max}
504	450	523	0.891	0.859



Operator
Telephone
Fax
e-Mail

Platform 1st floor typical 1 / Calculation Surface 3 / Isolines (E, Perpendicular)



Values in Lux, Scale 1 : 19

Position of surface in room:
Marked point:
(194.930 m, 76.236 m, 1.000 m)

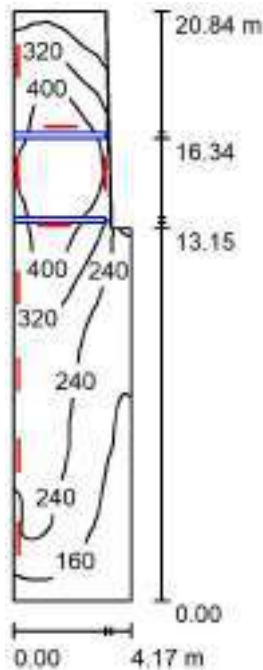


Grid: 16 x 16 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0	E_{min} / E_{max}
419	313	491	0.747	0.638

Operator
Telephone
Fax
e-Mail

Platform 1st floor typical 2 / Summary



Height of Room: 6.300 m, Light loss factor: 0.80

Values in Lux, Scale 1:268

Surface	ρ [%]	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	$u0$
Workplane	/	274	89	477	0.324
Floor	20	233	92	369	0.393
Ceiling	70	75	39	105	0.518
Walls (6)	50	152	35	2154	/

Workplane:

Height: 1.000 m
Grid: 128 x 64 Points
Boundary Zone: 0.000 m

Luminaire Parts List

No.	Pieces	Designation (Correction Factor)	Φ (Luminaire) [lm]	Φ (Lamps) [lm]	P [W]
1	9	Philips BN308C LED60S-6500 L120 PSU WH (1.000)	5702	5700	45.5
Total:			51314	51300	409.6

Specific connected load: $5.08 \text{ W/m}^2 = 1.86 \text{ W/m}^2/100 \text{ lx}$ (Ground area: 80.67 m^2)



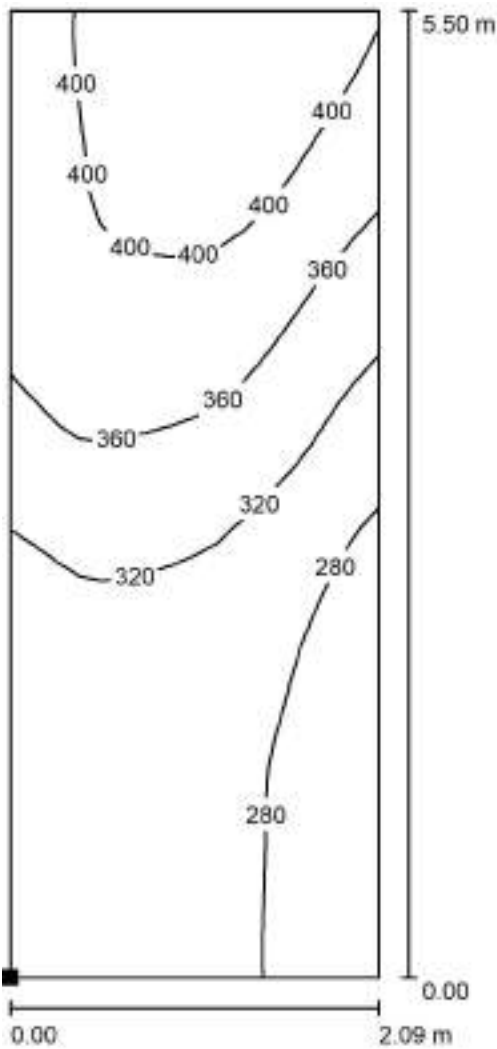
Operator
Telephone
Fax
e-Mail

Platform 1st floor typical 2 / 3D Rendering



Operator
Telephone
Fax
e-Mail

Platform 1st floor typical 2 / Calculation Surface 1 / Isolines (E, Perpendicular)



Position of surface in room:
Marked point:
(305.992 m, 75.771 m, 1.000 m)



Values in Lux, Scale 1 : 43

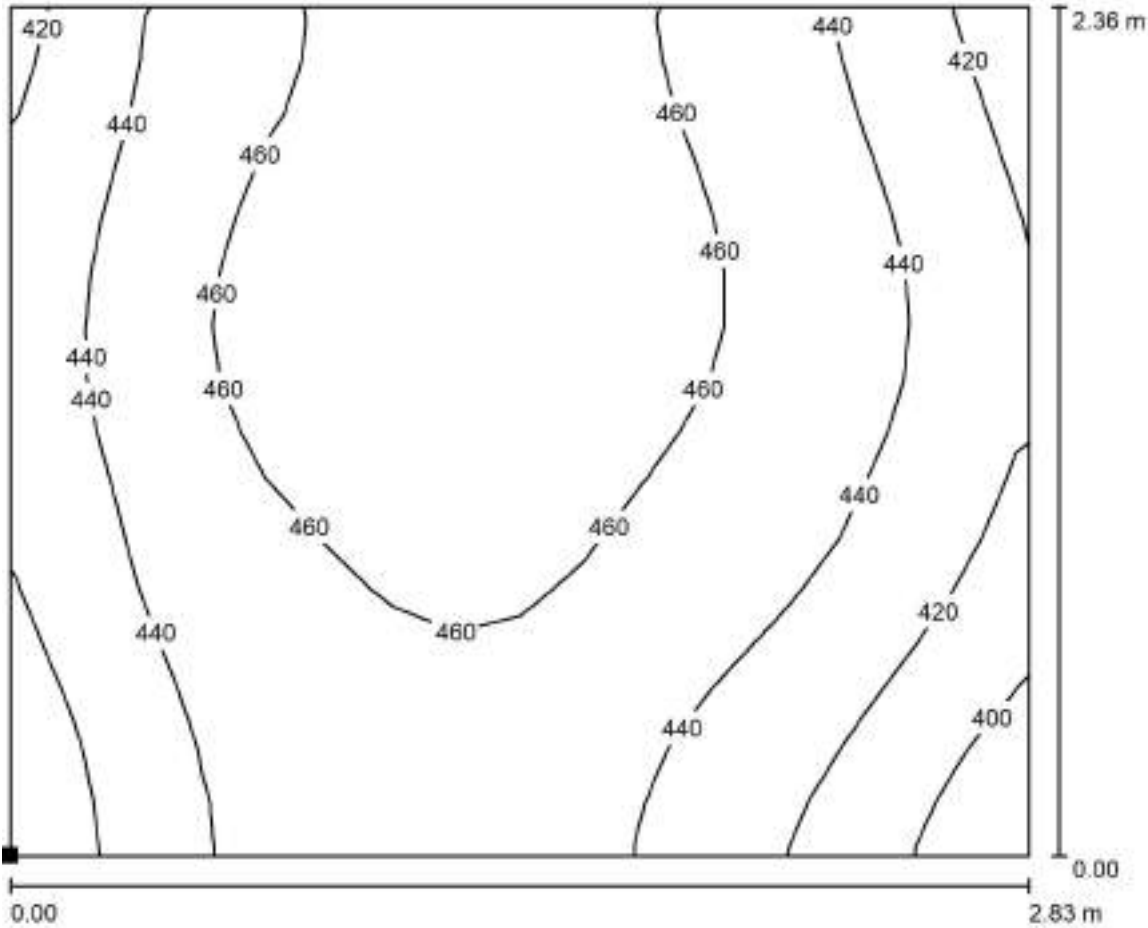
Grid: 16 x 32 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
338	244	436	0.721	0.558



Operator
Telephone
Fax
e-Mail

Platform 1st floor typical 2 / Calculation Surface 2 / Isolines (E, Perpendicular)



Values in Lux, Scale 1 : 21

Position of surface in room:
Marked point:
(306.091 m, 81.907 m, 1.000 m)



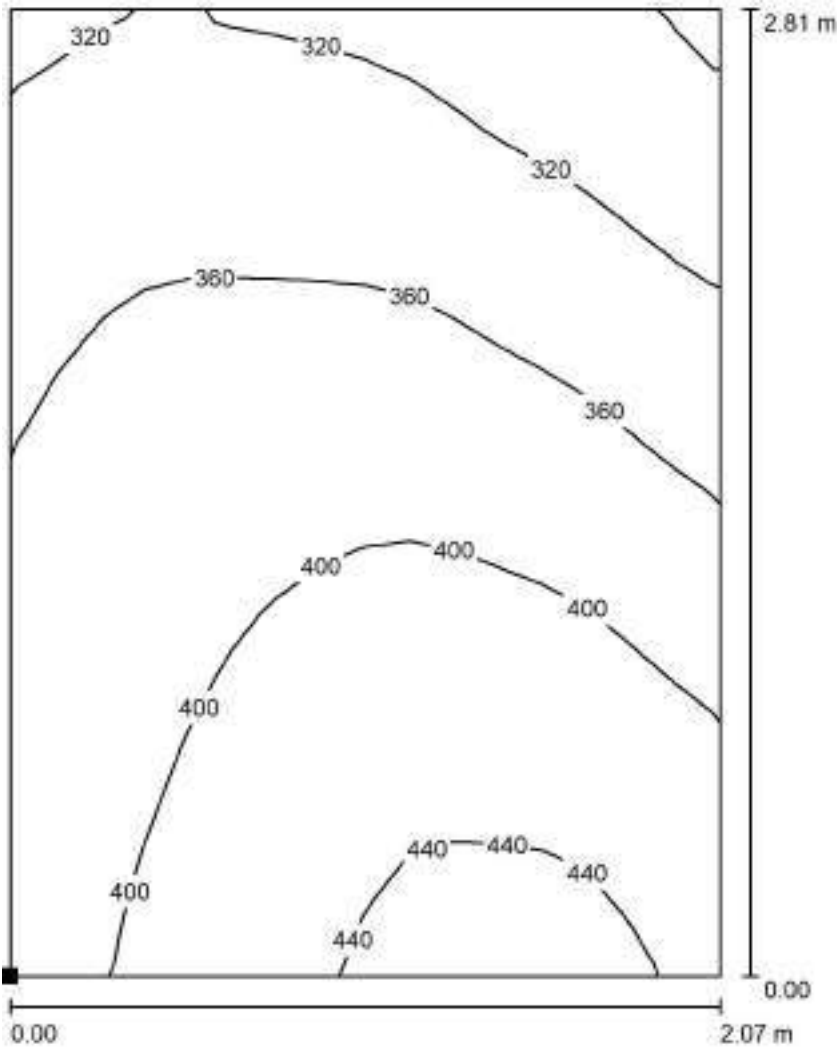
Grid: 16 x 16 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0	E_{min} / E_{max}
447	384	473	0.858	0.810



Operator
Telephone
Fax
e-Mail

Platform 1st floor typical 2 / Calculation Surface 3 / Isolines (E, Perpendicular)



Values in Lux, Scale 1 : 22

Position of surface in room:
Marked point:
(306.015 m, 84.888 m, 1.000 m)

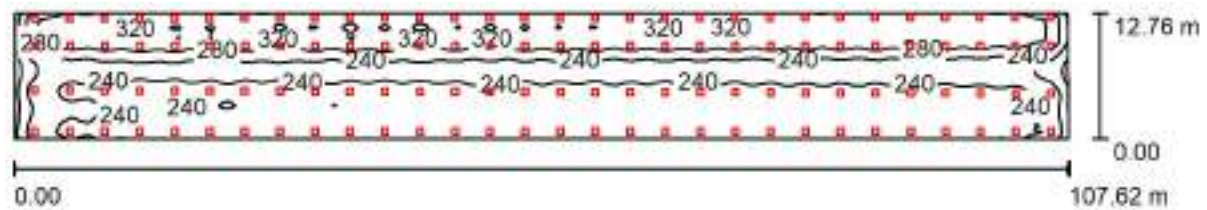


Grid: 16 x 16 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	$u0$	E_{min} / E_{max}
376	276	451	0.734	0.613

Operator
Telephone
Fax
e-Mail

Switchgear Room / Summary



Height of Room: 4.200 m, Mounting Height: 4.200 m, Light loss factor: 0.80

Values in Lux, Scale 1:770

Surface	ρ [%]	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0
Workplane	/	261	155	328	0.594
Floor	20	250	152	291	0.609
Ceiling	70	57	40	444	0.708
Walls (4)	50	152	46	1357	/

Workplane:

Height: 1.000 m
Grid: 128 x 128 Points
Boundary Zone: 0.000 m

Luminaire Parts List

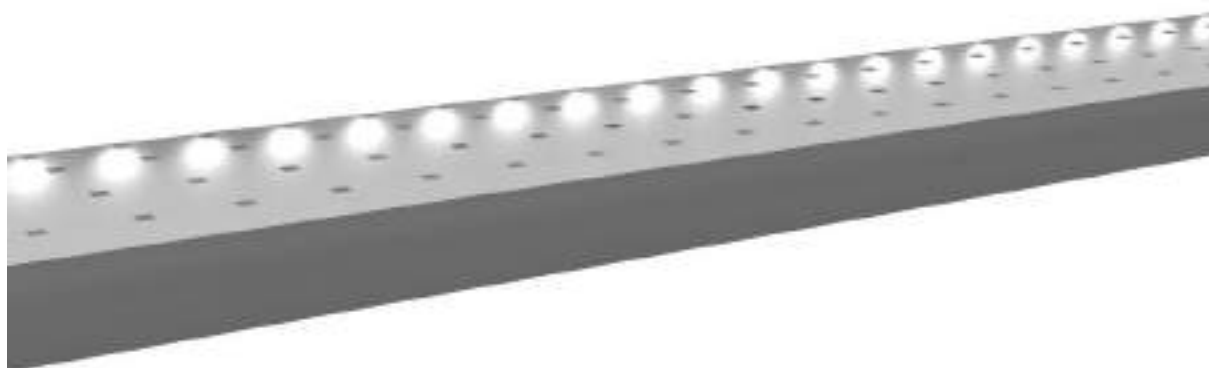
No.	Pieces	Designation (Correction Factor)	Φ (Luminaire) [lm]	Φ (Lamps) [lm]	P [W]
1	120	PHILIPS RC136B PSU W60L60 1 x28S_34S_40S/830 NOC (1.000)	4000	4000	31.0
Total:			480000	480000	3720.0

Specific connected load: $2.71 \text{ W/m}^2 = 1.04 \text{ W/m}^2/100 \text{ lx}$ (Ground area: 1371.40 m^2)



Operator
Telephone
Fax
e-Mail

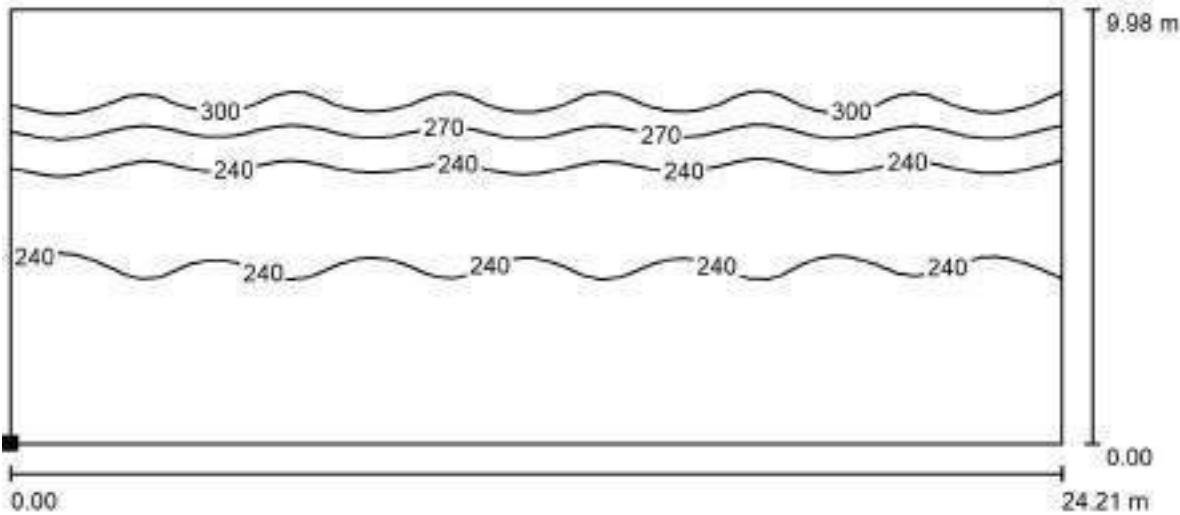
Switchgear Room / 3D Rendering





Operator
Telephone
Fax
e-Mail

Switchgear Room / Calculation Surface / Isolines (E, Perpendicular)



Position of surface in room:
Marked point:
(241.739 m, 76.764 m, 1.000 m)

Values in Lux, Scale 1 : 174

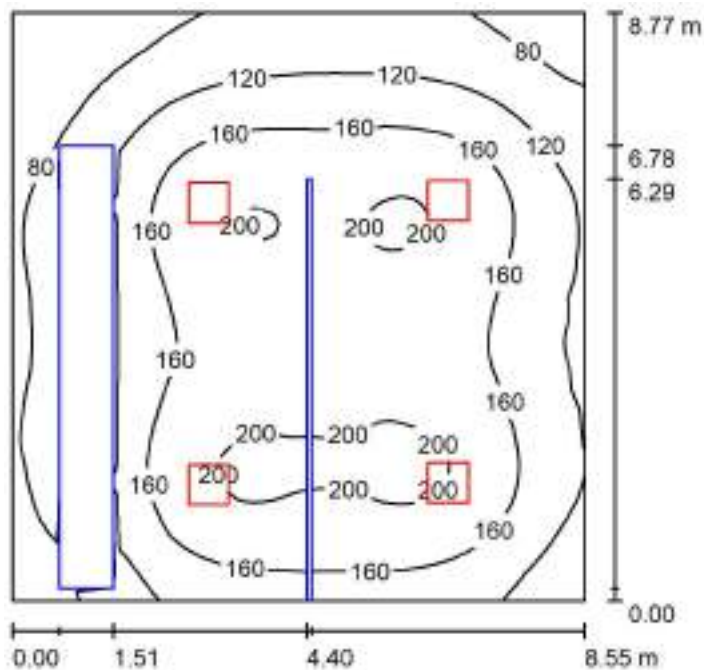


Grid: 64 x 32 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0	E_{min} / E_{max}
264	220	330	0.832	0.666

Operator
Telephone
Fax
e-Mail

Operator Room / Summary



Height of Room: 4.200 m, Mounting Height: 4.200 m, Light loss factor: 0.80

Values in Lux, Scale 1:113

Surface	ρ [%]	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0
Workplane	/	147	42	208	0.284
Floor	20	127	54	173	0.422
Ceiling	70	28	17	405	0.608
Walls (4)	50	61	21	146	/

Workplane:

Height: 1.000 m
Grid: 64 x 64 Points
Boundary Zone: 0.000 m

Luminaire Parts List

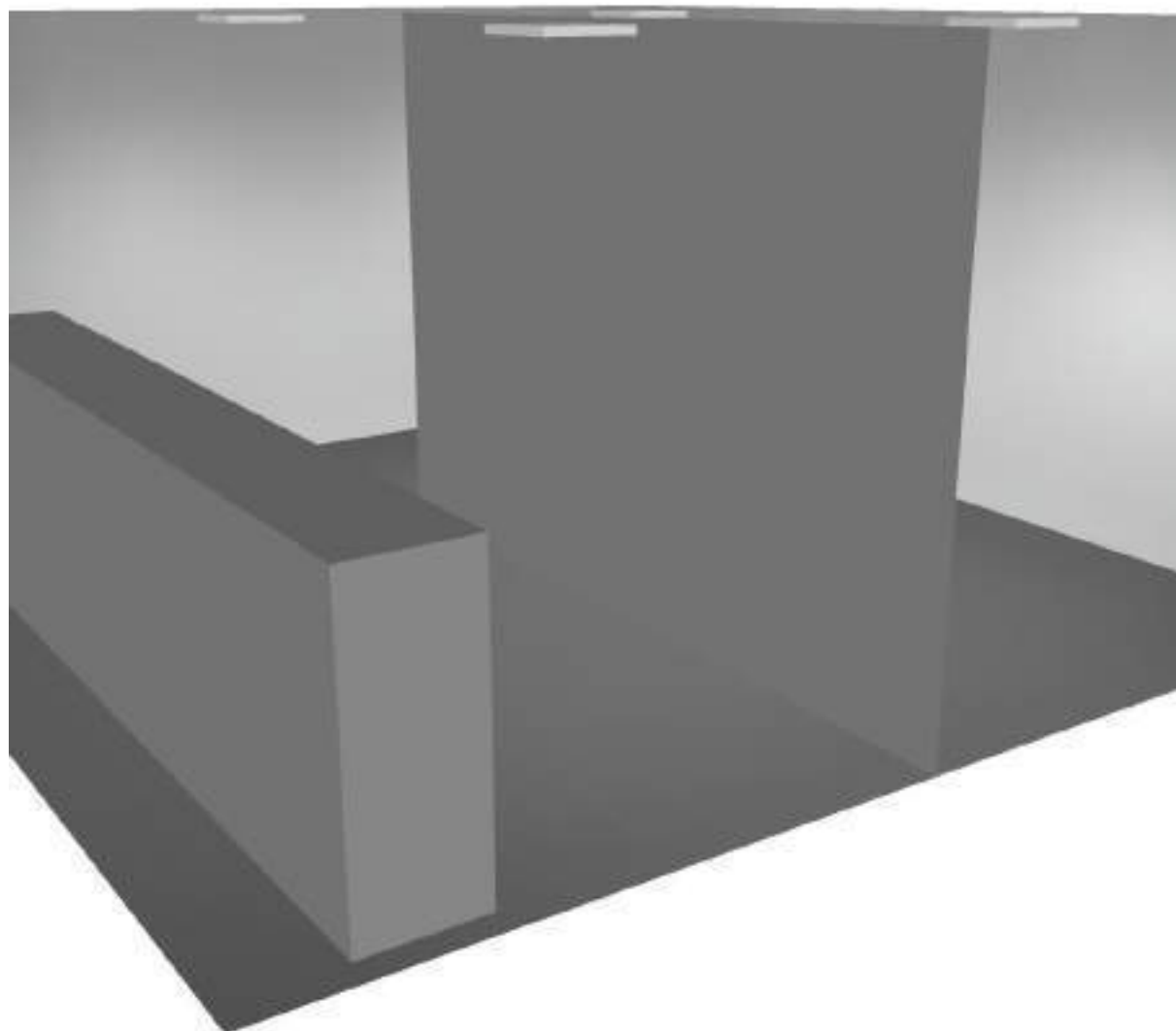
No.	Pieces	Designation (Correction Factor)	Φ (Luminaire) [lm]	Φ (Lamps) [lm]	P [W]
1	4	PHILIPS RC136B PSU W60L60 1 x28S_34S_40S/830 NOC (1.000)	4000	4000	31.0
Total:			16000	16000	124.0

Specific connected load: $1.65 \text{ W/m}^2 = 1.12 \text{ W/m}^2/100 \text{ lx}$ (Ground area: 74.94 m^2)



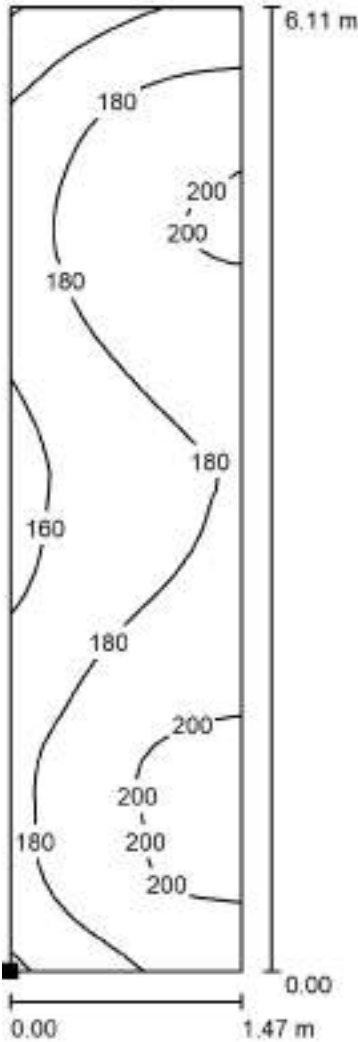
Operator
Telephone
Fax
e-Mail

Operator Room / 3D Rendering



Operator
Telephone
Fax
e-Mail

Operator Room / Calculation Surface 1 / Isolines (E, Perpendicular)



Position of surface in room:
Marked point:
(200.248 m, 67.059 m, 1.000 m)

Values in Lux, Scale 1 : 48

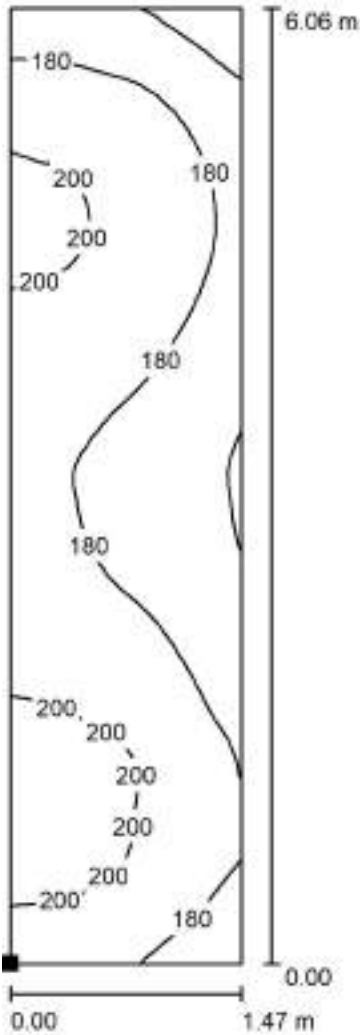


Grid: 16 x 64 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0	E_{min} / E_{max}
182	140	208	0.769	0.673

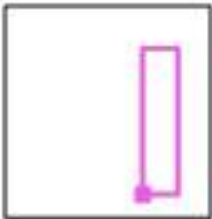
Operator
Telephone
Fax
e-Mail

Operator Room / Calculation Surface 2 / Isolines (E, Perpendicular)



Position of surface in room:
Marked point:
(203.761 m, 67.110 m, 1.000 m)

Values in Lux, Scale 1 : 48



Grid: 16 x 64 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	$u0$	E_{min} / E_{max}
185	145	209	0.785	0.694

Substation - Second Floor

Date: 09.02.2023
Operator:

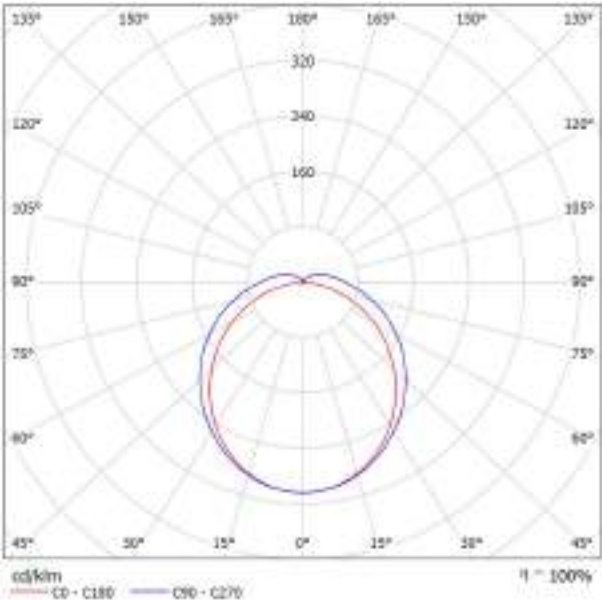


Operator
Telephone
Fax
e-Mail

Philips BN308C LED60S-6500 L120 PSU WH / Luminaire Data Sheet

Luminous emittance 1:

See our luminaire catalog for an image of the luminaire.



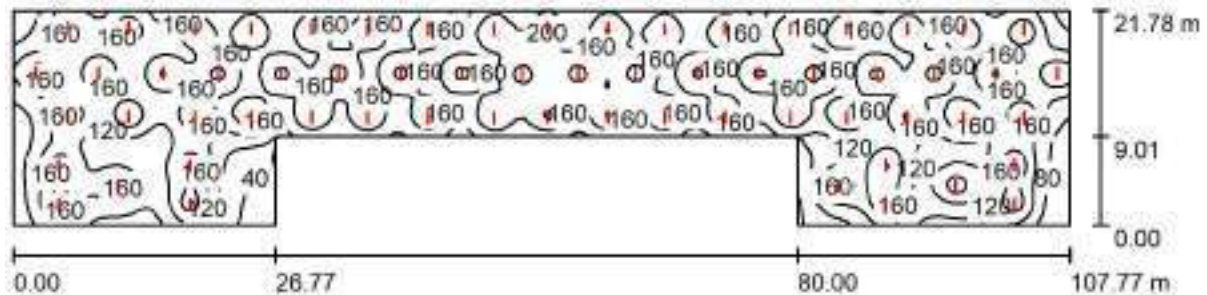
Luminaire classification according to CIE: 93
CIE flux code: 43 73 91 93 100

Luminous emittance 1:

Glare Evaluation According to UGR											
		70	70	30	30	30	70	70	30	30	30
UG Rating		90	90	90	90	90	90	90	90	90	90
UG Value		20	20	20	20	20	20	20	20	20	20
Room Size		Viewing direction at right angles to lamp axis					Viewing direction parallel to lamp axis				
2H	2H	22.4	24.7	23.8	25.0	25.4	21.6	24.8	24.0	25.1	25.6
	3H	24.0	26.0	25.2	26.4	26.8	23.4	26.6	25.8	27.0	27.4
	4H	25.4	28.4	27.6	29.0	29.4	25.1	28.4	27.6	28.0	28.4
	5H	25.8	28.8	28.0	29.2	29.6	25.5	28.8	28.0	28.4	28.8
	6H	25.9	28.9	28.1	29.3	29.7	25.6	28.9	28.1	28.5	28.9
4H	2H	25.9	28.9	28.1	29.3	29.7	25.6	28.9	28.1	28.5	28.9
	3H	24.0	26.0	25.2	26.4	26.8	23.4	26.6	25.8	27.0	27.4
	4H	25.4	28.4	27.6	29.0	29.4	25.1	28.4	27.6	28.0	28.4
	5H	25.8	28.8	28.0	29.2	29.6	25.5	28.8	28.0	28.4	28.8
	6H	25.9	28.9	28.1	29.3	29.7	25.6	28.9	28.1	28.5	28.9
6H	2H	27.0	29.7	27.7	29.7	30.2	26.8	29.7	28.9	29.3	29.7
	3H	27.1	29.7	27.7	29.7	30.2	26.8	29.7	28.9	29.3	29.7
	4H	28.8	31.4	29.3	30.6	31.0	28.5	31.3	30.5	30.9	31.3
	5H	27.8	29.8	28.8	30.0	30.4	27.5	29.5	28.7	29.1	29.5
	6H	28.1	30.1	29.1	30.3	30.7	27.8	29.8	29.0	29.4	29.8
12H	2H	27.5	29.5	28.5	29.5	30.0	28.0	30.0	29.0	29.5	30.0
	3H	27.6	29.6	28.6	29.6	30.1	28.1	29.6	28.6	29.6	30.1
	4H	28.9	31.7	29.9	31.1	31.5	29.4	31.4	30.4	30.9	31.4
	5H	27.9	29.9	28.9	30.1	30.5	28.2	29.9	29.1	29.6	30.1
	6H	28.2	30.2	29.2	30.4	30.8	28.5	30.2	29.4	29.8	30.2
Variation of the observer position for the luminance distance, h											
h = 1.0H		+0.1 / -0.1					+0.1 / -0.1				
h = 1.5H		+0.2 / -0.2					+0.2 / -0.2				
h = 2.0H		+0.4 / -0.4					+0.3 / -0.3				
Standard Value		1000					1000				
Correction		10.0					12.0				
Summed											
Corrected Glare Index referring to 5000lx Solid Luminous Flux											

Operator
Telephone
Fax
e-Mail

Cable Cellar / Summary



Height of Room: 4.300 m, Mounting Height: 4.300 m, Light loss factor: 0.80

Values in Lux, Scale 1:771

Surface	ρ [%]	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0
Workplane	/	146	30	219	0.203
Floor	20	139	34	184	0.248
Ceiling	70	44	15	11945	0.333
Walls (8)	50	86	29	342	/

Workplane:

Height: 1.000 m
Grid: 128 x 128 Points
Boundary Zone: 0.000 m

Luminaire Parts List

No.	Pieces	Designation (Correction Factor)	Φ (Luminaire) [lm]	Φ (Lamps) [lm]	P [W]
1	63	Philips BN308C LED60S-6500 L120 PSU WH (1.000)	5702	5700	45.5
Total:			359200	359100	2867.1

Specific connected load: $1.54 \text{ W/m}^2 = 1.05 \text{ W/m}^2/100 \text{ lx}$ (Ground area: 1867.26 m^2)



Operator
Telephone
Fax
e-Mail

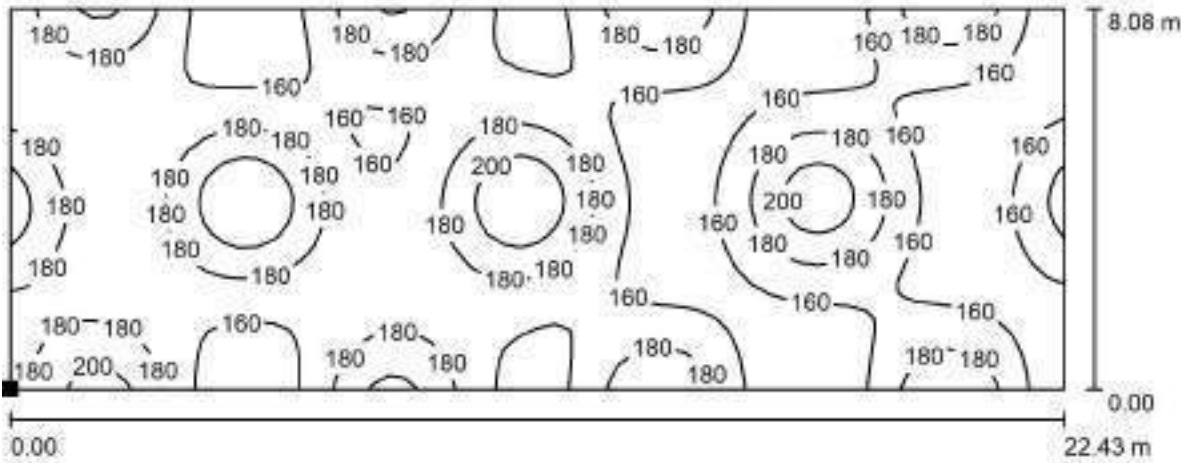
Cable Cellar / 3D Rendering





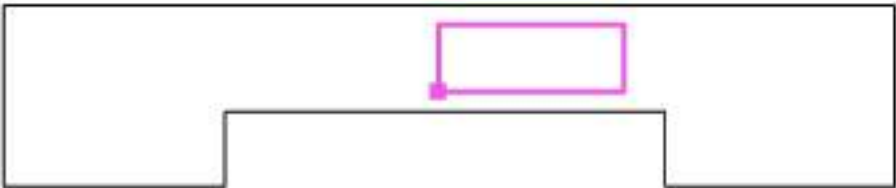
Operator
Telephone
Fax
e-Mail

Cable Cellar / Calculation Surface / Isolines (E, Perpendicular)



Values in Lux, Scale 1 : 161

Position of surface in room:
Marked point:
(57.041 m, 12.269 m, 1.000 m)

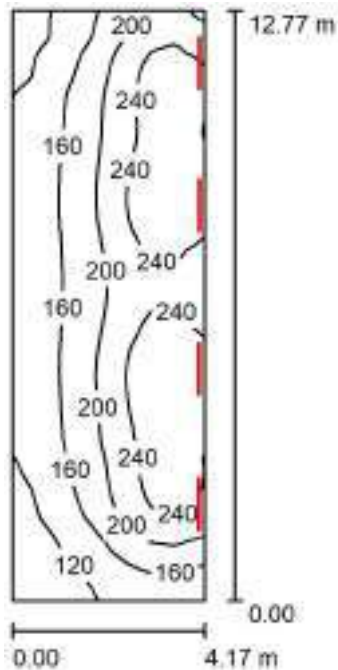


Grid: 64 x 32 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0	E_{min} / E_{max}
170	141	220	0.831	0.642

Operator
Telephone
Fax
e-Mail

Platform type 2nd floor / Summary



Height of Room: 4.300 m, Mounting Height: 3.800 m, Light loss factor: 0.80

Values in Lux, Scale 1:164

Surface	ρ [%]	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	$u0$
Workplane	/	191	85	272	0.443
Floor	20	161	89	203	0.552
Ceiling	70	90	43	269	0.482
Walls (4)	50	134	43	2780	/

Workplane:

Height: 1.000 m
Grid: 128 x 128 Points
Boundary Zone: 0.000 m

Luminaire Parts List

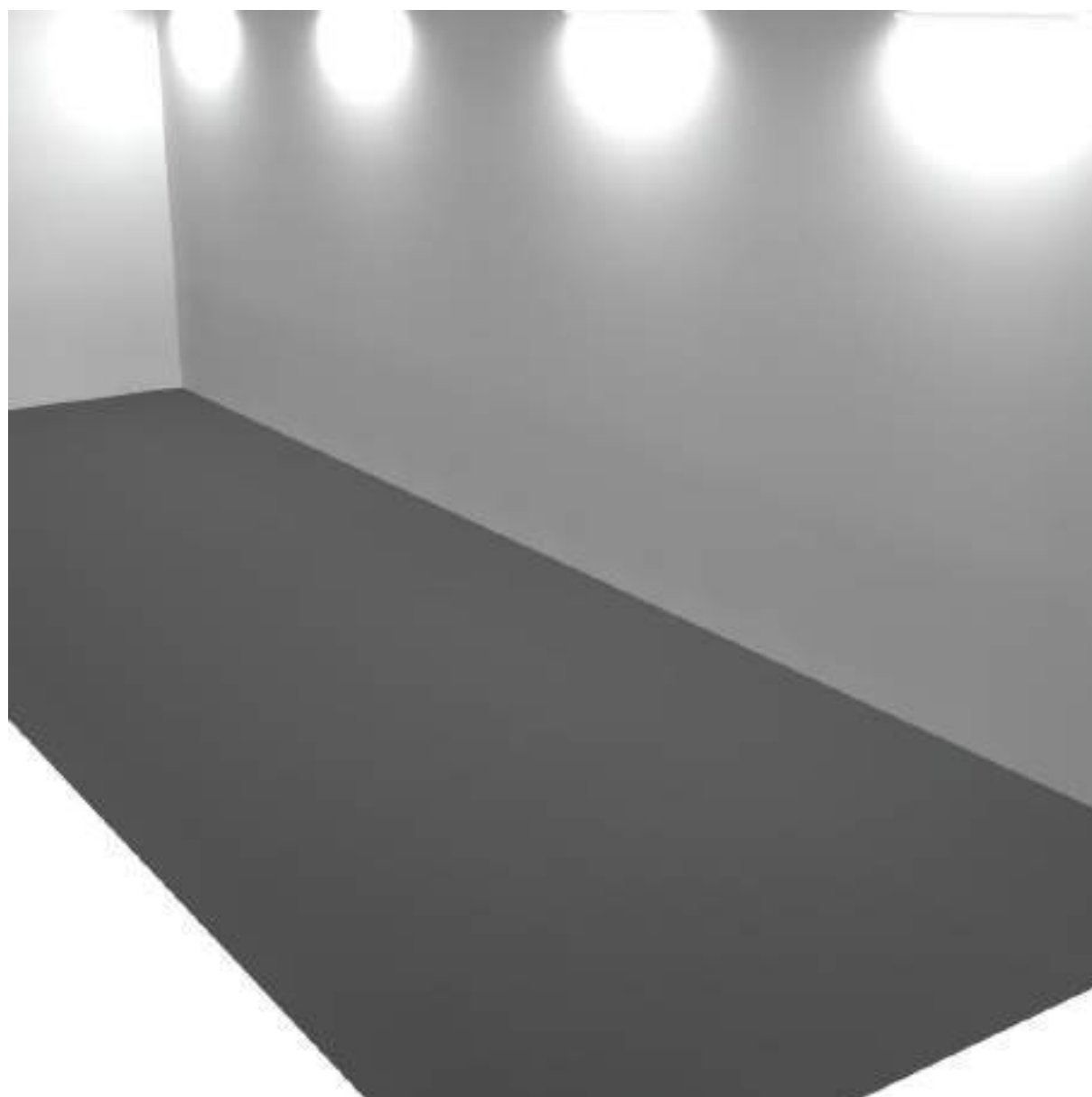
No.	Pieces	Designation (Correction Factor)	Φ (Luminaire) [lm]	Φ (Lamps) [lm]	P [W]
1	4	Philips BN308C LED60S-6500 L120 PSU WH (1.000)	5702	5700	45.5
Total:			22806	22800	182.0

Specific connected load: $3.42 \text{ W/m}^2 = 1.79 \text{ W/m}^2/100 \text{ lx}$ (Ground area: 53.25 m^2)



Operator
Telephone
Fax
e-Mail

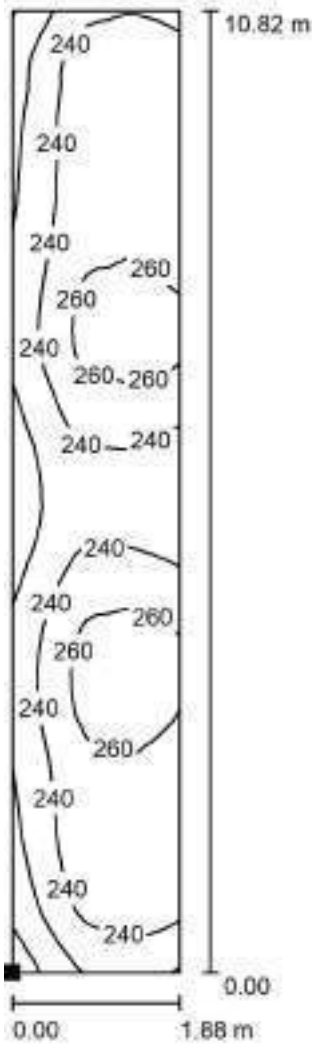
Platform type 2nd floor / 3D Rendering





Operator
Telephone
Fax
e-Mail

Platform type 2nd floor / Calculation Surface / Isolines (E, Perpendicular)



Position of surface in room:
Marked point:
(2.255 m, 11.336 m, 1.000 m)



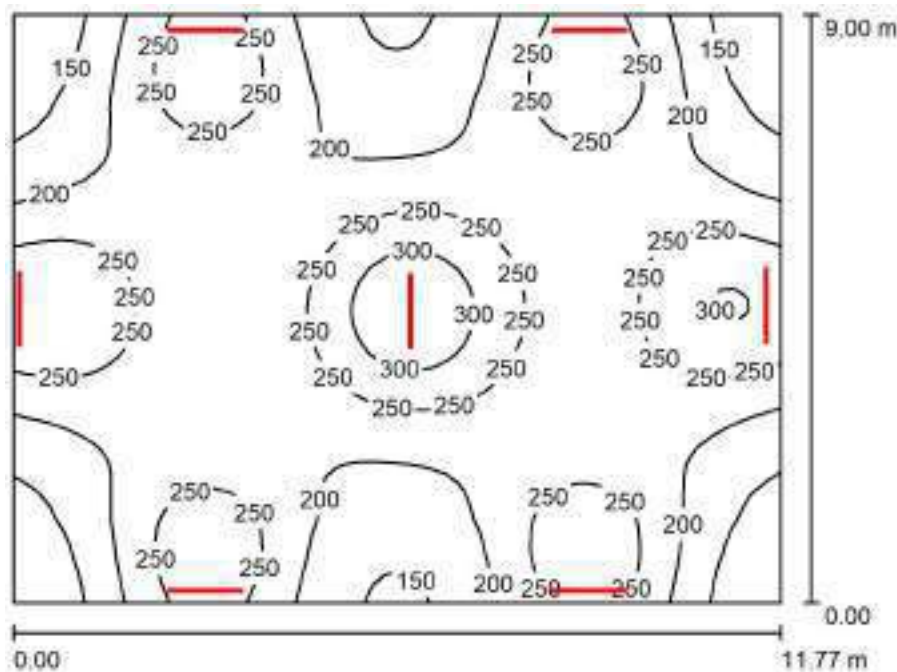
Values in Lux, Scale 1 : 85

Grid: 16 x 64 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	$u0$	E_{min} / E_{max}
244	189	272	0.771	0.694

Operator
Telephone
Fax
e-Mail

CFU Room / Summary



Height of Room: 4.300 m, Light loss factor: 0.80

Values in Lux, Scale 1:116

Surface	ρ [%]	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0
Workplane	/	223	110	348	0.492
Floor	20	200	121	261	0.602
Ceiling	70	81	41	169	0.501
Walls (4)	50	135	58	3381	/

Workplane:

Height: 1.000 m
Grid: 64 x 64 Points
Boundary Zone: 0.000 m

Luminaire Parts List

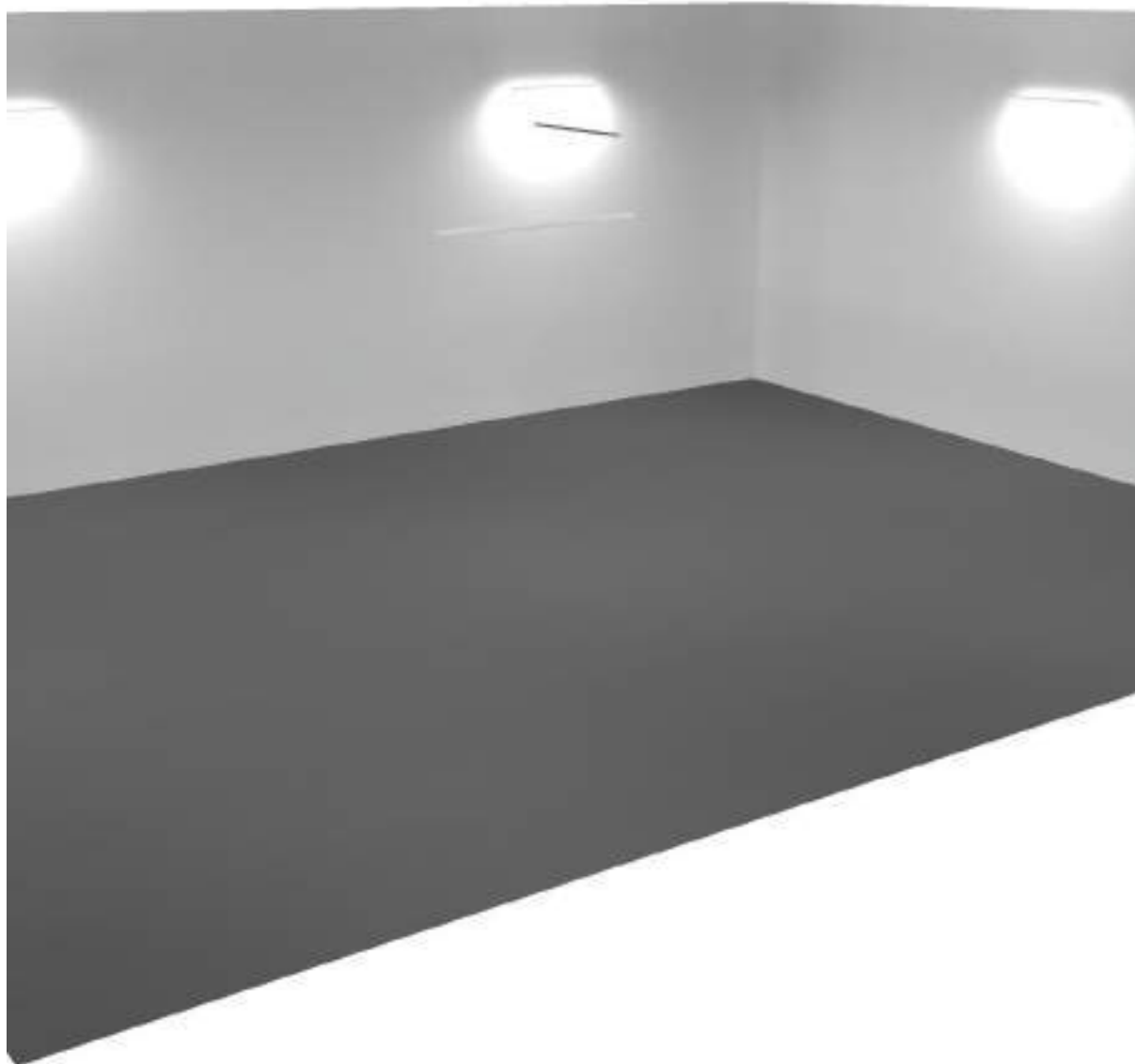
No.	Pieces	Designation (Correction Factor)	Φ (Luminaire) [lm]	Φ (Lamps) [lm]	P [W]
1	7	Philips BN308C LED60S-6500 L120 PSU WH (1.000)	5702	5700	45.5
Total:			39911	39900	318.6

Specific connected load: $3.01 \text{ W/m}^2 = 1.35 \text{ W/m}^2/100 \text{ lx}$ (Ground area: 105.93 m^2)



Operator
Telephone
Fax
e-Mail

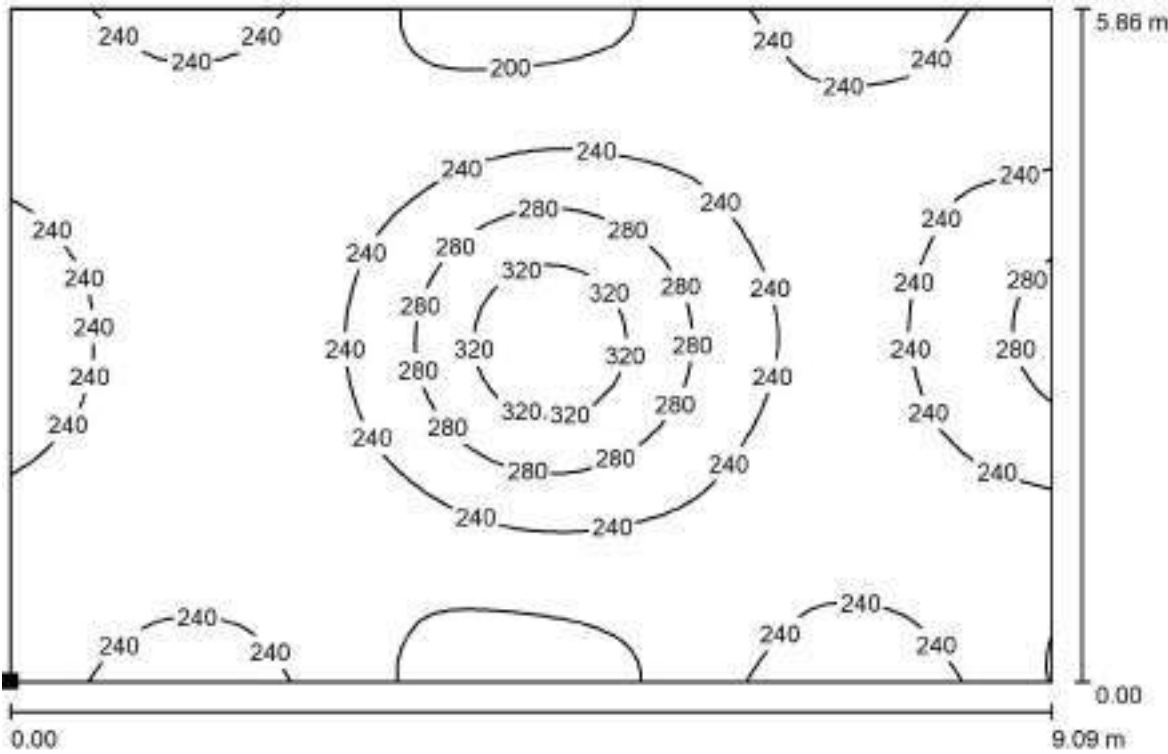
CFU Room / 3D Rendering





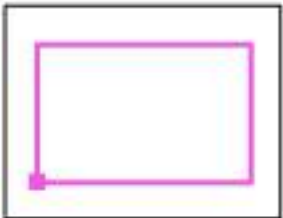
Operator
Telephone
Fax
e-Mail

CFU Room / Calculation Surface / Isolines (E, Perpendicular)



Values in Lux, Scale 1 : 66

Position of surface in room:
Marked point:
(59.852 m, 2.386 m, 1.000 m)



Grid: 64 x 64 Points

E_{av} [lx]
237

E_{min} [lx]
182

E_{max} [lx]
348

u_0
0.769

E_{min} / E_{max}
0.524

Substation - Third floor

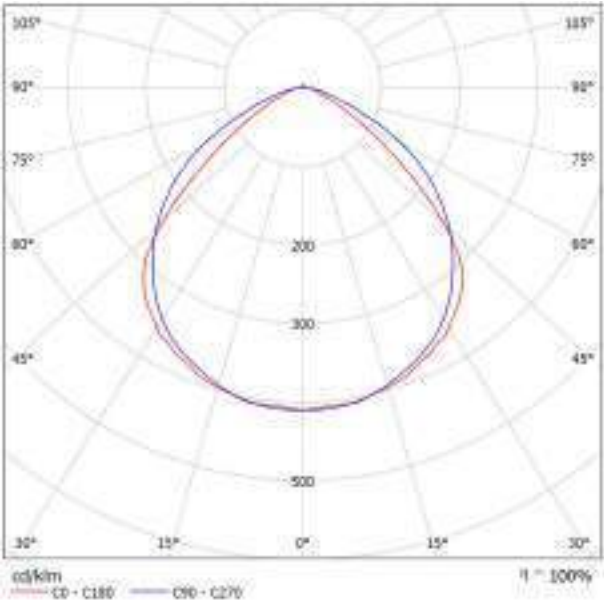
Date: 09.02.2023
Operator:



Operator
Telephone
Fax
e-Mail

PHILIPS RC136B PSU W60L60 1 x28S_34S_40S/830 NOC / Luminaire Data Sheet

Luminous emittance 1:



Luminaire classification according to CIE: 99
CIE flux code: 56 88 98 99 100

CoreLine empotrable: diseño elegante y fácil instalación La luminaria CoreLine empotrable de la familia CoreLine LED puede emplearse para sustituir punto a punto las luminarias de fluorescencia en aplicaciones generales de iluminación. El proceso de selección, instalación y mantenimiento muy sencillo.

Luminous emittance 1:

Glare Evaluation According to UGR												
ceiling	70	70	30	30	30	70	70	30	30	30		
walls	90	90	90	90	90	90	90	90	90	90		
floor	20	20	20	20	20	20	20	20	20	20		
Room Size x x	Viewing direction at right angles to lamp axis					Viewing direction parallel to lamp axis						
2H	2H	20.9	22.9	21.2	21.3	21.6	22.4	22.8	22.9	24.8	24.3	
	2H	21.1	22.1	21.4	21.4	21.7	22.1	24.4	22.5	24.8	24.9	
	4H	21.1	22.1	21.4	21.4	21.7	22.1	24.4	22.5	24.8	24.9	
	6H	21.1	22.9	21.5	21.3	21.6	22.6	24.5	24.0	24.9	25.1	
	8H	21.1	22.9	21.5	21.3	21.6	22.7	24.5	24.0	24.9	25.2	
4H	2H	21.1	21.8	21.5	21.3	21.6	22.7	24.5	24.1	24.9	25.2	
	2H	21.2	22.2	21.6	21.5	21.8	22.8	22.7	22.1	24.8	24.3	
	2H	21.6	22.4	21.8	21.7	21.1	22.6	24.4	22.9	24.7	25.1	
	4H	21.6	22.4	22.2	21.7	21.1	22.6	24.6	24.2	24.9	25.1	
	6H	21.7	22.3	21.1	21.7	21.1	24.8	24.6	24.4	25.8	25.4	
6H	2H	21.7	22.3	21.2	21.7	21.1	24.1	24.7	24.5	25.1	25.5	
	2H	21.7	22.3	21.2	21.7	21.1	24.1	24.7	24.5	25.1	25.5	
	4H	21.7	22.3	21.2	21.7	21.1	22.6	24.4	24.2	24.8	25.1	
	6H	21.8	22.3	21.3	21.7	21.2	24.6	24.5	24.5	25.8	25.4	
	8H	21.9	22.3	21.4	21.6	21.2	24.2	24.6	24.6	25.8	25.6	
12H	2H	21.9	22.3	21.4	21.7	21.3	24.2	24.6	24.7	25.1	25.6	
	4H	21.7	22.2	21.2	21.7	21.1	22.6	24.3	24.2	24.7	25.2	
	6H	21.8	22.3	21.3	21.7	21.2	24.6	24.4	24.3	24.8	25.4	
9H	21.9	22.3	21.4	21.7	21.3	24.1	24.5	24.6	25.8	25.5		
Variation of the observer position for the luminaires distance 3												
S = 1.0H		+0.6 / -0.9					+0.3 / -0.3					
S = 1.5H		+1.2 / -0.5					+0.6 / -0.9					
S = 2.0H		+2.4 / -0.9					+1.6 / -1.2					
Standard Value		0000					0000					
Correction Summed		4.2					6.7					
Corrected Glare Index referring to 0000lx Solid Luminous Flux												

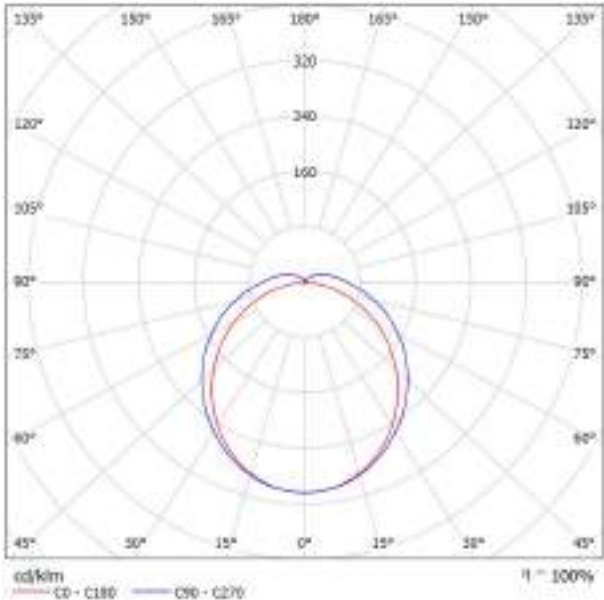


Operator
Telephone
Fax
e-Mail

Philips BN308C LED60S-6500 L120 PSU WH / Luminaire Data Sheet

Luminous emittance 1:

See our luminaire catalog for an image of the luminaire.



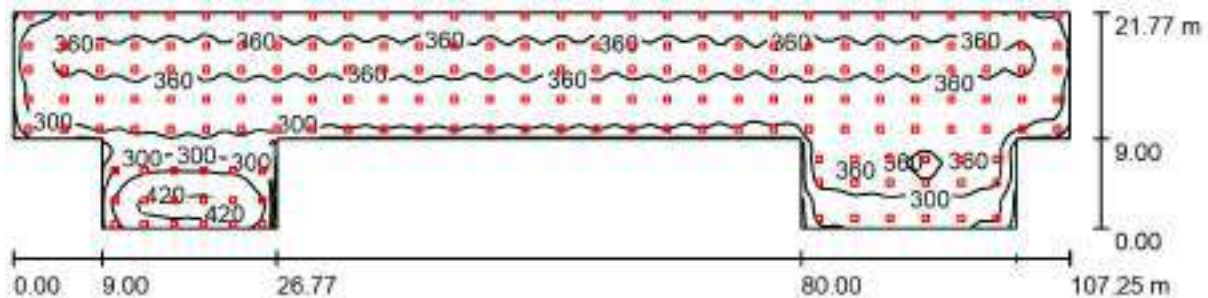
Luminaire classification according to CIE: 93
CIE flux code: 43 73 91 93 100

Luminous emittance 1:

Glare Evaluation According to UGR											
Room Size		70	70	30	30	30	70	70	30	30	30
Walls		90	90	90	90	90	90	90	90	90	90
Floor		20	20	20	20	20	20	20	20	20	20
Room Size		Viewing direction at right angles to lamp axis					Viewing direction parallel to lamp axis				
2H	2H	22.4	24.7	23.8	25.0	25.4	21.6	24.8	24.0	25.1	25.6
	4H	24.0	26.0	25.2	26.4	26.8	23.4	26.6	25.8	27.0	27.4
	6H	25.4	28.4	27.6	28.8	29.2	24.8	28.4	27.6	28.8	29.2
	8H	25.8	28.8	28.0	29.2	29.6	25.2	28.8	28.0	29.2	29.6
	12H	25.9	28.9	28.1	29.3	29.7	25.3	28.9	28.1	29.3	29.7
4H	2H	24.0	26.0	25.2	26.4	26.8	24.2	26.2	25.4	26.6	27.0
	4H	25.7	27.7	26.9	28.1	28.5	26.2	28.2	27.4	28.6	29.0
	6H	26.4	28.4	27.6	28.8	29.2	27.0	29.0	28.2	29.4	29.8
	8H	26.8	28.8	28.0	29.2	29.6	27.4	29.4	28.6	29.8	30.2
	12H	27.0	29.0	28.2	29.4	29.8	27.6	29.6	28.8	30.0	30.4
6H	2H	27.1	29.1	28.3	29.5	29.9	27.7	29.7	28.9	30.1	30.5
	4H	26.8	28.8	28.0	29.2	29.6	27.4	29.4	28.6	29.8	30.2
	6H	27.0	29.0	28.2	29.4	29.8	27.6	29.6	28.8	30.0	30.4
	8H	27.2	29.2	28.4	29.6	30.0	27.8	29.8	29.0	30.2	30.6
	12H	27.5	29.5	28.7	29.9	30.3	28.1	30.1	29.3	30.5	30.9
8H	2H	27.5	29.5	28.7	29.9	30.3	28.1	30.1	29.3	30.5	30.9
	4H	27.2	29.2	28.4	29.6	30.0	27.8	29.8	29.0	30.2	30.6
	6H	27.4	29.4	28.6	29.8	30.2	28.0	29.9	29.1	30.3	30.7
	8H	27.6	29.6	28.8	30.0	30.4	28.2	30.2	29.4	30.6	31.0
	12H	27.9	29.9	29.1	30.3	30.7	28.5	30.5	29.7	30.9	31.3
Variation of the observer position for the luminance distance, h											
h = 1.0H		+0.1 / -0.1					+0.1 / -0.1				
h = 1.5H		+0.2 / -0.2					+0.2 / -0.2				
h = 2.0H		+0.4 / -0.4					+0.3 / -0.3				
Standard table		1000					1000				
Correction		10.0					12.0				
Standard											
Corrected Glare Index referring to 5000lx Total Luminous Flux											

Operator
Telephone
Fax
e-Mail

Switchgear Room / Summary



Height of Room: 4.200 m, Mounting Height: 4.200 m, Light loss factor: 0.80

Values in Lux, Scale 1:767

Surface	ρ [%]	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0
Workplane	/	338	152	444	0.450
Floor	20	325	150	404	0.459
Ceiling	70	74	53	453	0.712
Walls (12)	50	176	59	1851	/

Workplane:

Height: 1.000 m
Grid: 64 x 128 Points
Boundary Zone: 0.000 m

Luminaire Parts List

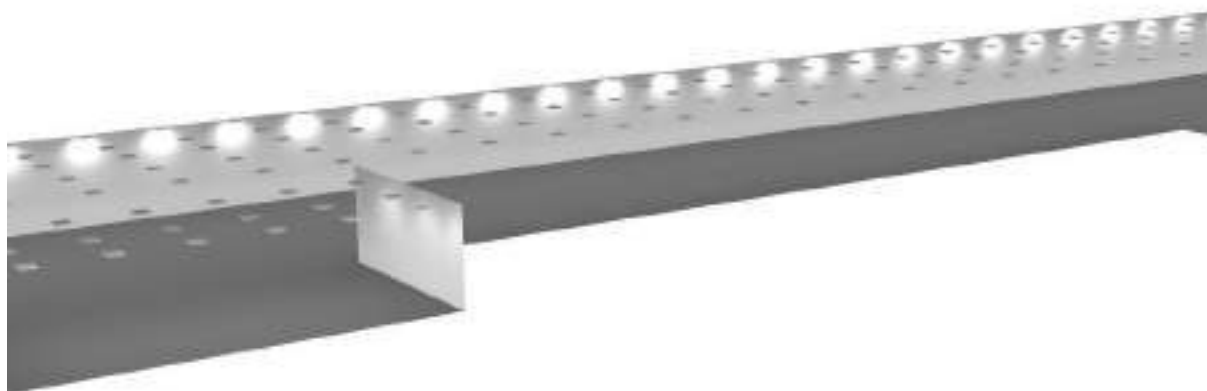
No.	Pieces	Designation (Correction Factor)	Φ (Luminaire) [lm]	Φ (Lamps) [lm]	P [W]
1	186	PHILIPS RC136B PSU W60L60 1 x28S_34S_40S/830 NOC (1.000)	4000	4000	31.0
Total:			744000	744000	5766.0

Specific connected load: $3.34 \text{ W/m}^2 = 0.99 \text{ W/m}^2/100 \text{ lx}$ (Ground area: 1725.44 m^2)



Operator
Telephone
Fax
e-Mail

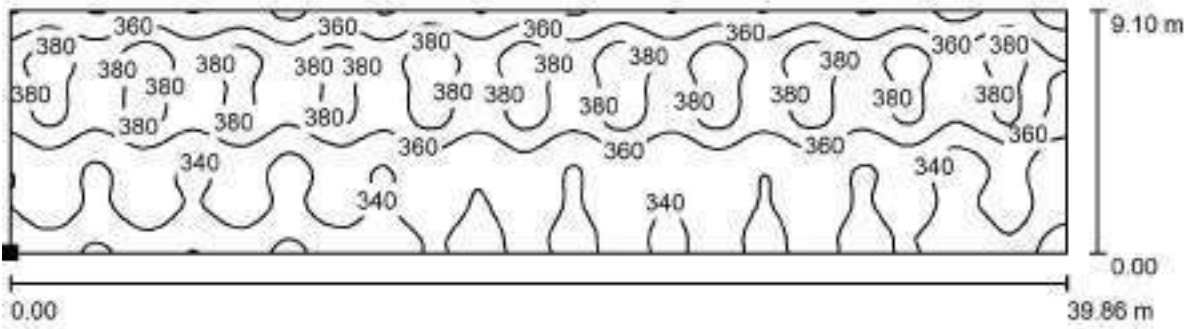
Switchgear Room / 3D Rendering





Operator
Telephone
Fax
e-Mail

Switchgear Room / Calculation Surface / Isolines (E, Perpendicular)



Position of surface in room:
Marked point:
(78.737 m, 80.870 m, 1.000 m)

Values in Lux, Scale 1 : 285

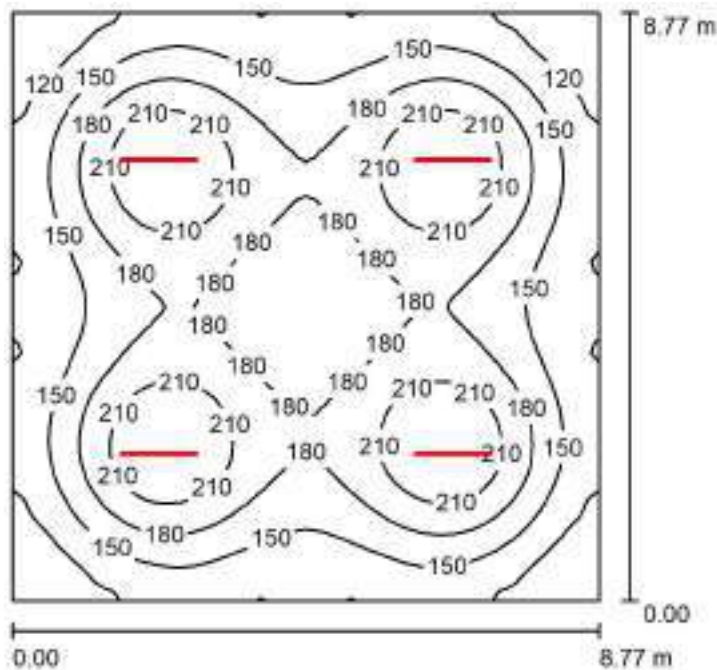


Grid: 128 x 32 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0	E_{min} / E_{max}
358	308	397	0.862	0.777

Operator
Telephone
Fax
e-Mail

Battery Room 1 / Summary



Height of Room: 6.300 m, Mounting Height: 3.800 m, Light loss factor: 0.80

Values in Lux, Scale 1:113

Surface	ρ [%]	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0
Workplane	/	169	93	241	0.546
Floor	20	146	87	176	0.598
Ceiling	70	34	24	40	0.701
Walls (4)	50	76	25	145	/

Workplane:

Height: 1.000 m
Grid: 64 x 64 Points
Boundary Zone: 0.000 m

UGR

Left Wall
Lower Wall
(CIE, SHR = 0.25.)

Lengthways-

26
26

Across

26
26

to luminaire axis

Luminaire Parts List

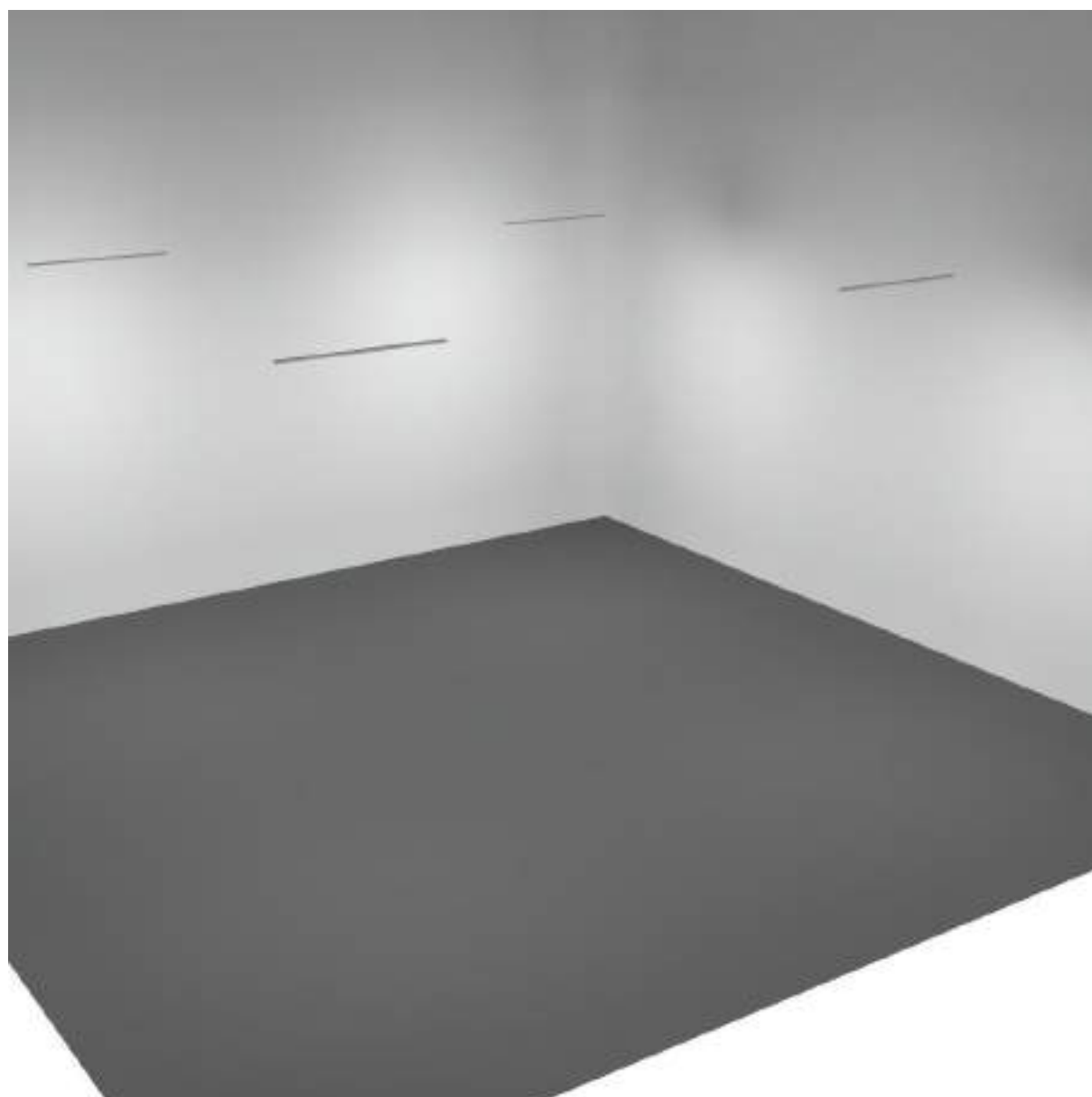
No.	Pieces	Designation (Correction Factor)	Φ (Luminaire) [lm]	Φ (Lamps) [lm]	P [W]
1	4	Philips BN308C LED60S-6500 L120 PSU WH (1.000)	5702	5700	45.5
Total:			22806	22800	182.0

Specific connected load: $2.37 \text{ W/m}^2 = 1.40 \text{ W/m}^2/100 \text{ lx}$ (Ground area: 76.91 m^2)



Operator
Telephone
Fax
e-Mail

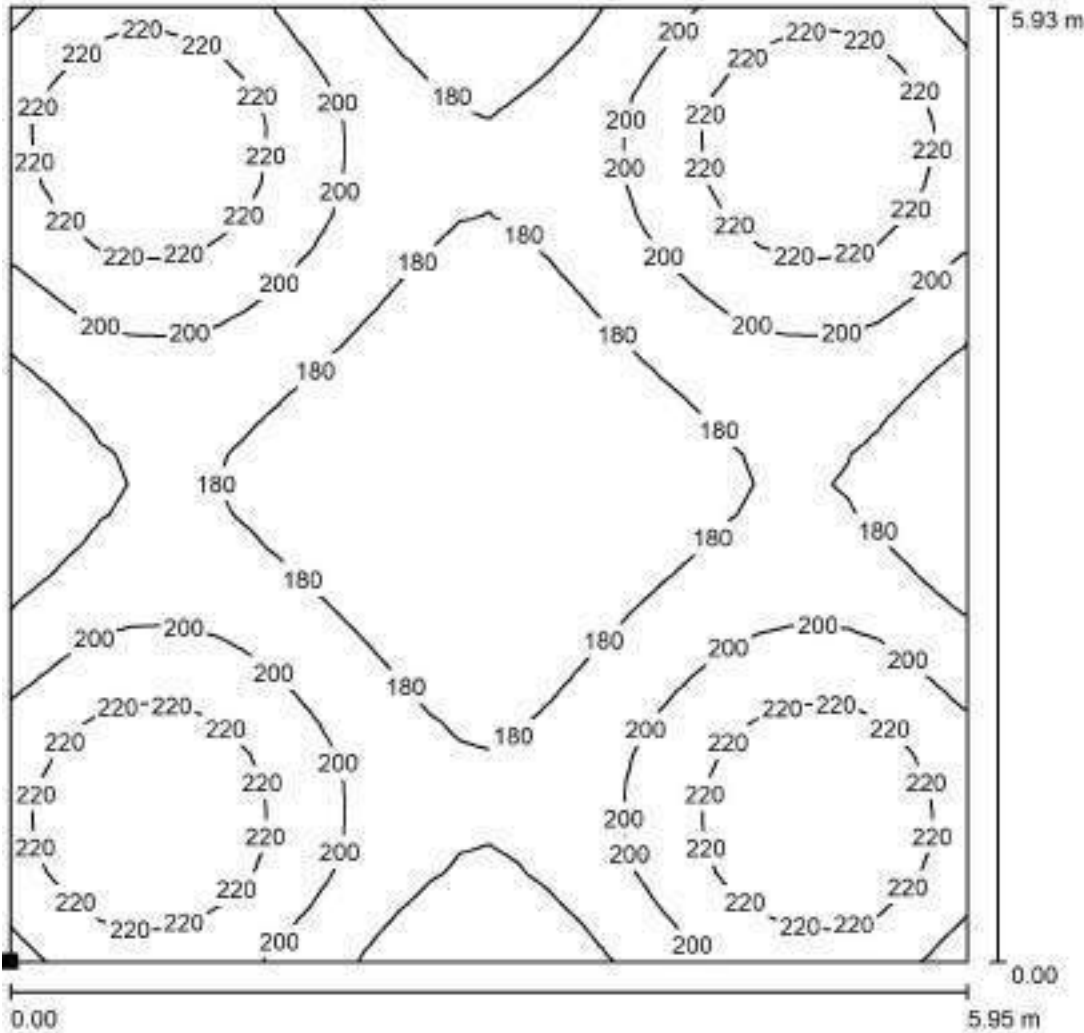
Battery Room 1 / 3D Rendering





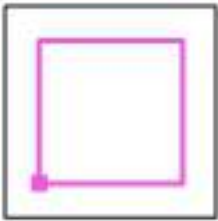
Operator
Telephone
Fax
e-Mail

Battery Room 1 / Calculation Surface / Isolines (E, Perpendicular)



Values in Lux, Scale 1 : 47

Position of surface in room:
Marked point:
(15.258 m, 71.300 m, 1.000 m)

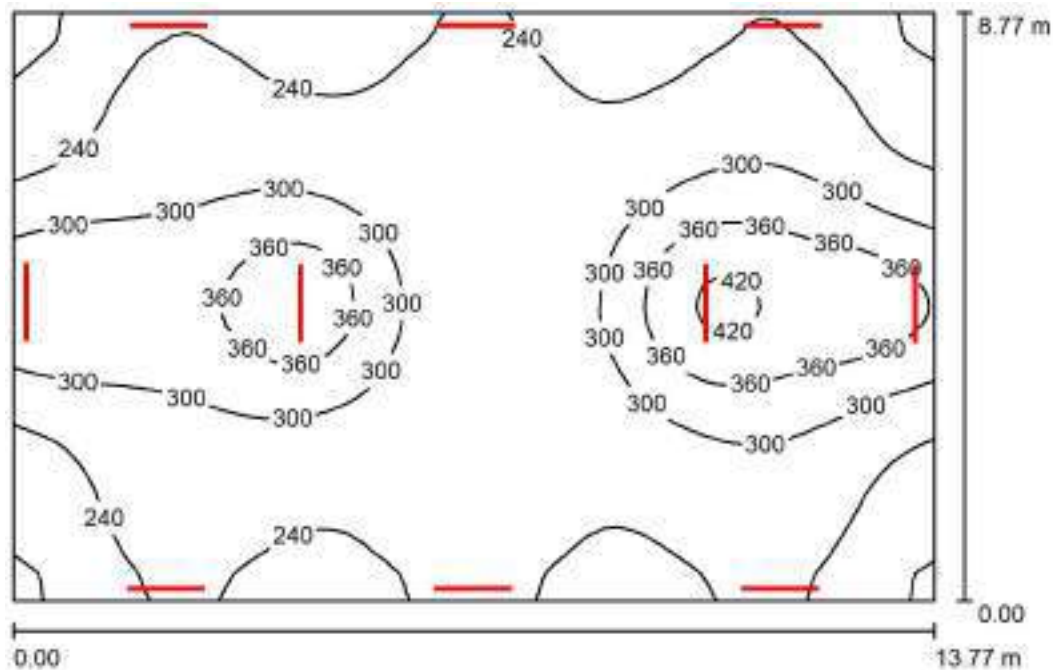


Grid: 32 x 32 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0	E_{min} / E_{max}
197	162	239	0.824	0.679

Operator
Telephone
Fax
e-Mail

AHU Room / Summary



Height of Room: 4.200 m, Light loss factor: 0.80

Values in Lux, Scale 1:113

Surface	ρ [%]	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	$u0$
Workplane	/	277	164	434	0.593
Floor	20	249	160	334	0.642
Ceiling	70	129	57	86044	0.443
Walls (4)	50	182	87	2229	/

Workplane :

Height: 1.000 m
Grid: 64 x 64 Points
Boundary Zone: 0.000 m

Luminaire Parts List

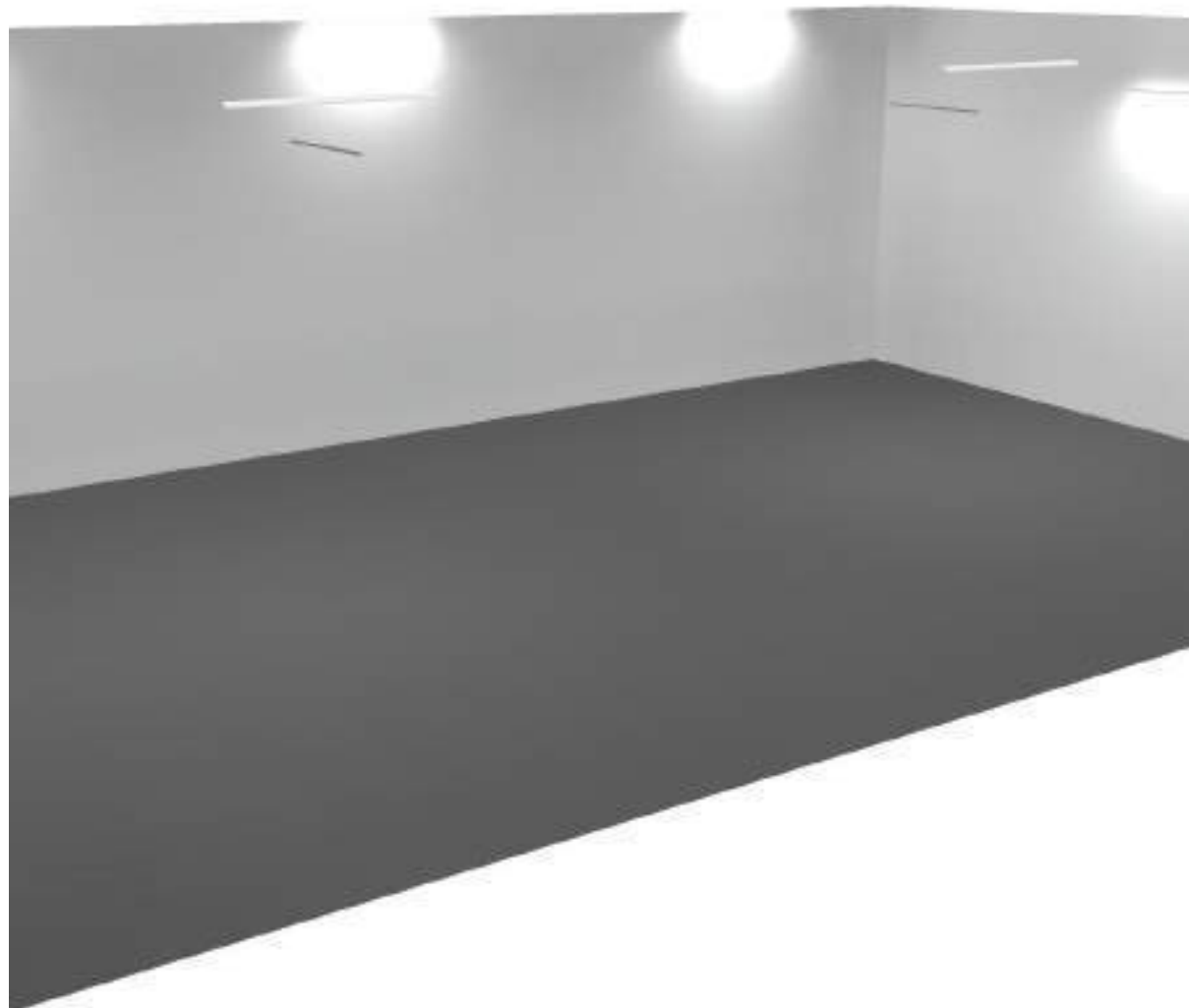
No.	Pieces	Designation (Correction Factor)	Φ (Luminaire) [lm]	Φ (Lamps) [lm]	P [W]
1	10	Philips BN308C LED60S-6500 L120 PSU WH (1.000)	5702	5700	45.5
Total:			57016	57000	455.1

Specific connected load: $3.77 \text{ W/m}^2 = 1.36 \text{ W/m}^2/100 \text{ lx}$ (Ground area: 120.76 m^2)



Operator
Telephone
Fax
e-Mail

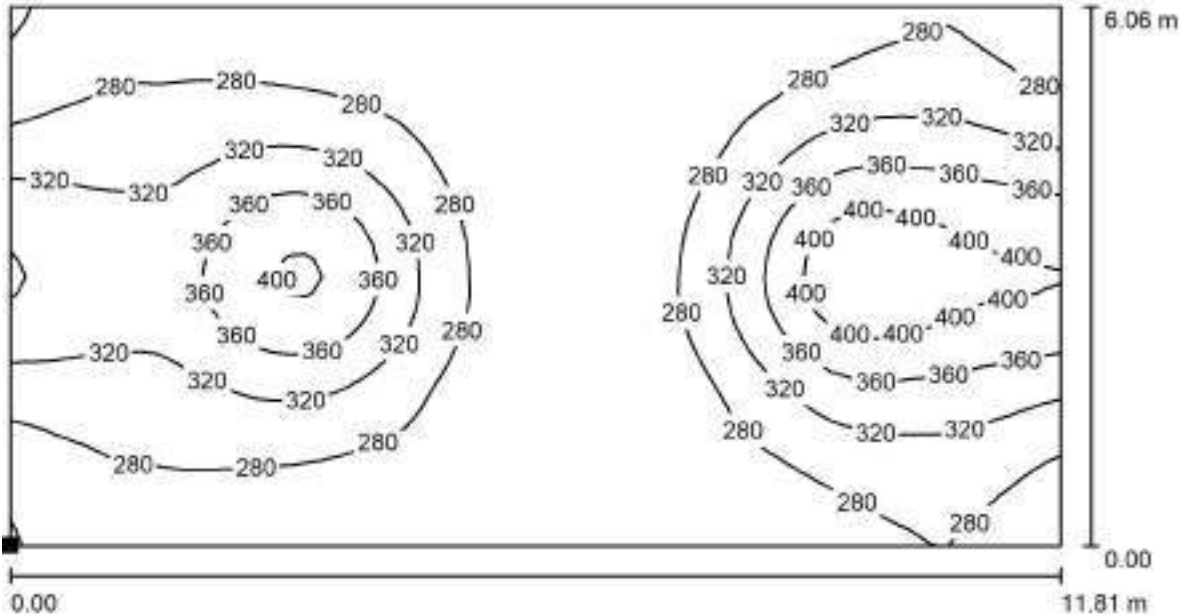
AHU Room / 3D Rendering





Operator
Telephone
Fax
e-Mail

AHU Room / Calculation Surface / Isolines (E, Perpendicular)



Values in Lux, Scale 1 : 85

Position of surface in room:
Marked point:
(66.775 m, 71.276 m, 1.000 m)

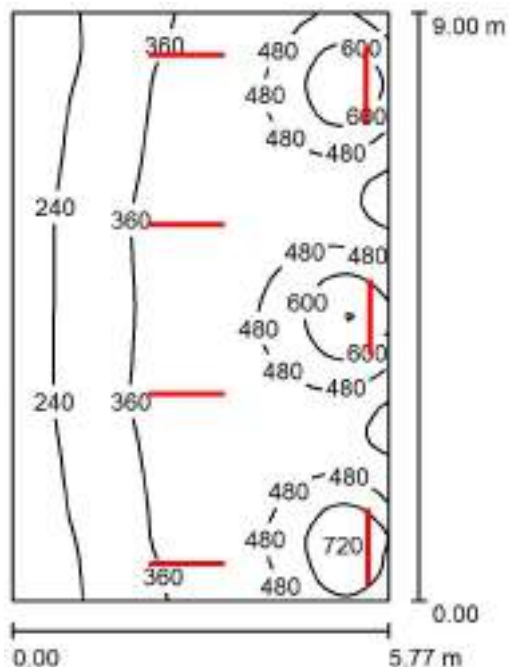


Grid: 64 x 32 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0	E_{min} / E_{max}
300	236	434	0.787	0.543

Operator
Telephone
Fax
e-Mail

Battery Room 2 / Summary



Height of Room: 6.300 m, Light loss factor: 0.80

Values in Lux, Scale 1:116

Surface	ρ [%]	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	$u0$
Workplane	/	396	168	735	0.424
Floor	20	333	185	439	0.556
Ceiling	70	80	57	95	0.703
Walls (4)	50	180	54	1140	/

Workplane:

Height: 1.000 m
Grid: 64 x 64 Points
Boundary Zone: 0.000 m

Luminaire Parts List

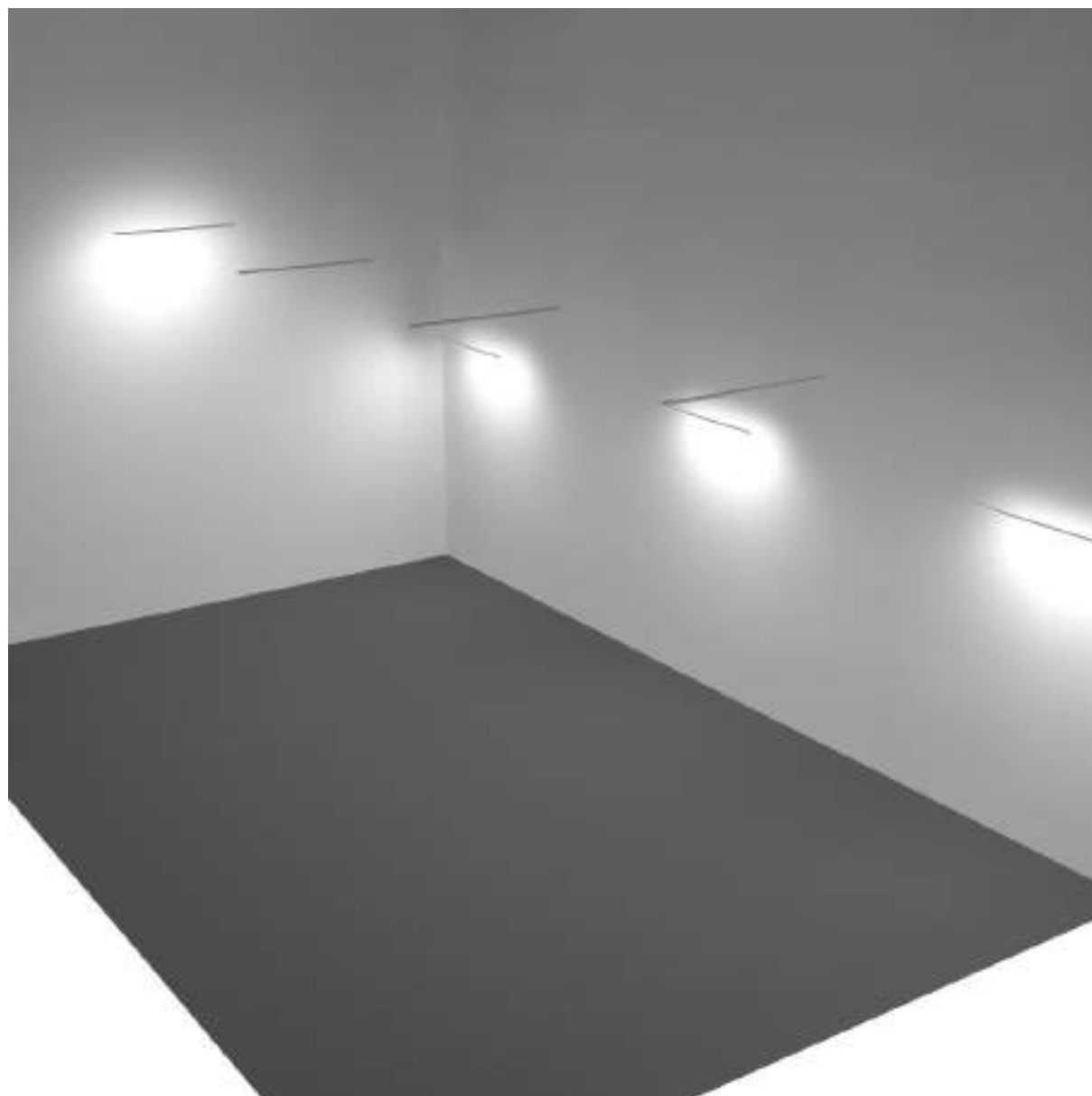
No.	Pieces	Designation (Correction Factor)	Φ (Luminaire) [lm]	Φ (Lamps) [lm]	P [W]
1	7	Philips BN308C LED60S-6500 L120 PSU WH (1.000)	5702	5700	45.5
Total:			39911	39900	318.6

Specific connected load: $6.13 \text{ W/m}^2 = 1.55 \text{ W/m}^2/100 \text{ lx}$ (Ground area: 51.93 m^2)



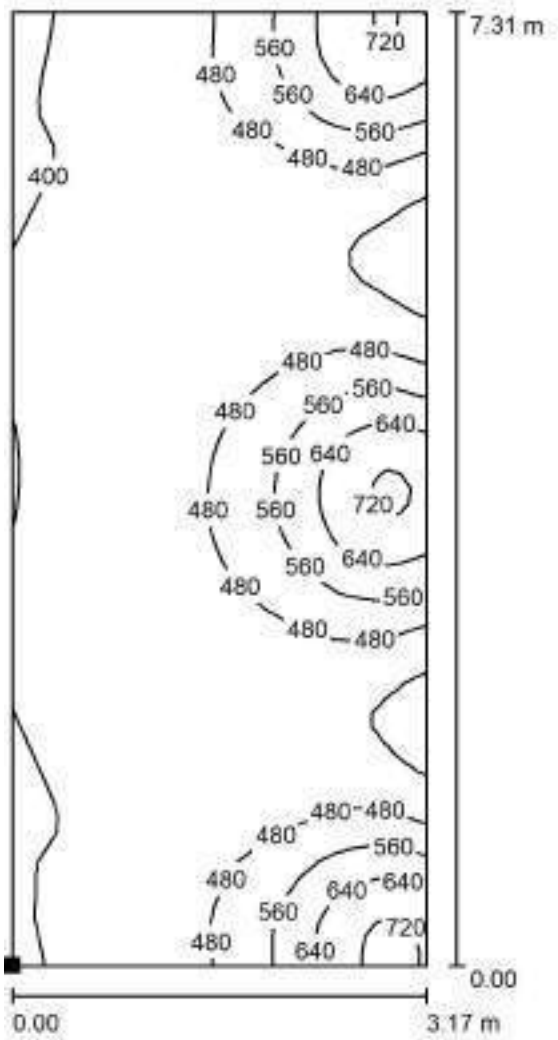
Operator
Telephone
Fax
e-Mail

Battery Room 2 / 3D Rendering

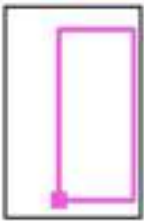


Operator
Telephone
Fax
e-Mail

Battery Room 2 / Calculation Surface / Isolines (E, Perpendicular)



Position of surface in room:
Marked point:
(118.116 m, 70.622 m, 1.000 m)



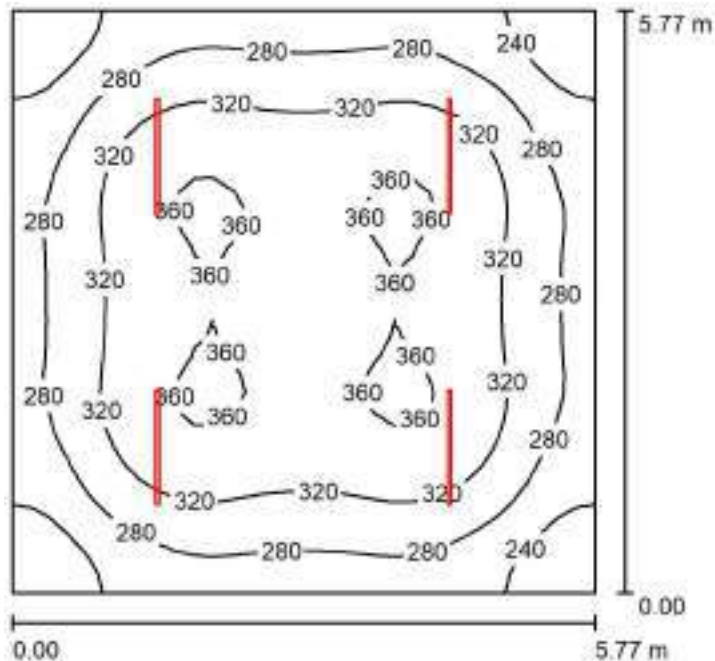
Values in Lux, Scale 1 : 58

Grid: 32 x 64 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0	E_{min} / E_{max}
472	359	746	0.761	0.481

Operator
Telephone
Fax
e-Mail

Maintenance Room / Summary



Height of Room: 6.300 m, Mounting Height: 3.800 m, Light loss factor: 0.80

Values in Lux, Scale 1:75

Surface	ρ [%]	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0
Workplane	/	308	202	368	0.655
Floor	20	250	176	295	0.705
Ceiling	70	61	46	71	0.744
Walls (4)	50	150	44	321	/

Workplane:

Height: 1.000 m
Grid: 32 x 32 Points
Boundary Zone: 0.000 m

UGR

Left Wall 23
Lower Wall 23
(CIE, SHR = 0.25.)

Lengthways-

23
23

Across

24
24

to luminaire axis

Luminaire Parts List

No.	Pieces	Designation (Correction Factor)	Φ (Luminaire) [lm]	Φ (Lamps) [lm]	P [W]
1	4	Philips BN308C LED60S-6500 L120 PSU WH (1.000)	5702	5700	45.5
Total:			22806	22800	182.0

Specific connected load: $5.47 \text{ W/m}^2 = 1.78 \text{ W/m}^2/100 \text{ lx}$ (Ground area: 33.28 m^2)



Operator
Telephone
Fax
e-Mail

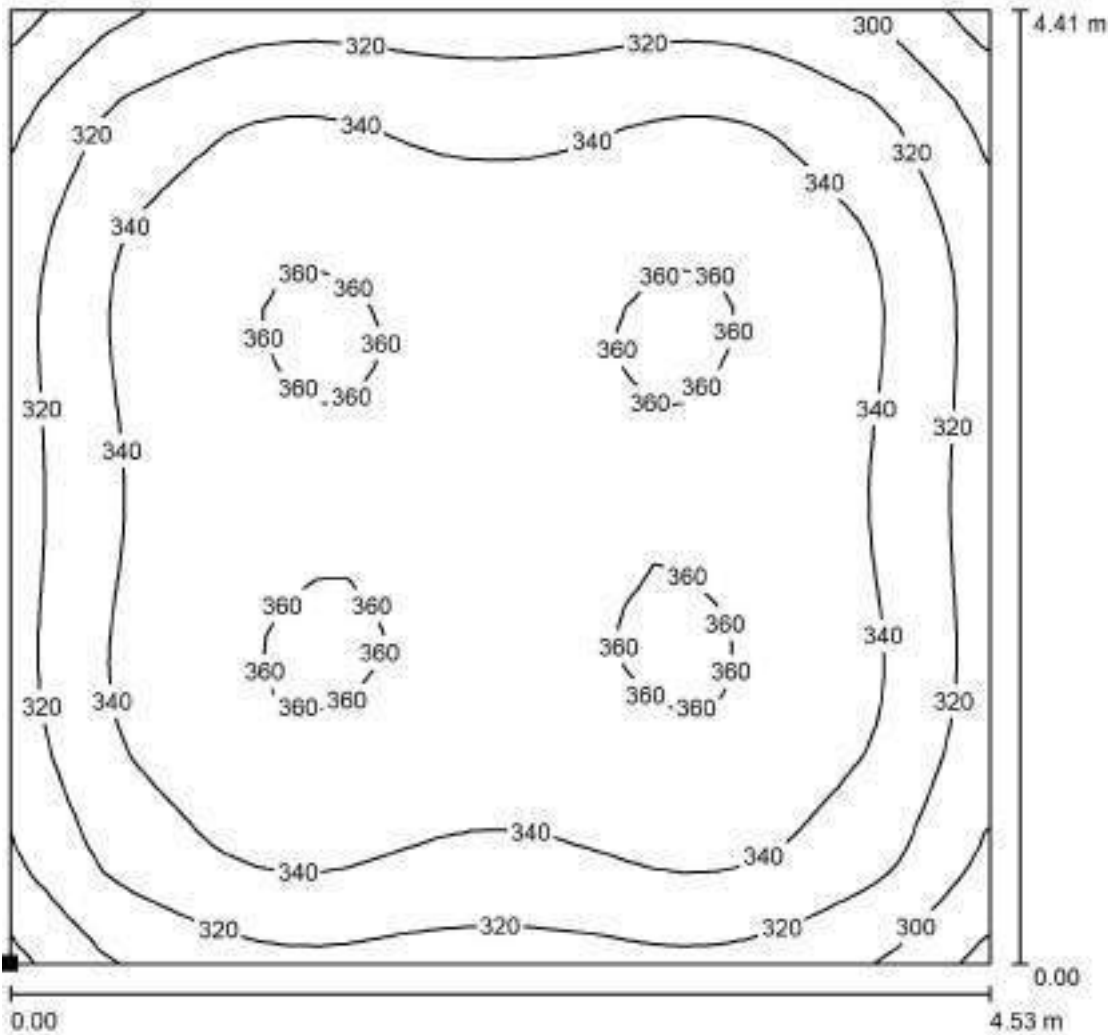
Maintenance Room / 3D Rendering





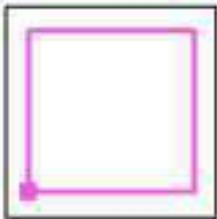
Operator
Telephone
Fax
e-Mail

Maintenance Room / Calculation Surface / Isolines (E, Perpendicular)



Values in Lux, Scale 1 : 35

Position of surface in room:
Marked point:
(116.449 m, 92.606 m, 1.000 m)

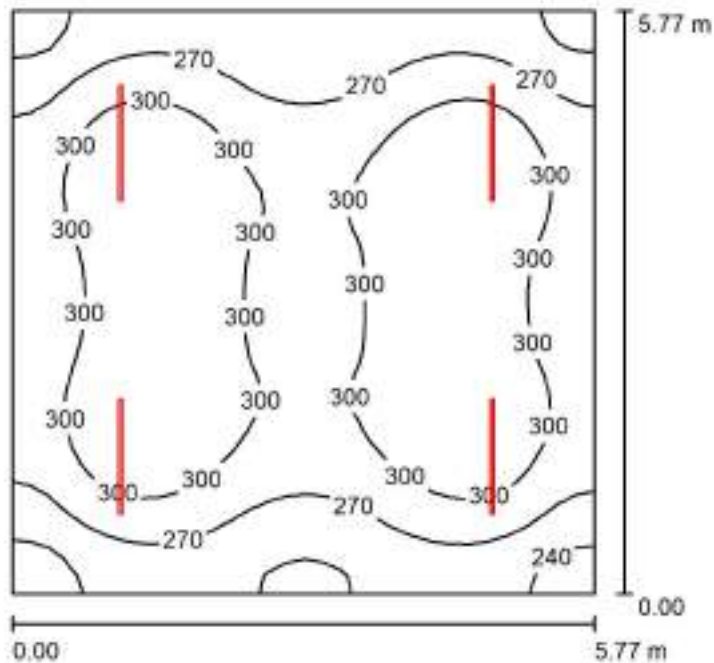


Grid: 32 x 32 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0	E_{min} / E_{max}
340	273	363	0.805	0.754

Operator
Telephone
Fax
e-Mail

Operation Room / Summary



Height of Room: 6.300 m, Mounting Height: 3.800 m, Light loss factor: 0.80

Values in Lux, Scale 1:75

Surface	ρ [%]	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0
Workplane	/	289	219	328	0.757
Floor	20	236	183	266	0.774
Ceiling	70	63	47	73	0.741
Walls (4)	50	155	47	485	/

Workplane:

Height: 1.000 m
Grid: 32 x 32 Points
Boundary Zone: 0.000 m

UGR

Left Wall
Lower Wall
(CIE, SHR = 0.25.)

Lengthways-

23
23

Across

24
24

to luminaire axis

Luminaire Parts List

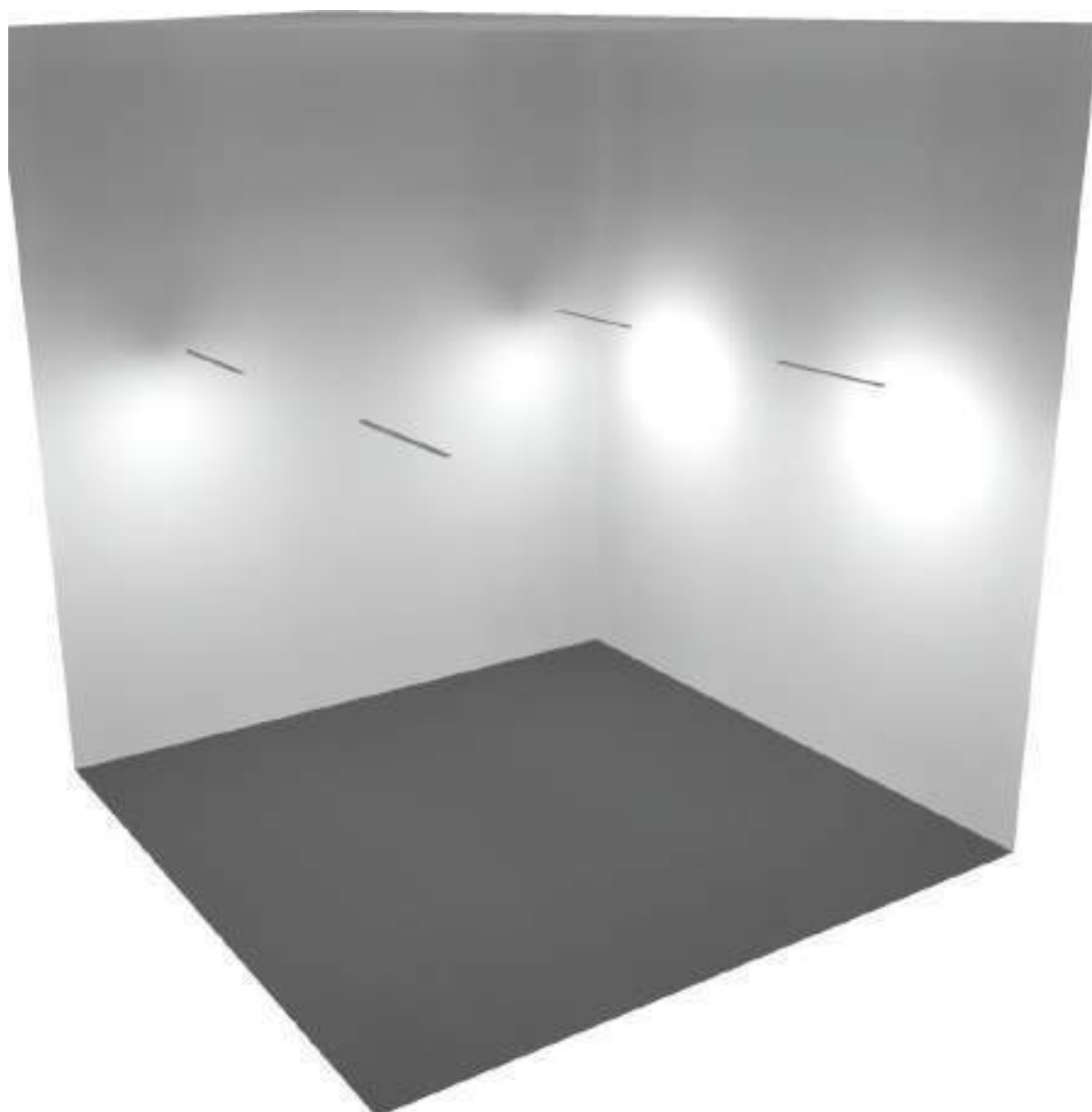
No.	Pieces	Designation (Correction Factor)	Φ (Luminaire) [lm]	Φ (Lamps) [lm]	P [W]
1	4	Philips BN308C LED60S-6500 L120 PSU WH (1.000)	5702	5700	45.5
Total:			22806	22800	182.0

Specific connected load: $5.47 \text{ W/m}^2 = 1.89 \text{ W/m}^2/100 \text{ lx}$ (Ground area: 33.29 m^2)



Operator
Telephone
Fax
e-Mail

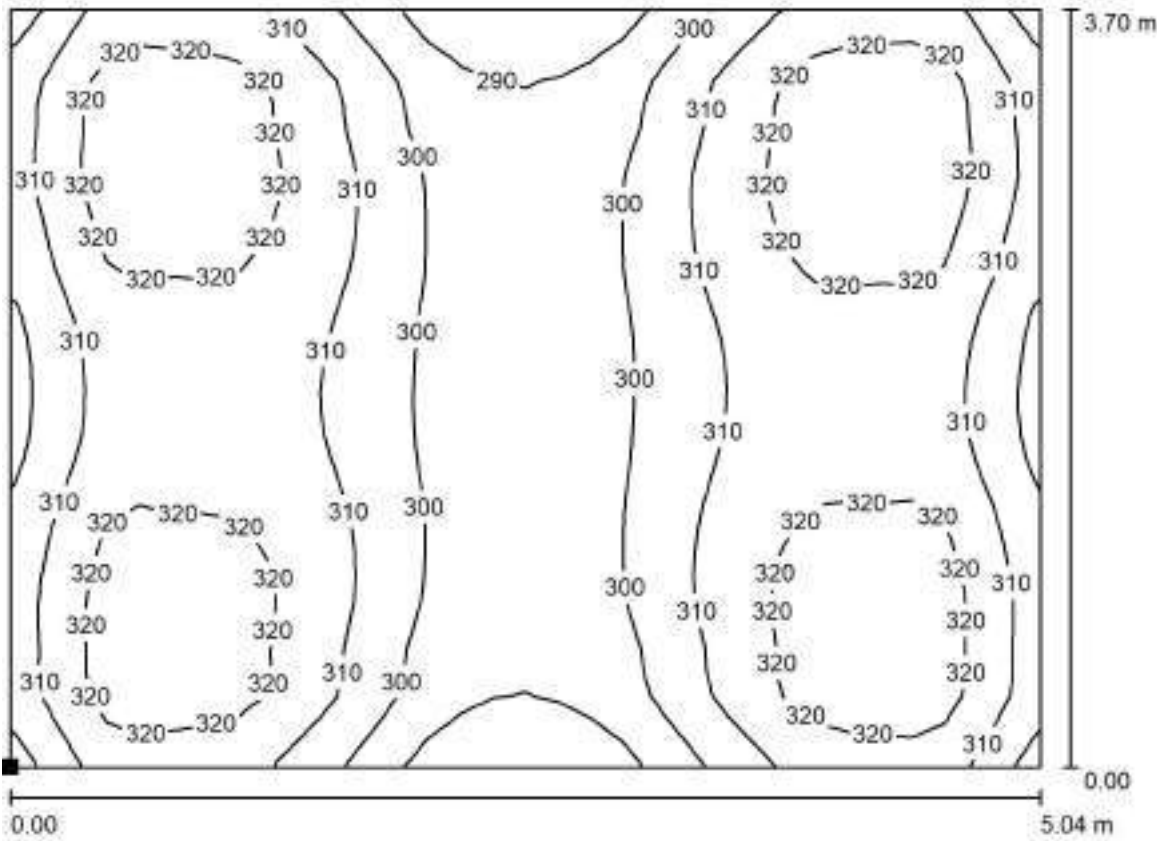
Operation Room / 3D Rendering





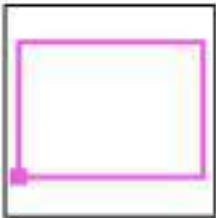
Operator
Telephone
Fax
e-Mail

Operation Room / Calculation Surface / Isolines (E, Perpendicular)



Values in Lux, Scale 1 : 37

Position of surface in room:
Marked point:
(110.211 m, 92.976 m, 1.000 m)



Grid: 32 x 32 Points

E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u_0	E_{min} / E_{max}
310	280	329	0.905	0.854

Project:
Location:
Contract:
Engineer:
Filename: TFM

ETAP
19.0.1C

Study Case: LF Normal

Page: 1
Date: 10-07-2023
SN:
Revision: Base
Config.: Normal

LOAD FLOW REPORT

Bus		Voltage		Generation		Load		Load Flow				XFMR	
ID	kV	kV	Ang.	kW	kvar	kW	kvar	ID	kW	kvar	Amp	%PF	%Tap
BUS 1 to AU-V REVAMP UNIT	33.000	32.973	0.0	0.0	0.0	0.0	0.0	Bus Prim TR-114B	2628.551	2093.672	58.8	78.2	
								BUS B 044-HT33-101	-2628.551	-2093.672	58.8	78.2	
BUS 1 to VDU UNIT	33.000	32.971	0.0	0.0	0.0	0.0	0.0	Bus Prim TR-109B	3078.273	1880.876	63.2	85.3	
								BUS A 044-HT33-101	-3078.273	-1880.876	63.2	85.3	
Bus 1 UPS101A	0.433	0.410	-4.4	0.0	0.0	21.2	7.0	BUS A 044-PMCC-103	-21.246	-6.983	31.5	95.0	
								044-UPS-101A	21.246	6.983	31.5	95.0	
Bus 1 UPS101C	0.433	0.431	-3.6	0.0	0.0	21.2	7.0	BUS B 044-PMCC-103	-21.246	-6.983	29.9	95.0	
								044-UPS-101C	21.246	6.983	29.9	95.0	
Bus 1 UPS102A	0.433	0.406	-4.1	0.0	0.0	21.2	10.3	BUS A 044-PMCC-103	-21.246	-10.290	33.6	90.0	
								044-UPS-102A	21.246	10.290	33.6	90.0	
Bus 1 UPS102C	0.433	0.428	-3.5	0.0	0.0	21.2	7.0	BUS B 044-PMCC-103	-21.246	-6.983	30.2	95.0	
								044-UPS-102C	21.246	6.983	30.2	95.0	
Bus 2 HT33	33.000	32.973	0.0	0.0	0.0	0.0	0.0	BUS Grid Power B	-10557.080	-3712.114	195.9	94.3	
								BUS B 044-HT33-101	10557.080	3712.114	195.9	94.3	
BUS 2 to AU-V REVAMP UNIT	33.000	32.971	0.0	0.0	0.0	0.0	0.0	Bus Prim TR-114A	2628.471	1744.552	55.2	83.3	
								BUS A 044-HT33-101	-2628.471	-1744.552	55.2	83.3	
BUS 2 to VDU UNIT	33.000	32.973	0.0	0.0	0.0	0.0	0.0	Bus Prim TR-109A	3129.212	1988.512	64.9	84.4	
								BUS B 044-HT33-101	-3129.212	-1988.512	64.9	84.4	
*Bus 2 UPS101A	0.110	0.110	0.0	10.6	1.9	0.0	0.0	Bus 3 UPS101A	10.623	1.941	56.7	98.4	
*Bus 2 UPS101C	0.110	0.110	0.0	10.6	1.9	0.0	0.0	Bus 3 UPS101C	10.623	1.941	56.7	98.4	
*Bus 2 UPS102A	0.110	0.110	0.0	10.6	1.9	0.0	0.0	Bus 3 UPS102A	10.623	1.941	56.7	98.4	
*Bus 2 UPS102C	0.110	0.110	0.0	10.6	1.9	0.0	0.0	Bus 3 UPS102C	10.623	1.941	56.7	98.4	
Bus 3 UPS101A	0.191	0.165	-10.4	0.0	0.0	9.3	0.0	Bus 2 UPS101A	-9.329	0.000	32.6	100.0	
Bus 3 UPS101C	0.191	0.165	-10.4	0.0	0.0	9.3	0.0	Bus 2 UPS101C	-9.329	0.000	32.6	100.0	
Bus 3 UPS102A	0.191	0.165	-10.4	0.0	0.0	9.3	0.0	Bus 2 UPS102A	-9.329	0.000	32.6	100.0	
Bus 3 UPS102C	0.191	0.165	-10.4	0.0	0.0	9.3	0.0	Bus 2 UPS102C	-9.329	0.000	32.6	100.0	
Bus 4 UPS101A	0.433	0.433	-3.2	0.0	0.0	0.0	0.0	BUS 044-EPMCC-101	0.000	0.000	0.0	0.0	
								Bus 5 UPS101A	0.000	0.000	0.0	0.0	-5.000
Bus 4 UPS101C	0.433	0.433	-3.2	0.0	0.0	0.0	0.0	BUS 044-EPMCC-101	0.000	0.000	0.0	0.0	
								Bus 5 UPS101C	0.000	0.000	0.0	0.0	-5.000
Bus 4 UPS102A	0.433	0.433	-3.2	0.0	0.0	0.0	0.0	BUS 044-EPMCC-101	0.000	0.000	0.0	0.0	

Project:
Location:
Contract:
Engineer:
Filename: TFM

ETAP
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Bus		Voltage		Generation		Load		Load Flow				XFMR	
ID	kV	kV	Ang.	kW	kvar	kW	kvar	ID	kW	kvar	Amp	%PF	%Tap
Bus 4 UPS102C	0.433	0.433	-3.2	0.0	0.0	0.0	0.0	Bus 5 UPS102A	0.000	0.000	0.0	0.0	
								Bus 044-EPMCC-101	0.000	0.000	0.0	0.0	
								Bus 5 UPS102C	0.000	0.000	0.0	0.0	
Bus 5 UPS101A	0.191	0.201	-3.2	0.0	0.0	0.0	0.0	Bus 4 UPS101A	0.000	0.000	0.0	0.0	
Bus 5 UPS101C	0.191	0.201	-3.2	0.0	0.0	0.0	0.0	Bus 4 UPS101C	0.000	0.000	0.0	0.0	
Bus 5 UPS102A	0.191	0.191	-3.2	0.0	0.0	0.0	0.0	Bus 4 UPS102A	0.000	0.000	0.0	0.0	
Bus 5 UPS102C	0.191	0.191	-3.2	0.0	0.0	0.0	0.0	Bus 4 UPS102C	0.000	0.000	0.0	0.0	
BUS 044-ELDB-101	0.415	0.424	-4.4	0.0	0.0	2.1	0.0	BUS B EMLDB-101	-2.085	0.000	2.8	100.0	
BUS 044-ELDB-102	0.415	0.420	-4.4	0.0	0.0	2.1	0.0	BUS B EMLDB-101	-2.051	0.000	2.8	100.0	
BUS 044-ELDB-103	0.415	0.422	-4.4	0.0	0.0	2.1	0.0	BUS A 044-EMLDB-101	-2.070	0.000	2.8	100.0	
BUS 044-ELDB-104	0.415	0.416	-4.4	0.0	0.0	4.0	0.0	BUS A 044-EMLDB-101	-4.019	0.000	5.6	100.0	
BUS 044-ELDB-105	0.415	0.422	-4.4	0.0	0.0	2.1	0.0	BUS B EMLDB-101	-2.066	0.000	2.8	100.0	
BUS 044-ELDB-106	0.415	0.423	-4.4	0.0	0.0	2.1	0.0	BUS A 044-EMLDB-101	-2.077	0.000	2.8	100.0	
BUS 044-ELDB-107	0.415	0.411	-4.4	0.0	0.0	2.0	0.0	BUS A 044-EMLDB-101	-1.957	0.000	2.8	100.0	
BUS 044-ELDB-108	0.415	0.417	-4.4	0.0	0.0	2.0	0.0	BUS B EMLDB-101	-2.018	0.000	2.8	100.0	
BUS 044-ELDB-109	0.415	0.421	-4.4	0.0	0.0	2.1	0.0	BUS A 044-EMLDB-101	-2.060	0.000	2.8	100.0	
BUS 044-ELDB-110	0.415	0.419	-4.4	0.0	0.0	2.0	0.0	BUS B EMLDB-101	-2.038	0.000	2.8	100.0	
BUS 044-ELDB-111	0.415	0.412	-4.4	0.0	0.0	2.0	0.0	BUS A 044-EMLDB-101	-1.973	0.000	2.8	100.0	
BUS 044-ELDB-112	0.415	0.419	-4.4	0.0	0.0	2.0	0.0	BUS B EMLDB-101	-2.038	0.000	2.8	100.0	
BUS 044-ELDB-113	0.415	0.419	-4.4	0.0	0.0	2.0	0.0	BUS A 044-EMLDB-101	-2.038	0.000	2.8	100.0	
BUS 044-ELDB-114	0.415	0.417	-4.4	0.0	0.0	2.0	0.0	BUS B EMLDB-101	-2.018	0.000	2.8	100.0	
BUS 044-ELDB-115	0.415	0.413	-4.4	0.0	0.0	2.0	0.0	BUS A 044-EMLDB-101	-1.977	0.000	2.8	100.0	
BUS 044-EPMCC-101	0.415	0.433	-3.2	0.0	0.0	452.8	231.2	Bus 4 UPS102A	0.000	0.000	0.0	0.0	
								Bus 4 UPS101A	0.000	0.000	0.0	0.0	
								Bus 4 UPS101C	0.000	0.000	0.0	0.0	
								Bus to Charger-DCDB101B	16.220	7.850	24.0	90.0	
								Bus Prim TR-108B	0.000	0.000	0.0	0.0	
								Bus to Charger-DCDB102	36.144	17.454	53.5	90.1	
								BUS HVAC EPMCC	143.906	69.670	213.0	90.0	
								Bus 4 UPS102C	0.000	0.000	0.0	0.0	
								Bus Prim TR-105A	-649.050	-326.127	967.9	89.4	
								BUS A 044-HT6-101	-558.608	-238.655	51.0	92.0	
BUS 044-HT6-102	6.900	6.874	-1.9	0.0	0.0	558.6	238.7	Bus Prim TR-105C	0.000	0.000	0.0	0.0	

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ID	kV	kV	Ang.	kW	kvar	kW	kvar	ID	kW	kvar	Amp	%PF	%Tap
BUS 044-HT11-101	11.000	10.993	0.0	0.0	0.0	1062.2	658.3	BUS Emergency Supply	-1062.223	-658.307	65.6	85.0	
								Bus Prim TR-106A	0.000	0.000	0.0	0.0	
BUS 044-LDB-101	0.415	0.435	-4.2	0.0	0.0	3.3	0.0	BUS B 044-MLDB-101	-3.292	0.000	4.4	100.0	
BUS 044-LDB-102	0.415	0.429	-4.2	0.0	0.0	5.3	0.0	BUS B 044-MLDB-101	-5.344	0.000	7.2	100.0	
BUS 044-LDB-103	0.415	0.427	-4.8	0.0	0.0	3.2	0.0	BUS A 044-MLDB-101	-3.175	0.000	4.3	100.0	
BUS 044-LDB-104	0.415	0.430	-4.8	0.0	0.0	3.2	0.0	BUS A 044-MLDB-101	-3.224	0.000	4.3	100.0	
BUS 044-LDB-105	0.415	0.434	-4.2	0.0	0.0	3.3	0.0	BUS B 044-MLDB-101	-3.278	0.000	4.4	100.0	
BUS 044-LDB-106	0.415	0.429	-4.3	0.0	0.0	3.2	0.0	BUS A 044-MLDB-102	-3.200	0.000	4.3	100.0	
BUS 044-LDB-107	0.415	0.419	-4.5	0.0	0.0	5.1	0.0	BUS B 044-MLDB-102	-5.097	0.000	7.0	100.0	
BUS 044-LDB-108	0.415	0.430	-4.3	0.0	0.0	5.4	0.0	BUS A 044-MLDB-102	-5.364	0.000	7.2	100.0	
BUS 044-LDB-109	0.415	0.431	-4.8	0.0	0.0	5.4	0.0	BUS A 044-MLDB-101	-5.385	0.000	7.2	100.0	
BUS 044-LDB-110	0.415	0.427	-4.8	0.0	0.0	5.3	0.0	BUS A 044-MLDB-101	-5.299	0.000	7.2	100.0	
BUS 044-LDB-111	0.415	0.427	-4.8	0.0	0.0	5.3	0.0	BUS A 044-MLDB-101	-5.291	0.000	7.2	100.0	
BUS 044-LDB-112	0.415	0.427	-4.8	0.0	0.0	5.3	0.0	BUS A 044-MLDB-101	-5.299	0.000	7.2	100.0	
BUS 044-LDB-113	0.415	0.421	-4.8	0.0	0.0	5.1	0.0	BUS A 044-MLDB-101	-5.149	0.000	7.1	100.0	
BUS 044-LDB-114	0.415	0.424	-4.2	0.0	0.0	5.2	0.0	BUS B 044-MLDB-101	-5.210	0.000	7.1	100.0	
BUS 044-LDB-115	0.415	0.431	-4.9	0.0	0.0	4.3	0.0	BUS A 044-MLDB-101	-4.314	0.000	5.8	100.0	
BUS 044-LDB-116	0.415	0.428	-4.3	0.0	0.0	2.3	0.0	BUS A 044-MLDB-102	-2.345	0.000	3.2	100.0	
BUS 044-LDB-117	0.415	0.418	-4.5	0.0	0.0	2.2	0.0	BUS B 044-MLDB-102	-2.228	0.000	3.1	100.0	
BUS 044-PDB-101	0.415	0.434	-4.8	0.0	0.0	4.4	0.0	BUS A 044-MLDB-101	-4.376	0.000	5.8	100.0	
BUS 044-PDB-102	0.415	0.432	-4.2	0.0	0.0	4.3	0.0	BUS B 044-MLDB-101	-4.335	0.000	5.8	100.0	
BUS 044-PDB-103	0.415	0.430	-4.8	0.0	0.0	4.3	0.0	BUS A 044-MLDB-101	-4.295	0.000	5.8	100.0	
BUS 044-PDB-104	0.415	0.428	-4.2	0.0	0.0	4.3	0.0	BUS B 044-MLDB-101	-4.264	0.000	5.7	100.0	
BUS 044-PDB-105	0.415	0.424	-4.2	0.0	0.0	20.9	0.0	BUS B 044-MLDB-101	-20.904	0.000	28.4	100.0	
BUS A 044-ASB-101	0.415	0.411	-4.4	0.0	0.0	82.7	8.6	BUS A 044-PMCC-103	-82.735	-8.617	116.9	99.5	
BUS A 044-ASB-102	0.415	0.411	-4.4	0.0	0.0	62.0	0.1	BUS A 044-PMCC-103	-62.034	-0.071	87.1	100.0	
BUS A 044-EMLDB-101	0.415	0.426	-4.4	0.0	0.0	0.0	0.0	BUS 044-ELDB-103	2.086	0.000	2.8	100.0	
								BUS 044-ELDB-104	4.111	0.001	5.6	100.0	
								BUS 044-ELDB-106	2.090	0.000	2.8	100.0	
								BUS 044-ELDB-107	2.029	0.001	2.8	100.0	
								BUS 044-ELDB-109	2.081	0.000	2.8	100.0	
								BUS 044-ELDB-111	2.037	0.001	2.8	100.0	
								BUS 044-ELDB-113	2.070	0.000	2.8	100.0	

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ID	kV	kV	Ang.	kW	kvar	kW	kvar	ID	kW	kvar	Amp	%PF	%Tap																					
BUS A 044-HT6-101	6.600	6.874	-1.9	0.0	0.0	1466.2	797.8	BUS 044-ELDB-115	2.039	0.001	2.8	100.0																						
								Bus Prim TR-108A	-40.505	-0.016	55.0	100.0																						
								BUS B EMLDB-101	21.962	0.012	29.8	100.0																						
								BUS 044-HT6-102	558.616	238.664	51.0	92.0																						
								Bus Prim TR-103A	1058.654	423.920	95.8	92.8																						
								Bus Prim TR-104A	1215.685	609.063	114.2	89.4																						
								Bus Prim TR-105A	651.107	346.620	62.0	88.3																						
								Bus Prim TR-102A	1130.653	466.481	102.7	92.4																						
BUS A 044-HT33-101	33.000	32.971	0.0	0.0	0.0	0.0	0.0	Bus Prim TR-101A	-6083.683	-124.110	511.1	100.0																						
								Bus to CB-101A	2.769	-2758.447	231.7	-0.1																						
								BUS Grid Power A	-11800.500	-3949.834	217.9	94.8																						
								Bus to ext. 1	0.000	0.000	0.0	0.0																						
								BUS 2 to AU-V REVAMP UNIT	2628.471	1744.552	55.2	83.3																						
								BUS 1 to VDU UNIT	3078.273	1880.876	63.2	85.3																						
								Bus to TR101A	6093.751	324.406	106.9	99.9																						
								BUS A 044-PMCC-101	-174.644	-88.154	261.7	89.3																						
BUS A 044-MCC-102	0.415	0.431	-4.0	0.0	0.0	68.4	33.1	Cab VFD-ACM 201 A1~	34.218	0.000	45.8	100.0																						
Cab VFD-ACM B1~								34.218	0.000	45.8	100.0																							
Cab VFD-ACM D1~								34.050	0.000	45.6	100.0																							
Cab VFD-ACM D2~								34.073	0.000	45.6	100.0																							
Cab VFD-ACM F1~								34.100	0.000	45.6	100.0																							
Cab VFD-ACM H1~								34.167	0.000	45.7	100.0																							
BUS A 044-PMCC-101								-273.204	-33.085	368.4	99.3																							
BUS A 044-MCC-103								0.415	0.432	-3.9	0.0	0.0	138.2	66.3	BUS A 044-PMCC-102	-276.117	-66.266	379.6	97.2															
Cab VFD-ACM K1~	34.208	0.000	45.7	100.0																														
Cab VFD-ACM M1~	34.490	0.000	46.1	100.0																														
Cab VFD-ACM N1~	34.562	0.000	46.2	100.0																														
Cab VFD-ACM Q1~	34.635	0.000	46.3	100.0																														
BUS A 044-MCC-104	0.415	0.431	-4.0	0.0	0.0	210.5	105.0								Cab VFD-ACM 202 A1~	2.882	-12.341	17.0	-22.7															
BUS A 044-PMCC-101															-213.388	-92.702	311.3	91.7																
BUS A 044-MCC-105															0.415	0.432	-3.8	0.0	0.0	139.4	73.8	BUS A 044-PMCC-102	-139.376	-73.770	210.6	88.4								
BUS A 044-MCC-106								0.415	0.432	-3.9	0.0	0.0	231.8	63.7								BUS A 044-PMCC-102	-231.788	-63.700	321.2	96.4								
BUS A 044-MCC-107																						0.415	0.411	-4.4	0.0	0.0	141.5	74.1	BUS A 044-PMCC-103	-141.540	-74.107	224.5	88.6	

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ID	kV	kV	Ang.	kW	kvar	kW	kvar	ID	kW	kvar	Amp	%PF	%Tap
BUS A 044-MLDB-101	0.415	0.438	-4.8	0.0	0.0	0.0	0.0	BUS 044-LDB-103	3.255	0.001	4.3	100.0	
								BUS 044-LDB-104	3.280	0.001	4.3	100.0	
								BUS 044-LDB-109	5.472	0.002	7.2	100.0	
								BUS 044-LDB-110	5.429	0.002	7.2	100.0	
								BUS 044-LDB-111	5.425	0.002	7.2	100.0	
								BUS 044-LDB-112	5.429	0.002	7.2	100.0	
								BUS 044-LDB-113	5.351	0.002	7.1	100.0	
								BUS 044-LDB-115	4.381	0.003	5.8	100.0	
								BUS 044-PDB-101	4.412	0.000	5.8	100.0	
								BUS 044-PDB-103	4.371	0.001	5.8	100.0	
							Bus Prim TR-107A	-46.806	-0.016	61.7	100.0		
BUS A 044-MLDB-102	0.415	0.434	-4.3	0.0	0.0	0.0	0.0	BUS 044-LDB-116	2.377	0.000	3.2	100.0	
								BUS 044-LDB-106	3.243	0.000	4.3	100.0	
								BUS 044-LDB-108	5.420	0.001	7.2	100.0	
								BUS B 044-MLDB-101	-11.040	-0.001	14.7	100.0	
BUS A 044-PMCC-101	0.415	0.432	-4.0	0.0	0.0	464.3	202.8	BUS A 044-MCC-101	174.921	88.256	261.7	89.3	
								BUS A 044-MCC-102	273.752	33.286	368.4	99.3	
								BUS A 044-MCC-104	213.779	92.845	311.3	91.7	
								Bus Prim TR-102A	-1126.765	-417.224	1605.0	93.8	
BUS A 044-PMCC-102	0.415	0.433	-3.9	0.0	0.0	406.8	177.0	BUS A 044-MCC-103	276.727	66.490	379.6	97.2	
								BUS A 044-MCC-105	139.564	73.839	210.6	88.4	
								BUS A 044-MCC-106	232.225	63.860	321.2	96.4	
								Bus Prim TR-103A	-1055.323	-381.164	1496.4	94.1	
BUS A 044-PMCC-103	0.415	0.411	-4.4	0.0	0.0	399.4	174.9	BUS A 044-ASB-101	82.860	8.647	116.9	99.5	
								BUS A 044-ASB-102	62.090	0.088	87.1	100.0	
								BUS A 044-MCC-107	141.754	74.185	224.5	88.6	
								Bus 1 UPS101A	21.328	7.003	31.5	95.0	
								Bus 1 UPS102A	21.587	10.333	33.6	90.2	
								BUS to HVAC-1	418.173	258.836	690.2	85.0	
								Bus to Charger-DCDB101A	16.232	7.850	25.3	90.0	
								Bus Prim TR-107A	47.076	0.392	66.1	100.0	
								Bus Prim TR-104A	-1210.526	-542.263	1861.6	91.3	
BUS AAU-V REVAMP	6.600	6.714	-1.7	0.0	0.0	2618.1	1963.6	Bus Prim TR-114A	-2618.138	-1963.603	281.4	80.0	

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BUS A to VDU UNIT	6.600	6.708	-2.1	0.0	0.0	3115.5	1927.8	Bus Prim TR-109A	-3115.529	-1927.767	315.3	85.0	
BUS B 044-ASB-101	0.415	0.433	-3.6	0.0	0.0	35.2	2.6	BUS B 044-PMCC-103	-35.184	-2.636	47.1	99.7	
BUS B 044-ASB-102	0.415	0.432	-3.6	0.0	0.0	65.3	0.1	BUS B 044-PMCC-103	-65.282	-0.066	87.2	100.0	
BUS B 044-HT6-101	6.600	6.902	-1.5	0.0	0.0	1433.7	774.8	Bus Prim TR-103B	1103.965	460.632	100.1	92.3	
								Bus Prim TR-104B	1147.711	549.561	106.5	90.2	
								Bus Prim TR-105B	0.000	0.000	0.0	0.0	
								Bus Prim TR-102B	1104.843	500.813	101.5	91.1	
								Bus Prim TR-101B	-4793.054	494.674	403.1	-99.5	
								Bus to CB-101B	2.791	-2780.471	232.6	-0.1	
BUS B 044-HT33-101	33.000	32.973	0.0	0.0	0.0	0.0	0.0	Bus to TR101B	4799.317	-370.070	84.3	-99.7	
								BUS 1 to AU-V REVAMP UNIT	2628.551	2093.672	58.8	78.2	
								Bus to ext. 2	0.000	0.000	0.0	0.0	
								BUS 2 to VDU UNIT	3129.212	1988.512	64.9	84.4	
								Bus 2 HT33	-10557.080	-3712.114	195.9	94.3	
BUS B 044-MCC-101	0.415	0.433	-3.5	0.0	0.0	203.0	101.0	BUS B 044-PMCC-101	-203.023	-100.976	302.5	89.5	
BUS B 044-MCC-102	0.415	0.433	-3.5	0.0	0.0	136.6	66.1	Cab VFD-ACM C1~	34.218	0.000	45.7	100.0	
								Cab VFD-ACM E1~	34.050	0.000	45.4	100.0	
								Cab VFD-ACM G1~	34.100	0.000	45.5	100.0	
								Cab VFD-ACM J1~	34.191	0.000	45.6	100.0	
								BUS B 044-PMCC-101	-273.199	-66.144	375.1	97.2	
BUS B 044-MCC-103	0.415	0.433	-3.5	0.0	0.0	172.5	82.8	BUS B 044-PMCC-102	-275.905	-82.816	384.0	95.8	
								Cab to VFD-ACM L1~	34.235	0.000	45.6	100.0	
								Cab to VFD-ACM P1~	34.561	0.000	46.1	100.0	
								Cab to VFD-ACM R1~	34.634	0.000	46.2	100.0	
BUS B 044-MCC-104	0.415	0.433	-3.5	0.0	0.0	213.5	106.9	BUS B 044-PMCC-101	-213.482	-106.902	318.5	89.4	
BUS B 044-MCC-105	0.415	0.434	-3.5	0.0	0.0	139.4	73.8	BUS B 044-PMCC-102	-139.350	-73.778	210.0	88.4	
BUS B 044-MCC-106	0.415	0.434	-3.5	0.0	0.0	126.7	14.6	BUS B 044-PMCC-102	-126.713	-14.631	169.8	99.3	
BUS B 044-MCC-107	0.415	0.432	-3.6	0.0	0.0	118.8	59.5	BUS B 044-PMCC-103	-118.836	-59.469	177.4	89.4	
BUS B 044-MLDB-101	0.415	0.437	-4.2	0.0	0.0	0.0	0.0	BUS 044-LDB-101	3.312	0.000	4.4	100.0	
								BUS 044-LDB-102	5.449	0.002	7.2	100.0	
								BUS 044-LDB-105	3.306	0.000	4.4	100.0	
								BUS 044-LDB-114	5.380	0.003	7.1	100.0	
								BUS 044-PDB-102	4.389	0.001	5.8	100.0	

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Bus		Voltage		Generation		Load		Load Flow				XFMR	
ID	kV	kV	Ang.	kW	kvar	kW	kvar	ID	kW	kvar	Amp	%PF	%Tap
BUS B 044-MLDB-102	0.415	0.423	-4.5	0.0	0.0	0.0	0.0	BUS 044-PDB-104	4.353	0.001	5.7	100.0	
								BUS 044-PDB-105	21.552	0.027	28.4	100.0	
								BUS A 044-MLDB-102	11.118	0.020	14.7	100.0	
								Bus Prim TR-107B	-58.859	-0.055	77.7	100.0	
								BUS 044-LDB-107	5.151	0.001	7.0	100.0	
BUS B 044-PMCC-101	0.415	0.434	-3.5	0.0	0.0	410.0	178.2	BUS 044-LDB-117	2.259	0.000	3.1	100.0	
								BUS B EMLDB-101	-7.409	-0.001	10.1	100.0	
								BUS B 044-MCC-101	203.392	101.112	302.5	89.5	
								BUS B 044-MCC-102	273.767	66.352	375.1	97.2	
								BUS B 044-MCC-104	213.892	107.052	318.5	89.4	
BUS B 044-PMCC-102	0.415	0.434	-3.5	0.0	0.0	557.4	242.4	Bus Prim TR-102B	-1101.049	-452.746	1585.4	92.5	
								BUS B 044-MCC-103	276.530	83.045	384.0	95.8	
								BUS B 044-MCC-105	139.537	73.846	210.0	88.4	
								BUS B 044-MCC-106	126.835	14.675	169.8	99.3	
								Bus Prim TR-103B	-1100.329	-413.959	1563.4	93.6	
BUS B 044-PMCC-103	0.415	0.433	-3.6	0.0	0.0	354.8	155.4	BUS B 044-ASB-101	35.204	2.641	47.1	99.7	
								BUS B 044-ASB-102	65.338	0.083	87.2	100.0	
								BUS B 044-MCC-107	118.969	59.518	177.4	89.4	
								Bus 1 UPS101C	21.320	7.001	29.9	95.0	
								Bus 1 UPS102C	21.521	7.018	30.2	95.1	
BUS B AU-REVAMP	6.600	6.714	-1.7	0.0	0.0	2618.2	1963.6	BUS to HVAC-2	426.241	263.856	668.7	85.0	
								Bus Prim TR-108A	40.936	0.602	54.6	100.0	
								Bus Prim TR-107B	59.283	0.647	79.1	100.0	
								Bus Prim TR-104B	-1143.634	-496.793	1663.1	91.7	
								Bus Prim TR-114B	-2618.195	-1963.646	281.4	80.0	
BUS B EMLDB-101	0.415	0.426	-4.4	0.0	0.0	0.0	0.0	BUS 044-ELDB-101	2.094	0.000	2.8	100.0	
								BUS 044-ELDB-102	2.077	0.000	2.8	100.0	
								BUS 044-ELDB-105	2.084	0.000	2.8	100.0	
								BUS 044-ELDB-108	2.060	0.000	2.8	100.0	
								BUS 044-ELDB-110	2.070	0.000	2.8	100.0	
								BUS 044-ELDB-112	2.070	0.000	2.8	100.0	
								BUS 044-ELDB-114	2.060	0.000	2.8	100.0	
								BUS B 044-MLDB-102	7.447	0.010	10.1	100.0	

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ID	kV	kV	Ang.	kW	kvar	kW	kvar	ID	kW	kvar	Amp	%PF	%Tap
								BUS A 044-EMLDB-101	-21.962	-0.012	29.8	100.0	
BUS B to VDU UNIT	6.600	6.420	-2.0	0.0	0.0	3065.5	1896.8	Bus Prim TR-109B	-3065.521	-1896.823	324.2	85.0	
*BUS Emergency Supply	11.000	11.000	0.0	1062.8	659.0	0.0	0.0	BUS 044-HT11-101	1062.755	658.995	65.6	85.0	
*BUS Grid Power A	33.000	33.000	0.0	11810.5	3955.1	0.0	0.0	BUS A 044-HT33-101	11810.450	3955.085	217.9	94.8	
*BUS Grid Power B	33.000	33.000	0.0	10565.1	3716.4	0.0	0.0	Bus 2 HT33	10565.130	3716.360	195.9	94.3	
BUS HVAC EPMCC	0.415	0.426	-3.2	0.0	0.0	141.6	68.6	BUS 044-EPMCC-101	-141.592	-68.576	213.0	90.0	
Bus Prim TR-101A	33.000	32.970	0.0	0.0	0.0	0.0	0.0	Bus to TR101A	-6093.697	-324.377	106.9	99.9	
								BUS A 044-HT6-101	6093.697	324.377	106.9	99.9	
Bus Prim TR-101B	33.000	32.973	0.0	0.0	0.0	0.0	0.0	Bus to TR101B	-4799.283	370.088	84.3	-99.7	
								BUS B 044-HT6-101	4799.283	-370.088	84.3	-99.7	
Bus Prim TR-102A	6.600	6.873	-1.9	0.0	0.0	0.0	0.0	BUS A 044-HT6-101	-1130.543	-466.340	102.7	92.4	
								BUS A 044-PMCC-101	1130.543	466.340	102.7	92.4	2.500
Bus Prim TR-102B	6.600	6.901	-1.5	0.0	0.0	0.0	0.0	BUS B 044-HT6-101	-1104.736	-500.675	101.5	91.1	
								BUS B 044-PMCC-101	1104.736	500.675	101.5	91.1	2.500
Bus Prim TR-103A	6.600	6.874	-1.9	0.0	0.0	0.0	0.0	BUS A 044-HT6-101	-1058.608	-423.860	95.8	92.8	
								BUS A 044-PMCC-102	1058.608	423.860	95.8	92.8	2.500
Bus Prim TR-103B	6.600	6.901	-1.5	0.0	0.0	0.0	0.0	BUS B 044-HT6-101	-1103.914	-460.566	100.1	92.3	
								BUS B 044-PMCC-102	1103.914	460.566	100.1	92.3	2.500
Bus Prim TR-104A	6.600	6.874	-1.9	0.0	0.0	0.0	0.0	BUS A 044-HT6-101	-1215.663	-609.034	114.2	89.4	
								BUS A 044-PMCC-103	1215.663	609.034	114.2	89.4	2.500
Bus Prim TR-104B	6.600	6.901	-1.5	0.0	0.0	0.0	0.0	BUS B 044-HT6-101	-1147.691	-549.535	106.5	90.2	
								BUS B 044-PMCC-103	1147.691	549.535	106.5	90.2	2.500
Bus Prim TR-105A	6.600	6.874	-1.9	0.0	0.0	0.0	0.0	BUS A 044-HT6-101	-651.098	-346.609	62.0	88.3	
								BUS 044-EPMCC-101	651.098	346.609	62.0	88.3	2.500
Bus Prim TR-105B	6.600	6.902	-1.5	0.0	0.0	0.0	0.0	BUS B 044-HT6-101	0.000	0.000	0.0	0.0	
Bus Prim TR-105C	6.600	6.874	-1.9	0.0	0.0	0.0	0.0	BUS 044-HT6-102	0.000	0.000	0.0	0.0	
Bus Prim TR-106A	11.000	10.993	0.0	0.0	0.0	0.0	0.0	BUS 044-HT11-101	0.000	0.000	0.0	0.0	
								Bus Sec TR-106A	0.000	0.000	0.0	0.0	
Bus Prim TR-107A	0.433	0.411	-4.4	0.0	0.0	0.0	0.0	BUS A 044-PMCC-103	-47.043	-0.373	66.1	100.0	
								BUS A 044-MLDB-101	47.043	0.373	66.1	100.0	-2.500
Bus Prim TR-107B	0.433	0.433	-3.6	0.0	0.0	0.0	0.0	BUS B 044-PMCC-103	-59.236	-0.620	79.1	100.0	
								BUS B 044-MLDB-101	59.236	0.620	79.1	100.0	2.500
Bus Prim TR-108A	0.415	0.432	-3.6	0.0	0.0	0.0	0.0	BUS B 044-PMCC-103	-40.882	-0.582	54.6	100.0	

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								BUS A 044-EMLDB-101	40.882	0.582	54.6	100.0	5.000
Bus Prim TR-108B	0.433	0.433	-3.2	0.0	0.0	0.0	0.0	BUS 044-EPMCC-101	0.000	0.000	0.0	0.0	
Bus Prim TR-109A	33.000	32.960	0.0	0.0	0.0	0.0	0.0	BUS 2 to VDU UNIT	-3128.233	-2092.909	65.9	83.1	
								BUS A to VDU UNIT	3128.233	2092.909	65.9	83.1	
Bus Prim TR-109B	33.000	32.964	0.0	0.0	0.0	0.0	0.0	BUS 1 to VDU UNIT	-3077.805	-2056.517	64.8	83.1	
								BUS B to VDU UNIT	3077.805	2056.517	64.8	83.1	
Bus Prim TR-114A	33.000	32.965	0.0	0.0	0.0	0.0	0.0	BUS 2 to AU-V REVAMP UNIT	-2628.099	-2093.092	58.8	78.2	
								BUS A AU-V REVAMP	2628.099	2093.092	58.8	78.2	
Bus Prim TR-114B	33.000	32.967	0.0	0.0	0.0	0.0	0.0	BUS 1 to AU-V REVAMP UNIT	-2628.155	-2093.127	58.8	78.2	
								BUS B AU-REVAMP	2628.155	2093.127	58.8	78.2	
Bus Sec TR-106A	6.900	6.896	0.0	0.0	0.0	0.0	0.0	Bus Prim TR-106A	0.000	0.000	0.0	0.0	
Bus to CB-101A	6.600	7.283	-1.9	0.0	0.0	0.1	-2922.4	BUS A 044-HT6-101	-0.124	2922.429	231.7	0.0	
Bus to CB-101B	6.600	7.312	-1.5	0.0	0.0	0.1	-2945.8	BUS B 044-HT6-101	-0.125	2945.762	232.6	0.0	
Bus to Charger-DCDB101A	0.415	0.411	-4.3	0.0	0.0	16.2	7.8	BUS A 044-PMCC-103	-16.200	-7.846	25.3	90.0	
Bus to Charger-DCDB101B	0.415	0.433	-3.2	0.0	0.0	16.2	7.8	BUS 044-EPMCC-101	-16.200	-7.846	24.0	90.0	
Bus to Charger-DCDB102	0.433	0.432	-3.2	0.0	0.0	36.0	17.4	BUS 044-EPMCC-101	-36.000	-17.436	53.5	90.0	
Bus to ext. 1	33.000	32.971	0.0	0.0	0.0	0.0	0.0	BUS A 044-HT33-101	0.000	0.000	0.0	0.0	
Bus to ext. 2	33.000	32.973	0.0	0.0	0.0	0.0	0.0	BUS B 044-HT33-101	0.000	0.000	0.0	0.0	
BUS to HVAC-1	0.433	0.409	-4.3	0.0	0.0	416.0	257.8	BUS A 044-PMCC-103	-415.966	-257.792	690.2	85.0	
BUS to HVAC-2	0.433	0.431	-3.6	0.0	0.0	424.2	262.9	BUS B 044-PMCC-103	-424.169	-262.876	668.7	85.0	
Bus to TR101A	33.000	32.971	0.0	0.0	0.0	0.0	0.0	Bus Prim TR-101A	6093.751	324.406	106.9	99.9	
								BUS A 044-HT33-101	-6093.751	-324.406	106.9	99.9	
Bus to TR101B	33.000	32.973	0.0	0.0	0.0	0.0	0.0	Bus Prim TR-101B	4799.317	-370.070	84.3	-99.7	
								BUS B 044-HT33-101	-4799.317	370.070	84.3	-99.7	
Cab to VFD-ACM L1~	0.453	0.433	-3.5	0.0	0.0	34.2	0.0	BUS B 044-MCC-103	-34.232	0.000	45.6	100.0	
								VFD-ACM L1	34.232	0.000	45.6	100.0	
Cab to VFD-ACM P1~	0.453	0.433	-3.5	0.0	0.0	34.6	0.0	BUS B 044-MCC-103	-34.559	0.000	46.1	100.0	
								VFD-ACM P1	34.559	0.000	46.1	100.0	
Cab to VFD-ACM R1~	0.453	0.433	-3.5	0.0	0.0	34.6	0.0	BUS B 044-MCC-103	-34.632	0.000	46.2	100.0	
								VFD-ACM R1	34.632	0.000	46.2	100.0	
Cab VFD-ACM 201 A1~	0.453	0.431	-4.0	0.0	0.0	34.2	0.0	BUS A 044-MCC-102	-34.215	0.000	45.8	100.0	
								VFD-ACM 201 A1	34.215	0.000	45.8	100.0	
Cab VFD-ACM 202 A1~	0.453	0.431	-4.0	0.0	0.0	2.9	0.0	BUS A 044-MCC-104	-2.881	0.000	3.9	100.0	

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ID	kV	kV	Ang.	kW	kvar	kW	kvar	ID	kW	kvar	Amp	%PF	%Tap
Cab VFD-ACM B1~	0.453	0.431	-4.0	0.0	0.0	34.2	0.0	VFD-ACM 202 A1	2.881	0.000	3.9	100.0	
								BUS A 044-MCC-102	-34.215	0.000	45.8	100.0	
								VFD-ACM B1	34.215	0.000	45.8	100.0	
Cab VFD-ACM C1~	0.453	0.433	-3.5	0.0	0.0	34.2	0.0	BUS B 044-MCC-102	-34.215	0.000	45.7	100.0	
								VFD-ACM C1	34.215	0.000	45.7	100.0	
								BUS A 044-MCC-102	-34.047	0.000	45.6	100.0	
Cab VFD-ACM D1~	0.453	0.431	-4.0	0.0	0.0	34.0	0.0	VFD-ACM D1	34.047	0.000	45.6	100.0	
								BUS A 044-MCC-102	-34.070	0.000	45.6	100.0	
								VFD-ACM D2	34.070	0.000	45.6	100.0	
Cab VFD-ACM E1~	0.453	0.433	-3.5	0.0	0.0	34.0	0.0	BUS B 044-MCC-102	-34.047	0.000	45.4	100.0	
								VFD-ACM E1	34.047	0.000	45.4	100.0	
								BUS A 044-MCC-102	-34.097	0.000	45.6	100.0	
Cab VFD-ACM F1~	0.453	0.431	-4.0	0.0	0.0	34.1	0.0	VFD-ACM F1	34.097	0.000	45.6	100.0	
								BUS B 044-MCC-102	-34.097	0.000	45.5	100.0	
								VFD-ACM G1	34.097	0.000	45.5	100.0	
Cab VFD-ACM G1~	0.453	0.433	-3.5	0.0	0.0	34.1	0.0	BUS A 044-MCC-102	-34.164	0.000	45.7	100.0	
								VFD-ACM H1	34.164	0.000	45.7	100.0	
								BUS B 044-MCC-102	-34.188	0.000	45.6	100.0	
Cab VFD-ACM H1~	0.453	0.431	-4.0	0.0	0.0	34.2	0.0	VFD-ACM J1	34.188	0.000	45.6	100.0	
								BUS A 044-MCC-103	-34.205	0.000	45.7	100.0	
								VFD-ACM K1	34.205	0.000	45.7	100.0	
Cab VFD-ACM J1~	0.453	0.433	-3.5	0.0	0.0	34.2	0.0	BUS A 044-MCC-103	-34.487	0.000	46.1	100.0	
								VFD-ACM M1	34.487	0.000	46.1	100.0	
								BUS A 044-MCC-103	-34.559	0.000	46.2	100.0	
Cab VFD-ACM K1~	0.453	0.432	-3.9	0.0	0.0	34.2	0.0	VFD-ACM N1	34.559	0.000	46.2	100.0	
								BUS A 044-MCC-103	-34.632	0.000	46.3	100.0	
								VFD-ACM Q1	34.632	0.000	46.3	100.0	
Cab VFD-ACM M1~	0.453	0.432	-3.9	0.0	0.0	34.5	0.0	Bus 2 UPS101A	10.623	1.941	56.7	98.4	
								Bus 2 UPS101C	10.623	1.941	56.7	98.4	
								Bus 2 UPS102A	10.623	1.941	56.7	98.4	
Cab VFD-ACM N1~	0.453	0.432	-3.9	0.0	0.0	34.6	0.0	Bus 2 UPS102C	10.623	1.941	56.7	98.4	
								Bus VFD-ACM 201 A1	34.215	16.546	52.9	90.0	
								Bus VFD-ACM 202 A1	2.881	1.854	4.8	84.1	
Cab VFD-ACM Q1~	0.453	0.432	-3.9	0.0	0.0	34.6	0.0						
044-UPS-101A	0.110	0.110	0.0	10.6	1.9	0.0	0.0						
044-UPS-101C	0.110	0.110	0.0	10.6	1.9	0.0	0.0						
044-UPS-102A	0.110	0.110	0.0	10.6	1.9	0.0	0.0						
044-UPS-102C	0.110	0.110	0.0	10.6	1.9	0.0	0.0						
VFD-ACM 201 A1	0.415	0.415	0.0	34.2	16.5	0.0	0.0						
VFD-ACM 202 A1	0.415	0.415	0.0	2.9	1.9	0.0	0.0						

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ID	kV	kV	Ang.	kW	kvar	kW	kvar	ID	kW	kvar	Amp	%PF	%Tap
VFD-ACM B1	0.415	0.415	0.0	34.2	16.5	0.0	0.0	Bus VFD-ACM B1	34.215	16.546	52.9	90.0	
VFD-ACM C1	0.415	0.415	0.0	34.2	16.5	0.0	0.0	Bus VFD-ACM C1	34.215	16.546	52.9	90.0	
VFD-ACM D1	0.415	0.415	0.0	34.0	16.5	0.0	0.0	Bus VFD-ACM D1	34.047	16.514	52.6	90.0	
VFD-ACM D2	0.415	0.415	0.0	34.1	16.5	0.0	0.0	Bus VFD-ACM D2	34.070	16.518	52.7	90.0	
VFD-ACM E1	0.415	0.415	0.0	34.0	16.5	0.0	0.0	Bus VFD-ACM E1	34.047	16.514	52.6	90.0	
VFD-ACM F1	0.415	0.415	0.0	34.1	16.5	0.0	0.0	Bus VFD-ACM F1	34.097	16.523	52.7	90.0	
VFD-ACM G1	0.415	0.415	0.0	34.1	16.5	0.0	0.0	Bus VFD-ACM G1	34.097	16.523	52.7	90.0	
VFD-ACM H1	0.415	0.415	0.0	34.2	16.5	0.0	0.0	Bus VFD-ACM H1	34.164	16.536	52.8	90.0	
VFD-ACM J1	0.415	0.415	0.0	34.2	16.5	0.0	0.0	Bus VFD-ACM J1	34.188	16.541	52.8	90.0	
VFD-ACM K1	0.415	0.415	0.0	34.2	16.5	0.0	0.0	Bus VFD-ACM K1	34.205	16.544	52.9	90.0	
VFD-ACM L1	0.415	0.415	0.0	34.2	16.5	0.0	0.0	Bus VFD-ACM L1	34.232	16.549	52.9	90.0	
VFD-ACM M1	0.415	0.415	0.0	34.5	16.6	0.0	0.0	Bus VFD-ACM M1	34.487	16.556	53.2	90.1	
VFD-ACM N1	0.415	0.415	0.0	34.6	16.6	0.0	0.0	Bus VFD-ACM N1	34.559	16.566	53.3	90.2	
VFD-ACM P1	0.415	0.415	0.0	34.6	16.6	0.0	0.0	Bus VFD-ACM P1	34.559	16.566	53.3	90.2	
VFD-ACM Q1	0.415	0.415	0.0	34.6	16.6	0.0	0.0	Bus VFD-ACM Q1	34.632	16.577	53.4	90.2	
VFD-ACM R1	0.415	0.415	0.0	34.6	16.6	0.0	0.0	Bus VFD-ACM R1	34.632	16.577	53.4	90.2	

* Indicates a voltage regulated bus (voltage controlled or swing type machine connected to it)

Indicates a bus with a load mismatch of more than 0.1 MVA

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Directly Connected Load												Total Bus Load			
Bus			Constant kVA		Constant Z		Constant I		Generic		Percent Loading	kVA	% PF	Amp	
ID	kV	Rated Amp	kW	kvar	kW	kvar	kW	kvar	kW	kvar					
Bus 5 UPS101A	0.191													-	
Bus 5 UPS101C	0.191													-	
Bus 5 UPS102A	0.191														
Bus 5 UPS102C	0.191														
BUS 044-ELDB-101	0.415				2.085							2.085	100.0	2.8	
BUS 044-ELDB-102	0.415				2.051							2.051	100.0	2.8	
BUS 044-ELDB-103	0.415				2.070							2.070	100.0	2.8	
BUS 044-ELDB-104	0.415				4.019							4.019	100.0	5.6	
BUS 044-ELDB-105	0.415				2.066							2.066	100.0	2.8	
BUS 044-ELDB-106	0.415				2.077							2.077	100.0	2.8	
BUS 044-ELDB-107	0.415				1.957							1.957	100.0	2.8	
BUS 044-ELDB-108	0.415				2.018							2.018	100.0	2.8	
BUS 044-ELDB-109	0.415				2.060							2.060	100.0	2.8	
BUS 044-ELDB-110	0.415				2.038							2.038	100.0	2.8	
BUS 044-ELDB-111	0.415				1.973							1.973	100.0	2.8	
BUS 044-ELDB-112	0.415				2.038							2.038	100.0	2.8	
BUS 044-ELDB-113	0.415				2.038							2.038	100.0	2.8	
BUS 044-ELDB-114	0.415				2.018							2.018	100.0	2.8	
BUS 044-ELDB-115	0.415				1.977							1.977	100.0	2.8	
BUS 044-EPMCC-101	0.415	3150.0	424.183	213.431	28.597	17.723						726.378	89.4	967.9	30.7
BUS 044-HT6-102	6.900	630.0	558.608	238.655								607.453	92.0	51.0	8.1
BUS 044-HT11-101	11.000	630.0	850.000	526.783	212.223	131.524						1249.674	85.0	65.6	10.4
BUS 044-LDB-101	0.415				3.292							3.292	100.0	4.4	
BUS 044-LDB-102	0.415				5.344							5.344	100.0	7.2	
BUS 044-LDB-103	0.415				3.175							3.175	100.0	4.3	
BUS 044-LDB-104	0.415				3.224							3.224	100.0	4.3	
BUS 044-LDB-105	0.415				3.278							3.278	100.0	4.4	
BUS 044-LDB-106	0.415				3.200							3.200	100.0	4.3	
BUS 044-LDB-107	0.415				5.097							5.097	100.0	7.0	
BUS 044-LDB-108	0.415				5.364							5.364	100.0	7.2	
BUS 044-LDB-109	0.415				5.385							5.385	100.0	7.2	
BUS 044-LDB-110	0.415				5.299							5.299	100.0	7.2	
BUS 044-LDB-111	0.415				5.291							5.291	100.0	7.2	
BUS 044-LDB-112	0.415				5.299							5.299	100.0	7.2	
BUS 044-LDB-113	0.415				5.149							5.149	100.0	7.1	
BUS 044-LDB-114	0.415				5.210							5.210	100.0	7.1	
BUS 044-LDB-115	0.415				4.314							4.314	100.0	5.8	
BUS 044-LDB-116	0.415				2.345							2.345	100.0	3.2	
BUS 044-LDB-117	0.415				2.228							2.228	100.0	3.1	
BUS 044-PDB-101	0.415				4.376							4.376	100.0	5.8	
BUS 044-PDB-102	0.415				4.335							4.335	100.0	5.8	
BUS 044-PDB-103	0.415				4.295							4.295	100.0	5.8	

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Directly Connected Load											Total Bus Load			
Bus			Constant kVA		Constant Z		Constant I		Generic		kVA	% PF	Amp	Percent Loading
ID	kV	Rated Amp	kW	kvar	kW	kvar	kW	kvar	kW	kvar				
BUS 044-PDB-104	0.415				4.264						4.264	100.0	5.7	
BUS 044-PDB-105	0.415				20.904						20.904	100.0	28.4	
BUS A 044-ASB-101	0.415		16.104	8.568	66.631	0.049					83.182	99.5	116.9	
BUS A 044-ASB-102	0.415				62.034	0.071					62.034	100.0	87.1	
BUS A 044-EMLDB-101	0.415										40.505	100.0	55.0	
BUS A 044-HT6-101	6.600	2000.0	1466.199	797.808							6732.038	90.4	565.4	28.3
BUS A 044-HT33-101	33.000	1250.0									12443.990	94.8	217.9	17.4
BUS A 044-MCC-101	0.415	800.0	174.644	88.154							195.632	89.3	261.7	32.7
BUS A 044-MCC-102	0.415	800.0	68.380	33.082							275.200	99.3	368.4	46.0
BUS A 044-MCC-103	0.415	800.0	138.222	66.264							283.958	97.2	379.6	47.4
BUS A 044-MCC-104	0.415	800.0	210.506	105.043							237.841	89.7	318.3	39.8
BUS A 044-MCC-105	0.415	800.0	139.376	73.770							157.695	88.4	210.6	26.3
BUS A 044-MCC-106	0.415	800.0	127.773	63.693	104.015	0.007					240.382	96.4	321.2	40.1
BUS A 044-MCC-107	0.415	630.0	141.540	74.107							159.767	88.6	224.5	35.6
BUS A 044-MLDB-101	0.415										46.806	100.0	61.7	
BUS A 044-MLDB-102	0.415										11.040	100.0	14.7	
BUS A 044-PMCC-101	0.415	4000.0	464.314	202.837							1201.530	93.8	1605.0	40.1
BUS A 044-PMCC-102	0.415	4000.0	406.807	176.975							1122.049	94.1	1496.4	37.4
BUS A 044-PMCC-103	0.415	4000.0	399.427	174.929							1326.433	91.3	1861.6	46.5
BUS A AU-V REVAMP	6.600		2080.000	1560.000	538.138	403.604					3272.673	80.0	281.4	
BUS A to VDU UNIT	6.600		2520.034	1559.297	595.496	368.469					3663.715	85.0	315.3	
BUS B 044-ASB-101	0.415		4.769	2.633	30.415	0.002					35.283	99.7	47.1	
BUS B 044-ASB-102	0.415				65.282	0.066					65.282	100.0	87.2	
BUS B 044-HT6-101	6.600	2000.0	1433.743	774.792							5541.153	86.5	463.5	23.2
BUS B 044-HT33-101	33.000	1250.0									11318.840	93.3	198.2	15.9
BUS B 044-MCC-101	0.415	800.0	203.023	100.976							226.748	89.5	302.5	37.8
BUS B 044-MCC-102	0.415	800.0	136.642	66.142							281.092	97.2	375.1	46.9
BUS B 044-MCC-103	0.415	800.0	172.475	82.815							288.066	95.8	384.0	48.0
BUS B 044-MCC-104	0.415	800.0	213.482	106.902							238.753	89.4	318.5	39.8
BUS B 044-MCC-105	0.415	800.0	139.350	73.778							157.676	88.4	210.0	26.2
BUS B 044-MCC-106	0.415	800.0	28.140	14.624	98.574	0.007					127.555	99.3	169.8	21.2
BUS B 044-MCC-107	0.415	630.0	118.836	59.469							132.885	89.4	177.4	28.2
BUS B 044-MLDB-101	0.415										58.860	100.0	77.7	
BUS B 044-MLDB-102	0.415										7.409	100.0	10.1	
BUS B 044-PMCC-101	0.415	4000.0	409.999	178.230							1190.499	92.5	1585.4	39.6
BUS B 044-PMCC-102	0.415	4000.0	557.427	242.392							1175.621	93.6	1563.4	39.1
BUS B 044-PMCC-103	0.415	4000.0	354.821	155.428							1246.876	91.7	1663.1	41.6
BUS B AU-REVAMP	6.600		2080.000	1560.000	538.195	403.646					3272.743	80.0	281.4	
BUS B EMLDB-101	0.415										21.962	100.0	29.8	
BUS B to VDU UNIT	6.600		2520.034	1559.297	545.487	337.526					3604.907	85.0	324.2	
BUS Emergency Supply	11.000										1250.489	85.0	65.6	
BUS Grid Power A	33.000										12455.100	94.8	217.9	

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Bus			Directly Connected Load								Total Bus Load			
			Constant kVA		Constant Z		Constant I		Generic		kVA	% PF	Amp	Percent Loading
ID	kV	Rated Amp	kW	kvar	kW	kvar	kW	kvar	kW	kvar				
BUS Grid Power B	33.000										11199.700	94.3	195.9	
BUS HVAC EPMCC	0.415		112.032	54.260	29.560	14.317					157.325	90.0	213.0	
Bus Prim TR-101A	33.000										6102.324	99.9	106.9	
Bus Prim TR-101B	33.000										4813.531	99.7	84.3	
Bus Prim TR-102A	6.600										1222.948	92.4	102.7	
Bus Prim TR-102B	6.600										1212.896	91.1	101.5	
Bus Prim TR-103A	6.600										1140.310	92.8	95.8	
Bus Prim TR-103B	6.600										1196.138	92.3	100.1	
Bus Prim TR-104A	6.600										1359.691	89.4	114.2	
Bus Prim TR-104B	6.600										1272.471	90.2	106.5	
Bus Prim TR-105A	6.600										737.609	88.3	62.0	
Bus Prim TR-105B	6.600												-	
Bus Prim TR-105C	6.600													
Bus Prim TR-106A	11.000												-	
Bus Prim TR-107A	0.433										47.045	100.0	66.1	
Bus Prim TR-107B	0.433										59.239	100.0	79.1	
Bus Prim TR-108A	0.415										40.886	100.0	54.6	
Bus Prim TR-108B	0.433													
Bus Prim TR-109A	33.000										3763.789	83.1	65.9	
Bus Prim TR-109B	33.000										3701.641	83.1	64.8	
Bus Prim TR-114A	33.000										3359.753	78.2	58.8	
Bus Prim TR-114B	33.000										3359.818	78.2	58.8	
Bus Sec TR-106A	6.900													
Bus to CB-101A	6.600				0.124	-2922.429					2922.429	-	231.7	
Bus to CB-101B	6.600				0.125	-2945.762					2945.762	-	232.6	
Bus to Charger-DCDB101A	0.415		16.200	7.846							18.000	90.0	25.3	
Bus to Charger-DCDB101B	0.415		16.200	7.846							18.000	90.0	24.0	
Bus to Charger-DCDB102	0.433		36.000	17.436							40.000	90.0	53.5	
Bus to ext. 1	33.000													
Bus to ext. 2	33.000													
BUS to HVAC-1	0.433		340.000	210.713	75.966	47.079					489.371	85.0	690.2	
BUS to HVAC-2	0.433		340.000	210.713	84.169	52.163					499.023	85.0	668.7	
Bus to TR101A	33.000										6102.381	99.9	106.9	
Bus to TR101B	33.000										4813.564	99.7	84.3	

* Indicates operating load of a bus exceeds the bus critical limit (100.0% of the Continuous Ampere rating).
Indicates operating load of a bus exceeds the bus marginal limit (95.0% of the Continuous Ampere rating).

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Branch Loading Summary Report

CKT / Branch		Busway / Cable & Reactor			Transformer				
ID	Type	Ampacity (Amp)	Loading Amp	%	Capability (kVA)	Loading (input)		Loading (output)	
						kVA	%	kVA	%
Cab 1 EPMCC to UPS102	Cable	104.29	0.00	0.00					
Cab 1 EPMCC101 to UPS101	Cable	300.78	0.00	0.00					
Cab 2 EPMCC101 to UPS101	Cable	300.78	0.00	0.00					
Cab 044-ELDB-101	Cable	27.94	2.84	10.17					
Cab 044-ELDB-102	Cable	27.94	2.82	10.09					
Cab 044-ELDB-103	Cable	27.94	2.83	10.13					
Cab 044-ELDB-104	Cable	27.94	5.58	19.97					
Cab 044-ELDB-105	Cable	27.94	2.83	10.12					
Cab 044-ELDB-106	Cable	27.94	2.84	10.15					
Cab 044-ELDB-107	Cable	27.94	2.75	9.85					
Cab 044-ELDB-108	Cable	27.94	2.79	10.00					
Cab 044-ELDB-109	Cable	27.94	2.82	10.11					
Cab 044-ELDB-110	Cable	27.94	2.81	10.06					
Cab 044-ELDB-111	Cable	27.94	2.76	9.89					
Cab 044-ELDB-112	Cable	27.94	2.81	10.06					
Cab 044-ELDB-113	Cable	27.94	2.81	10.06					
Cab 044-ELDB-114	Cable	55.87	2.79	5.00					
Cab 044-ELDB-115	Cable	27.94	2.77	9.90					
Cab 044-ELDB-116	Cable	27.94	3.16	11.31					
Cab 044-LDB-101	Cable	27.94	4.37	15.65					
Cab 044-LDB-102	Cable	37.25	7.19	19.31					
Cab 044-LDB-103	Cable	27.94	4.29	15.37					
Cab 044-LDB-104	Cable	27.94	4.33	15.49					
Cab 044-LDB-105	Cable	37.25	4.36	11.71					
Cab 044-LDB-106	Cable	27.94	4.31	15.43					
Cab 044-LDB-107	Cable	27.94	7.02	25.14					
Cab 044-LDB-108	Cable	27.94	7.20	25.79					
Cab 044-LDB-109	Cable	37.25	7.22	19.38					
Cab 044-LDB-110	Cable	37.25	7.16	19.23					
Cab 044-LDB-111	Cable	74.50	7.16	9.61					
Cab 044-LDB-112	Cable	37.25	7.16	19.23					
Cab 044-LDB-113	Cable	27.94	7.06	25.27					
Cab 044-LDB-114	Cable	74.50	7.10	9.53					

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CKT / Branch		Busway / Cable & Reactor			Transformer				
ID	Type	Ampacity (Amp)	Loading Amp	%	Capability (kVA)	Loading (input)		Loading (output)	
						kVA	%	kVA	%
Cab 044-LDB-115	Cable	66.12	5.78	8.74					
Cab 044-LDB-117	Cable	27.94	3.08	11.03					
Cab 044-PDB-101	Cable	27.94	5.82	20.83					
Cab 044-PDB-102	Cable	27.94	5.79	20.74					
Cab 044-PDB-103	Cable	27.94	5.77	20.64					
Cab 044-PDB-104	Cable	27.94	5.75	20.57					
Cab 044-PDB-105	Cable	66.12	28.45	43.02					
Cab A HT6-101 to HT6-102	Cable	1352.13	51.02	3.77					
Cab A HT6-101 to TR103A	Cable	450.71	95.78	21.25					
Cab A PMCC102 to MCC103	Cable	902.33	379.56	42.06					
Cab A PMCC102 to MCC105	Cable	902.33	210.57	23.34					
Cab A PMCC102 to MCC106	Cable	902.33	321.20	35.60					
Cab A PMCC103 to ASB101	Cable	456.29	116.92	25.62					
Cab A PMCC103 to ASB102	Cable	527.06	87.14	16.53					
Cab A PMCC103 to MCC107	Cable	902.33	224.55	24.89					
Cab A PMCC103 to UPS101	Cable	456.29	31.51	6.90					
Cab A PMCC103 to UPS102	Cable	162.03	33.59	20.73					
Cab B HT6-101 to TR103B	Cable	450.71	100.07	22.20					
Cab B PMCC102 to MCC103	Cable	902.33	383.98	42.55					
Cab B PMCC102 to MCC105	Cable	902.33	209.95	23.27					
Cab B PMCC102 to MCC106	Cable	902.33	169.80	18.82					
Cab B PMCC103 to ASB101	Cable	456.29	47.09	10.32					
Cab B PMCC103 to ASB102	Cable	527.06	87.15	16.54					
Cab B PMCC103 to MCC107	Cable	902.33	177.44	19.66					
Cab B PMCC103 to UPS101	Cable	456.29	29.93	6.56					
Cab B PMCC103 to UPS102	Cable	162.03	30.19	18.63					
Cab Emergency to HT11	Cable	1352.13	65.63	4.85					
Cab EMLDB to MLDB102	Cable	684.43	10.10	1.48					
Cab EPMCC101 to DC101B	Cable	196.48	24.01	12.22					
Cab EPMCC101 to TR108B	Cable	300.78							
Cab EPMCC101-DC102	Cable	162.03	53.48	33.01					
Cab HT6-101 to TR10AB	Cable	1352.13	106.45	7.87					
Cab HT6-101 to TR104A	Cable	1352.13	114.20	8.45					
Cab HT11 to TR106A	Cable	1352.13	0.00	0.00					
Cab HT33 to TR109A	Cable	432.68	65.93	15.24					

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CKT / Branch		Busway / Cable & Reactor			Transformer				
ID	Type	Ampacity (Amp)	Loading Amp	%	Capability (kVA)	Loading (input)		Loading (output)	
						kVA	%	kVA	%
Cab HT33 to TR109B	Cable	865.36	64.83	7.49					
Cab HT33 to TR114A	Cable	865.36	58.84	6.80					
Cab HT33 to TR114B	Cable	865.36	58.84	6.80					
Cab HT601 to TR105A	Cable	1352.13	61.95	4.58					
Cab HT601 to TR105B	Cable	1352.13	0.00	0.00					
Cab HT602 to TR105C	Cable	1352.13	0.00	0.00					
Cab HT6101 to TR102A	Cable	450.71	102.73	22.79					
Cab HT6101 to TR102B	Cable	450.71	101.48	22.52					
Cab HVAC-1	Cable	711.44	690.23	97.02					
Cab HVAC-2	Cable	711.44	668.66	93.99					
Cab MLDB101 to MLDB102	Cable	684.43	14.67	2.14					
Cab PMCC101 to TR-108A	Cable	300.78	54.61	18.16					
Cab PMCC103 to DC101A	Cable	162.03	25.31	15.62					
Cab PMCC103 to TR107A	Cable	409.73	66.07	16.13					
Cab PMCC103 to TR107B	Cable	409.73	79.08	19.30					
Cab to HVAC MCC	Cable	711.44	213.05	29.95					
Cab to VFD-ACM L1	Cable	126.64	45.63	36.03					
Cab to VFD-ACM P1	Cable	126.64	46.07	36.38					
Cab to VFD-ACM R1	Cable	126.64	46.17	36.45					
Cab VFD-ACM 201 A1	Cable	126.64	45.80	36.17					
Cab VFD-ACM 202 A1	Cable	48.42	16.96	35.02					
Cab VFD-ACM B1	Cable	126.64	45.80	36.17					
Cab VFD-ACM C1	Cable	126.64	45.67	36.06					
Cab VFD-ACM D1	Cable	126.64	45.58	35.99					
Cab VFD-ACM D2	Cable	126.64	45.61	36.01					
Cab VFD-ACM E1	Cable	126.64	45.44	35.88					
Cab VFD-ACM F1	Cable	126.64	45.64	36.04					
Cab VFD-ACM G1	Cable	126.64	45.51	35.94					
Cab VFD-ACM H1	Cable	126.64	45.73	36.11					
Cab VFD-ACM J1	Cable	126.64	45.63	36.03					
Cab VFD-ACM K1	Cable	126.64	45.72	36.10					
Cab VFD-ACM M1	Cable	162.03	46.10	28.45					
Cab VFD-ACM N1	Cable	162.03	46.20	28.51					
Cab VFD-ACM Q1	Cable	162.03	46.30	28.57					
Cable 2 EPMCC to UPS102	Cable	104.29	0.00	0.00					

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Study Case: LF Normal

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CKT / Branch		Busway / Cable & Reactor			Transformer				
ID	Type	Ampacity (Amp)	Loading Amp	%	Capability (kVA)	Loading (input)		Loading (output)	
						kVA	%	kVA	%
Cable A PMCC101 to MCC101	Cable	902.33	261.71	29.00					
Cable A PMCC101 to MCC102	Cable	902.33	368.36	40.82					
Cable B PMCC101 to MCC101	Cable	902.33	302.49	33.52					
Cable B PMCC101 to MCC102	Cable	902.33	375.14	41.58					
Cable B PMCC101 to MCC104	Cable	902.33	318.54	35.30					
044-TR-101 A	Transformer				20000.0	6102.3	30.5	6084.9	30.4
044-TR-101 B	Transformer				22000.0	4818.5	21.9	4813.5	21.9
044-TR-102 A	Transformer				2500.0	1222.9	48.9	1201.5	48.1
044-TR-102 B	Transformer				2500.0	1212.9	48.5	1190.5	47.6
044-TR-103 A	Transformer				2500.0	1140.3	45.6	1122.0	44.9
044-TR-103 B	Transformer				2500.0	1196.1	47.8	1175.6	47.0
044-TR-104 A	Transformer				2500.0	1359.7	54.4	1326.4	53.1
044-TR-104 B	Transformer				2500.0	1272.5	50.9	1246.9	49.9
044-TR-105 A	Transformer				1600.0	737.6	46.1	726.4	45.4
044-TR-106 A	Transformer				3937.5				
044-TR-107 A	Transformer				200.0	47.0	23.5	46.8	23.4
044-TR-107 B	Transformer				200.0	59.2	29.6	58.9	29.4
044-TR-108 A	Transformer				100.0	40.9	40.9	40.5	40.5
044-TR-109 A	Transformer				7875.0	3763.8	47.8	3663.7	46.5
044-TR-109 B	Transformer				7875.0	3701.6	47.0	3604.9	45.8
044-TR-114 A	Transformer				8000.0	3359.8	42.0	3272.7	40.9
044-TR-114 B	Transformer				8000.0	3359.8	42.0	3272.7	40.9
* T UPS101A	Transformer				1.0	10.8	1079.9	9.3	932.9
* T UPS101C	Transformer				1.0	10.8	1079.9	9.3	932.9
* T UPS102A	Transformer				1.0	10.8	1079.9	9.3	932.9
* T UPS102C	Transformer				1.0	10.8	1079.9	9.3	932.9
UPS101-STABILIZER 1	Transformer				200.0				
UPS101-STABILIZER 5	Transformer				200.0				
UPS102-STABILIZER 1	Transformer				200000.0				
UPS102-STABILIZER 2	Transformer				100.0				
Reactor 1	Reactor	400.00	231.68	57.92					
Reactor 2	Reactor	400.00	232.60	58.15					

* Indicates a branch with operating load exceeding the branch capability.

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Branch Losses Summary Report

Branch ID	From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		Vd % Drop in Vmag
	kw	kvar	kw	kvar	kW	kvar	From	To	
044-TR-101 A	-6083.7	-124.1	6093.7	324.4	10.0	200.3	104.2	99.9	0.28
044-TR-101 B	-4793.1	494.7	4799.3	-370.1	6.2	124.6	104.6	99.9	0.10
044-TR-102 A	-1126.8	-417.2	1130.5	466.3	3.8	49.1	104.2	104.1	4.32
044-TR-102 B	-1101.0	-452.7	1104.7	500.7	3.7	47.9	104.5	104.6	4.43
044-TR-103 A	-1055.3	-381.2	1058.6	423.9	3.3	42.7	104.3	104.1	4.17
044-TR-103 B	-1100.3	-414.0	1103.9	460.6	3.6	46.6	104.6	104.6	4.30
044-TR-104 A	-1210.5	-542.3	1215.7	609.0	5.1	66.8	99.1	104.2	5.03
044-TR-104 B	-1143.6	-496.8	1147.7	549.5	4.1	52.7	104.3	104.6	4.60
044-TR-105 A	-649.1	-326.1	651.1	346.6	2.0	20.5	104.4	104.2	4.09
044-TR-106 A	0.0	0.0	0.0	0.0			99.9	99.9	0.00
044-TR-107 A	-46.8	0.0	47.0	0.4	0.2	0.4	105.5	94.9	1.94
044-TR-107 B	-58.9	-0.1	59.2	0.6	0.4	0.6	105.4	99.9	3.06
044-TR-108 A	-40.5	0.0	40.9	0.6	0.4	0.6	102.5	104.2	5.88
044-TR-109 A	-3115.5	-1927.8	3128.2	2092.9	12.7	165.1	101.6	99.9	2.66
044-TR-109 B	-3065.5	-1896.8	3077.8	2056.5	12.3	159.7	97.3	99.9	2.61
044-TR-114 A	-2618.1	-1963.6	2628.1	2093.1	10.0	129.5	101.7	99.9	2.59
044-TR-114 B	-2618.2	-1963.6	2628.2	2093.1	10.0	129.5	101.7	99.9	2.59
Cab 044-ELDB-101	-2.1	0.0	2.1	0.0	0.0	0.0	102.1	102.5	0.43
Cab 044-ELDB-102	-2.1	0.0	2.1	0.0	0.0	0.0	101.3	102.5	1.27
Cab 044-ELDB-103	-2.1	0.0	2.1	0.0	0.0	0.0	101.7	102.5	0.80
Cab 044-ELDB-104	-4.0	0.0	4.1	0.0	0.1	0.0	100.2	102.5	2.31
Cab 044-ELDB-105	-2.1	0.0	2.1	0.0	0.0	0.0	101.6	102.5	0.90
Cab 044-ELDB-106	-2.1	0.0	2.1	0.0	0.0	0.0	101.9	102.5	0.64
Cab 044-ELDB-107	-2.0	0.0	2.0	0.0	0.1	0.0	98.9	102.5	3.62
Cab 044-ELDB-108	-2.0	0.0	2.1	0.0	0.0	0.0	100.4	102.5	2.10
Cab 044-ELDB-109	-2.1	0.0	2.1	0.0	0.0	0.0	101.5	102.5	1.06
Cab 044-ELDB-110	-2.0	0.0	2.1	0.0	0.0	0.0	101.0	102.5	1.58
Cab 044-ELDB-111	-2.0	0.0	2.0	0.0	0.1	0.0	99.3	102.5	3.22
Cab 044-ELDB-112	-2.0	0.0	2.1	0.0	0.0	0.0	101.0	102.5	1.58
Cab 044-ELDB-113	-2.0	0.0	2.1	0.0	0.0	0.0	101.0	102.5	1.58
Cab 044-ELDB-114	-2.0	0.0	2.1	0.0	0.0	0.0	100.4	102.5	2.10
Cab 044-ELDB-115	-2.0	0.0	2.0	0.0	0.1	0.0	99.4	102.5	3.12
Cab 044-ELDB-116	-2.3	0.0	2.4	0.0	0.0	0.0	103.2	104.7	1.43
Cab 044-LDB-101	-3.3	0.0	3.3	0.0	0.0	0.0	104.7	105.4	0.66

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Study Case: LF Normal

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Branch ID	From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		Vd % Drop in Vmag
	kw	kvar	kw	kvar	kW	kvar	From	To	
Cab 044-LDB-102	-5.3	0.0	5.4	0.0	0.1	0.0	103.4	105.4	2.02
Cab 044-LDB-103	-3.2	0.0	3.3	0.0	0.1	0.0	102.9	105.5	2.58
Cab 044-LDB-104	-3.2	0.0	3.3	0.0	0.1	0.0	103.7	105.5	1.79
Cab 044-LDB-105	-3.3	0.0	3.3	0.0	0.0	0.0	104.5	105.4	0.87
Cab 044-LDB-106	-3.2	0.0	3.2	0.0	0.0	0.0	103.3	104.7	1.38
Cab 044-LDB-107	-5.1	0.0	5.2	0.0	0.1	0.0	101.0	102.0	1.06
Cab 044-LDB-108	-5.4	0.0	5.4	0.0	0.1	0.0	103.6	104.7	1.08
Cab 044-LDB-109	-5.4	0.0	5.5	0.0	0.1	0.0	103.8	105.5	1.69
Cab 044-LDB-110	-5.3	0.0	5.4	0.0	0.1	0.0	103.0	105.5	2.51
Cab 044-LDB-111	-5.3	0.0	5.4	0.0	0.1	0.0	102.9	105.5	2.60
Cab 044-LDB-112	-5.3	0.0	5.4	0.0	0.1	0.0	103.0	105.5	2.51
Cab 044-LDB-113	-5.1	0.0	5.4	0.0	0.2	0.0	101.5	105.5	3.98
Cab 044-LDB-114	-5.2	0.0	5.4	0.0	0.2	0.0	102.1	105.4	3.32
Cab 044-LDB-115	-4.3	0.0	4.4	0.0	0.1	0.0	103.9	105.5	1.61
Cab 044-LDB-117	-2.2	0.0	2.3	0.0	0.0	0.0	100.6	102.0	1.39
Cab 044-PDB-101	-4.4	0.0	4.4	0.0	0.0	0.0	104.6	105.5	0.88
Cab 044-PDB-102	-4.3	0.0	4.4	0.0	0.1	0.0	104.1	105.4	1.31
Cab 044-PDB-103	-4.3	0.0	4.4	0.0	0.1	0.0	103.6	105.5	1.84
Cab 044-PDB-104	-4.3	0.0	4.4	0.0	0.1	0.0	103.2	105.4	2.16
Cab 044-PDB-105	-20.9	0.0	21.6	0.0	0.6	0.0	102.2	105.4	3.17
Cab 1 EPMCC to UPS102	0.0	0.0	0.0	0.0			100.1	104.4	0.00
Cab 1 EPMCC101 to UPS101	0.0	0.0	0.0	0.0			100.1	104.4	0.00
Cab 2 EPMCC101 to UPS101	0.0	0.0	0.0	0.0			100.1	104.4	0.00
Cab A HT6 to PMCC101	-11800.5	-3949.8	11810.5	3955.1	10.0	5.3	99.9	100.0	0.09
Cab A HT6-101 to HT6-102	-558.6	-238.7	558.6	238.7	0.0	0.0	99.6	104.2	0.00
Cab A HT6-101 to TR103A	1058.7	423.9	-1058.6	-423.9	0.0	0.1	104.2	104.1	0.01
Cab A PMCC102 to MCC103	-276.1	-66.3	276.7	66.5	0.6	0.2	104.1	104.3	0.24
Cab A PMCC102 to MCC105	-139.4	-73.8	139.6	73.8	0.2	0.1	104.2	104.3	0.13
Cab A PMCC102 to MCC106	-231.8	-63.7	232.2	63.9	0.4	0.2	104.1	104.3	0.20
Cab A PMCC103 to ASB101	-82.7	-8.6	82.9	8.6	0.1	0.0	99.0	99.1	0.15
Cab A PMCC103 to ASB102	-62.0	-0.1	62.1	0.1	0.1	0.0	99.0	99.1	0.09
Cab A PMCC103 to MCC107	-141.5	-74.1	141.8	74.2	0.2	0.1	99.0	99.1	0.14
Cab A PMCC103 to UPS101	-21.2	-7.0	21.3	7.0	0.1	0.0	94.7	99.1	0.37
Cab A PMCC103 to UPS102	-21.2	-10.3	21.6	10.3	0.3	0.0	93.7	99.1	1.35
Cab B HT6 to PMCC101	-10557.1	-3712.1	10565.1	3716.4	8.0	4.2	99.9	100.0	0.08
Cab B HT6-101 to TR103B	1104.0	460.6	-1103.9	-460.6	0.1	0.1	104.6	104.6	0.01
Cab B PMCC102 to MCC103	-275.9	-82.8	276.5	83.0	0.6	0.2	104.4	104.6	0.24

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Study Case: LF Normal

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Config.: Normal

Branch ID	From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		Vd % Drop in Vmag
	kw	kvar	kw	kvar	kW	kvar	From	To	
Cab B PMCC102 to MCC105	-139.4	-73.8	139.5	73.8	0.2	0.1	104.5	104.6	0.13
Cab B PMCC102 to MCC106	-126.7	-14.6	126.8	14.7	0.1	0.0	104.5	104.6	0.10
Cab B PMCC103 to ASB101	-35.2	-2.6	35.2	2.6	0.0	0.0	104.2	104.3	0.06
Cab B PMCC103 to ASB102	-65.3	-0.1	65.3	0.1	0.1	0.0	104.2	104.3	0.09
Cab B PMCC103 to MCC107	-118.8	-59.5	119.0	59.5	0.1	0.0	104.2	104.3	0.11
Cab B PMCC103 to UPS101	-21.2	-7.0	21.3	7.0	0.1	0.0	99.6	104.3	0.35
Cab B PMCC103 to UPS102	-21.2	-7.0	21.5	7.0	0.3	0.0	98.8	104.3	1.25
Cab Emergency to HT11	-1062.2	-658.3	1062.8	659.0	0.5	0.7	99.9	100.0	0.07
Cab EMLDB to MLDB102	-7.4	0.0	7.4	0.0	0.0	0.0	102.0	102.5	0.51
Cab EPMCC101 to DC101B	16.2	7.8	-16.2	-7.8	0.0	0.0	104.4	104.3	0.12
Cab EPMCC101 to TR108B	0.0	0.0	0.0	0.0			104.4	100.1	0.00
Cab EPMCC101-DC102	36.1	17.5	-36.0	-17.4	0.1	0.0	104.4	99.7	0.36
Cab HT11 to TR106A	0.0	0.0	0.0	0.0			99.9	99.9	0.00
Cab HT33 to TR101A	-6093.7	-324.4	6093.8	324.4	0.1	0.0	99.9	99.9	0.00
Cab HT33 to TR101B	-4799.3	370.1	4799.3	-370.1	0.0	0.0	99.9	99.9	0.00
Cab HT33 to TR109A	3129.2	1988.5	-3128.2	-2092.9	1.0	-104.4	99.9	99.9	0.04
Cab HT33 to TR109B	3078.3	1880.9	-3077.8	-2056.5	0.5	-175.6	99.9	99.9	0.02
Cab HT33 to TR114A	2628.5	1744.6	-2628.1	-2093.1	0.4	-348.5	99.9	99.9	0.02
Cab HT33 to TR114B	2628.6	2093.7	-2628.2	-2093.1	0.4	0.5	99.9	99.9	0.02
Cab HT601 to TR105A	651.1	346.6	-651.1	-346.6	0.0	0.0	104.2	104.2	0.00
Cab HT601 to TR105B	0.0	0.0	0.0	0.0			104.6	104.6	
Cab HT602 to TR105C	0.0	0.0	0.0	0.0			99.6	104.2	
Cab HT6101 to TR102A	1130.7	466.5	-1130.5	-466.3	0.1	0.1	104.2	104.1	0.01
Cab HT6101 to TR102B	1104.8	500.8	-1104.7	-500.7	0.1	0.1	104.6	104.6	0.01
Cab HT6-101 to TR104A	1215.7	609.1	-1215.7	-609.0	0.0	0.0	104.2	104.2	0.00
Cab HT6-101 to TR10AB	1147.7	549.6	-1147.7	-549.5	0.0	0.0	104.6	104.6	0.00
Cab HVAC-1	418.2	258.8	-416.0	-257.8	2.2	1.0	99.1	94.5	0.49
Cab HVAC-2	426.2	263.9	-424.2	-262.9	2.1	1.0	104.3	99.5	0.47
Cab MLDB101 to MLDB102	-11.0	0.0	11.1	0.0	0.1	0.0	104.7	105.4	0.75
Cab PMCC101 to TR-108A	40.9	0.6	-40.9	-0.6	0.1	0.0	104.3	104.2	0.14
Cab PMCC103 to DC101A	16.2	7.9	-16.2	-7.8	0.0	0.0	99.1	99.0	0.17
Cab PMCC103 to TR107A	47.1	0.4	-47.0	-0.4	0.0	0.0	99.1	94.9	0.07
Cab PMCC103 to TR107B	59.3	0.6	-59.2	-0.6	0.0	0.0	104.3	99.9	0.08
Cab to HVAC MCC	143.9	69.7	-141.6	-68.6	2.3	1.1	104.4	102.7	1.67
Cab to VFD-ACM L1	34.2	0.0	-34.2	0.0	0.0	0.0	104.4	95.7	0.01
Cab to VFD-ACM P1	34.6	0.0	-34.6	0.0	0.0	0.0	104.4	95.7	0.01
Cab to VFD-ACM R1	34.6	0.0	-34.6	0.0	0.0	0.0	104.4	95.7	0.01

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Config.: Normal

Branch ID	From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		Vd % Drop in Vmag
	kw	kvar	kw	kvar	kW	kvar	From	To	
Cab VFD-ACM 201 A1	34.2	0.0	-34.2	0.0	0.0	0.0	103.9	95.3	0.01
Cab VFD-ACM 202 A1	2.9	-12.3	-2.9	0.0	0.0	-12.3	104.0	95.3	0.01
Cab VFD-ACM B1	34.2	0.0	-34.2	0.0	0.0	0.0	103.9	95.3	0.01
Cab VFD-ACM C1	34.2	0.0	-34.2	0.0	0.0	0.0	104.2	95.6	0.01
Cab VFD-ACM D1	34.0	0.0	-34.0	0.0	0.0	0.0	103.9	95.3	0.01
Cab VFD-ACM D2	34.1	0.0	-34.1	0.0	0.0	0.0	103.9	95.3	0.01
Cab VFD-ACM E1	34.0	0.0	-34.0	0.0	0.0	0.0	104.2	95.6	0.01
Cab VFD-ACM F1	34.1	0.0	-34.1	0.0	0.0	0.0	103.9	95.3	0.01
Cab VFD-ACM G1	34.1	0.0	-34.1	0.0	0.0	0.0	104.2	95.6	0.01
Cab VFD-ACM H1	34.2	0.0	-34.2	0.0	0.0	0.0	103.9	95.3	0.01
Cab VFD-ACM J1	34.2	0.0	-34.2	0.0	0.0	0.0	104.2	95.6	0.01
Cab VFD-ACM K1	34.2	0.0	-34.2	0.0	0.0	0.0	104.1	95.4	0.01
Cab VFD-ACM M1	34.5	0.0	-34.5	0.0	0.0	0.0	104.1	95.4	0.01
Cab VFD-ACM N1	34.6	0.0	-34.6	0.0	0.0	0.0	104.1	95.4	0.01
Cab VFD-ACM Q1	34.6	0.0	-34.6	0.0	0.0	0.0	104.1	95.4	0.01
Cable 2 EPMCC to UPS102	0.0	0.0	0.0	0.0			100.1	104.4	0.00
Cable A PMCC101 to MCC101	-174.6	-88.2	174.9	88.3	0.3	0.1	104.0	104.2	0.16
Cable A PMCC101 to MCC102	-273.2	-33.1	273.8	33.3	0.5	0.2	103.9	104.2	0.21
Cable A PMCC101 to MCC104	-213.4	-92.7	213.8	92.8	0.4	0.1	104.0	104.2	0.19
Cable B PMCC101 to MCC101	-203.0	-101.0	203.4	101.1	0.4	0.1	104.3	104.5	0.18
Cable B PMCC101 to MCC102	-273.2	-66.1	273.8	66.4	0.6	0.2	104.2	104.5	0.22
Cable B PMCC101 to MCC104	-213.5	-106.9	213.9	107.1	0.4	0.2	104.3	104.5	0.19
Reactor 1	2.8	-2758.4	-0.1	2922.4	2.6	164.0	104.2	110.3	6.19
Reactor 2	2.8	-2780.5	-0.1	2945.8	2.7	165.3	104.6	110.8	6.22
T UPS101A	10.6	1.9	-9.3	0.0	1.3	1.9	100.0	86.4	13.61
T UPS101C	10.6	1.9	-9.3	0.0	1.3	1.9	100.0	86.4	13.61
T UPS102A	10.6	1.9	-9.3	0.0	1.3	1.9	100.0	86.4	13.61
T UPS102C	10.6	1.9	-9.3	0.0	1.3	1.9	100.0	86.4	13.61
UPS101-STABILIZER 1	0.0	0.0	0.0	0.0			100.1	105.3	5.27
UPS101-STABILIZER 5	0.0	0.0	0.0	0.0			100.1	105.3	5.27
UPS102-STABILIZER 1	0.0	0.0	0.0	0.0			100.1	100.1	
UPS102-STABILIZER 2	0.0	0.0	0.0	0.0			100.1	100.1	
					135.5	949.2			

* This Transmission Line includes Series Capacitor.

Project: ETAP
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Equipment Cable and Overload Heater Losses Summary Report

Connected Load		Cable /Overload Heater		Losses		% Voltage			% Vd	% Vst
						Terminal on				
ID	Type	ID	Library	kW	kvar	Bus	Bus kV	Load kV	Operating	Starting
1803-PM-609 B	Ind. Motor	Cab PM-609 B	11NALS3	0.0	0.0	99.62	99.60	104.13	0.02	99.54
1803-PM-609 A	Ind. Motor	Cab PM-609 A	11NALS3	0.0	0.0	99.62	99.60	104.13	0.02	99.54
1803-PM-609 C	Ind. Motor	Cab PM-609 C	11NALS3	0.0	0.0	99.62	99.62	104.15	0.00	99.54
1803-PM-204 A	Ind. Motor	Cab PM-204 A	11NALS3	0.1	0.0	104.15	104.12	104.12	0.03	104.03
1803-PM-222 A	Ind. Motor	Cab PM-222 A	11NALS3	0.0	0.0	104.15	104.14	104.14	0.01	104.08
1803-PM-213 A	Ind. Motor	Cab PM-213 A	11NALS3	0.0	0.0	104.15	104.15	104.15	0.00	104.07
1803-PM-205 A	Ind. Motor	Cab PM-205 A	11NALS3	0.0	0.0	104.15	104.15	104.15	0.00	103.90
1803-PM-202 A	Ind. Motor	Cab PM-202 A	11NALS3	0.1	0.1	104.15	104.12	104.12	0.03	104.02
1803-PM-101 A	Ind. Motor	Cab PM-101 A	11NALS3	0.0	0.0	104.15	104.14	104.14	0.02	104.09
1803-X-107-K-001 A	Ind. Motor	Cab X-107-K-001 A	11NALS3	0.0	0.0	104.15	104.15	104.15	0.01	104.11
1803-PM-214 A	Ind. Motor	Cab PM-214 A	11NALS3	0.0	0.0	104.15	104.15	104.15	0.00	104.06
1803-X-107-K-001 C	Ind. Motor	Cab X-107-K-001 C	11NALS3	0.0	0.0	104.15	104.15	104.15	0.00	104.11
1803-PM-204 B	Ind. Motor	Cab PM-204 B	11NALS3	0.1	0.0	104.15	104.12	104.12	0.03	104.03
1803-PM-101 B	Ind. Motor	Cab PM-101 B	11NALS3	0.0	0.0	104.57	104.57	104.57	0.00	104.50
1803-PM-202 B	Ind. Motor	Cab PM-202 B	11NALS3	0.1	0.1	104.57	104.54	104.54	0.03	104.43
1803-PM-202 C	Ind. Motor	Cab PM-202 C	11NALS3	0.0	0.0	104.57	104.57	104.57	0.00	104.43
1803-PM-204 C	Ind. Motor	Cab PM-204 C	11NALS3	0.0	0.0	104.57	104.57	104.57	0.00	104.44
1803-PM-205 B	Ind. Motor	Cab PM-205 B	11NALS3	0.2	0.1	104.57	104.52	104.52	0.05	104.32
1803-PM-213 B	Ind. Motor	Cab PM-213 B	11NALS3	0.0	0.0	104.57	104.55	104.55	0.02	104.48
1803-PM-214 B	Ind. Motor	Cab PM-214 B	11NALS3	0.0	0.0	104.57	104.55	104.55	0.02	104.47
1803-PM-222 B	Ind. Motor	Cab PM-22B	11NALS3	0.0	0.0	104.57	104.57	104.57	0.00	104.49
1803-X-107-K-001 B	Ind. Motor	Cab X-107-K-001 B	11NALS3	0.0	0.0	104.57	104.56	104.56	0.01	104.53
1803-PM-604 A	Ind. Motor	Cab PM-604 A	1,0NALN3	0.1	0.0	104.40	103.67	103.67	0.74	89.60
1803-PM-604 B	Ind. Motor	Cab PM-604 B	1,0NALN3	0.1	0.0	104.40	103.67	99.36	0.74	90.66
1803-PM-608 A	Ind. Motor	Cab PM-608 A	1,0NALN3	3.7	0.7	104.40	99.09	94.97	5.31	79.56
1803-PM-608 B	Ind. Motor	Cab PM-608 B	1,0NALN3	0.0	0.0	104.40	103.90	99.58	0.51	79.56
1803-PM-610 A	Ind. Motor	Cab PM-610 A	1,0NALN3	7.0	2.6	104.40	99.98	95.82	4.43	88.97
1803-PM-610 B	Ind. Motor	Cab PM-610 B	1,0NALN3	0.1	0.0	104.40	103.98	99.66	0.43	86.11
1803-PM-603	Ind. Motor	Cab PM-603	1,0NCUN3	0.1	0.0	104.40	103.15	98.86	1.26	82.20
1803-P-226 S	Ind. Motor	Cab P-226 S	1,0NCUN3	0.0	0.0	104.40	104.34	104.34	0.06	99.69
1803-P-226 A	Ind. Motor	Cab P-226 A	1,0NCUN3	0.0	0.0	104.40	103.77	103.77	0.64	99.69
1803-P-227 S	Ind. Motor	Cab PM-227 A6	1,0NCUN3	0.0	0.0	104.40	104.34	100.00	0.06	100.06
1803-P-227 A	Ind. Motor	Cab PM-227 A	1,0NCUN3	0.0	0.0	104.40	103.77	99.45	0.64	99.82
1803-P-228 S	Ind. Motor	Cab PM-227 A4	1,0NCUN3	0.0	0.0	104.40	104.34	100.00	0.06	100.06
1803-P-228 A	Ind. Motor	Cab PM-227 A2	1,0NCUN3	0.0	0.0	104.40	103.77	99.45	0.64	100.06

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Contract:		SN:	
Engineer:	Study Case: LF Normal	Revision:	Base
Filename: TFM		Config.:	Normal

Equipment Cable and Overload Heater Losses Summary Report

Connected Load		Cable /Overload Heater		Losses		% Voltage			% Vd	% Vst
						Terminal on				
ID	Type	ID	Library	kW	kvar	Bus	Bus kV	Load kV	Operating	Starting
1803-P-229 S	Ind. Motor	Cab PM-229 A2	1,0NCUN3	0.0	0.0	104.40	104.34	100.00	0.06	100.06
1803-P-229 A	Ind. Motor	Cab PM-229 A	1,0NCUN3	0.0	0.0	104.40	103.77	99.45	0.64	100.06
1803-P-230 S	Ind. Motor	Cab 1803-PM-230 S	1,0NCUN3	0.0	0.0	104.40	104.34	100.00	0.06	100.06
1803-P-230 A	Ind. Motor	Cab PM-230 A	1,0NCUN3	0.0	0.0	104.40	103.77	99.45	0.64	100.06
1803-P-234 S	Ind. Motor	Cab 1803-PM-234 S	1,0NCUN3	0.0	0.0	104.40	104.34	100.00	0.06	100.06
1803-P-234 A	Ind. Motor	Cab 1803-PM-234 A	1,0NCUN3	0.0	0.0	104.40	103.77	99.45	0.64	100.06
1803-P-233 S	Ind. Motor	Cab 1803-PM-233 S	1,0NCUN3	0.0	0.0	104.40	104.34	100.00	0.06	100.06
1803-P-233 A	Ind. Motor	Cab 1803-PM-233 A	1,0NCUN3	0.0	0.0	104.40	103.77	99.45	0.64	100.06
1803-P-232 S	Ind. Motor	Cab 1803-PM-232 S	1,0NCUN3	0.0	0.0	104.40	104.34	100.00	0.06	100.06
1803-P-232 A	Ind. Motor	Cab 1803-PM-232 A	1,0NCUN3	0.0	0.0	104.40	103.77	99.45	0.64	100.06
1803-P-231 S	Ind. Motor	Cab 1803-PM-231 S	1,0NCUN3	0.0	0.0	104.40	104.34	100.00	0.06	100.06
1803-P-231 A	Ind. Motor	Cab 1803-PM-231 A	1,0NCUN3	0.0	0.0	104.40	103.77	99.45	0.64	100.06
1803-X-105-P-1	Ind. Motor	Cab 1803-X-105-P-1	1,0NCUN3	0.1	0.0	104.40	102.64	98.37	1.77	95.01
1803-X-105-P-2	Ind. Motor	Cab 1803-X-105-P-2	1,0NCUN3	0.1	0.0	104.40	102.64	98.37	1.77	95.01
1803-X-105-FD-1	Ind. Motor	Cab 1803-X-105-FD-1	1,0NCUN3	0.1	0.0	104.40	102.64	98.37	1.77	95.01
1803-X-105-P-5	Ind. Motor	Cab 1803-X-105-P-5	1,0NCUN3	0.1	0.0	104.40	102.64	98.37	1.77	95.01
1803-K-201-P-2	Ind. Motor	Cab 1803-K-201-P-2	1,0NCUN3	0.1	0.0	104.40	101.88	97.65	2.52	91.45
1803-K-201-P-1	Ind. Motor	Cab 1803-K-201-P-1	1,0NCUN3	0.1	0.0	104.40	101.88	97.65	2.52	91.45
St Rotor Turnning (MAB)	Ind. Motor	Cab Rotor Turnning (MAB)	1,0NCUN3	0.0	0.0	104.40	103.92	99.60	0.48	100.90
St Rotor Turning (WGC)	Ind. Motor	Cab St Rotor Turning (WGC)	1,0NCUN3	0.0	0.0	104.40	103.72	99.41	0.68	99.51
1803-K-105-P-3 (2)	Ind. Motor	Cab 1803-K-105-P-3 (2)	1,0NCUN3	0.3	0.0	104.40	99.58	95.44	4.82	83.62
1803-K-105-P-4 (2)	Ind. Motor	Cab 1803-K-105-P-4 (2)	1,0NCUN3	0.0	0.0	104.40	103.95	99.63	0.46	83.62
1803-K-201-P-3 (2)	Ind. Motor	Cab 1803-K-201-P-3 (2)	1,0NCUN3	0.3	0.0	104.40	99.58	95.44	4.82	83.62
1803-K-201-P-4 (2)	Ind. Motor	Cab 1803-K-201-P-4 (2)	1,0NCUN3	0.0	0.0	104.40	103.95	99.63	0.46	83.62
1803-K-201-P-5	Ind. Motor	Cab 1803-K-201-P-5	1,0NCUN3	0.1	0.0	104.40	101.88	97.65	2.52	91.45
1803-K-201-FD-1	Ind. Motor	Cab 1803-K-201-FD-1	1,0NCUN3	0.1	0.0	104.40	101.88	97.65	2.52	91.45
1803-PM-614	Ind. Motor	Cab 1803-PM-614	1,0NCUN3	0.1	0.0	98.97	97.79	93.72	1.18	85.10
1803-X-702 A	Ind. Motor	Cab 1803-X-702 A	1,0NCUN4	0.8	0.0	98.97	94.02	90.11	4.95	82.47
1803-ACM-208 A	Ind. Motor	Cab ACM-208 A	1,0NALN3	0.2	0.0	104.00	102.78	102.78	1.21	98.18
1803-ACM-206 A2	Ind. Motor	Cab ACM-206 A2	1,0NALN3	0.6	0.1	104.00	101.90	101.90	2.09	95.10
1803-ACM-206 A1	Ind. Motor	Cab ACM-206 A1	1,0NALN3	0.6	0.1	104.00	101.94	101.94	2.06	95.25
1803-AM-1005	Ind. Motor	Cab 1803-AM-1005	1,0NCUN3	0.0	0.0	104.00	103.51	99.21	0.48	94.94
1803-AM-1003	Ind. Motor	Cab 1803-AM-1003	1,0NCUN3	0.0	0.0	104.00	103.72	99.41	0.28	98.69
1803-AM-1001	Ind. Motor	Cab 1803-AM-1001	1,0NCUN3	0.0	0.0	104.00	103.49	99.19	0.51	94.53
1803-PM-612 A	Ind. Motor	Cab 1803-PM-612 A	1,0NCUN3	0.1	0.0	104.00	103.12	98.83	0.88	93.20
1803-PM-611 A	Ind. Motor	Cab 1803-PM-611 A	1,0NALN3	0.0	0.0	104.00	103.71	99.40	0.29	100.57

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Engineer:	Study Case: LF Normal	Revision:	Base
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Equipment Cable and Overload Heater Losses Summary Report

Connected Load		Cable /Overload Heater		Losses		% Voltage			% Vd	% Vst
						Terminal on				
ID	Type	ID	Library	kW	kvar	Bus	Bus kV	Load kV	Operating	Starting
1803-PM-606 A	Ind. Motor	Cab PM-606 A	1,0NCUN3	0.6	0.0	104.00	101.31	101.31	2.69	91.21
1803-PM-602 A	Ind. Motor	Cab 1803-PM-602 A	1,0NCUN3	0.1	0.0	104.00	102.70	98.43	1.30	87.38
1803-PM-223 B	Ind. Motor	Cab PM-223 B	1,0NALN3	0.0	0.0	104.00	103.85	103.85	0.15	96.69
1803-PM-211 A	Ind. Motor	Cab 1803-PM-211 A	1,0NCUN3	0.0	0.0	104.00	103.25	98.96	0.75	93.16
1803-PM-210 A	Ind. Motor	Cab PM-210 A	1,0NCUN3	0.6	0.0	104.00	101.30	101.30	2.69	93.14
1803-PM-208 B	Ind. Motor	Cab PM-208 B	1,0NALN3	0.0	0.0	104.00	103.92	103.92	0.08	99.50
1803-PM-201 A	Ind. Motor	Cab PM-201 A	1,0NALN3	0.8	0.2	104.00	101.84	101.84	2.15	93.52
1803-PM-601 A	Ind. Motor	Cab 1803-PM-601 A	1,0NCUN3	0.1	0.0	104.00	102.91	98.63	1.09	90.42
1803-ACM-201 B2	Ind. Motor	Cab ACM-201 B2	1,0NALN3	0.5	0.1	103.94	102.72	102.72	1.21	97.91
1803-ACM-201 G2	Ind. Motor	Cab ACM-201 G2	1,0NALN3	0.4	0.1	103.94	102.73	102.73	1.21	97.95
1803-ACM-201 Q2	Ind. Motor	Cab ACM-201 Q2	1,0NALN3	0.9	0.1	104.08	101.77	101.77	2.31	93.34
1803-ACM-201 N2	Ind. Motor	Cab ACM-201 N2	1,0NALN3	0.8	0.1	104.08	101.94	101.94	2.14	94.11
1803-ACM-201 L2	Ind. Motor	Cab ACM-201 L2	1,0NALN3	0.8	0.1	104.08	102.10	102.10	1.98	94.83
1803-ACM-201 J2	Ind. Motor	Cab ACM-201 J2	1,0NALN3	0.7	0.1	104.08	102.31	102.31	1.77	95.76
1803-ACM-204 C2	Ind. Motor	Cab ACM-204 C2	1,0NALN3	0.7	0.1	103.97	102.20	102.20	1.77	96.74
1803-ACM-204 A2	Ind. Motor	Cab ACM-204 A2	1,0NALN3	0.6	0.1	103.97	102.25	102.25	1.72	96.94
1803-ACM-204 C1	Ind. Motor	Cab ACM-204 C1	1,0NALN3	0.6	0.1	103.97	102.29	102.29	1.68	97.10
1803-ACM-204 A1	Ind. Motor	Cab ACM-204 A1	1,0NALN3	0.7	0.1	103.97	102.21	102.21	1.75	96.80
1803-ACM-601 B	Ind. Motor	Cab ACM-601 B	1,0NCUN3	0.1	0.0	103.97	100.22	100.22	3.74	85.32
1803-ACM-207 D2	Ind. Motor	Cab ACM-207 D2	1,0NALN3	0.3	0.0	103.97	102.55	102.55	1.42	97.75
1803-ACM-207 B2	Ind. Motor	Cab ACM-207 B2	1,0NALN3	0.3	0.0	103.97	102.44	102.44	1.52	97.31
1803-ACM-207 D1	Ind. Motor	Cab ACM-207 D1	1,0NALN3	0.3	0.0	103.97	102.48	102.48	1.49	97.45
1803-ACM-207 A1	Ind. Motor	Cab ACM-207 A1	1,0NALN3	0.2	0.0	103.97	102.92	102.92	1.04	99.17
1803-ACM-205 A1	Ind. Motor	Cab ACM-205 A1	1,0NALN3	0.2	0.0	104.19	103.14	103.14	1.05	99.32
1803-ACM-205 C1	Ind. Motor	Cab ACM-205 C1	1,0NALN3	0.2	0.0	104.19	103.11	103.11	1.08	99.21
1803-ACM-205 E1	Ind. Motor	Cab ACM-205 E1	1,0NALN3	0.2	0.0	104.19	103.08	103.08	1.10	99.09
1803-ACM-205 G1	Ind. Motor	Cab ACM-205 G1	1,0NALN3	0.2	0.0	104.19	103.06	103.06	1.13	98.98
1803-ACM-205 A2	Ind. Motor	Cab ACM-205 A2	1,0NALN3	0.2	0.0	104.19	103.03	103.03	1.16	98.84
1803-ACM-205 C2	Ind. Motor	Cab ACM-205 C2	1,0NALN3	0.2	0.0	104.19	103.00	103.00	1.19	98.71
1803-ACM-205 E2	Ind. Motor	Cab ACM-205 E2	1,0NALN3	0.2	0.0	104.19	102.97	102.97	1.21	98.60
1803-ACM-205 G2	Ind. Motor	Cab ACM-205 G2	1,0NALN3	0.2	0.0	104.19	102.92	102.92	1.26	98.37
1803-X-106 A	Ind. Motor	Cab X-106 A	1,0NALN3	1.1	0.2	104.12	102.16	102.16	1.95	95.13
1803-X-107-P-006 A	Ind. Motor	Cab X-107-P-006 A	1,0NCUN3	0.1	0.0	104.12	102.22	102.22	1.90	94.63
1803-X-107-P-001 A	Ind. Motor	Cab X-107-P-001 A	1,0MCUN3	0.0	0.0	104.12	103.29	103.29	0.83	98.23
1803-X-107-P-005 A	Ind. Motor	Cab X-107-P-005 A	1,0NCUN3	0.0		104.12	102.72	102.72	1.40	95.99
1803-X-107-P-002 A	Ind. Motor	Cab X-107-P-002 A	1,0NALN3	0.1	0.0	104.12	103.74	103.74	0.38	102.33

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Contract:		SN:	
Engineer:	Study Case: LF Normal	Revision:	Base
Filename: TFM		Config.:	Normal

Equipment Cable and Overload Heater Losses Summary Report

Connected Load		Cable /Overload Heater		Losses		% Voltage			% Vd	% Vst
						Terminal on				
ID	Type	ID	Library	kW	kvar	Bus	Bus kV	Load kV	Operating	Starting
1803-X-107-P-007 A	Ind. Motor	Cab X-107-P-007 A	1,0NALN3	0.1	0.0	104.12	103.74	103.74	0.38	101.98
1803-X-106 LRSB	Ind. Motor	Cab X-106 LRSB	1,0NALN3	0.1	0.0	104.12	103.60	103.60	0.52	101.54
1803-X-208-P-XX1	Ind. Motor	Cab X-208-P-XX1	1,0NCUN3	0.2	0.0	98.99	93.34	89.46	5.65	76.96
1803-X-208-P-XX2	Ind. Motor	Cab X-208-P-XX2	1,0NCUN3	0.0	0.0	98.99	97.48	93.43	1.50	90.62
1803-X-205-P-012 A	Ind. Motor	Cab X-205-P-012 A	1,0NCUN3	0.2	0.0	98.99	96.97	92.94	2.02	89.40
1803-X-205-P-011 A	Ind. Motor	Cab X-205-P-011 A	1,0NCUN3	0.2	0.0	98.99	96.97	92.94	2.02	90.94
1803-X-205-P-007 A	Ind. Motor	Cab X-205-P-007 A	1,0NALN3	1.1	0.3	98.99	96.52	92.51	2.47	90.19
1803-X-205-P-008 A	Ind. Motor	Cab X-205-P-008 A	1,0NCUN3	0.2	0.0	98.99	96.97	92.94	2.02	90.94
1803-X-205-P-005 B	Ind. Motor	Cab X-205-P-005 B	1,0NALN3	0.0	0.0	98.99	98.83	94.72	0.15	93.07
1803-X-205-P-004 B	Ind. Motor	Cab X-205-P-004 B	1,0NALN3	0.0	0.0	98.99	98.83	94.72	0.15	93.07
1803-X-205-P-003 A	Ind. Motor	Cab X-205-P-003 A	1,0NCUN3	0.3	0.0	98.99	96.32	92.32	2.66	89.02
1803-X-205-P-002 A	Ind. Motor	Cab X-205-P-002 A	1,0NALN3	0.4	0.1	98.99	97.28	93.24	1.70	92.72
1803-X-205-P-001 A	Ind. Motor	Cab X-205-P-001 A	1,0NALN3	0.5	0.1	98.99	97.04	93.00	1.95	91.86
1803-X-205-P-014 B	Ind. Motor	Cab X-205-P-014 B	1,0NALN3	0.0	0.0	98.99	98.74	94.64	0.24	89.76
HV-1401-1	Ind. Motor	Cab HV-1401-1	1,0NCUN3	0.0	0.0	98.99	98.95	94.83	0.04	98.45
HV-1601-1	Ind. Motor	Cab HV-1601-1	1,0NCUN3	0.0	0.0	98.99	98.95	94.83	0.04	98.45
HV-2201-1	Ind. Motor	Cab HV-2201-1	1,0NCUN3	0.0	0.0	98.99	98.95	94.83	0.04	98.45
XZV-2301-1	Ind. Motor	Cab XZV-2301-1	1,0NCUN3	0.0	0.0	98.99	98.95	94.83	0.04	98.45
H-4001	Ind. Motor	Cab H-4001	1,0NCUN3	0.0	0.0	98.99	98.92	94.81	0.06	98.28
1803-X-603	Ind. Motor	Cab XZV-2301-4	1,0NCUN3	0.0	0.0	98.99	98.93	94.82	0.06	98.71
OXTM-C	Ind. Motor	Cab OXTMC	1,0NALN3	0.0	0.0	104.15	104.03	99.70	0.12	99.83
OXTM-A	Ind. Motor	Cab OXTMA	1,0NALN3	1.1	0.3	104.15	102.89	98.61	1.26	99.83
1803-PM-217 B	Ind. Motor	Cab PM-217 B	1,0NALN3	0.0	0.0	104.15	103.93	99.61	0.22	96.61
1803-PM-224 A	Ind. Motor	Cab PM-224 A	1,0NALN3	0.7	0.3	104.15	103.29	99.00	0.86	100.39
1803-PM-207 A	Ind. Motor	Cab PM-207 A	1,0NALN3	2.4	0.8	104.15	102.43	98.17	1.72	98.06
1803-PM-206 B	Ind. Motor	Cab PM-206 B	1,0NALN3	0.1	0.0	104.15	103.75	99.43	0.40	91.10
1803-PM-102 A	Ind. Motor	Cab PM-102 A	1,0NALN3	2.9	0.7	104.15	101.82	97.59	2.33	96.56
1803-PM-216 B	Ind. Motor	Cab PM-216 B	1,0NALN3	0.0	0.0	104.32	104.07	99.75	0.24	94.50
1803-PM-218 A	Ind. Motor	Cab PM-218 A	1,0NALN3	4.8	1.4	104.32	101.03	96.83	3.28	91.03
1803-X-107-P-004 A	Ind. Motor	Cab X-107-P-004 A	1,0NALN3	0.0	0.0	104.32	104.23	99.90	0.08	100.03
1803-PM-219 B	Ind. Motor	Cab PM-219 B	1,0NALN3	0.0	0.0	104.32	104.01	99.68	0.31	90.79
1803-PM-215 A	Ind. Motor	Cab PM-215 A	1,0NALN3	1.9	0.7	104.32	102.03	97.78	2.29	93.75
1803-X-107-P-003 A	Ind. Motor	Cab X-107-P-003 A	1,0NALN3	1.2	0.4	104.32	103.45	99.15	0.87	100.71
1803-PM-212 B	Ind. Motor	Cab PM-212 B	1,0NALN3	0.0	0.0	99.13	98.93	94.82	0.20	92.07
1803-PM-220 A	Ind. Motor	Cab PM-220 A	1,0NALN3	1.0	0.4	99.13	97.99	93.92	1.14	94.25
1803-PM-225 A	Ind. Motor	Cab PM-225 A	1,0NALN3	0.9	0.4	99.13	98.09	94.01	1.04	95.02

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Contract:		SN:	
Engineer:	Study Case: LF Normal	Revision:	Base
Filename: TFM		Config.:	Normal

Equipment Cable and Overload Heater Losses Summary Report

Connected Load		Cable /Overload Heater		Losses		% Voltage			% Vd	% Vst
						Terminal on				
ID	Type	ID	Library	kW	kvar	Bus	Bus kV	Load kV	Operating	Starting
1803-PM-209 B	Ind. Motor	Cab PM-209 B	1,0NALN3	0.0	0.0	99.13	98.90	94.79	0.22	90.73
1803-X-205-P-006 B	Ind. Motor	Cab X-205-P-006 B	1,0NALN3	0.0	0.0	99.13	98.94	94.82	0.19	91.82
1803-PM-203 A	Ind. Motor	Cab PM-203 A	1,0NALN3	2.4	0.6	99.13	95.65	91.68	3.47	85.96
1803-X-205-P-010 A	Ind. Motor	Cab X-205-P-010 A	1,0NALN3	5.7	1.7	99.13	95.21	91.25	3.92	84.93
1803-PM-613	Ind. Motor	Cab 1803-PM-613	1,0NCUN3	0.0	0.0	104.24	103.87	99.55	0.37	89.63
1803-X-702 B	Ind. Motor	Cab 1803-X-702 B	1,0NCUN4	0.1	0.0	104.24	102.89	98.61	1.35	86.86
1803-PM-208 A	Ind. Motor	Cab PM-208 A	1,0NALN3	0.2	0.1	104.28	103.48	103.48	0.80	99.78
1803-PM-223 A	Ind. Motor	Cab PM-223 A	1,0NALN3	0.7	0.1	104.28	102.76	102.76	1.52	96.96
1803-PM-606 B	Ind. Motor	Cab PM-606 B	1,0NCUN3	0.0	0.0	104.28	104.02	104.02	0.26	91.47
1803-PM-611 B	Ind. Motor	Cab 1803-PM-611 B	1,0NALN3	0.0	0.0	104.28	104.00	99.67	0.29	100.85
1803-AM-1002	Ind. Motor	Cab 1803-AM-1002	1,0NCUN3	0.0	0.0	104.28	103.82	99.51	0.46	95.61
1803-AM-1004	Ind. Motor	Cab 1803-AM-1004	1,0NCUN3	0.0	0.0	104.28	103.78	99.46	0.51	94.79
1803-AM-1006	Ind. Motor	Cab 1803-AM-1006	1,0NCUN3	0.0	0.0	104.28	103.80	99.49	0.48	95.20
1803-ACM-206 B1	Ind. Motor	Cab ACM-206 B1	1,0NALN3	0.6	0.1	104.28	102.23	102.23	2.05	95.52
1803-ACM-206 B2	Ind. Motor	Cab ACM-206 B2	1,0NALN3	0.6	0.1	104.28	102.20	102.20	2.09	95.36
1803-ACM-208 B	Ind. Motor	Cab ACM-208 B	1,0NALN3	0.2	0.0	104.28	103.08	103.08	1.21	98.46
1803-ACM-208 C	Ind. Motor	Cab ACM-208 C	1,0NALN3	0.2	0.0	104.28	103.08	103.08	1.21	98.46
HEATER-2 (WGC 1803-K-1 02)	Ind. Motor	Cab Heather-2 K102	1,0NALN4	0.0	0.0	104.28	104.23	104.23	0.06	104.05
1803-PM-210 B	Ind. Motor	Cab PM-210 B	1,0NCUN3	0.0	0.0	104.28	104.02	104.02	0.26	93.40
1803-PM-201 B	Ind. Motor	Cab PM-201 B	1,0NALN3	0.0	0.0	104.28	104.07	104.07	0.21	93.76
1803-ACM-201 C2	Ind. Motor	Cab ACM-201 C2	1,0NALN3	0.4	0.1	104.24	103.03	103.03	1.21	98.20
1803-ACM-201 E2	Ind. Motor	Cab ACM-201 E2	1,0NALN3	0.3	0.1	104.24	103.33	103.33	0.91	99.66
1803-ACM-201 A2	Ind. Motor	Cab ACM-201 A2	1,0NALN3	0.5	0.1	104.24	102.97	102.97	1.27	97.91
1803-ACM-201 F2	Ind. Motor	Cab ACM-201 F2	1,0NALN3	0.4	0.1	104.24	103.10	103.10	1.14	98.52
1803-ACM-201 H2	Ind. Motor	Cab ACM-201 H2	1,0NALN3	0.5	0.1	104.37	103.13	103.13	1.24	98.16
1803-ACM-201 K2	Ind. Motor	Cab ACM-201 K2	1,0NALN3	0.7	0.1	104.37	102.49	102.49	1.88	95.51
1803-ACM-201 P2	Ind. Motor	Cab ACM-201 P2	1,0NALN3	0.8	0.1	104.37	102.24	102.24	2.13	94.37
1803-ACM-201 R2	Ind. Motor	Cab ACM-201 R2	1,0NALN3	0.9	0.1	104.37	102.07	102.07	2.30	93.60
1803-ACM-201 M2	Ind. Motor	Cab ACM-201 M2	1,0NALN3	0.8	0.1	104.37	102.40	102.40	1.97	95.09
1803-ACM-207 C2	Ind. Motor	Cab ACM-207 C2	1,0NALN3	0.3	0.0	104.28	102.76	102.76	1.52	97.60
1803-ACM-207 B1	Ind. Motor	Cab ACM-207 B1	1,0NALN3	0.2	0.0	104.28	103.21	103.21	1.07	99.35
1803-ACM-207 A2	Ind. Motor	Cab ACM-207 A2	1,0NALN3	0.3	0.0	104.28	102.79	102.79	1.48	97.74
1803-ACM-601 A	Ind. Motor	Cab ACM-601 A	1,0NCUN3	0.2	0.0	104.28	98.89	98.89	5.39	79.11
1803-ACM-204 B1	Ind. Motor	Cab ACM-204 B1	1,0NALN3	0.6	0.1	104.28	102.60	102.60	1.67	97.39
1803-ACM-204 D1	Ind. Motor	Cab ACM-204 D1	1,0NALN3	0.6	0.1	104.28	102.56	102.56	1.71	97.23

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Contract:		SN:	
Engineer:	Study Case: LF Normal	Revision:	Base
Filename: TFM		Config.:	Normal

Equipment Cable and Overload Heater Losses Summary Report

Connected Load		Cable /Overload Heater		Losses		% Voltage			% Vd	% Vst
						Terminal on				
ID	Type	ID	Library	kW	kvar	Bus	Bus kV	Load kV	Operating	Starting
1803-ACM-207 C1	Ind. Motor	Cab ACM-207 C1	1,0NALN3	0.3	0.0	104.28	102.83	102.83	1.45	97.89
1803-ACM-202 B1	Ind. Motor	Cab ACM-202 B1	1,0NCUN3	0.1	0.0	104.28	102.97	102.97	1.30	97.04
1803-ACM-204 D2	Ind. Motor	Cab ACM-204 D2	1,0NALN3	0.7	0.1	104.28	102.51	102.51	1.76	98.22
1803-ACM-204 B2	Ind. Motor	Cab ACM-204 B2	1,0NALN3	0.7	0.1	104.28	102.51	102.51	1.76	97.03
1803-ACM-205 B1	Ind. Motor	Cab ACM-205 B1	1,0NALN3	0.2	0.0	104.48	103.41	103.41	1.07	99.49
1803-ACM-205 D1	Ind. Motor	Cab ACM-205 D1	1,0NALN3	0.2	0.0	104.48	103.38	103.38	1.10	99.37
1803-ACM-205 F1	Ind. Motor	Cab ACM-205 F1	1,0NALN3	0.2	0.0	104.48	103.36	103.36	1.12	99.26
1803-ACM-205 H1	Ind. Motor	Cab ACM-205 H1	1,0NALN3	0.2	0.0	104.48	103.33	103.33	1.15	99.12
1803-ACM-205 B2	Ind. Motor	Cab ACM-205 B2	1,0NALN3	0.2	0.0	104.48	103.59	103.59	0.89	100.08
1803-ACM-205 D2	Ind. Motor	Cab ACM-205 D2	1,0NALN3	0.2	0.0	104.48	103.30	103.30	1.18	98.99
1803-ACM-205 F2	Ind. Motor	Cab ACM-205 F2	1,0NALN3	0.2	0.0	104.48	103.27	103.27	1.21	98.88
1803-ACM-205 H2	Ind. Motor	Cab ACM-205 H2	1,0NALN3	0.3	0.0	104.48	103.16	103.16	1.32	98.36
1803-X-107-P-002 B	Ind. Motor	Cab X-107-P-002 B	1,0NALN3	0.0	0.0	104.51	104.47	104.47	0.04	102.72
1803-X-107-P-007 B	Ind. Motor	Cab X-107-P-007 B	1,0NALN3	0.0	0.0	104.51	104.47	104.47	0.04	102.36
1803-X-107-P-001 B	Ind. Motor	Cab X-107-P-001 B	1,0NCUS3	0.0	0.0	104.51	104.43	104.43	0.08	99.55
1803-X-107-P-005 B	Ind. Motor	Cab X-107-P-005 B	1,0NCUN3	0.0	0.0	104.51	104.43	104.43	0.08	99.56
1803-X-107-P-006 B	Ind. Motor	Cab X-107-P-006 B	1,0NCUN3	0.0	0.0	104.51	104.32	104.32	0.19	94.99
1803-X-106 B	Ind. Motor	Cab X-106 B	1,0NALN3	0.0	0.0	104.51	104.32	104.32	0.19	95.48
1803-X-205-P-007 B	Ind. Motor	Cab X-205-P-007B	1,0NALN3	0.0	0.0	104.19	103.96	99.64	0.23	94.93
1803-X-205-P-011 B	Ind. Motor	Cab X-205-P-011 B	1,0NCUN3	0.0	0.0	104.19	103.94	99.62	0.25	93.70
1803-X-208-P-014 A	Ind. Motor	Cab X-205-P-014 A	1,0NALN3	1.2	0.4	104.19	101.82	97.58	2.37	94.48
1803-X-208-P-XX3	Ind. Motor	Cab X-208-P-XX3	1,0NCUN3	0.8	0.0	104.19	98.82	94.71	5.37	84.64
1803-X-205-P-012 B	Ind. Motor	Cab X-205-P-012 B	1,0NCUN3	0.0	0.0	104.19	104.00	99.68	0.19	95.72
1803-X-205-P-008 B	Ind. Motor	Cab X-205-P-008 B	1,0NCUN3	0.0	0.0	104.19	103.94	99.62	0.25	93.70
1803-X-205-P-005 A	Ind. Motor	Cab X-205-P-005 A	1,0NALN3	0.3	0.1	104.19	102.71	98.44	1.48	97.96
1803-X-205-P-004 A	Ind. Motor	Cab X-205-P-004 A	1,0NALN3	0.3	0.1	104.19	102.71	98.44	1.48	97.96
1803-X-205-P-003 B	Ind. Motor	Cab X-205-P-003 B	1,0NCUN3	0.0	0.0	104.19	103.94	99.62	0.25	93.70
1803-X-205-P-002 B	Ind. Motor	Cab X-205-P-002 B	1,0NALN3	0.0	0.0	104.19	104.01	99.68	0.18	96.69
1803-X-205-P-001 B	Ind. Motor	Cab X-205-P-001 B	1,0NALN3	0.0	0.0	104.19	104.01	99.68	0.18	96.69
XZV-2301-2	Ind. Motor	Cab XZV-2301-2	1,0NCUN3	0.0	0.0	104.19	104.15	99.82	0.04	103.62
HV-2201-2	Ind. Motor	Cab HV-2201-2	1,0NCUN3	0.0	0.0	104.19	104.15	99.82	0.04	103.62
HV-1401-2	Ind. Motor	Cab HV-1401-2	1,0NCUN3	0.0	0.0	104.19	104.15	99.82	0.04	103.62
HV-1601-2	Ind. Motor	Cab HV-1601-2	1,0NCUN3	0.0	0.0	104.19	104.15	99.82	0.04	103.62
1803-PM-217 A	Ind. Motor	Cab PM-217 A	1,0NALN3	3.2	0.9	104.46	102.26	98.01	2.20	96.90
1803-PM-224 B	Ind. Motor	Cab PM-224 B	1,0NALN3	0.0	0.0	104.46	104.38	100.04	0.08	100.70
1803-PM-102 B	Ind. Motor	Cab PM-102 B	1,0NALN3	0.0	0.0	104.46	104.24	99.90	0.23	96.85

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Contract:		SN:	
Engineer:	Study Case: LF Normal	Revision:	Base
Filename: TFM		Config.:	Normal

Equipment Cable and Overload Heater Losses Summary Report

Connected Load		Cable /Overload Heater		Losses		% Voltage			% Vd	% Vst
						Terminal on				
ID	Type	ID	Library	kW	kvar	Bus	Bus kV	Load kV	Operating	Starting
1803-PM-206 A	Ind. Motor	Cab PM-206 A	1,0NALN3	4.1	1.5	104.46	101.65	97.42	2.82	94.25
1803-PM-207 B	Ind. Motor	Cab PM-207 B	1,0NALN3	0.0	0.0	104.46	104.29	99.96	0.17	98.42
OXTM-B	Ind. Motor	Cab OXTMB	1,0NALN3	1.1	0.3	104.46	103.20	98.91	1.26	100.13
1803-PM-218 B	Ind. Motor	Cab PM-218 B	1,0NALN3	0.0	0.0	104.61	104.29	99.96	0.32	91.29
1803-PM-215 B	Ind. Motor	Cab PM-215 B	1,0NALN3	0.0	0.0	104.61	104.39	100.05	0.22	94.01
1803-X-107-P-003 B	Ind. Motor	Cab X-107-P-003 B	1,0NALN3	0.0	0.0	104.61	104.53	100.18	0.09	100.99
1803-PM-216 A	Ind. Motor	Cab PM-216 A	1,0NALN3	3.1	0.7	104.61	102.12	97.87	2.50	94.77
1803-PM-219 A	Ind. Motor	Cab PM-219 A	1,0NALN3	5.0	1.8	104.61	101.44	97.23	3.17	91.05
1803-X-107-P-004 B	Ind. Motor	Cab X-107-P-004 B	1,0NALN3	0.8	0.4	104.61	103.79	99.47	0.82	100.32
1803-X-107-P-003 C	Ind. Motor	Cab X-107-P-003 C	1,0NALN3	1.2	0.4	104.61	103.74	99.43	0.87	100.99
1803-X-205-P-010 B	Ind. Motor	Cab X-205-P-010 B	1,0NALN3	0.0	0.0	104.30	103.94	99.62	0.36	91.79
1803-PM-203 B	Ind. Motor	Cab PM-203 B	1,0NALN3	0.0	0.0	104.30	103.98	99.66	0.32	90.45
1803-X-205-P-006 A	Ind. Motor	Cab X-205-P-006 A	1,0NALN3	1.7	0.8	104.30	102.47	98.21	1.83	96.62
1803-PM-212 A	Ind. Motor	Cab PM-212 A	1,0NALN3	1.6	0.6	104.30	102.40	98.14	1.90	96.88
1803-PM-209 A	Ind. Motor	Cab PM-209 A	1,0NALN3	3.1	0.9	104.30	102.15	97.91	2.15	95.47
1803-PM-225 B	Ind. Motor	Cab PM-225 B	1,0NALN3	0.0	0.0	104.30	104.30	99.96	0.00	104.25
1803-PM-220 B	Ind. Motor	Cab PM-220 B	1,0NALN3	0.0	0.0	104.30	104.19	99.86	0.11	99.17
1803-ACM-201 A1	Ind. Motor	Cab ACM-201 A1	1,0NALN3	0.5	0.1	100.00	98.68	98.68	1.32	93.93
1803-ACM-202 A1	Ind. Motor	Cab ACM-202 A1	1,0NCUN3	0.1	0.0	100.00	98.64	98.64	1.36	93.06
1803-ACM-201 B1	Ind. Motor	Cab ACM-201 B1	1,0NALN3	0.5	0.1	100.00	98.68	98.68	1.32	93.93
1803-ACM-201 C1	Ind. Motor	Cab ACM-201 C1	1,0NALN3	0.5	0.1	100.00	98.68	98.68	1.32	93.93
1803-ACM-201 D1	Ind. Motor	Cab ACM-201 D1	1,0NALN3	0.3	0.1	100.00	99.11	99.11	0.89	95.88
1803-ACM-201 D2	Ind. Motor	Cab ACM-201 D2	1,0NALN3	0.4	0.1	100.00	99.05	99.05	0.95	95.61
1803-ACM-201 E1	Ind. Motor	Cab ACM-201 E1	1,0NALN3	0.3	0.1	100.00	99.11	99.11	0.89	95.88
1803-ACM-201 F1	Ind. Motor	Cab ACM-201 F1	1,0NALN3	0.4	0.1	100.00	98.98	98.98	1.02	95.29
1803-ACM-201 G1	Ind. Motor	Cab ACM-201 G1	1,0NALN3	0.4	0.1	100.00	98.98	98.98	1.02	95.29
1803-ACM-201 H1	Ind. Motor	Cab ACM-201 H1	1,0NALN3	0.5	0.1	100.00	98.81	98.81	1.19	94.51
1803-ACM-201 J1	Ind. Motor	Cab ACM-201 J1	1,0NALN3	0.5	0.1	100.00	98.74	98.74	1.26	94.24
1803-ACM-201 K1	Ind. Motor	Cab ACM-201 K1	1,0NALN3	0.5	0.1	100.00	98.70	98.70	1.30	94.05
1803-ACM-201 L1	Ind. Motor	Cab ACM-201 L1	1,0NALN3	0.5	0.1	100.00	98.63	98.63	1.37	93.74
1803-ACM-201 M1	Ind. Motor	Cab ACM-201 M1	1,0NALN3	0.8	0.1	100.00	98.03	98.03	1.97	91.51
1803-ACM-201 N1	Ind. Motor	Cab ACM-201 N1	1,0NALN3	0.9	0.1	100.00	97.86	97.86	2.14	90.76
1803-ACM-201 P1	Ind. Motor	Cab ACM-201 P1	1,0NALN3	0.9	0.1	100.00	97.86	97.86	2.14	90.76
1803-ACM-201 Q1	Ind. Motor	Cab ACM-201 Q1	1,0NALN3	0.9	0.1	100.00	97.68	97.68	2.32	90.02
1803-ACM-201 R1	Ind. Motor	Cab ACM-201 R1	1,0NALN3	0.9	0.1	100.00	97.68	97.68	2.32	90.02
044-NON UPS DB-1	St. Load	Cab NON UPS DB 1	1,0NALN4	0.4	0.1	99.04	97.95	97.95	1.09	0.00

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Equipment Cable and Overload Heater Losses Summary Report

Connected Load		Cable /Overload Heater		Losses		% Voltage			% Vd	% Vst
						Terminal on				
ID	Type	ID	Library	kW	kvar	Bus	Bus kV	Load kV	Operating	Starting
044-NON UPS DB-2	St. Load	Cab NON UPS DB 2	1,0NALN4	0.4	0.1	104.21	103.16	98.87	1.05	0.00
1803-K-105-F-1	St. Load	Cab 1803-K-105-F-1	1,0NALN4	0.0	0.0	104.51	104.45	104.45	0.05	0.00
1803-K-105-F-2	St. Load	Cab 1803-K-105-F-2	1,0NALN4	0.0	0.0	104.12	104.06	104.06	0.05	0.00
1803-K-105-P-3 (1)	St. Load	Cab 1803-K-105-P-3 (1)	1,0NALN4	0.0	0.0	104.12	104.11	104.11	0.01	0.00
1803-K-105-P-4 (1)	St. Load	Cab 1803-K-105-P-4 (1)	1,0NALN4	0.0	0.0	104.51	104.51	104.51	0.00	0.00
1803-K-201-F-1	St. Load	Cab 1803-K-201-F-1	1,0NALN4	0.0	0.0	104.12	104.06	104.06	0.05	0.00
1803-K-201-P-3 (1)	St. Load	Cab 1803-K-201-P-3 (1)	1,0NALN4	0.0	0.0	104.12	104.11	104.11	0.01	0.00
1803-K-201-P-4 (1)	St. Load	Cab 1803-K-201-P-4 (1)	1,0NALN4			104.51	104.51	104.51	0.00	0.00
1803-WO-101	St. Load	Cab 1803-WO-101	1,0NCUN4	0.0	0.0	104.21	104.12	99.79	0.09	0.00
1803-WO-102	St. Load	Cab 1803-WO-102	1,0NCUN4	0.0	0.0	99.04	98.93	94.82	0.11	0.00
1803-WO-103	St. Load	Cab 1803-WO-103	1,0NCUN4	0.0	0.0	104.21	103.96	99.64	0.25	0.00
1803-WO-104	St. Load	Cab 1803-WO-104	1,0NCUN4	0.0	0.0	99.04	98.70	94.60	0.34	0.00
1803-WO-105	St. Load	Cab 1803-WO-105	1,0NCUN3	0.0	0.0	104.21	103.97	99.65	0.24	0.00
1803-WO-106	St. Load	Cab 1803-WO-106	1,0NCUN4	0.0	0.0	99.04	98.68	94.58	0.35	0.00
1803-WO-107	St. Load	Cab 1803-WO-107	1,0NCUN4	0.0	0.0	104.21	103.90	99.58	0.31	0.00
1803-WO-108	St. Load	Cab 1803-WO-108	1,0NCUN4	0.0	0.0	99.04	98.81	94.70	0.23	0.00
1803-WO-109	St. Load	Cab 1803-WO-109	1,0NCUN4	0.0	0.0	104.21	103.91	99.59	0.31	0.00
1803-WO-110	St. Load	Cab 1803-WO-110	1,0NCUN4	0.0	0.0	99.04	98.47	94.38	0.57	0.00
1803-WO-111	St. Load	Cab 1803-WO-111	1,0NCUN4	0.0	0.0	104.21	103.87	99.55	0.34	0.00
1803-WO-112	St. Load	Cab 1803-WO-112	1,0NCUN4	0.0	0.0	99.04	98.79	94.69	0.24	0.00
1803-X-109	St. Load	Cab 1803-X-109	1,0NCUN3	0.0	0.0	104.24	103.82	99.51	0.42	0.00
1803-X-206	St. Load	Cab 1803-X-206	1,0NCUN3	0.2	0.0	98.97	97.95	93.88	1.03	0.00
HB-001	St. Load	Cab HB-001	1,0NALN4	0.0	0.0	98.97	98.81	94.70	0.16	0.00
IGV INLET MAB	St. Load	Cab IGV INLET MAB	1,0NALN4	0.0	0.0	104.12	104.06	104.06	0.05	0.00
TRS-101 A	St. Load	Cab TRS-101 A	1,0NALN4	0.0	0.0	98.97	98.93	94.81	0.05	0.00
TRS-101 B	St. Load	Cab TRS-101 B	1,0NALN4	0.0	0.0	104.24	104.19	99.86	0.04	0.00
TRS-102 A	St. Load	Cab TRS-102 A	1,0NALN4	0.0	0.0	104.24	104.20	99.87	0.04	0.00
TRS-102 B	St. Load	Cab TRS-102 B	1,0NALN4	0.0	0.0	98.97	98.93	94.82	0.04	0.00
TRS-103 A	St. Load	Cab TRS-103 A	1,0NALN4	0.0	0.0	104.24	104.19	99.86	0.05	0.00
TRS-103 B	St. Load	Cab TRS-103 B	1,0NALN4	0.0	0.0	98.97	98.94	94.82	0.04	0.00
TRS-104 A	St. Load	Cab TRS-104 A	1,0NALN4	0.0	0.0	104.24	104.19	99.86	0.05	0.00
TRS-104 B	St. Load	Cab TRS-104 B	1,0NALN4	0.0	0.0	98.97	98.91	94.80	0.06	0.00
TRS-105 A	St. Load	Cab TRS-105 A	1,0NALN4	0.0	0.0	104.24	104.20	99.87	0.04	0.00
TRS-105 B	St. Load	Cab TRS-105 B	1,0NALN4	0.0	0.0	98.97	98.93	94.82	0.04	0.00
TRS-105 C	St. Load	Cab TRS-105 C	1,0NALN4	0.0	0.0	104.24	104.23	99.90	0.00	0.00
TRS-106 A	St. Load	Cab TRS-106 A	1,0NALN4	0.0	0.0	98.97	98.91	94.80	0.06	0.00

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Equipment Cable and Overload Heater Losses Summary Report

Connected Load		Cable /Overload Heater		Losses		% Voltage			% Vd	% Vst
						Terminal on				
ID	Type	ID	Library	kW	kvar	Bus	Bus kV	Load kV	Operating	Starting
UCP MAB	St. Load	Cab UCP MAB	1,0NALN4	0.0	0.0	104.51	104.45	104.45	0.05	0.00
UCP WGC	St. Load	Cab UCP WGC	1,0NALN4	0.0	0.0	104.51	104.45	104.45	0.05	0.00
1803-MOV-2305	MOV	Cab MOV-2305	0,5NCUN1			104.12	104.12	104.12	0.00	0.00
1803-MOV-2306	MOV	Cab MOV-2306	1,0NCUN3			104.51	104.51	104.51	0.00	0.00
1803-MOV-4001	MOV	Cab MOV-4001	1,0MCUN3			104.12	104.12	104.12	0.00	0.00
1803-MOV-5801	MOV	Cab MOV-5801	1,0NCUN3			104.51	104.51	104.51	0.00	0.00
1803-MOV-5802	MOV	Cab MOV-5802	1,0NCUN3			104.12	104.12	104.12	0.00	0.00
1803-MOV-5803	MOV	Cab MOV-5803	1,0NCUN3			104.51	104.51	104.51	0.00	0.00
1803-MOV-5804	MOV	Cab MOV-5804	1,0MCUN3			104.12	104.12	104.12	0.00	0.00
1803-X-106-MOV A	MOV	Cab X-106-MOV A	1,0NALN3			104.51	104.51	104.51	0.00	0.00
1803-X-106-MOV B	MOV	Cab X-106-MOV B	1,0NALN3			104.12	104.12	104.12	0.00	0.00
1803-X-106-MOV C	MOV	Cab X-106-MOV C	1,0NALN3			104.51	104.51	104.51	0.00	0.00
044-CB-101A	Capacitor	Cab CB-101A	6,6NALS1	0.1	0.2	110.35	110.35	110.35	-0.01	0.00
044-CB-101B	Capacitor	Cab CB-101B	6,6NALS1	0.1	0.2	110.79	110.79	110.79	-0.01	0.00

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Alert Summary Report

	% Alert Settings	
	<u>Critical</u>	<u>Marginal</u>
<u>Loading</u>		
Bus	100.0	95.0
Cable / Busway	100.0	95.0
Reactor	100.0	95.0
Line	100.0	95.0
Transformer	100.0	95.0
Panel	100.0	95.0
Protective Device	100.0	95.0
Generator	100.0	95.0
Inverter/Charger	100.0	95.0
<u>Bus Voltage</u>		
OverVoltage	105.0	102.0
UnderVoltage	95.0	98.0
<u>Generator Excitation</u>		
OverExcited (Q Max.)	100.0	95.0
UnderExcited (Q Min.)	100.0	

Critical Report

Device ID	Type	Condition	Rating/Limit	Unit	Operating	% Operating	Phase Type
Bus 1 UPS101A	Bus	Under Voltage	0.433	kV	0.410	94.7	3-Phase
Bus 1 UPS102A	Bus	Under Voltage	0.433	kV	0.406	93.7	3-Phase
Bus 3 UPS101A	Bus	Under Voltage	0.191	kV	0.165	86.4	3-Phase
Bus 3 UPS101C	Bus	Under Voltage	0.191	kV	0.165	86.4	3-Phase
Bus 3 UPS102A	Bus	Under Voltage	0.191	kV	0.165	86.4	3-Phase
Bus 3 UPS102C	Bus	Under Voltage	0.191	kV	0.165	86.4	3-Phase
Bus 5 UPS101A	Bus	Over Voltage	0.191	kV	0.201	105.3	3-Phase
Bus 5 UPS101C	Bus	Over Voltage	0.191	kV	0.201	105.3	3-Phase
BUS A 044-MLDB-101	Bus	Over Voltage	0.415	kV	0.438	105.5	3-Phase
BUS B 044-MLDB-101	Bus	Over Voltage	0.415	kV	0.437	105.4	3-Phase
Bus Prim TR-107A	Bus	Under Voltage	0.433	kV	0.411	94.9	3-Phase
Bus to CB-101A	Bus	Over Voltage	6.600	kV	7.283	110.3	3-Phase
Bus to CB-101B	Bus	Over Voltage	6.600	kV	7.312	110.8	3-Phase
BUS to HVAC-1	Bus	Under Voltage	0.433	kV	0.409	94.5	3-Phase
T UPS101A	Transformer	Overload	1.000	kVA	10.799	1079.9	3-Phase

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Critical Report

Device ID	Type	Condition	Rating/Limit	Unit	Operating	% Operating	Phase Type
T UPS101C	Transformer	Overload	1.000	kVA	10.799	1079.9	3-Phase
T UPS102A	Transformer	Overload	1.000	kVA	10.799	1079.9	3-Phase
T UPS102C	Transformer	Overload	1.000	kVA	10.799	1079.9	3-Phase
VFD-ACM 201 A1	VFD	Overload	41.736	Amp	45.801	109.7	3-Phase
VFD-ACM B1	VFD	Overload	41.736	Amp	45.801	109.7	3-Phase
VFD-ACM C1	VFD	Overload	41.736	Amp	45.667	109.4	3-Phase
VFD-ACM D1	VFD	Overload	41.736	Amp	45.576	109.2	3-Phase
VFD-ACM D2	VFD	Overload	41.736	Amp	45.607	109.3	3-Phase
VFD-ACM E1	VFD	Overload	41.736	Amp	45.442	108.9	3-Phase
VFD-ACM F1	VFD	Overload	41.736	Amp	45.643	109.4	3-Phase
VFD-ACM G1	VFD	Overload	41.736	Amp	45.509	109.0	3-Phase
VFD-ACM H1	VFD	Overload	41.736	Amp	45.733	109.6	3-Phase
VFD-ACM J1	VFD	Overload	41.736	Amp	45.631	109.3	3-Phase
VFD-ACM K1	VFD	Overload	31.123	Amp	45.724	146.9	3-Phase
VFD-ACM K1	VFD	OverCurrent	46.684	Amp	52.860	113.2	3-Phase
VFD-ACM L1	VFD	Overload	41.736	Amp	45.633	109.3	3-Phase
VFD-ACM M1	VFD	Overload	41.736	Amp	46.102	110.5	3-Phase
VFD-ACM N1	VFD	Overload	41.736	Amp	46.198	110.7	3-Phase
VFD-ACM P1	VFD	Overload	41.736	Amp	46.068	110.4	3-Phase
VFD-ACM Q1	VFD	Overload	41.736	Amp	46.295	110.9	3-Phase
VFD-ACM R1	VFD	Overload	41.736	Amp	46.165	110.6	3-Phase

Marginal Report

Device ID	Type	Condition	Rating/Limit	Unit	Operating	% Operating	Phase Type
BUS 044-ELDB-101	Bus	Over Voltage	0.415	kV	0.424	102.1	3-Phase
BUS 044-EPMCC-101	Bus	Over Voltage	0.415	kV	0.433	104.4	3-Phase
BUS 044-LDB-101	Bus	Over Voltage	0.415	kV	0.435	104.7	3-Phase
BUS 044-LDB-102	Bus	Over Voltage	0.415	kV	0.429	103.4	3-Phase
BUS 044-LDB-103	Bus	Over Voltage	0.415	kV	0.427	102.9	3-Phase
BUS 044-LDB-104	Bus	Over Voltage	0.415	kV	0.430	103.7	3-Phase
BUS 044-LDB-105	Bus	Over Voltage	0.415	kV	0.434	104.5	3-Phase
BUS 044-LDB-106	Bus	Over Voltage	0.415	kV	0.429	103.3	3-Phase
BUS 044-LDB-108	Bus	Over Voltage	0.415	kV	0.430	103.6	3-Phase
BUS 044-LDB-109	Bus	Over Voltage	0.415	kV	0.431	103.8	3-Phase
BUS 044-LDB-110	Bus	Over Voltage	0.415	kV	0.427	103.0	3-Phase
BUS 044-LDB-111	Bus	Over Voltage	0.415	kV	0.427	102.9	3-Phase

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Device ID	Type	Condition	Rating/Limit	Unit	Operating	% Operating	Phase Type
BUS 044-LDB-112	Bus	Over Voltage	0.415	kV	0.427	103.0	3-Phase
BUS 044-LDB-114	Bus	Over Voltage	0.415	kV	0.424	102.1	3-Phase
BUS 044-LDB-115	Bus	Over Voltage	0.415	kV	0.431	103.9	3-Phase
BUS 044-LDB-116	Bus	Over Voltage	0.415	kV	0.428	103.2	3-Phase
BUS 044-PDB-101	Bus	Over Voltage	0.415	kV	0.434	104.6	3-Phase
BUS 044-PDB-102	Bus	Over Voltage	0.415	kV	0.432	104.1	3-Phase
BUS 044-PDB-103	Bus	Over Voltage	0.415	kV	0.430	103.6	3-Phase
BUS 044-PDB-104	Bus	Over Voltage	0.415	kV	0.428	103.2	3-Phase
BUS 044-PDB-105	Bus	Over Voltage	0.415	kV	0.424	102.2	3-Phase
BUS A 044-EMLDB-101	Bus	Over Voltage	0.415	kV	0.426	102.5	3-Phase
BUS A 044-HT6-101	Bus	Over Voltage	6.600	kV	6.874	104.2	3-Phase
BUS A 044-MCC-101	Bus	Over Voltage	0.415	kV	0.432	104.0	3-Phase
BUS A 044-MCC-102	Bus	Over Voltage	0.415	kV	0.431	103.9	3-Phase
BUS A 044-MCC-103	Bus	Over Voltage	0.415	kV	0.432	104.1	3-Phase
BUS A 044-MCC-104	Bus	Over Voltage	0.415	kV	0.431	104.0	3-Phase
BUS A 044-MCC-105	Bus	Over Voltage	0.415	kV	0.432	104.2	3-Phase
BUS A 044-MCC-106	Bus	Over Voltage	0.415	kV	0.432	104.1	3-Phase
BUS A 044-MLDB-102	Bus	Over Voltage	0.415	kV	0.434	104.7	3-Phase
BUS A 044-PMCC-101	Bus	Over Voltage	0.415	kV	0.432	104.2	3-Phase
BUS A 044-PMCC-102	Bus	Over Voltage	0.415	kV	0.433	104.3	3-Phase
BUS B 044-ASB-101	Bus	Over Voltage	0.415	kV	0.433	104.2	3-Phase
BUS B 044-ASB-102	Bus	Over Voltage	0.415	kV	0.432	104.2	3-Phase
BUS B 044-HT6-101	Bus	Over Voltage	6.600	kV	6.902	104.6	3-Phase
BUS B 044-MCC-101	Bus	Over Voltage	0.415	kV	0.433	104.3	3-Phase
BUS B 044-MCC-102	Bus	Over Voltage	0.415	kV	0.433	104.2	3-Phase
BUS B 044-MCC-103	Bus	Over Voltage	0.415	kV	0.433	104.4	3-Phase
BUS B 044-MCC-104	Bus	Over Voltage	0.415	kV	0.433	104.3	3-Phase
BUS B 044-MCC-105	Bus	Over Voltage	0.415	kV	0.434	104.5	3-Phase
BUS B 044-MCC-106	Bus	Over Voltage	0.415	kV	0.434	104.5	3-Phase
BUS B 044-MCC-107	Bus	Over Voltage	0.415	kV	0.432	104.2	3-Phase
BUS B 044-MLDB-102	Bus	Over Voltage	0.415	kV	0.423	102.0	3-Phase
BUS B 044-PMCC-101	Bus	Over Voltage	0.415	kV	0.434	104.5	3-Phase
BUS B 044-PMCC-102	Bus	Over Voltage	0.415	kV	0.434	104.6	3-Phase
BUS B 044-PMCC-103	Bus	Over Voltage	0.415	kV	0.433	104.3	3-Phase
BUS B EMLDB-101	Bus	Over Voltage	0.415	kV	0.426	102.5	3-Phase
BUS B to VDU UNIT	Bus	Under Voltage	6.600	kV	6.420	97.3	3-Phase

Marginal Report

Device ID	Type	Condition	Rating/Limit	Unit	Operating	% Operating	Phase Type
BUS HVAC EPMCC	Bus	Over Voltage	0.415	kV	0.426	102.7	3-Phase
Bus Prim TR-102A	Bus	Over Voltage	6.600	kV	6.873	104.1	3-Phase
Bus Prim TR-102B	Bus	Over Voltage	6.600	kV	6.901	104.6	3-Phase
Bus Prim TR-103A	Bus	Over Voltage	6.600	kV	6.874	104.1	3-Phase
Bus Prim TR-103B	Bus	Over Voltage	6.600	kV	6.901	104.6	3-Phase
Bus Prim TR-104A	Bus	Over Voltage	6.600	kV	6.874	104.2	3-Phase
Bus Prim TR-104B	Bus	Over Voltage	6.600	kV	6.901	104.6	3-Phase
Bus Prim TR-105A	Bus	Over Voltage	6.600	kV	6.874	104.2	3-Phase
Bus Prim TR-105B	Bus	Over Voltage	6.600	kV	6.902	104.6	3-Phase
Bus Prim TR-105C	Bus	Over Voltage	6.600	kV	6.874	104.2	3-Phase
Bus Prim TR-108A	Bus	Over Voltage	0.415	kV	0.432	104.2	3-Phase
Bus to Charger-DCDB101B	Bus	Over Voltage	0.415	kV	0.433	104.3	3-Phase
Cab HVAC-1	Cable	Overload	711.437	Amp	690.226	97.0	3-Phase

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SUMMARY OF TOTAL GENERATION, LOADING & DEMAND

	<u>kW</u>	<u>kvar</u>	<u>kVA</u>	<u>% PF</u>
Source (Swing Buses):	23438.3	8330.4	24874.7	94.23 Lagging
Source (Non-Swing Buses):	0.0	0.0	0.0	
Total Demand:	23438.3	8330.4	24874.7	94.23 Lagging
Total Motor Load:	20004.8	11732.8	23191.6	86.26 Lagging
Total Static Load:	3255.5	-4091.9	5229.0	62.26 Leading
Total Constant I Load:	0.0	0.0	0.0	
Total Generic Load:	0.0	0.0	0.0	
Apparent Losses:	178.0	689.6		
System Mismatch:	0.0	0.0		

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LOAD FLOW REPORT

Bus		Voltage		Generation		Load		Load Flow				XFMR	
ID	kV	kV	Ang.	kW	kvar	kW	kvar	ID	kW	kvar	Amp	%PF	%Tap
BUS 1 to AU-V REVAMP UNIT	33.000	32.943	0.0	0.0	0.0	0.0	0.0	Bus Prim TR-114B	0.000	0.000	0.0	0.0	
								BUS B 044-HT33-101	0.000	0.000	0.0	0.0	
BUS 1 to VDU UNIT	33.000	32.943	0.0	0.0	0.0	0.0	0.0	Bus Prim TR-109B	0.000	-176.025	3.1	0.0	
								BUS A 044-HT33-101	0.000	176.025	3.1	0.0	
Bus 1 UPS101A	0.433	0.401	-7.9	0.0	0.0	0.0	0.0	BUS A 044-PMCC-103	0.000	0.000	0.0	0.0	
								044-UPS-101A	0.000	0.000	0.0	0.0	
Bus 1 UPS101C	0.433	0.401	-7.9	0.0	0.0	0.0	0.0	BUS B 044-PMCC-103	0.000	0.000	0.0	0.0	
								044-UPS-101C	0.000	0.000	0.0	0.0	
Bus 1 UPS102A	0.433	0.401	-7.9	0.0	0.0	0.0	0.0	BUS A 044-PMCC-103	0.000	0.000	0.0	0.0	
								044-UPS-102A	0.000	0.000	0.0	0.0	
Bus 1 UPS102C	0.433	0.401	-7.9	0.0	0.0	0.0	0.0	BUS B 044-PMCC-103	0.000	0.000	0.0	0.0	
								044-UPS-102C	0.000	0.000	0.0	0.0	
Bus 2 HT33	33.000	32.943	0.0	0.0	0.0	0.0	0.0	BUS B 044-HT33-101	0.000	0.000	0.0	0.0	
BUS 2 to AU-V REVAMP UNIT	33.000	32.943	0.0	0.0	0.0	0.0	0.0	Bus Prim TR-114A	5216.548	4070.376	116.0	78.8	
								BUS A 044-HT33-101	-5216.548	-4070.376	116.0	78.8	
BUS 2 to VDU UNIT	33.000	32.943	0.0	0.0	0.0	0.0	0.0	Bus Prim TR-109A	6214.853	4397.783	133.4	81.6	
								BUS B 044-HT33-101	-6214.853	-4397.783	133.4	81.6	
* Bus 2 UPS101A	0.110	0.110	0.0	0.0	0.0	0.0	0.0	Bus 3 UPS101A	0.000	0.000	0.0	0.0	
* Bus 2 UPS101C	0.110	0.110	0.0	0.0	0.0	0.0	0.0	Bus 3 UPS101C	0.000	0.000	0.0	0.0	
* Bus 2 UPS102A	0.110	0.110	0.0	0.0	0.0	0.0	0.0	Bus 3 UPS102A	0.000	0.000	0.0	0.0	
* Bus 2 UPS102C	0.110	0.110	0.0	0.0	0.0	0.0	0.0	Bus 3 UPS102C	0.000	0.000	0.0	0.0	
Bus 3 UPS101A	0.191	0.191	0.0	0.0	0.0	0.0	0.0	Bus 2 UPS101A	0.000	0.000	0.0	0.0	
Bus 3 UPS101C	0.191	0.191	0.0	0.0	0.0	0.0	0.0	Bus 2 UPS101C	0.000	0.000	0.0	0.0	
Bus 3 UPS102A	0.191	0.191	0.0	0.0	0.0	0.0	0.0	Bus 2 UPS102A	0.000	0.000	0.0	0.0	
Bus 3 UPS102C	0.191	0.191	0.0	0.0	0.0	0.0	0.0	Bus 2 UPS102C	0.000	0.000	0.0	0.0	
Bus 4 UPS101A	0.433	0.431	-5.0	0.0	0.0	0.0	0.0	BUS 044-EPMCC-101	-13.693	-0.028	18.4	100.0	
								Bus 5 UPS101A	13.693	0.028	18.4	100.0	-5.000
Bus 4 UPS101C	0.433	0.431	-5.0	0.0	0.0	0.0	0.0	BUS 044-EPMCC-101	-13.693	-0.028	18.4	100.0	
								Bus 5 UPS101C	13.693	0.028	18.4	100.0	-5.000
Bus 4 UPS102A	0.433	0.430	-5.0	0.0	0.0	0.0	0.0	BUS 044-EPMCC-101	-12.325	0.000	16.6	100.0	
								Bus 5 UPS102A	12.325	0.000	16.6	100.0	

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ID	kV	kV	Ang.	kW	kvar	kW	kvar	ID	kW	kvar	Amp	%PF	%Tap
Bus 4 UPS102C	0.433	0.430	-5.0	0.0	0.0	0.0	0.0	BUS 044-EPMCC-101	-12.291	-0.051	16.5	100.0	
								Bus 5 UPS102C	12.291	0.051	16.5	100.0	
Bus 5 UPS101A	0.191	0.200	-5.1	0.0	0.0	13.7	0.0	Bus 4 UPS101A	-13.674	0.000	39.5	100.0	
Bus 5 UPS101C	0.191	0.200	-5.1	0.0	0.0	13.7	0.0	Bus 4 UPS101C	-13.674	0.000	39.5	100.0	
Bus 5 UPS102A	0.191	0.190	-5.0	0.0	0.0	12.3	0.0	Bus 4 UPS102A	-12.325	0.000	37.5	100.0	
Bus 5 UPS102C	0.191	0.189	-5.2	0.0	0.0	12.3	0.0	Bus 4 UPS102C	-12.257	0.000	37.4	100.0	
BUS 044-ELDB-101	0.415	0.416	-5.9	0.0	0.0	2.0	0.0	BUS B EMLDB-101	-2.005	0.000	2.8	100.0	
BUS 044-ELDB-102	0.415	0.412	-5.9	0.0	0.0	2.0	0.0	BUS B EMLDB-101	-1.972	0.000	2.8	100.0	
BUS 044-ELDB-103	0.415	0.414	-5.9	0.0	0.0	2.0	0.0	BUS A 044-EMLDB-101	-1.990	0.000	2.8	100.0	
BUS 044-ELDB-104	0.415	0.408	-5.9	0.0	0.0	3.9	0.0	BUS A 044-EMLDB-101	-3.864	0.000	5.5	100.0	
BUS 044-ELDB-105	0.415	0.414	-5.9	0.0	0.0	2.0	0.0	BUS B EMLDB-101	-1.986	0.000	2.8	100.0	
BUS 044-ELDB-106	0.415	0.415	-5.9	0.0	0.0	2.0	0.0	BUS A 044-EMLDB-101	-1.997	0.000	2.8	100.0	
BUS 044-ELDB-107	0.415	0.403	-5.9	0.0	0.0	1.9	0.0	BUS A 044-EMLDB-101	-1.881	0.000	2.7	100.0	
BUS 044-ELDB-108	0.415	0.409	-5.9	0.0	0.0	1.9	0.0	BUS B EMLDB-101	-1.940	0.000	2.7	100.0	
BUS 044-ELDB-109	0.415	0.413	-5.9	0.0	0.0	2.0	0.0	BUS A 044-EMLDB-101	-1.980	0.000	2.8	100.0	
BUS 044-ELDB-110	0.415	0.411	-5.9	0.0	0.0	2.0	0.0	BUS B EMLDB-101	-1.960	0.000	2.8	100.0	
BUS 044-ELDB-111	0.415	0.404	-5.9	0.0	0.0	1.9	0.0	BUS A 044-EMLDB-101	-1.897	0.000	2.7	100.0	
BUS 044-ELDB-112	0.415	0.411	-5.9	0.0	0.0	2.0	0.0	BUS B EMLDB-101	-1.960	0.000	2.8	100.0	
BUS 044-ELDB-113	0.415	0.411	-5.9	0.0	0.0	2.0	0.0	BUS A 044-EMLDB-101	-1.960	0.000	2.8	100.0	
BUS 044-ELDB-114	0.415	0.409	-5.9	0.0	0.0	1.9	0.0	BUS B EMLDB-101	-1.940	0.000	2.7	100.0	
BUS 044-ELDB-115	0.415	0.405	-5.9	0.0	0.0	1.9	0.0	BUS A 044-EMLDB-101	-1.901	0.000	2.7	100.0	
BUS 044-EPMCC-101	0.415	0.432	-4.9	0.0	0.0	452.6	231.0	Bus 4 UPS102A	12.383	0.008	16.6	100.0	
								Bus 4 UPS101A	13.730	0.042	18.4	100.0	
								Bus 4 UPS101C	13.730	0.042	18.4	100.0	
								Bus to Charger-DCDB101B	16.220	7.850	24.1	90.0	
								Bus Prim TR-108B	49.565	0.877	66.3	100.0	
								Bus to Charger-DCDB102	36.145	17.454	53.6	90.1	
								BUS HVAC EPMCC	143.734	69.586	213.4	90.0	
								Bus 4 UPS102C	12.349	0.059	16.5	100.0	
								Bus Prim TR-105A	-750.466	-326.967	1094.0	91.7	
BUS 044-HT6-102	6.900	6.858	-3.4	0.0	0.0	558.6	238.7	BUS A 044-HT6-101	-558.608	-238.655	51.1	92.0	
								Bus Prim TR-105C	0.000	0.000	0.0	0.0	
BUS 044-HT11-101	11.000	10.993	0.0	0.0	0.0	1062.2	658.3	BUS Emergency Supply	-1062.223	-658.307	65.6	85.0	

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ID	kV	kV	Ang.	kW	kvar	kW	kvar	ID	kW	kvar	Amp	%PF	%Tap
								Bus Prim TR-106A	0.000	0.000	0.0	0.0	
BUS 044-LDB-101	0.415	0.421	-8.8	0.0	0.0	3.1	0.0	BUS B 044-MLDB-101	-3.092	0.000	4.2	100.0	
BUS 044-LDB-102	0.415	0.416	-8.9	0.0	0.0	5.0	0.0	BUS B 044-MLDB-101	-5.020	0.000	7.0	100.0	
BUS 044-LDB-103	0.415	0.414	-8.8	0.0	0.0	3.0	0.0	BUS A 044-MLDB-101	-2.979	0.000	4.2	100.0	
BUS 044-LDB-104	0.415	0.417	-8.8	0.0	0.0	3.0	0.0	BUS A 044-MLDB-101	-3.025	0.000	4.2	100.0	
BUS 044-LDB-105	0.415	0.420	-8.8	0.0	0.0	3.1	0.0	BUS B 044-MLDB-101	-3.079	0.000	4.2	100.0	
BUS 044-LDB-106	0.415	0.407	-6.1	0.0	0.0	2.9	0.0	BUS A 044-MLDB-102	-2.883	0.000	4.1	100.0	
BUS 044-LDB-107	0.415	0.408	-6.1	0.0	0.0	4.8	0.0	BUS B 044-MLDB-102	-4.832	0.000	6.8	100.0	
BUS 044-LDB-108	0.415	0.408	-6.1	0.0	0.0	4.8	0.0	BUS A 044-MLDB-102	-4.832	0.000	6.8	100.0	
BUS 044-LDB-109	0.415	0.417	-8.8	0.0	0.0	5.1	0.0	BUS A 044-MLDB-101	-5.052	0.000	7.0	100.0	
BUS 044-LDB-110	0.415	0.414	-8.9	0.0	0.0	5.0	0.0	BUS A 044-MLDB-101	-4.972	0.000	6.9	100.0	
BUS 044-LDB-111	0.415	0.414	-8.9	0.0	0.0	5.0	0.0	BUS A 044-MLDB-101	-4.964	0.000	6.9	100.0	
BUS 044-LDB-112	0.415	0.414	-8.9	0.0	0.0	5.0	0.0	BUS A 044-MLDB-101	-4.972	0.000	6.9	100.0	
BUS 044-LDB-113	0.415	0.408	-8.9	0.0	0.0	4.8	0.0	BUS A 044-MLDB-101	-4.831	0.000	6.8	100.0	
BUS 044-LDB-114	0.415	0.411	-8.9	0.0	0.0	4.9	0.0	BUS B 044-MLDB-101	-4.894	0.000	6.9	100.0	
BUS 044-LDB-115	0.415	0.417	-8.9	0.0	0.0	4.0	0.0	BUS A 044-MLDB-101	-4.048	0.000	5.6	100.0	
BUS 044-LDB-116	0.415	0.407	-6.1	0.0	0.0	2.1	0.0	BUS A 044-MLDB-102	-2.112	0.000	3.0	100.0	
BUS 044-LDB-117	0.415	0.407	-6.1	0.0	0.0	2.1	0.0	BUS B 044-MLDB-102	-2.112	0.000	3.0	100.0	
BUS 044-PDB-101	0.415	0.420	-8.8	0.0	0.0	4.1	0.0	BUS A 044-MLDB-101	-4.105	0.000	5.6	100.0	
BUS 044-PDB-102	0.415	0.419	-8.8	0.0	0.0	4.1	0.0	BUS B 044-MLDB-101	-4.071	0.000	5.6	100.0	
BUS 044-PDB-103	0.415	0.417	-8.8	0.0	0.0	4.0	0.0	BUS A 044-MLDB-101	-4.029	0.000	5.6	100.0	
BUS 044-PDB-104	0.415	0.415	-8.8	0.0	0.0	4.0	0.0	BUS B 044-MLDB-101	-4.005	0.000	5.6	100.0	
BUS 044-PDB-105	0.415	0.411	-8.9	0.0	0.0	19.6	0.0	BUS B 044-MLDB-101	-19.634	0.000	27.6	100.0	
BUS A 044-ASB-101	0.415	0.400	-7.9	0.0	0.0	79.3	8.6	BUS A 044-PMCC-103	-110.056	-11.250	159.7	99.5	
								BUS B 044-ASB-101	30.770	2.635	44.6	99.6	
BUS A 044-ASB-102	0.415	0.400	-7.9	0.0	0.0	58.8	0.1	BUS A 044-PMCC-103	-114.676	-0.124	165.5	100.0	
								BUS B 044-ASB-102	55.881	0.057	80.6	100.0	
BUS A 044-EMLDB-101	0.415	0.417	-5.9	0.0	0.0	0.0	0.0	BUS 044-ELDB-103	2.006	0.000	2.8	100.0	
								BUS 044-ELDB-104	3.953	0.001	5.5	100.0	
								BUS 044-ELDB-106	2.009	0.000	2.8	100.0	
								BUS 044-ELDB-107	1.950	0.001	2.7	100.0	
								BUS 044-ELDB-109	2.001	0.000	2.8	100.0	
								BUS 044-ELDB-111	1.958	0.001	2.7	100.0	

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ID	kV	kV	Ang.	kW	kvar	kW	kvar	ID	kW	kvar	Amp	%PF	%Tap
BUS A 044-HT6-101	6.600	6.858	-3.4	0.0	0.0	1466.2	797.8	BUS 044-ELDB-113	1.991	0.000	2.8	100.0	
								BUS 044-ELDB-115	1.960	0.001	2.7	100.0	
								BUS B EMLDB-101	-17.828	-0.004	24.7	100.0	
								BUS 044-HT6-102	558.616	238.664	51.1	92.0	
								Bus Prim TR-103A	2162.430	982.283	200.0	91.0	
								Bus Prim TR-104A	2176.508	1215.754	209.9	87.3	
								Bus Prim TR-105A	753.094	353.150	70.0	90.5	
								Bus Prim TR-102A	2246.866	1077.029	209.8	90.2	
								Bus Prim TR-101A	-10802.970	51.417	909.5	100.0	
								Bus to CB-101A	2.756	-2745.448	231.1	-0.1	
BUS A 044-HT33-101	33.000	32.943	0.0	0.0	0.0	0.0	0.0	BUS B 044-HT6-101	1436.499	-1970.656	205.3	-58.9	
								BUS Grid Power A	-22266.250	-8875.032	420.1	92.9	
								BUS B 044-HT33-101	6214.853	4397.783	133.4	81.6	
								Bus to ext. 1	0.000	0.000	0.0	0.0	
								BUS 2 to AU-V REVAMP UNIT	5216.548	4070.376	116.0	78.8	
								BUS 1 to VDU UNIT	0.000	-176.025	3.1	0.0	
BUS A 044-MCC-101	0.415	0.420	-7.6	0.0	0.0	174.6	88.2	Bus to TR101A	10834.850	582.899	190.2	99.9	
								BUS A 044-PMCC-101	-377.668	-189.131	580.0	89.4	
								BUS B 044-MCC-101	203.023	100.976	311.3	89.5	
BUS A 044-MCC-102	0.415	0.420	-7.7	0.0	0.0	68.4	33.1	Cab VFD-ACM 201 A1~	34.218	0.001	47.0	100.0	
								Cab VFD-ACM B1~	34.218	0.001	47.0	100.0	
								Cab VFD-ACM D1~	34.050	0.000	46.8	100.0	
								Cab VFD-ACM D2~	34.073	0.001	46.8	100.0	
								Cab VFD-ACM F1~	34.100	0.001	46.9	100.0	
								Cab VFD-ACM H1~	34.167	0.001	47.0	100.0	
								BUS A 044-PMCC-101	-546.405	-99.230	763.3	98.4	
								BUS B 044-MCC-102	273.200	66.144	386.4	97.2	
								BUS A 044-PMCC-102	-552.024	-149.082	783.6	96.5	
								Cab VFD-ACM K1~	34.208	0.001	46.9	100.0	
BUS A 044-MCC-103	0.415	0.421	-7.5	0.0	0.0	138.2	66.3	Cab VFD-ACM M1~	34.490	0.001	47.3	100.0	
								Cab VFD-ACM N1~	34.562	0.001	47.4	100.0	
								Cab VFD-ACM Q1~	34.635	0.001	47.5	100.0	
								BUS B 044-MCC-103	275.906	82.816	394.8	95.8	

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ID	kV	kV	Ang.	kW	kvar	kW	kvar	ID	kW	kvar	Amp	%PF	%Tap
BUS A 044-MCC-104	0.415	0.420	-7.6	0.0	0.0	210.5	105.0	Cab VFD-ACM 202 A1~	2.882	-11.711	16.6	-23.9	
								BUS A 044-PMCC-101	-426.870	-200.234	647.7	90.5	
								BUS B 044-MCC-104	213.482	106.902	328.0	89.4	
BUS A 044-MCC-105	0.415	0.422	-7.4	0.0	0.0	139.4	73.8	BUS A 044-PMCC-102	-278.726	-147.548	431.2	88.4	
								BUS B 044-MCC-105	139.350	73.778	215.6	88.4	
BUS A 044-MCC-106	0.415	0.422	-7.5	0.0	0.0	227.0	63.7	BUS A 044-PMCC-102	-348.530	-78.330	488.6	97.6	
								BUS B 044-MCC-106	121.500	14.630	167.4	99.3	
BUS A 044-MCC-107	0.415	0.400	-7.9	0.0	0.0	141.5	74.1	BUS A 044-PMCC-103	-260.376	-133.576	422.7	89.0	
								BUS B 044-MCC-107	118.836	59.469	191.9	89.4	
BUS A 044-MLDB-101	0.415	0.424	-8.8	0.0	0.0	0.0	0.0	BUS 044-LDB-103	3.054	0.001	4.2	100.0	
								BUS 044-LDB-104	3.077	0.001	4.2	100.0	
								BUS 044-LDB-109	5.134	0.001	7.0	100.0	
								BUS 044-LDB-110	5.093	0.002	6.9	100.0	
								BUS 044-LDB-111	5.089	0.002	6.9	100.0	
								BUS 044-LDB-112	5.093	0.002	6.9	100.0	
								BUS 044-LDB-113	5.021	0.002	6.8	100.0	
								BUS 044-LDB-115	4.110	0.003	5.6	100.0	
								BUS 044-PDB-101	4.139	0.000	5.6	100.0	
								BUS 044-PDB-103	4.101	0.001	5.6	100.0	
								Bus Prim TR-107A	-88.752	-0.047	120.9	100.0	
								BUS B 044-MLDB-101	44.840	0.032	61.1	100.0	
BUS A 044-MLDB-102	0.415	0.412	-6.1	0.0	0.0	0.0	0.0	BUS 044-LDB-116	2.141	0.000	3.0	100.0	
								BUS 044-LDB-106	2.921	0.000	4.1	100.0	
								BUS 044-LDB-108	4.882	0.001	6.8	100.0	
								BUS B 044-MLDB-102	-9.945	-0.001	13.9	100.0	
BUS A 044-PMCC-101	0.415	0.422	-7.6	0.0	0.0	464.3	202.8	BUS A 044-MCC-101	379.024	189.628	580.0	89.4	
								BUS A 044-MCC-102	548.755	100.092	763.3	98.4	
								BUS A 044-MCC-104	428.562	200.855	647.7	90.5	
								Bus Prim TR-102A	-2230.654	-871.642	3277.3	93.1	
								BUS B 044-PMCC-101	409.999	178.230	611.8	91.7	
BUS A 044-PMCC-102	0.415	0.423	-7.5	0.0	0.0	406.8	177.0	BUS A 044-MCC-103	554.624	150.036	783.6	96.5	
								BUS A 044-MCC-105	279.514	147.837	431.2	88.4	
								BUS A 044-MCC-106	349.541	78.701	488.6	97.6	

Bus		Voltage		Generation		Load		Load Flow				XFMR	
ID	kV	kV	Ang.	kW	kvar	kW	kvar	ID	kW	kvar	Amp	%PF	%Tap
BUS A 044-PMCC-103	0.415	0.401	-7.9	0.0	0.0	399.4	174.9	Bus Prim TR-103A	-2147.913	-795.941	3123.9	93.8	
								BUS B 044-PMCC-102	557.427	242.392	829.0	91.7	
								BUS A 044-ASB-101	110.290	11.306	159.7	99.5	
								BUS A 044-ASB-102	114.878	0.185	165.5	100.0	
								BUS A 044-MCC-107	261.133	133.853	422.7	89.0	
								Bus 1 UPS101A	0.000	0.000	0.0	0.0	
								Bus 1 UPS102A	0.000	0.000	0.0	0.0	
								BUS to HVAC-1	414.374	256.470	701.9	85.0	
								Bus Prim TR-107A	89.788	1.488	129.3	100.0	
								Bus Prim TR-104A	-2159.085	-990.131	3421.3	90.9	
BUS A AU-V REVAMP	6.600	6.516	-3.4	0.0	0.0	2586.8	1940.1	BUS B 044-PMCC-103	769.196	411.898	1256.8	88.2	
								Bus Prim TR-114A	-5173.660	-3880.244	573.0	80.0	
								BUS B AU-REVAMP	2586.830	1940.122	286.5	80.0	
BUS A to VDU UNIT	6.600	6.499	-4.2	0.0	0.0	3078.9	1905.1	Bus Prim TR-109A	-6157.869	-3810.246	643.3	85.0	
								BUS B to VDU UNIT	3078.935	1905.123	321.7	85.0	
BUS B 044-ASB-101	0.415	0.400	-7.9	0.0	0.0	30.8	2.6	BUS A 044-ASB-101	-30.770	-2.635	44.6	99.6	
BUS B 044-ASB-102	0.415	0.400	-7.9	0.0	0.0	55.9	0.1	BUS A 044-ASB-102	-55.881	-0.057	80.6	100.0	
BUS B 044-HT6-101	6.600	6.858	-3.4	0.0	0.0	1433.7	774.8	Bus Prim TR-103B	0.000	0.000	0.0	0.0	
								Bus Prim TR-104B	0.000	0.000	0.0	0.0	
								Bus Prim TR-105B	0.000	0.000	0.0	0.0	
								Bus Prim TR-102B	0.000	0.000	0.0	0.0	
								Bus to CB-101B	2.756	-2745.448	231.1	-0.1	
								BUS A 044-HT6-101	-1436.499	1970.656	205.3	-58.9	
								BUS A 044-HT33-101	-6214.853	-4397.783	133.4	81.6	
								Bus to TR101B	0.000	0.000	0.0	0.0	
								BUS 1 to AU-V REVAMP UNIT	0.000	0.000	0.0	0.0	
								Bus to ext. 2	0.000	0.000	0.0	0.0	
BUS B 044-HT33-101	33.000	32.943	0.0	0.0	0.0	0.0	0.0	BUS 2 to VDU UNIT	6214.853	4397.783	133.4	81.6	
								Bus 2 HT33	0.000	0.000	0.0	0.0	
								BUS B 044-MCC-101	0.415	0.420	-7.6	0.0	0.0
								BUS A 044-MCC-101	-203.023	-100.976	311.3	89.5	
BUS B 044-MCC-102	0.415	0.420	-7.7	0.0	0.0	136.6	66.1	Cab VFD-ACM C1~	34.218	0.001	47.0	100.0	
								Cab VFD-ACM E1~	34.050	0.000	46.8	100.0	
								Cab VFD-ACM G1~	34.100	0.001	46.9	100.0	

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Bus		Voltage		Generation		Load		Load Flow				XFMR	
ID	kV	kV	Ang.	kW	kvar	kW	kvar	ID	kW	kvar	Amp	%PF	%Tap
BUS B 044-MCC-103	0.415	0.421	-7.5	0.0	0.0	172.5	82.8	Cab VFD-ACM J1~	34.191	0.001	47.0	100.0	
								BUS A 044-MCC-102	-273.200	-66.144	386.4	97.2	
								Cab to VFD-ACM L1~	34.235	0.001	46.9	100.0	
								Cab to VFD-ACM P1~	34.562	0.001	47.4	100.0	
								Cab to VFD-ACM R1~	34.634	0.001	47.5	100.0	
BUS B 044-MCC-104	0.415	0.420	-7.6	0.0	0.0	213.5	106.9	BUS A 044-MCC-103	-275.906	-82.816	394.8	95.8	
								BUS A 044-MCC-104	-213.482	-106.902	328.0	89.4	
								BUS A 044-MCC-105	-139.350	-73.778	215.6	88.4	
								BUS A 044-MCC-106	-121.500	-14.630	167.4	99.3	
								BUS A 044-MCC-107	-118.836	-59.469	191.9	89.4	
BUS B 044-MLDB-101	0.415	0.424	-8.8	0.0	0.0	0.0	0.0	BUS 044-LDB-101	3.111	0.000	4.2	100.0	
								BUS 044-LDB-102	5.118	0.002	7.0	100.0	
								BUS 044-LDB-105	3.105	0.000	4.2	100.0	
								BUS 044-LDB-114	5.053	0.003	6.9	100.0	
								BUS 044-PDB-102	4.122	0.001	5.6	100.0	
								BUS 044-PDB-104	4.088	0.001	5.6	100.0	
								BUS 044-PDB-105	20.243	0.025	27.6	100.0	
								BUS A 044-MLDB-101	-44.840	-0.032	61.1	100.0	
								BUS 044-LDB-107	4.882	0.001	6.8	100.0	
								BUS 044-LDB-117	2.141	0.000	3.0	100.0	
BUS B 044-MLDB-102	0.415	0.412	-6.1	0.0	0.0	0.0	0.0	BUS B EMLDB-101	-16.968	-0.002	23.8	100.0	
								BUS A 044-MLDB-102	9.945	0.001	13.9	100.0	
								BUS B 044-PMCC-101	0.415	0.422	-7.6	0.0	0.0
								BUS B 044-PMCC-102	0.415	0.423	-7.5	0.0	0.0
								BUS B 044-PMCC-103	0.415	0.401	-7.9	0.0	0.0
								Bus 1 UPS101C	0.000	0.000	0.0	0.0	
								Bus 1 UPS102C	0.000	0.000	0.0	0.0	
								BUS to HVAC-2	414.374	256.470	701.9	85.0	
								Bus Prim TR-108A	0.000	0.000	0.0	0.0	
								Bus Prim TR-107B	0.000	0.000	0.0	0.0	
BUS B AU-REVAMP	6.600	6.516	-3.4	0.0	0.0	2586.8	1940.1	BUS A 044-PMCC-103	-769.196	-411.898	1256.8	88.2	
								BUS A AU-V REVAMP	-2586.830	-1940.122	286.5	80.0	
								BUS 044-ELDB-101	2.013	0.000	2.8	100.0	
BUS B EMLDB-101	0.415	0.417	-5.9	0.0	0.0	0.0	0.0	BUS 044-ELDB-102	1.997	0.000	2.8	100.0	

Bus		Voltage		Generation		Load		Load Flow				XFMR	
ID	kV	kV	Ang.	kW	kvar	kW	kvar	ID	kW	kvar	Amp	%PF	%Tap
BUS B to VDU UNIT	6.600	6.499	-4.2	0.0	0.0	3078.9	1905.1	BUS 044-ELDB-105	2.004	0.000	2.8	100.0	
								BUS 044-ELDB-108	1.980	0.000	2.7	100.0	
								BUS 044-ELDB-110	1.991	0.000	2.8	100.0	
								BUS 044-ELDB-112	1.991	0.000	2.8	100.0	
								BUS 044-ELDB-114	1.980	0.000	2.7	100.0	
								BUS B 044-MLDB-102	17.175	0.052	23.8	100.0	
								Bus Prim TR-108B	-48.959	-0.058	67.7	100.0	
								BUS A 044-EMLDB-101	17.828	0.004	24.7	100.0	
								BUS A to VDU UNIT	-3078.935	-1905.123	321.7	85.0	
								BUS 044-HT11-101	1062.755	658.995	65.6	85.0	
*BUS Emergency Supply	11.000	11.000	0.0	1062.8	659.0	0.0	0.0	BUS A 044-HT33-101	22303.250	8894.548	420.1	92.9	
*BUS Grid Power A	33.000	33.000	0.0	22303.3	8894.5	0.0	0.0	BUS 044-EPMCC-101	-141.412	-68.489	213.4	90.0	
BUS HVAC EPMCC	0.415	0.425	-4.9	0.0	0.0	141.4	68.5	Bus to TR101A	-10834.680	-582.808	190.2	99.9	
Bus Prim TR-101A	33.000	32.942	0.0	0.0	0.0	0.0	0.0	BUS A 044-HT6-101	10834.680	582.808	190.2	99.9	
Bus Prim TR-101B	33.000	32.943	0.0	0.0	0.0	0.0	0.0	Bus to TR101B	0.000	0.000	0.0	0.0	
Bus Prim TR-102A	6.600	6.856	-3.4	0.0	0.0	0.0	0.0	BUS A 044-HT6-101	-2246.408	-1076.440	209.8	90.2	
								BUS A 044-PMCC-101	2246.408	1076.440	209.8	90.2	2.500
Bus Prim TR-102B	6.600	6.858	-3.4	0.0	0.0	0.0	0.0	BUS B 044-HT6-101	0.000	0.000	0.0	0.0	
Bus Prim TR-103A	6.600	6.857	-3.4	0.0	0.0	0.0	0.0	BUS A 044-HT6-101	-2162.227	-982.021	200.0	91.0	
								BUS A 044-PMCC-102	2162.227	982.021	200.0	91.0	2.500
Bus Prim TR-103B	6.600	6.858	-3.4	0.0	0.0	0.0	0.0	BUS B 044-HT6-101	0.000	0.000	0.0	0.0	
Bus Prim TR-104A	6.600	6.858	-3.4	0.0	0.0	0.0	0.0	BUS A 044-HT6-101	-2176.434	-1215.657	209.9	87.3	
								BUS A 044-PMCC-103	2176.434	1215.657	209.9	87.3	2.500
Bus Prim TR-104B	6.600	6.858	-3.4	0.0	0.0	0.0	0.0	BUS B 044-HT6-101	0.000	0.000	0.0	0.0	
Bus Prim TR-105A	6.600	6.858	-3.4	0.0	0.0	0.0	0.0	BUS A 044-HT6-101	-753.083	-353.135	70.0	90.5	
								BUS 044-EPMCC-101	753.083	353.135	70.0	90.5	2.500
Bus Prim TR-105B	6.600	6.858	-3.4	0.0	0.0	0.0	0.0	BUS B 044-HT6-101	0.000	0.000	0.0	0.0	
Bus Prim TR-105C	6.600	6.858	-3.4	0.0	0.0	0.0	0.0	BUS 044-HT6-102	0.000	0.000	0.0	0.0	
Bus Prim TR-106A	11.000	10.993	0.0	0.0	0.0	0.0	0.0	BUS 044-HT11-101	0.000	0.000	0.0	0.0	
								Bus Sec TR-106A	0.000	0.000	0.0	0.0	
Bus Prim TR-107A	0.433	0.400	-8.0	0.0	0.0	0.0	0.0	BUS A 044-PMCC-103	-89.664	-1.415	129.3	100.0	
								BUS A 044-MLDB-101	89.664	1.415	129.3	100.0	-2.500
Bus Prim TR-107B	0.433	0.401	-7.9	0.0	0.0	0.0	0.0	BUS B 044-PMCC-103	0.000	0.000	0.0	0.0	

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Bus		Voltage		Generation		Load		Load Flow				XFMR	
ID	kV	kV	Ang.	kW	kvar	kW	kvar	ID	kW	kvar	Amp	%PF	%Tap
Bus Prim TR-108A	0.415	0.401	-7.9	0.0	0.0	0.0	0.0	BUS B 044-PMCC-103	0.000	0.000	0.0	0.0	
Bus Prim TR-108B	0.433	0.431	-5.0	0.0	0.0	0.0	0.0	BUS 044-EPMCC-101	-49.485	-0.847	66.3	100.0	
								BUS B EMLDB-101	49.485	0.847	66.3	100.0	-2.000
Bus Prim TR-109A	33.000	32.914	0.0	0.0	0.0	0.0	0.0	BUS 2 to VDU UNIT	-6210.745	-4497.631	134.5	81.0	
								BUS A to VDU UNIT	6210.745	4497.631	134.5	81.0	
Bus Prim TR-109B	33.000	32.943	0.0	0.0	0.0	0.0	0.0	BUS 1 to VDU UNIT	0.000	0.000	0.0	0.0	
Bus Prim TR-114A	33.000	32.932	0.0	0.0	0.0	0.0	0.0	BUS 2 to AU-V REVAMP UNIT	-5214.958	-4417.122	119.8	76.3	
								BUS A AU-V REVAMP	5214.958	4417.122	119.8	76.3	
Bus Prim TR-114B	33.000	32.943	0.0	0.0	0.0	0.0	0.0	BUS 1 to AU-V REVAMP UNIT	0.000	0.000	0.0	0.0	
Bus Sec TR-106A	6.900	6.896	0.0	0.0	0.0	0.0	0.0	Bus Prim TR-106A	0.000	0.000	0.0	0.0	
Bus to CB-101A	6.600	7.266	-3.4	0.0	0.0	0.1	-2908.7	BUS A 044-HT6-101	-0.124	2908.657	231.1	0.0	
Bus to CB-101B	6.600	7.266	-3.4	0.0	0.0	0.1	-2908.7	BUS B 044-HT6-101	-0.124	2908.657	231.1	0.0	
Bus to Charger-DCDB101B	0.415	0.432	-4.9	0.0	0.0	16.2	7.8	BUS 044-EPMCC-101	-16.200	-7.846	24.1	90.0	
Bus to Charger-DCDB102	0.433	0.431	-4.9	0.0	0.0	36.0	17.4	BUS 044-EPMCC-101	-36.000	-17.436	53.6	90.0	
Bus to ext. 1	33.000	32.943	0.0	0.0	0.0	0.0	0.0	BUS A 044-HT33-101	0.000	0.000	0.0	0.0	
Bus to ext. 2	33.000	32.943	0.0	0.0	0.0	0.0	0.0	BUS B 044-HT33-101	0.000	0.000	0.0	0.0	
BUS to HVAC-1	0.433	0.399	-7.9	0.0	0.0	412.1	255.4	BUS A 044-PMCC-103	-412.091	-255.391	701.9	85.0	
BUS to HVAC-2	0.433	0.399	-7.9	0.0	0.0	412.1	255.4	BUS B 044-PMCC-103	-412.091	-255.391	701.9	85.0	
Bus to TR101A	33.000	32.943	0.0	0.0	0.0	0.0	0.0	Bus Prim TR-101A	10834.850	582.899	190.2	99.9	
								BUS A 044-HT33-101	-10834.850	-582.899	190.2	99.9	
Bus to TR101B	33.000	32.943	0.0	0.0	0.0	0.0	0.0	Bus Prim TR-101B	0.000	0.000	0.0	0.0	
								BUS B 044-HT33-101	0.000	0.000	0.0	0.0	
Cab to VFD-ACM L1~	0.453	0.421	-7.5	0.0	0.0	34.2	0.0	BUS B 044-MCC-103	-34.232	0.000	46.9	100.0	
								VFD-ACM L1	34.232	0.000	46.9	100.0	
Cab to VFD-ACM P1~	0.453	0.421	-7.5	0.0	0.0	34.6	0.0	BUS B 044-MCC-103	-34.559	0.000	47.4	100.0	
								VFD-ACM P1	34.559	0.000	47.4	100.0	
Cab to VFD-ACM R1~	0.453	0.421	-7.5	0.0	0.0	34.6	0.0	BUS B 044-MCC-103	-34.632	0.000	47.5	100.0	
								VFD-ACM R1	34.632	0.000	47.5	100.0	
Cab VFD-ACM 201 A1~	0.453	0.420	-7.7	0.0	0.0	34.2	0.0	BUS A 044-MCC-102	-34.215	0.000	47.0	100.0	
								VFD-ACM 201 A1	34.215	0.000	47.0	100.0	
Cab VFD-ACM 202 A1~	0.453	0.420	-7.6	0.0	0.0	2.9	0.0	BUS A 044-MCC-104	-2.881	0.000	4.0	100.0	
								VFD-ACM 202 A1	2.881	0.000	4.0	100.0	
Cab VFD-ACM B1~	0.453	0.420	-7.7	0.0	0.0	34.2	0.0	BUS A 044-MCC-102	-34.215	0.000	47.0	100.0	

Bus		Voltage		Generation		Load		Load Flow				XFMR	
ID	kV	kV	Ang.	kW	kvar	kW	kvar	ID	kW	kvar	Amp	%PF	%Tap
Cab VFD-ACM C1~	0.453	0.420	-7.7	0.0	0.0	34.2	0.0	VFD-ACM B1	34.215	0.000	47.0	100.0	
								BUS B 044-MCC-102	-34.215	0.000	47.0	100.0	
Cab VFD-ACM D1~	0.453	0.420	-7.7	0.0	0.0	34.0	0.0	VFD-ACM C1	34.215	0.000	47.0	100.0	
								BUS A 044-MCC-102	-34.047	0.000	46.8	100.0	
Cab VFD-ACM D2~	0.453	0.420	-7.7	0.0	0.0	34.1	0.0	VFD-ACM D1	34.047	0.000	46.8	100.0	
								BUS A 044-MCC-102	-34.070	0.000	46.8	100.0	
Cab VFD-ACM E1~	0.453	0.420	-7.7	0.0	0.0	34.0	0.0	VFD-ACM D2	34.070	0.000	46.8	100.0	
								BUS B 044-MCC-102	-34.047	0.000	46.8	100.0	
Cab VFD-ACM F1~	0.453	0.420	-7.7	0.0	0.0	34.1	0.0	VFD-ACM E1	34.047	0.000	46.8	100.0	
								BUS A 044-MCC-102	-34.097	0.000	46.9	100.0	
Cab VFD-ACM G1~	0.453	0.420	-7.7	0.0	0.0	34.1	0.0	VFD-ACM F1	34.097	0.000	46.9	100.0	
								BUS B 044-MCC-102	-34.097	0.000	46.9	100.0	
Cab VFD-ACM H1~	0.453	0.420	-7.7	0.0	0.0	34.2	0.0	VFD-ACM G1	34.097	0.000	46.9	100.0	
								BUS A 044-MCC-102	-34.164	0.000	47.0	100.0	
Cab VFD-ACM J1~	0.453	0.420	-7.7	0.0	0.0	34.2	0.0	VFD-ACM H1	34.164	0.000	47.0	100.0	
								BUS B 044-MCC-102	-34.188	0.000	47.0	100.0	
Cab VFD-ACM K1~	0.453	0.421	-7.5	0.0	0.0	34.2	0.0	VFD-ACM J1	34.188	0.000	47.0	100.0	
								BUS A 044-MCC-103	-34.205	0.000	46.9	100.0	
Cab VFD-ACM M1~	0.453	0.421	-7.5	0.0	0.0	34.5	0.0	VFD-ACM K1	34.205	0.000	46.9	100.0	
								BUS A 044-MCC-103	-34.487	0.000	47.3	100.0	
Cab VFD-ACM N1~	0.453	0.421	-7.5	0.0	0.0	34.6	0.0	VFD-ACM M1	34.487	0.000	47.3	100.0	
								BUS A 044-MCC-103	-34.559	0.000	47.4	100.0	
Cab VFD-ACM Q1~	0.453	0.421	-7.5	0.0	0.0	34.6	0.0	VFD-ACM N1	34.559	0.000	47.4	100.0	
								BUS A 044-MCC-103	-34.632	0.000	47.5	100.0	
044-UPS-101A	0.110	0.110	0.0	0.0	0.0	0.0	0.0	VFD-ACM Q1	34.632	0.000	47.5	100.0	
								BUS 2 UPS101A	0.000	0.000	0.0	0.0	
044-UPS-101C	0.110	0.110	0.0	0.0	0.0	0.0	0.0	BUS 2 UPS101C	0.000	0.000	0.0	0.0	
								BUS 2 UPS102A	0.000	0.000	0.0	0.0	
044-UPS-102A	0.110	0.110	0.0	0.0	0.0	0.0	0.0	BUS 2 UPS102C	0.000	0.000	0.0	0.0	
								BUS VFD-ACM 201 A1	34.215	16.546	52.9	90.0	
VFD-ACM 201 A1	0.415	0.415	0.0	34.2	16.5	0.0	0.0	BUS VFD-ACM 202 A1	2.881	1.854	4.8	84.1	
								BUS VFD-ACM B1	34.215	16.546	52.9	90.0	
VFD-ACM B1	0.415	0.415	0.0	34.2	16.5	0.0	0.0	BUS VFD-ACM C1	34.215	16.546	52.9	90.0	

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Bus		Voltage		Generation		Load		Load Flow				XFMR	
ID	kV	kV	Ang.	kW	kvar	kW	kvar	ID	kW	kvar	Amp	%PF	%Tap
VFD-ACM D1	0.415	0.415	0.0	34.0	16.5	0.0	0.0	Bus VFD-ACM D1	34.047	16.514	52.6	90.0	
VFD-ACM D2	0.415	0.415	0.0	34.1	16.5	0.0	0.0	Bus VFD-ACM D2	34.070	16.518	52.7	90.0	
VFD-ACM E1	0.415	0.415	0.0	34.0	16.5	0.0	0.0	Bus VFD-ACM E1	34.047	16.514	52.6	90.0	
VFD-ACM F1	0.415	0.415	0.0	34.1	16.5	0.0	0.0	Bus VFD-ACM F1	34.097	16.523	52.7	90.0	
VFD-ACM G1	0.415	0.415	0.0	34.1	16.5	0.0	0.0	Bus VFD-ACM G1	34.097	16.523	52.7	90.0	
VFD-ACM H1	0.415	0.415	0.0	34.2	16.5	0.0	0.0	Bus VFD-ACM H1	34.164	16.536	52.8	90.0	
VFD-ACM J1	0.415	0.415	0.0	34.2	16.5	0.0	0.0	Bus VFD-ACM J1	34.188	16.541	52.8	90.0	
VFD-ACM K1	0.415	0.415	0.0	34.2	16.5	0.0	0.0	Bus VFD-ACM K1	34.205	16.544	52.9	90.0	
VFD-ACM L1	0.415	0.415	0.0	34.2	16.5	0.0	0.0	Bus VFD-ACM L1	34.232	16.549	52.9	90.0	
VFD-ACM M1	0.415	0.415	0.0	34.5	16.6	0.0	0.0	Bus VFD-ACM M1	34.487	16.556	53.2	90.1	
VFD-ACM N1	0.415	0.415	0.0	34.6	16.6	0.0	0.0	Bus VFD-ACM N1	34.559	16.566	53.3	90.2	
VFD-ACM P1	0.415	0.415	0.0	34.6	16.6	0.0	0.0	Bus VFD-ACM P1	34.559	16.566	53.3	90.2	
VFD-ACM Q1	0.415	0.415	0.0	34.6	16.6	0.0	0.0	Bus VFD-ACM Q1	34.632	16.577	53.4	90.2	
VFD-ACM R1	0.415	0.415	0.0	34.6	16.6	0.0	0.0	Bus VFD-ACM R1	34.632	16.577	53.4	90.2	

* Indicates a voltage regulated bus (voltage controlled or swing type machine connected to it)

Indicates a bus with a load mismatch of more than 0.1 MVA

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Bus Loading Summary Report

Bus			Directly Connected Load								Total Bus Load			
			Constant kVA		Constant Z		Constant I		Generic		kVA	% PF	Amp	Percent Loading
ID	kV	Rated Amp	kW	kvar	kW	kvar	kW	kvar	kW	kvar				
BUS Grid Power B	33.000													
Bus VFD-ACM 201 A1	0.415										38.006	90.0	52.9	
Bus VFD-ACM 202 A1	0.415										3.426	84.1	4.8	
Bus VFD-ACM B1	0.415										38.006	90.0	52.9	
Bus VFD-ACM C1	0.415										38.006	90.0	52.9	
Bus VFD-ACM D1	0.415										37.841	90.0	52.6	
Bus VFD-ACM D2	0.415										37.864	90.0	52.7	
Bus VFD-ACM E1	0.415										37.841	90.0	52.6	
Bus VFD-ACM F1	0.415										37.890	90.0	52.7	
Bus VFD-ACM G1	0.415										37.890	90.0	52.7	
Bus VFD-ACM H1	0.415										37.956	90.0	52.8	
Bus VFD-ACM J1	0.415										37.979	90.0	52.8	
Bus VFD-ACM K1	0.415										37.996	90.0	52.9	
Bus VFD-ACM L1	0.415										38.023	90.0	52.9	
Bus VFD-ACM M1	0.415										38.255	90.1	53.2	
Bus VFD-ACM N1	0.415										38.324	90.2	53.3	
Bus VFD-ACM P1	0.415										38.324	90.2	53.3	
Bus VFD-ACM Q1	0.415										38.394	90.2	53.4	
Bus VFD-ACM R1	0.415										38.394	90.2	53.4	
BUS 1 to AU-V REVAMP UNIT	33.000													
BUS 1 to VDU UNIT	33.000										176.025	-	3.1	
Bus 1 UPS101A	0.433												-	
Bus 1 UPS101C	0.433												-	
Bus 1 UPS102A	0.433													
Bus 1 UPS102C	0.433													
Bus 2 HT33	33.000													
BUS 2 to AU-V REVAMP UNIT	33.000										6616.671	78.8	116.0	
BUS 2 to VDU UNIT	33.000										7613.468	81.6	133.4	
Bus 2 UPS101A	0.110													
Bus 2 UPS101C	0.110													
Bus 2 UPS102A	0.110													
Bus 2 UPS102C	0.110													
Bus 3 UPS101A	0.191													
Bus 3 UPS101C	0.191													
Bus 3 UPS102A	0.191													
Bus 3 UPS102C	0.191													
Bus 4 UPS101A	0.433										13.693	100.0	18.4	
Bus 4 UPS101C	0.433										13.693	100.0	18.4	
Bus 4 UPS102A	0.433										12.325	100.0	16.6	

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Directly Connected Load											Total Bus Load			
Bus			Constant kVA		Constant Z		Constant I		Generic		kVA	% PF	Amp	Percent Loading
ID	kV	Rated Amp	kW	kvar	kW	kvar	kW	kvar	kW	kvar				
Bus 4 UPS102C	0.433										12.291	100.0	16.5	
Bus 5 UPS101A	0.191				13.674						13.674	100.0	39.5	
Bus 5 UPS101C	0.191				13.674						13.674	100.0	39.5	
Bus 5 UPS102A	0.191				12.325						12.325	100.0	37.5	
Bus 5 UPS102C	0.191				12.257						12.257	100.0	37.4	
BUS 044-ELDB-101	0.415				2.005						2.005	100.0	2.8	
BUS 044-ELDB-102	0.415				1.972						1.972	100.0	2.8	
BUS 044-ELDB-103	0.415				1.990						1.990	100.0	2.8	
BUS 044-ELDB-104	0.415				3.864						3.864	100.0	5.5	
BUS 044-ELDB-105	0.415				1.986						1.986	100.0	2.8	
BUS 044-ELDB-106	0.415				1.997						1.997	100.0	2.8	
BUS 044-ELDB-107	0.415				1.881						1.881	100.0	2.7	
BUS 044-ELDB-108	0.415				1.940						1.940	100.0	2.7	
BUS 044-ELDB-109	0.415				1.980						1.980	100.0	2.8	
BUS 044-ELDB-110	0.415				1.960						1.960	100.0	2.8	
BUS 044-ELDB-111	0.415				1.897						1.897	100.0	2.7	
BUS 044-ELDB-112	0.415				1.960						1.960	100.0	2.8	
BUS 044-ELDB-113	0.415				1.960						1.960	100.0	2.8	
BUS 044-ELDB-114	0.415				1.940						1.940	100.0	2.7	
BUS 044-ELDB-115	0.415				1.901						1.901	100.0	2.7	
BUS 044-EPMCC-101	0.415	3150.0	424.183	213.431	28.427	17.618					818.601	91.7	1094.0	34.7
BUS 044-HT6-102	6.900	630.0	558.608	238.655							607.453	92.0	51.1	8.1
BUS 044-HT11-101	11.000	630.0	850.000	526.783	212.223	131.524					1249.674	85.0	65.6	10.4
BUS 044-LDB-101	0.415				3.092						3.092	100.0	4.2	
BUS 044-LDB-102	0.415				5.020						5.020	100.0	7.0	
BUS 044-LDB-103	0.415				2.979						2.979	100.0	4.2	
BUS 044-LDB-104	0.415				3.025						3.025	100.0	4.2	
BUS 044-LDB-105	0.415				3.079						3.079	100.0	4.2	
BUS 044-LDB-106	0.415				2.883						2.883	100.0	4.1	
BUS 044-LDB-107	0.415				4.832						4.832	100.0	6.8	
BUS 044-LDB-108	0.415				4.832						4.832	100.0	6.8	
BUS 044-LDB-109	0.415				5.052						5.052	100.0	7.0	
BUS 044-LDB-110	0.415				4.972						4.972	100.0	6.9	
BUS 044-LDB-111	0.415				4.964						4.964	100.0	6.9	
BUS 044-LDB-112	0.415				4.972						4.972	100.0	6.9	
BUS 044-LDB-113	0.415				4.831						4.831	100.0	6.8	
BUS 044-LDB-114	0.415				4.894						4.894	100.0	6.9	
BUS 044-LDB-115	0.415				4.048						4.048	100.0	5.6	
BUS 044-LDB-116	0.415				2.112						2.112	100.0	3.0	
BUS 044-LDB-117	0.415				2.112						2.112	100.0	3.0	
BUS 044-PDB-101	0.415				4.105						4.105	100.0	5.6	
BUS 044-PDB-102	0.415				4.071						4.071	100.0	5.6	

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Directly Connected Load											Total Bus Load			
Bus			Constant kVA		Constant Z		Constant I		Generic		kVA	% PF	Amp	Percent Loading
ID	kV	Rated Amp	kW	kvar	kW	kvar	kW	kvar	kW	kvar				
BUS 044-PDB-103	0.415				4.029						4.029	100.0	5.6	
BUS 044-PDB-104	0.415				4.005						4.005	100.0	5.6	
BUS 044-PDB-105	0.415				19.634						19.634	100.0	27.6	
BUS A 044-ASB-101	0.415		16.104	8.568	63.182	0.046					110.630	99.5	159.7	
BUS A 044-ASB-102	0.415				58.794	0.067					114.676	100.0	165.5	
BUS A 044-EMLDB-101	0.415										17.828	100.0	24.7	
BUS A 044-HT6-101	6.600	2000.0	1466.199	797.808							11787.530	91.6	992.4	49.6
BUS A 044-HT33-101	33.000	1250.0									24035.550	92.6	421.2	33.7
BUS A 044-MCC-101	0.415	800.0	174.644	88.154							422.378	89.4	580.0	72.5
BUS A 044-MCC-102	0.415	800.0	68.380	33.082							555.342	98.4	763.3	95.4#
BUS A 044-MCC-103	0.415	800.0	138.222	66.264							571.800	96.5	783.6	97.9#
BUS A 044-MCC-104	0.415	800.0	210.506	105.043							476.591	89.6	654.7	81.8
BUS A 044-MCC-105	0.415	800.0	139.376	73.770							315.371	88.4	431.2	53.9
BUS A 044-MCC-106	0.415	800.0	127.773	63.693	99.257	0.007					357.224	97.6	488.6	61.1
BUS A 044-MCC-107	0.415	630.0	141.540	74.107							292.640	89.0	422.7	67.1
BUS A 044-MLDB-101	0.415										88.752	100.0	120.9	
BUS A 044-MLDB-102	0.415										9.945	100.0	13.9	
BUS A 044-PMCC-101	0.415	4000.0	464.314	202.837							2394.907	93.1	3277.3	81.9
BUS A 044-PMCC-102	0.415	4000.0	406.807	176.975							2290.644	93.8	3123.9	78.1
BUS A 044-PMCC-103	0.415	4000.0	399.427	174.929							2375.291	90.9	3421.3	85.5
BUS A AU-V REVAMP	6.600		2080.000	1560.000	506.830	380.122					6467.074	80.0	573.0	
BUS A to VDU UNIT	6.600		2520.034	1559.297	558.901	345.826					7241.363	85.0	643.3	
BUS B 044-ASB-101	0.415		4.769	2.633	26.001	0.002					30.883	99.6	44.6	
BUS B 044-ASB-102	0.415				55.881	0.057					55.881	100.0	80.6	
BUS B 044-HT6-101	6.600	2000.0	1433.743	774.792							3098.551	46.4	260.9	13.0
BUS B 044-HT33-101	33.000	1250.0									7613.468	81.6	133.4	10.7
BUS B 044-MCC-101	0.415	800.0	203.023	100.976							226.748	89.5	311.3	38.9
BUS B 044-MCC-102	0.415	800.0	136.642	66.142							281.093	97.2	386.4	48.3
BUS B 044-MCC-103	0.415	800.0	172.475	82.815							288.067	95.8	394.8	49.3
BUS B 044-MCC-104	0.415	800.0	213.482	106.902							238.753	89.4	328.0	41.0
BUS B 044-MCC-105	0.415	800.0	139.350	73.778							157.676	88.4	215.6	27.0
BUS B 044-MCC-106	0.415	800.0	28.140	14.624	93.361	0.007					122.378	99.3	167.4	20.9
BUS B 044-MCC-107	0.415	630.0	118.836	59.469							132.885	89.4	191.9	30.5
BUS B 044-MLDB-101	0.415										44.840	100.0	61.1	
BUS B 044-MLDB-102	0.415										16.968	100.0	23.8	
BUS B 044-PMCC-101	0.415	4000.0	409.999	178.230							447.062	91.7	611.8	15.3
BUS B 044-PMCC-102	0.415	4000.0	557.427	242.392							607.847	91.7	829.0	20.7
BUS B 044-PMCC-103	0.415	4000.0	354.821	155.428							872.538	88.2	1256.8	31.4
BUS B AU-REVAMP	6.600		2080.000	1560.000	506.830	380.122					3233.537	80.0	286.5	
BUS B EMLDB-101	0.415										48.959	100.0	67.7	
BUS B to VDU UNIT	6.600		2520.034	1559.297	558.901	345.826					3620.681	85.0	321.7	
BUS Emergency Supply	11.000										1250.489	85.0	65.6	

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Bus			Directly Connected Load								Total Bus Load			
			Constant kVA		Constant Z		Constant I		Generic		kVA	% PF	Amp	Percent Loading
ID	kV	Rated Amp	kW	kvar	kW	kvar	kW	kvar	kW	kvar				
BUS Grid Power A	33.000										24011.410	92.9	420.1	
BUS HVAC EPMCC	0.415		112.032	54.260	29.380	14.230					157.125	90.0	213.4	
Bus Prim TR-101A	33.000										10850.340	99.9	190.2	
Bus Prim TR-101B	33.000												-	
Bus Prim TR-102A	6.600										2490.998	90.2	209.8	
Bus Prim TR-102B	6.600												-	
Bus Prim TR-103A	6.600										2374.782	91.0	200.0	
Bus Prim TR-103B	6.600												-	
Bus Prim TR-104A	6.600										2492.927	87.3	209.9	
Bus Prim TR-104B	6.600												-	
Bus Prim TR-105A	6.600										831.768	90.5	70.0	
Bus Prim TR-105B	6.600												-	
Bus Prim TR-105C	6.600												-	
Bus Prim TR-106A	11.000												-	
Bus Prim TR-107A	0.433										89.675	100.0	129.3	
Bus Prim TR-107B	0.433												-	
Bus Prim TR-108A	0.415												-	
Bus Prim TR-108B	0.433										49.492	100.0	66.3	
Bus Prim TR-109A	33.000										7668.248	81.0	134.5	
Bus Prim TR-109B	33.000													
Bus Prim TR-114A	33.000										6834.234	76.3	119.8	
Bus Prim TR-114B	33.000													
Bus Sec TR-106A	6.900													
Bus to CB-101A	6.600				0.124	-2908.657					2908.657	-	231.1	
Bus to CB-101B	6.600				0.124	-2908.657					2908.657	-	231.1	
Bus to Charger-DCDB101B	0.415		16.200	7.846							18.000	90.0	24.1	
Bus to Charger-DCDB102	0.433		36.000	17.436							40.000	90.0	53.6	
Bus to ext. 1	33.000													
Bus to ext. 2	33.000													
BUS to HVAC-1	0.433		340.000	210.713	72.091	44.678					484.813	85.0	701.9	
BUS to HVAC-2	0.433		340.000	210.713	72.091	44.678					484.813	85.0	701.9	
Bus to TR101A	33.000										10850.520	99.9	190.2	
Bus to TR101B	33.000													

* Indicates operating load of a bus exceeds the bus critical limit (100.0% of the Continuous Ampere rating).
Indicates operating load of a bus exceeds the bus marginal limit (95.0% of the Continuous Ampere rating).

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Branch Loading Summary Report

CKT / Branch		Busway / Cable & Reactor			Transformer				
ID	Type	Ampacity (Amp)	Loading Amp	%	Capability (kVA)	Loading (input)		Loading (output)	
						kVA	%	kVA	%
Cab 1 EPMCC to UPS102	Cable	104.29	16.55	15.87					
Cab 1 EPMCC101 to UPS101	Cable	300.78	18.35	6.10					
Cab 2 EPMCC101 to UPS101	Cable	300.78	18.35	6.10					
Cab 044-ELDB-101	Cable	27.94	2.79	9.97					
Cab 044-ELDB-102	Cable	27.94	2.76	9.89					
Cab 044-ELDB-103	Cable	27.94	2.78	9.94					
Cab 044-ELDB-104	Cable	27.94	5.47	19.58					
Cab 044-ELDB-105	Cable	27.94	2.77	9.93					
Cab 044-ELDB-106	Cable	27.94	2.78	9.95					
Cab 044-ELDB-107	Cable	27.94	2.70	9.66					
Cab 044-ELDB-108	Cable	27.94	2.74	9.81					
Cab 044-ELDB-109	Cable	27.94	2.77	9.91					
Cab 044-ELDB-110	Cable	27.94	2.75	9.86					
Cab 044-ELDB-111	Cable	27.94	2.71	9.70					
Cab 044-ELDB-112	Cable	27.94	2.75	9.86					
Cab 044-ELDB-113	Cable	27.94	2.75	9.86					
Cab 044-ELDB-114	Cable	55.87	2.74	4.90					
Cab 044-ELDB-115	Cable	27.94	2.71	9.71					
Cab 044-ELDB-116	Cable	27.94	3.00	10.73					
Cab 044-LDB-101	Cable	27.94	4.24	15.17					
Cab 044-LDB-102	Cable	37.25	6.97	18.71					
Cab 044-LDB-103	Cable	27.94	4.16	14.89					
Cab 044-LDB-104	Cable	27.94	4.19	15.00					
Cab 044-LDB-105	Cable	37.25	4.23	11.35					
Cab 044-LDB-106	Cable	27.94	4.09	14.64					
Cab 044-LDB-107	Cable	27.94	6.84	24.48					
Cab 044-LDB-108	Cable	27.94	6.84	24.48					
Cab 044-LDB-109	Cable	37.25	6.99	18.77					
Cab 044-LDB-110	Cable	37.25	6.94	18.62					
Cab 044-LDB-111	Cable	74.50	6.93	9.30					
Cab 044-LDB-112	Cable	37.25	6.94	18.62					
Cab 044-LDB-113	Cable	27.94	6.84	24.48					
Cab 044-LDB-114	Cable	74.50	6.88	9.24					

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CKT / Branch		Busway / Cable & Reactor			Transformer				
ID	Type	Ampacity (Amp)	Loading Amp	%	Capability (kVA)	Loading (input)		Loading (output)	
						kVA	%	kVA	%
Cab 044-LDB-115	Cable	66.12	5.60	8.47					
Cab 044-LDB-117	Cable	27.94	3.00	10.73					
Cab 044-PDB-101	Cable	27.94	5.64	20.18					
Cab 044-PDB-102	Cable	27.94	5.61	20.10					
Cab 044-PDB-103	Cable	27.94	5.59	19.99					
Cab 044-PDB-104	Cable	27.94	5.57	19.93					
Cab 044-PDB-105	Cable	66.12	27.57	41.70					
Cab A HT6-101 to HT6-102	Cable	1352.13	51.14	3.78					
Cab A HT6-101 to TR103A	Cable	450.71	199.95	44.36					
Cab A PMCC102 to MCC103	Cable	902.33	783.57	86.84					
Cab A PMCC102 to MCC105	Cable	902.33	431.23	47.79					
Cab A PMCC102 to MCC106	Cable	902.33	488.63	54.15					
Cab A PMCC103 to ASB101	Cable	456.29	159.69	35.00					
Cab A PMCC103 to ASB102	Cable	527.06	165.47	31.39					
Cab A PMCC103 to MCC107	Cable	902.33	422.67	46.84					
Cab A PMCC103 to UPS101	Cable	456.29	0.00	0.00					
Cab A PMCC103 to UPS102	Cable	162.03							
Cab B HT6-101 to TR103B	Cable	450.71	0.00	0.00					
Cab B PMCC103 to UPS101	Cable	456.29	0.00	0.00					
Cab B PMCC103 to UPS102	Cable	162.03							
Cab Emergency to HT11	Cable	1352.13	65.63	4.85					
Cab EMLDB to MLDB102	Cable	684.43	23.76	3.47					
Cab EPMCC101 to DC101B	Cable	196.48	24.08	12.26					
Cab EPMCC101 to TR108B	Cable	300.78	66.25	22.03					
Cab EPMCC101-DC102	Cable	162.03	53.64	33.11					
Cab HT6-101 to TR10AB	Cable	1352.13	0.00	0.00					
Cab HT6-101 to TR104A	Cable	1352.13	209.88	15.52					
Cab HT11 to TR106A	Cable	1352.13	0.00	0.00					
Cab HT33 to TR109A	Cable	432.68	134.51	31.09					
Cab HT33 to TR109B	Cable	865.36	3.08	0.36					
Cab HT33 to TR114A	Cable	865.36	119.81	13.85					
Cab HT33 to TR114B	Cable	865.36							
Cab HT601 to TR105A	Cable	1352.13	70.03	5.18					
Cab HT601 to TR105B	Cable	1352.13	0.00	0.00					
Cab HT602 to TR105C	Cable	1352.13	0.00	0.00					

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CKT / Branch		Busway / Cable & Reactor			Transformer				
ID	Type	Ampacity (Amp)	Loading Amp	%	Capability (kVA)	Loading (input)		Loading (output)	
						kVA	%	kVA	%
Cab HT6101 to TR102A	Cable	450.71	209.77	46.54					
Cab HT6101 to TR102B	Cable	450.71	0.00	0.00					
Cab HVAC-1	Cable	711.44	701.93	98.66					
Cab HVAC-2	Cable	711.44	701.93	98.66					
Cab PMCC101 to TR-108A	Cable	300.78	0.00	0.00					
Cab PMCC103 to TR107A	Cable	409.73	129.35	31.57					
Cab PMCC103 to TR107B	Cable	409.73							
Cab to HVAC MCC	Cable	711.44	213.43	30.00					
Cab to VFD-ACM L1	Cable	126.64	46.91	37.04					
Cab to VFD-ACM P1	Cable	126.64	47.36	37.40					
Cab to VFD-ACM R1	Cable	126.64	47.46	37.48					
Cab VFD-ACM 201 A1	Cable	126.64	47.03	37.14					
Cab VFD-ACM 202 A1	Cable	48.42	16.57	34.21					
Cab VFD-ACM B1	Cable	126.64	47.03	37.14					
Cab VFD-ACM C1	Cable	126.64	47.03	37.14					
Cab VFD-ACM D1	Cable	126.64	46.80	36.96					
Cab VFD-ACM D2	Cable	126.64	46.83	36.98					
Cab VFD-ACM E1	Cable	126.64	46.80	36.96					
Cab VFD-ACM F1	Cable	126.64	46.87	37.01					
Cab VFD-ACM G1	Cable	126.64	46.87	37.01					
Cab VFD-ACM H1	Cable	126.64	46.96	37.08					
Cab VFD-ACM J1	Cable	126.64	47.00	37.11					
Cab VFD-ACM K1	Cable	126.64	46.88	37.01					
Cab VFD-ACM M1	Cable	162.03	47.26	29.17					
Cab VFD-ACM N1	Cable	162.03	47.36	29.23					
Cab VFD-ACM Q1	Cable	162.03	47.46	29.29					
Cable 2 EPMCC to UPS102	Cable	104.29	16.50	15.82					
Cable A PMCC101 to MCC101	Cable	902.33	579.97	64.27					
Cable A PMCC101 to MCC102	Cable	902.33	763.33	84.60					
044-TR-101 A	Transformer				20000.0	10850.3	54.3	10803.1	54.0
044-TR-102 A	Transformer				2500.0	2491.0	99.6	2394.9	95.8
044-TR-103 A	Transformer				2500.0	2374.8	95.0	2290.6	91.6
044-TR-104 A	Transformer				2500.0	2492.9	99.7	2375.3	95.0
044-TR-105 A	Transformer				1600.0	831.8	52.0	818.6	51.2
044-TR-106 A	Transformer				3937.5				

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CKT / Branch		Busway / Cable & Reactor			Transformer				
ID	Type	Ampacity (Amp)	Loading Amp	%	Capability (kVA)	Loading (input)		Loading (output)	
						kVA	%	kVA	%
044-TR-107 A	Transformer				200.0	89.7	44.8	88.8	44.4
044-TR-108 B	Transformer				100.0	49.5	49.5	49.0	49.0
044-TR-109 A	Transformer				7875.0	7668.2	97.4	7241.4	92.0
044-TR-114 A	Transformer				8000.0	6834.2	85.4	6467.1	80.8
T UPS101A	Transformer				1.0				
T UPS101C	Transformer				1.0				
T UPS102A	Transformer				1.0				
T UPS102C	Transformer				1.0				
UPS101-STABILIZER 1	Transformer				200.0	13.7	6.8	13.7	6.8
UPS101-STABILIZER 5	Transformer				200.0	13.7	6.8	13.7	6.8
UPS102-STABILIZER 1	Transformer				200000.0	12.3	0.0	12.3	0.0
UPS102-STABILIZER 2	Transformer				100.0	12.3	12.3	12.3	12.3
Reactor 1	Reactor	400.00	231.13	57.78					
Reactor 2	Reactor	400.00	231.13	57.78					

* Indicates a branch with operating load exceeding the branch capability.

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Branch Losses Summary Report

Branch ID	From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		Vd % Drop in Vmag
	kw	kvar	kw	kvar	kW	kvar	From	To	
044-TR-101 A	-10803.0	51.4	10834.7	582.8	31.7	634.2	103.9	99.8	0.43
044-TR-102 A	-2230.7	-871.6	2246.4	1076.4	15.8	204.8	101.7	103.9	6.44
044-TR-103 A	-2147.9	-795.9	2162.2	982.0	14.3	186.1	102.0	103.9	6.13
044-TR-104 A	-2159.1	-990.1	2176.4	1215.7	17.3	225.5	96.6	103.9	7.32
044-TR-105 A	-750.5	-327.0	753.1	353.1	2.6	26.2	104.1	103.9	4.14
044-TR-106 A	0.0	0.0	0.0	0.0			99.9	99.9	0.00
044-TR-107 A	-88.8	0.0	89.7	1.4	0.9	1.4	102.2	92.4	1.39
044-TR-108 B	-49.0	-0.1	49.5	0.8	0.5	0.8	100.5	99.6	0.94
044-TR-109 A	-6157.9	-3810.2	6210.7	4497.6	52.9	687.4	98.5	99.7	5.55
044-TR-114 A	-5173.7	-3880.2	5215.0	4417.1	41.3	536.9	98.7	99.8	5.36
Cab 044-ELDB-101	-2.0	0.0	2.0	0.0	0.0	0.0	100.1	100.5	0.42
Cab 044-ELDB-102	-2.0	0.0	2.0	0.0	0.0	0.0	99.3	100.5	1.25
Cab 044-ELDB-103	-2.0	0.0	2.0	0.0	0.0	0.0	99.8	100.5	0.78
Cab 044-ELDB-104	-3.9	0.0	4.0	0.0	0.1	0.0	98.3	100.5	2.26
Cab 044-ELDB-105	-2.0	0.0	2.0	0.0	0.0	0.0	99.7	100.5	0.89
Cab 044-ELDB-106	-2.0	0.0	2.0	0.0	0.0	0.0	99.9	100.5	0.63
Cab 044-ELDB-107	-1.9	0.0	2.0	0.0	0.1	0.0	97.0	100.5	3.55
Cab 044-ELDB-108	-1.9	0.0	2.0	0.0	0.0	0.0	98.5	100.5	2.06
Cab 044-ELDB-109	-2.0	0.0	2.0	0.0	0.0	0.0	99.5	100.5	1.04
Cab 044-ELDB-110	-2.0	0.0	2.0	0.0	0.0	0.0	99.0	100.5	1.55
Cab 044-ELDB-111	-1.9	0.0	2.0	0.0	0.1	0.0	97.4	100.5	3.16
Cab 044-ELDB-112	-2.0	0.0	2.0	0.0	0.0	0.0	99.0	100.5	1.55
Cab 044-ELDB-113	-2.0	0.0	2.0	0.0	0.0	0.0	99.0	100.5	1.55
Cab 044-ELDB-114	-1.9	0.0	2.0	0.0	0.0	0.0	98.5	100.5	2.06
Cab 044-ELDB-115	-1.9	0.0	2.0	0.0	0.1	0.0	97.5	100.5	3.06
Cab 044-ELDB-116	-2.1	0.0	2.1	0.0	0.0	0.0	98.0	99.3	1.35
Cab 044-LDB-101	-3.1	0.0	3.1	0.0	0.0	0.0	101.5	102.2	0.64
Cab 044-LDB-102	-5.0	0.0	5.1	0.0	0.1	0.0	100.2	102.2	1.96
Cab 044-LDB-103	-3.0	0.0	3.1	0.0	0.1	0.0	99.6	102.2	2.50
Cab 044-LDB-104	-3.0	0.0	3.1	0.0	0.1	0.0	100.4	102.2	1.73
Cab 044-LDB-105	-3.1	0.0	3.1	0.0	0.0	0.0	101.3	102.2	0.84
Cab 044-LDB-106	-2.9	0.0	2.9	0.0	0.0	0.0	98.0	99.3	1.31
Cab 044-LDB-107	-4.8	0.0	4.9	0.0	0.1	0.0	98.3	99.3	1.03
Cab 044-LDB-108	-4.8	0.0	4.9	0.0	0.1	0.0	98.3	99.3	1.03

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Branch ID	From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		Vd % Drop in Vmag
	kw	kvar	kw	kvar	kW	kvar	From	To	
Cab 044-LDB-109	-5.1	0.0	5.1	0.0	0.1	0.0	100.5	102.2	1.64
Cab 044-LDB-110	-5.0	0.0	5.1	0.0	0.1	0.0	99.7	102.2	2.43
Cab 044-LDB-111	-5.0	0.0	5.1	0.0	0.1	0.0	99.6	102.2	2.51
Cab 044-LDB-112	-5.0	0.0	5.1	0.0	0.1	0.0	99.7	102.2	2.43
Cab 044-LDB-113	-4.8	0.0	5.0	0.0	0.2	0.0	98.3	102.2	3.86
Cab 044-LDB-114	-4.9	0.0	5.1	0.0	0.2	0.0	98.9	102.2	3.22
Cab 044-LDB-115	-4.0	0.0	4.1	0.0	0.1	0.0	100.6	102.2	1.56
Cab 044-LDB-117	-2.1	0.0	2.1	0.0	0.0	0.0	98.0	99.3	1.35
Cab 044-PDB-101	-4.1	0.0	4.1	0.0	0.0	0.0	101.3	102.2	0.85
Cab 044-PDB-102	-4.1	0.0	4.1	0.0	0.1	0.0	100.9	102.2	1.27
Cab 044-PDB-103	-4.0	0.0	4.1	0.0	0.1	0.0	100.4	102.2	1.79
Cab 044-PDB-104	-4.0	0.0	4.1	0.0	0.1	0.0	100.1	102.2	2.09
Cab 044-PDB-105	-19.6	0.0	20.2	0.0	0.6	0.0	99.1	102.2	3.07
Cab 1 EPMCC to UPS102	-12.3	0.0	12.4	0.0	0.1	0.0	99.3	104.1	0.49
Cab 1 EPMCC101 to UPS101	-13.7	0.0	13.7	0.0	0.0	0.0	99.5	104.1	0.28
Cab 2 EPMCC101 to UPS101	-13.7	0.0	13.7	0.0	0.0	0.0	99.5	104.1	0.28
Cab A HT6 to PMCC101	-22266.3	-8875.0	22303.3	8894.5	37.0	19.5	99.8	100.0	0.17
Cab A HT6-101 to HT6-102	-558.6	-238.7	558.6	238.7	0.0	0.0	99.4	103.9	0.00
Cab A HT6-101 to TR103A	2162.4	982.3	-2162.2	-982.0	0.2	0.3	103.9	103.9	0.01
Cab A PMCC102 to MCC103	-552.0	-149.1	554.6	150.0	2.6	1.0	101.5	102.0	0.49
Cab A PMCC102 to MCC105	-278.7	-147.5	279.5	147.8	0.8	0.3	101.7	102.0	0.27
Cab A PMCC102 to MCC106	-348.5	-78.3	349.5	78.7	1.0	0.4	101.7	102.0	0.30
Cab A PMCC103 to ASB101	-110.1	-11.3	110.3	11.3	0.2	0.1	96.4	96.6	0.21
Cab A PMCC103 to ASB102	-114.7	-0.1	114.9	0.2	0.2	0.1	96.4	96.6	0.17
Cab A PMCC103 to MCC107	-260.4	-133.6	261.1	133.9	0.8	0.3	96.3	96.6	0.26
Cab A PMCC103 to UPS101	0.0	0.0	0.0	0.0			92.6	96.6	
Cab A PMCC103 to UPS102	0.0	0.0	0.0	0.0			92.6	96.6	0.00
Cab B HT6-101 to TR103B	0.0	0.0	0.0	0.0			103.9	103.9	
Cab B PMCC103 to UPS101	0.0	0.0	0.0	0.0			92.6	96.6	
Cab B PMCC103 to UPS102	0.0	0.0	0.0	0.0			92.6	96.6	0.00
Cab Emergency to HT11	-1062.2	-658.3	1062.8	659.0	0.5	0.7	99.9	100.0	0.07
Cab EMLDB to MLDB102	-17.0	0.0	17.2	0.1	0.2	0.0	99.3	100.5	1.21
Cab EPMCC101 to DC101B	16.2	7.8	-16.2	-7.8	0.0	0.0	104.1	104.0	0.12
Cab EPMCC101 to TR108B	49.6	0.9	-49.5	-0.8	0.1	0.0	104.1	99.6	0.17
Cab EPMCC101-DC102	36.1	17.5	-36.0	-17.4	0.1	0.0	104.1	99.4	0.36
Cab HT11 to TR106A	0.0	0.0	0.0	0.0			99.9	99.9	0.00
Cab HT33 to TR101A	-10834.7	-582.8	10834.9	582.9	0.2	0.1	99.8	99.8	0.00

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Branch ID	From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		Vd % Drop in Vmag
	kw	kvar	kw	kvar	kW	kvar	From	To	
Cab HT33 to TR101B	0.0	0.0	0.0	0.0			99.8	99.8	0.00
Cab HT33 to TR109A	6214.9	4397.8	-6210.7	-4497.6	4.1	-99.8	99.8	99.7	0.09
Cab HT33 to TR109B	0.0	-176.0	0.0	0.0	0.0	-176.0	99.8	99.8	0.00
Cab HT33 to TR114A	5216.5	4070.4	-5215.0	-4417.1	1.6	-346.7	99.8	99.8	0.03
Cab HT33 to TR114B	0.0	0.0	0.0	0.0			99.8	99.8	
Cab HT601 to TR105A	753.1	353.1	-753.1	-353.1	0.0	0.0	103.9	103.9	0.00
Cab HT601 to TR105B	0.0	0.0	0.0	0.0			103.9	103.9	
Cab HT602 to TR105C	0.0	0.0	0.0	0.0			99.4	103.9	0.00
Cab HT6101 to TR102A	2246.9	1077.0	-2246.4	-1076.4	0.5	0.6	103.9	103.9	0.03
Cab HT6101 to TR102B	0.0	0.0	0.0	0.0			103.9	103.9	0.00
Cab HT6-101 to TR104A	2176.5	1215.8	-2176.4	-1215.7	0.1	0.1	103.9	103.9	0.00
Cab HT6-101 to TR10AB	0.0	0.0	0.0	0.0			103.9	103.9	0.00
Cab HVAC-1	414.4	256.5	-412.1	-255.4	2.3	1.1	96.6	92.1	0.50
Cab HVAC-2	414.4	256.5	-412.1	-255.4	2.3	1.1	96.6	92.1	0.50
Cab PMCC101 to TR-108A	0.0	0.0	0.0	0.0			96.6	96.6	0.00
Cab PMCC103 to TR107A	89.8	1.5	-89.7	-1.4	0.1	0.1	96.6	92.4	0.14
Cab PMCC103 to TR107B	0.0	0.0	0.0	0.0			96.6	92.6	
Cab to HVAC MCC	143.7	69.6	-141.4	-68.5	2.3	1.1	104.1	102.4	1.67
Cab to VFD-ACM L1	34.2	0.0	-34.2	0.0	0.0	0.0	101.5	93.1	0.01
Cab to VFD-ACM P1	34.6	0.0	-34.6	0.0	0.0	0.0	101.5	93.1	0.01
Cab to VFD-ACM R1	34.6	0.0	-34.6	0.0	0.0	0.0	101.5	93.1	0.01
Cab VFD-ACM 201 A1	34.2	0.0	-34.2	0.0	0.0	0.0	101.2	92.8	0.01
Cab VFD-ACM 202 A1	2.9	-11.7	-2.9	0.0	0.0	-11.7	101.3	92.8	0.01
Cab VFD-ACM B1	34.2	0.0	-34.2	0.0	0.0	0.0	101.2	92.8	0.01
Cab VFD-ACM C1	34.2	0.0	-34.2	0.0	0.0	0.0	101.2	92.8	0.01
Cab VFD-ACM D1	34.0	0.0	-34.0	0.0	0.0	0.0	101.2	92.8	0.01
Cab VFD-ACM D2	34.1	0.0	-34.1	0.0	0.0	0.0	101.2	92.8	0.01
Cab VFD-ACM E1	34.0	0.0	-34.0	0.0	0.0	0.0	101.2	92.8	0.01
Cab VFD-ACM F1	34.1	0.0	-34.1	0.0	0.0	0.0	101.2	92.8	0.01
Cab VFD-ACM G1	34.1	0.0	-34.1	0.0	0.0	0.0	101.2	92.8	0.01
Cab VFD-ACM H1	34.2	0.0	-34.2	0.0	0.0	0.0	101.2	92.8	0.01
Cab VFD-ACM J1	34.2	0.0	-34.2	0.0	0.0	0.0	101.2	92.8	0.01
Cab VFD-ACM K1	34.2	0.0	-34.2	0.0	0.0	0.0	101.5	93.1	0.01
Cab VFD-ACM M1	34.5	0.0	-34.5	0.0	0.0	0.0	101.5	93.1	0.01
Cab VFD-ACM N1	34.6	0.0	-34.6	0.0	0.0	0.0	101.5	93.1	0.01
Cab VFD-ACM Q1	34.6	0.0	-34.6	0.0	0.0	0.0	101.5	93.1	0.01
Cable 2 EPMCC to UPS102	-12.3	-0.1	12.3	0.1	0.1	0.0	99.3	104.1	0.49

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Contingency

Branch ID	From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		Vd % Drop in Vmag
	kw	kvar	kw	kvar	kW	kvar	From	To	
Cable A PMCC101 to MCC101	-377.7	-189.1	379.0	189.6	1.4	0.5	101.3	101.7	0.34
Cable A PMCC101 to MCC102	-546.4	-99.2	548.8	100.1	2.4	0.9	101.2	101.7	0.45
Cable A PMCC101 to MCC104	-426.9	-200.2	428.6	200.9	1.7	0.6	101.3	101.7	0.39
Reactor 1	2.8	-2745.4	-0.1	2908.7	2.6	163.2	103.9	110.1	6.18
Reactor 2	2.8	-2745.4	-0.1	2908.7	2.6	163.2	103.9	110.1	6.18
T UPS101A	0.0	0.0	0.0	0.0			100.0	100.0	
T UPS101C	0.0	0.0	0.0	0.0			100.0	100.0	
T UPS102A	0.0	0.0	0.0	0.0			100.0	100.0	
T UPS102C	0.0	0.0	0.0	0.0			100.0	100.0	
UPS101-STABILIZER 1	13.7	0.0	-13.7	0.0	0.0	0.0	99.5	104.6	5.09
UPS101-STABILIZER 5	13.7	0.0	-13.7	0.0	0.0	0.0	99.5	104.6	5.09
UPS102-STABILIZER 1	12.3	0.0	-12.3	0.0	0.0	0.0	99.3	99.3	0.00
UPS102-STABILIZER 2	12.3	0.1	-12.3	0.0	0.0	0.1	99.3	99.0	0.28
					248.3	2224.2			

* This Transmission Line includes Series Capacitor.

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Equipment Cable and Overload Heater Losses Summary Report

Connected Load		Cable /Overload Heater		Losses		% Voltage			% Vd Operating	% Vst Starting
						Bus	Terminal on Bus kV	Load kV		
ID	Type	ID	Library	kW	kvar	Bus	Bus kV	Load kV		
1803-PM-609 B	Ind. Motor	Cab PM-609 B	11NALS3	0.0	0.0	99.39	99.37	103.89	0.02	99.31
1803-PM-609 A	Ind. Motor	Cab PM-609 A	11NALS3	0.0	0.0	99.39	99.37	103.89	0.02	99.31
1803-PM-609 C	Ind. Motor	Cab PM-609 C	11NALS3	0.0	0.0	99.39	99.39	103.90	0.00	99.31
1803-PM-204 A	Ind. Motor	Cab PM-204 A	11NALS3	0.1	0.0	103.91	103.88	103.88	0.03	103.78
1803-PM-222 A	Ind. Motor	Cab PM-222 A	11NALS3	0.0	0.0	103.91	103.89	103.89	0.01	103.83
1803-PM-213 A	Ind. Motor	Cab PM-213 A	11NALS3	0.0	0.0	103.91	103.91	103.91	0.00	103.82
1803-PM-205 A	Ind. Motor	Cab PM-205 A	11NALS3	0.0	0.0	103.91	103.90	103.90	0.00	103.66
1803-PM-202 A	Ind. Motor	Cab PM-202 A	11NALS3	0.1	0.1	103.91	103.88	103.88	0.03	103.77
1803-PM-101 A	Ind. Motor	Cab PM-101 A	11NALS3	0.0	0.0	103.91	103.89	103.89	0.02	103.84
1803-X-107-K-001 A	Ind. Motor	Cab X-107-K-001 A	11NALS3	0.0	0.0	103.91	103.90	103.90	0.01	103.87
1803-PM-214 A	Ind. Motor	Cab PM-214 A	11NALS3	0.0	0.0	103.91	103.91	103.91	0.00	103.81
1803-X-107-K-001 C	Ind. Motor	Cab X-107-K-001 C	11NALS3	0.0	0.0	103.91	103.91	103.91	0.00	103.87
1803-PM-204 B	Ind. Motor	Cab PM-204 B	11NALS3	0.1	0.0	103.91	103.88	103.88	0.03	103.78
1803-PM-101 B	Ind. Motor	Cab PM-101 B	11NALS3	0.0	0.0	103.91	103.91	103.91	0.00	103.84
1803-PM-202 B	Ind. Motor	Cab PM-202 B	11NALS3	0.1	0.1	103.91	103.88	103.88	0.03	103.77
1803-PM-202 C	Ind. Motor	Cab PM-202 C	11NALS3	0.0	0.0	103.91	103.90	103.90	0.00	103.77
1803-PM-204 C	Ind. Motor	Cab PM-204 C	11NALS3	0.0	0.0	103.91	103.91	103.91	0.00	103.78
1803-PM-205 B	Ind. Motor	Cab PM-205 B	11NALS3	0.2	0.1	103.91	103.86	103.86	0.05	103.66
1803-PM-213 B	Ind. Motor	Cab PM-213 B	11NALS3	0.0	0.0	103.91	103.89	103.89	0.02	103.82
1803-PM-214 B	Ind. Motor	Cab PM-214 B	11NALS3	0.0	0.0	103.91	103.89	103.89	0.02	103.81
1803-PM-222 B	Ind. Motor	Cab PM-22B	11NALS3	0.0	0.0	103.91	103.91	103.91	0.00	103.83
1803-X-107-K-001 B	Ind. Motor	Cab X-107-K-001 B	11NALS3	0.0	0.0	103.91	103.90	103.90	0.01	103.87
1803-PM-604 A	Ind. Motor	Cab PM-604 A	1,0NALN3	0.1	0.0	104.09	103.35	103.35	0.74	89.34
1803-PM-604 B	Ind. Motor	Cab PM-604 B	1,0NALN3	0.1	0.0	104.09	103.35	99.06	0.74	90.39
1803-PM-608 A	Ind. Motor	Cab PM-608 A	1,0NALN3	3.7	0.7	104.09	98.76	94.66	5.33	79.32
1803-PM-608 B	Ind. Motor	Cab PM-608 B	1,0NALN3	0.0	0.0	104.09	103.59	99.28	0.51	79.32
1803-PM-610 A	Ind. Motor	Cab PM-610 A	1,0NALN3	7.1	2.6	104.09	99.65	95.51	4.44	88.71
1803-PM-610 B	Ind. Motor	Cab PM-610 B	1,0NALN3	0.1	0.0	104.09	103.67	99.36	0.43	85.86
1803-PM-603	Ind. Motor	Cab PM-603	1,0NCUN3	0.1	0.0	104.09	102.83	98.56	1.26	81.95
1803-P-226 S	Ind. Motor	Cab P-226 S	1,0NCUN3	0.0	0.0	104.09	104.03	104.03	0.06	99.40
1803-P-226 A	Ind. Motor	Cab P-226 A	1,0NCUN3	0.0	0.0	104.09	103.46	103.46	0.64	99.40
1803-P-227 S	Ind. Motor	Cab PM-227 A6	1,0NCUN3	0.0	0.0	104.09	104.03	99.71	0.06	99.77
1803-P-227 A	Ind. Motor	Cab PM-227 A	1,0NCUN3	0.0	0.0	104.09	103.46	99.15	0.64	99.52
1803-P-228 S	Ind. Motor	Cab PM-227 A4	1,0NCUN3	0.0	0.0	104.09	104.03	99.71	0.06	99.77
1803-P-228 A	Ind. Motor	Cab PM-227 A2	1,0NCUN3	0.0	0.0	104.09	103.46	99.15	0.64	99.77

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Equipment Cable and Overload Heater Losses Summary Report

Connected Load		Cable /Overload Heater		Losses		% Voltage			% Vd	% Vst
						Terminal on				
ID	Type	ID	Library	kW	kvar	Bus	Bus kV	Load kV	Operating	Starting
1803-P-229 S	Ind. Motor	Cab PM-229 A2	1,0NCUN3	0.0	0.0	104.09	104.03	99.71	0.06	99.77
1803-P-229 A	Ind. Motor	Cab PM-229 A	1,0NCUN3	0.0	0.0	104.09	103.46	99.15	0.64	99.77
1803-P-230 S	Ind. Motor	Cab 1803-PM-230 S	1,0NCUN3	0.0	0.0	104.09	104.03	99.71	0.06	99.77
1803-P-230 A	Ind. Motor	Cab PM-230 A	1,0NCUN3	0.0	0.0	104.09	103.46	99.15	0.64	99.77
1803-P-234 S	Ind. Motor	Cab 1803-PM-234 S	1,0NCUN3	0.0	0.0	104.09	104.03	99.71	0.06	99.77
1803-P-234 A	Ind. Motor	Cab 1803-PM-234 A	1,0NCUN3	0.0	0.0	104.09	103.46	99.15	0.64	99.77
1803-P-233 S	Ind. Motor	Cab 1803-PM-233 S	1,0NCUN3	0.0	0.0	104.09	104.03	99.71	0.06	99.77
1803-P-233 A	Ind. Motor	Cab 1803-PM-233 A	1,0NCUN3	0.0	0.0	104.09	103.46	99.15	0.64	99.77
1803-P-232 S	Ind. Motor	Cab 1803-PM-232 S	1,0NCUN3	0.0	0.0	104.09	104.03	99.71	0.06	99.77
1803-P-232 A	Ind. Motor	Cab 1803-PM-232 A	1,0NCUN3	0.0	0.0	104.09	103.46	99.15	0.64	99.77
1803-P-231 S	Ind. Motor	Cab 1803-PM-231 S	1,0NCUN3	0.0	0.0	104.09	104.03	99.71	0.06	99.77
1803-P-231 A	Ind. Motor	Cab 1803-PM-231 A	1,0NCUN3	0.0	0.0	104.09	103.46	99.15	0.64	99.77
1803-X-105-P-1	Ind. Motor	Cab 1803-X-105-P-1	1,0NCUN3	0.1	0.0	104.09	102.32	98.07	1.78	94.72
1803-X-105-P-2	Ind. Motor	Cab 1803-X-105-P-2	1,0NCUN3	0.1	0.0	104.09	102.32	98.07	1.78	94.72
1803-X-105-FD-1	Ind. Motor	Cab 1803-X-105-FD-1	1,0NCUN3	0.1	0.0	104.09	102.32	98.07	1.78	94.72
1803-X-105-P-5	Ind. Motor	Cab 1803-X-105-P-5	1,0NCUN3	0.1	0.0	104.09	102.32	98.07	1.78	94.72
1803-K-201-P-2	Ind. Motor	Cab 1803-K-201-P-2	1,0NCUN3	0.1	0.0	104.09	101.57	97.34	2.53	91.18
1803-K-201-P-1	Ind. Motor	Cab 1803-K-201-P-1	1,0NCUN3	0.1	0.0	104.09	101.57	97.34	2.53	91.18
St Rotor Turnning (MAB)	Ind. Motor	Cab Rotor Turnning (MAB)	1,0NCUN3	0.0	0.0	104.09	103.61	99.30	0.48	100.60
St Rotor Turning (WGC)	Ind. Motor	Cab St Rotor Turning (WGC)	1,0NCUN3	0.0	0.0	104.09	103.41	99.11	0.68	99.22
1803-K-105-P-3 (2)	Ind. Motor	Cab 1803-K-105-P-3 (2)	1,0NCUN3	0.3	0.0	104.09	99.26	95.13	4.84	83.37
1803-K-105-P-4 (2)	Ind. Motor	Cab 1803-K-105-P-4 (2)	1,0NCUN3	0.0	0.0	104.09	103.63	99.33	0.46	83.37
1803-K-201-P-3 (2)	Ind. Motor	Cab 1803-K-201-P-3 (2)	1,0NCUN3	0.3	0.0	104.09	99.26	95.13	4.84	83.37
1803-K-201-P-4 (2)	Ind. Motor	Cab 1803-K-201-P-4 (2)	1,0NCUN3	0.0	0.0	104.09	103.63	99.33	0.46	83.37
1803-K-201-P-5	Ind. Motor	Cab 1803-K-201-P-5	1,0NCUN3	0.1	0.0	104.09	101.57	97.34	2.53	91.18
1803-K-201-FD-1	Ind. Motor	Cab 1803-K-201-FD-1	1,0NCUN3	0.1	0.0	104.09	101.57	97.34	2.53	91.18
1803-PM-614	Ind. Motor	Cab 1803-PM-614	1,0NCUN3	0.1	0.0	96.38	95.16	91.21	1.22	82.87
1803-X-702 A	Ind. Motor	Cab 1803-X-702 A	1,0NCUN4	0.8	0.0	96.38	91.27	87.48	5.10	80.31
1803-ACM-208 A	Ind. Motor	Cab ACM-208 A	1,0NALN3	0.2	0.0	101.32	100.07	100.07	1.24	95.66
1803-ACM-206 A2	Ind. Motor	Cab ACM-206 A2	1,0NALN3	0.6	0.1	101.32	99.17	99.17	2.15	92.65
1803-ACM-206 A1	Ind. Motor	Cab ACM-206 A1	1,0NALN3	0.6	0.1	101.32	99.21	99.21	2.11	92.80
1803-AM-1005	Ind. Motor	Cab 1803-AM-1005	1,0NCUN3	0.0	0.0	101.32	100.82	96.63	0.50	92.49
1803-AM-1003	Ind. Motor	Cab 1803-AM-1003	1,0NCUN3	0.0	0.0	101.32	101.04	96.84	0.28	96.15
1803-AM-1001	Ind. Motor	Cab 1803-AM-1001	1,0NCUN3	0.0	0.0	101.32	100.80	96.61	0.52	92.10
1803-PM-612 A	Ind. Motor	Cab 1803-PM-612 A	1,0NCUN3	0.1	0.0	101.32	100.42	96.24	0.90	90.80
1803-PM-611 A	Ind. Motor	Cab 1803-PM-611 A	1,0NALN3	0.0	0.0	101.32	101.02	96.82	0.30	97.98

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Equipment Cable and Overload Heater Losses Summary Report

Connected Load		Cable /Overload Heater		Losses		% Voltage			% Vd	% Vst
						Terminal on				
ID	Type	ID	Library	kW	kvar	Bus	Bus kV	Load kV	Operating	Starting
1803-PM-606 A	Ind. Motor	Cab PM-606 A	1,0NCUN3	0.6	0.0	101.32	98.56	98.56	2.76	88.87
1803-PM-602 A	Ind. Motor	Cab 1803-PM-602 A	1,0NCUN3	0.1	0.0	101.32	99.99	95.83	1.33	85.13
1803-PM-223 B	Ind. Motor	Cab PM-223 B	1,0NALN3	0.0	0.0	101.32	101.16	101.16	0.15	94.20
1803-PM-211 A	Ind. Motor	Cab 1803-PM-211 A	1,0NCUN3	0.0	0.0	101.32	100.55	96.37	0.77	90.76
1803-PM-210 A	Ind. Motor	Cab PM-210 A	1,0NCUN3	0.6	0.0	101.32	98.55	98.55	2.77	90.75
1803-PM-208 B	Ind. Motor	Cab PM-208 B	1,0NALN3	0.0	0.0	101.32	101.24	101.24	0.08	96.94
1803-PM-201 A	Ind. Motor	Cab PM-201 A	1,0NALN3	0.9	0.2	101.32	99.11	99.11	2.21	91.11
1803-PM-601 A	Ind. Motor	Cab 1803-PM-601 A	1,0NCUN3	0.1	0.0	101.32	100.20	96.04	1.12	88.09
1803-ACM-201 B2	Ind. Motor	Cab ACM-201 B2	1,0NALN3	0.5	0.1	101.21	99.97	99.97	1.25	95.35
1803-ACM-201 G2	Ind. Motor	Cab ACM-201 G2	1,0NALN3	0.5	0.1	101.21	99.97	99.97	1.24	95.39
1803-ACM-201 Q2	Ind. Motor	Cab ACM-201 Q2	1,0NALN3	0.9	0.1	101.52	99.15	99.15	2.37	91.04
1803-ACM-201 N2	Ind. Motor	Cab ACM-201 N2	1,0NALN3	0.9	0.1	101.52	99.33	99.33	2.19	91.79
1803-ACM-201 L2	Ind. Motor	Cab ACM-201 L2	1,0NALN3	0.8	0.1	101.52	99.49	99.49	2.03	92.50
1803-ACM-201 J2	Ind. Motor	Cab ACM-201 J2	1,0NALN3	0.7	0.1	101.52	99.70	99.70	1.82	93.40
1803-ACM-204 C2	Ind. Motor	Cab ACM-204 C2	1,0NALN3	0.7	0.1	101.28	99.46	99.46	1.82	94.24
1803-ACM-204 A2	Ind. Motor	Cab ACM-204 A2	1,0NALN3	0.7	0.1	101.28	99.51	99.51	1.77	94.43
1803-ACM-204 C1	Ind. Motor	Cab ACM-204 C1	1,0NALN3	0.7	0.1	101.28	99.55	99.55	1.72	94.59
1803-ACM-204 A1	Ind. Motor	Cab ACM-204 A1	1,0NALN3	0.7	0.1	101.28	99.48	99.48	1.80	94.30
1803-ACM-601 B	Ind. Motor	Cab ACM-601 B	1,0NCUN3	0.2	0.0	101.28	97.43	97.43	3.85	83.12
1803-ACM-207 D2	Ind. Motor	Cab ACM-207 D2	1,0NALN3	0.3	0.0	101.28	99.82	99.82	1.46	95.22
1803-ACM-207 B2	Ind. Motor	Cab ACM-207 B2	1,0NALN3	0.3	0.0	101.28	99.71	99.71	1.56	94.79
1803-ACM-207 D1	Ind. Motor	Cab ACM-207 D1	1,0NALN3	0.3	0.0	101.28	99.75	99.75	1.53	94.93
1803-ACM-207 A1	Ind. Motor	Cab ACM-207 A1	1,0NALN3	0.2	0.0	101.28	100.21	100.21	1.07	96.60
1803-ACM-205 A1	Ind. Motor	Cab ACM-205 A1	1,0NALN3	0.2	0.0	101.74	100.67	100.67	1.08	96.99
1803-ACM-205 C1	Ind. Motor	Cab ACM-205 C1	1,0NALN3	0.2	0.0	101.74	100.64	100.64	1.10	96.88
1803-ACM-205 E1	Ind. Motor	Cab ACM-205 E1	1,0NALN3	0.2	0.0	101.74	100.61	100.61	1.13	96.77
1803-ACM-205 G1	Ind. Motor	Cab ACM-205 G1	1,0NALN3	0.2	0.0	101.74	100.59	100.59	1.15	96.66
1803-ACM-205 A2	Ind. Motor	Cab ACM-205 A2	1,0NALN3	0.2	0.0	101.74	100.56	100.56	1.18	96.53
1803-ACM-205 C2	Ind. Motor	Cab ACM-205 C2	1,0NALN3	0.2	0.0	101.74	100.53	100.53	1.22	96.40
1803-ACM-205 E2	Ind. Motor	Cab ACM-205 E2	1,0NALN3	0.2	0.0	101.74	100.50	100.50	1.24	96.28
1803-ACM-205 G2	Ind. Motor	Cab ACM-205 G2	1,0NALN3	0.3	0.0	101.74	100.45	100.45	1.29	96.06
1803-X-106 A	Ind. Motor	Cab X-106 A	1,0NALN3	1.1	0.2	101.71	99.71	99.71	2.00	92.93
1803-X-107-P-006 A	Ind. Motor	Cab X-107-P-006 A	1,0NCUN3	0.1	0.0	101.71	99.76	99.76	1.95	92.44
1803-X-107-P-001 A	Ind. Motor	Cab X-107-P-001 A	1,0MCUN3	0.0	0.0	101.71	100.86	100.86	0.85	95.96
1803-X-107-P-005 A	Ind. Motor	Cab X-107-P-005 A	1,0NCUN3	0.0		101.71	100.27	100.27	1.43	93.77
1803-X-107-P-002 A	Ind. Motor	Cab X-107-P-002 A	1,0NALN3	0.1	0.0	101.71	101.32	101.32	0.39	99.97

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Equipment Cable and Overload Heater Losses Summary Report

Connected Load		Cable /Overload Heater		Losses		% Voltage			% Vd	% Vst
						Terminal on				
ID	Type	ID	Library	kW	kvar	Bus	Bus kV	Load kV	Operating	Starting
1803-X-107-P-007 A	Ind. Motor	Cab X-107-P-007 A	1,0NALN3	0.1	0.0	101.71	101.32	101.32	0.39	99.62
1803-X-106 LRSB	Ind. Motor	Cab X-106 LRSB	1,0NALN3	0.1	0.0	101.71	101.18	101.18	0.53	99.19
1803-X-208-P-XX1	Ind. Motor	Cab X-208-P-XX1	1,0NCUN3	0.3	0.0	96.32	90.50	86.73	5.83	74.89
1803-X-208-P-XX2	Ind. Motor	Cab X-208-P-XX2	1,0NCUN3	0.0	0.0	96.32	94.78	90.84	1.54	88.19
1803-X-205-P-012 A	Ind. Motor	Cab X-205-P-012 A	1,0NCUN3	0.2	0.0	96.32	94.25	90.33	2.08	86.99
1803-X-205-P-011 A	Ind. Motor	Cab X-205-P-011 A	1,0NCUN3	0.2	0.0	96.32	94.25	90.33	2.08	88.50
1803-X-205-P-007 A	Ind. Motor	Cab X-205-P-007 A	1,0NALN3	1.2	0.4	96.32	93.78	89.89	2.54	87.76
1803-X-205-P-008 A	Ind. Motor	Cab X-205-P-008 A	1,0NCUN3	0.2	0.0	96.32	94.25	90.33	2.08	88.50
1803-X-205-P-005 B	Ind. Motor	Cab X-205-P-005 B	1,0NALN3	0.0	0.0	96.32	96.16	92.17	0.16	90.57
1803-X-205-P-004 B	Ind. Motor	Cab X-205-P-004 B	1,0NALN3	0.0	0.0	96.32	96.16	92.17	0.16	90.57
1803-X-205-P-003 A	Ind. Motor	Cab X-205-P-003 A	1,0NCUN3	0.3	0.0	96.32	93.58	89.69	2.74	86.63
1803-X-205-P-002 A	Ind. Motor	Cab X-205-P-002 A	1,0NALN3	0.4	0.1	96.32	94.57	90.64	1.75	90.23
1803-X-205-P-001 A	Ind. Motor	Cab X-205-P-001 A	1,0NALN3	0.5	0.1	96.32	94.32	90.40	2.00	89.39
1803-X-205-P-014 B	Ind. Motor	Cab X-205-P-014 B	1,0NALN3	0.0	0.0	96.32	96.07	92.08	0.25	87.34
HV-1401-1	Ind. Motor	Cab HV-1401-1	1,0NCUN3	0.0	0.0	96.32	96.28	92.28	0.04	95.80
HV-1601-1	Ind. Motor	Cab HV-1601-1	1,0NCUN3	0.0	0.0	96.32	96.28	92.28	0.04	95.80
HV-2201-1	Ind. Motor	Cab HV-2201-1	1,0NCUN3	0.0	0.0	96.32	96.28	92.28	0.04	95.80
XZV-2301-1	Ind. Motor	Cab XZV-2301-1	1,0NCUN3	0.0	0.0	96.32	96.28	92.28	0.04	95.80
H-4001	Ind. Motor	Cab H-4001	1,0NCUN3	0.0	0.0	96.32	96.26	92.26	0.06	95.64
1803-X-603	Ind. Motor	Cab XZV-2301-4	1,0NCUN3	0.0	0.0	96.32	96.26	92.26	0.06	96.06
OXTM-C	Ind. Motor	Cab OXTMC	1,0NALN3	0.0	0.0	101.66	101.54	97.31	0.13	97.44
OXTM-A	Ind. Motor	Cab OXTMA	1,0NALN3	1.1	0.3	101.66	100.37	96.20	1.30	97.44
1803-PM-217 B	Ind. Motor	Cab PM-217 B	1,0NALN3	0.0	0.0	101.66	101.44	97.22	0.22	94.31
1803-PM-224 A	Ind. Motor	Cab PM-224 A	1,0NALN3	0.7	0.3	101.66	100.78	96.59	0.88	98.00
1803-PM-207 A	Ind. Motor	Cab PM-207 A	1,0NALN3	2.6	0.8	101.66	99.90	95.75	1.77	95.72
1803-PM-206 B	Ind. Motor	Cab PM-206 B	1,0NALN3	0.1	0.0	101.66	101.25	97.04	0.41	88.92
1803-PM-102 A	Ind. Motor	Cab PM-102 A	1,0NALN3	3.0	0.7	101.66	99.27	95.14	2.39	94.25
1803-PM-216 B	Ind. Motor	Cab PM-216 B	1,0NALN3	0.0	0.0	102.01	101.76	97.53	0.25	92.41
1803-PM-218 A	Ind. Motor	Cab PM-218 A	1,0NALN3	5.0	1.5	102.01	98.65	94.55	3.36	89.02
1803-X-107-P-004 A	Ind. Motor	Cab X-107-P-004 A	1,0NALN3	0.0	0.0	102.01	101.93	97.69	0.08	97.82
1803-PM-219 B	Ind. Motor	Cab PM-219 B	1,0NALN3	0.0	0.0	102.01	101.69	97.47	0.32	88.78
1803-PM-215 A	Ind. Motor	Cab PM-215 A	1,0NALN3	2.0	0.7	102.01	99.66	95.52	2.35	91.67
1803-X-107-P-003 A	Ind. Motor	Cab X-107-P-003 A	1,0NALN3	1.3	0.4	102.01	101.12	96.92	0.89	98.48
1803-PM-212 B	Ind. Motor	Cab PM-212 B	1,0NALN3	0.0	0.0	96.59	96.38	92.38	0.20	89.71
1803-PM-220 A	Ind. Motor	Cab PM-220 A	1,0NALN3	1.0	0.4	96.59	95.42	91.45	1.17	91.84
1803-PM-225 A	Ind. Motor	Cab PM-225 A	1,0NALN3	0.9	0.4	96.59	95.52	91.55	1.07	92.59

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Equipment Cable and Overload Heater Losses Summary Report

Connected Load		Cable /Overload Heater		Losses		% Voltage			% Vd	% Vst
						Bus	Bus kV	Terminal on Load kV		
ID	Type	ID	Library	kW	kvar	Bus	Bus kV	Load kV	Operating	Starting
1803-PM-209 B	Ind. Motor	Cab PM-209 B	1,0NALN3	0.0	0.0	96.59	96.36	92.35	0.23	88.41
1803-X-205-P-006 B	Ind. Motor	Cab X-205-P-006 B	1,0NALN3	0.0	0.0	96.59	96.39	92.38	0.19	89.47
1803-PM-203 A	Ind. Motor	Cab PM-203 A	1,0NALN3	2.6	0.6	96.59	93.01	89.15	3.57	83.76
1803-X-205-P-010 A	Ind. Motor	Cab X-205-P-010 A	1,0NALN3	6.1	1.8	96.59	92.56	88.71	4.03	82.76
1803-PM-613	Ind. Motor	Cab 1803-PM-613	1,0NCUN3	0.0	0.0	96.38	95.98	91.99	0.40	82.87
1803-X-702 B	Ind. Motor	Cab 1803-X-702 B	1,0NCUN4	0.1	0.0	96.38	94.91	90.97	1.46	80.31
1803-PM-208 A	Ind. Motor	Cab PM-208 A	1,0NALN3	0.2	0.1	101.32	100.49	100.49	0.83	96.94
1803-PM-223 A	Ind. Motor	Cab PM-223 A	1,0NALN3	0.7	0.1	101.32	99.75	99.75	1.57	94.20
1803-PM-606 B	Ind. Motor	Cab PM-606 B	1,0NCUN3	0.0	0.0	101.32	101.05	101.05	0.27	88.87
1803-PM-611 B	Ind. Motor	Cab 1803-PM-611 B	1,0NALN3	0.0	0.0	101.32	101.02	96.82	0.30	97.98
1803-AM-1002	Ind. Motor	Cab 1803-AM-1002	1,0NCUN3	0.0	0.0	101.32	100.85	96.65	0.47	92.89
1803-AM-1004	Ind. Motor	Cab 1803-AM-1004	1,0NCUN3	0.0	0.0	101.32	100.80	96.61	0.52	92.10
1803-AM-1006	Ind. Motor	Cab 1803-AM-1006	1,0NCUN3	0.0	0.0	101.32	100.82	96.63	0.50	92.49
1803-ACM-206 B1	Ind. Motor	Cab ACM-206 B1	1,0NALN3	0.6	0.1	101.32	99.21	99.21	2.11	92.80
1803-ACM-206 B2	Ind. Motor	Cab ACM-206 B2	1,0NALN3	0.6	0.1	101.32	99.17	99.17	2.15	92.65
1803-ACM-208 B	Ind. Motor	Cab ACM-208 B	1,0NALN3	0.2	0.0	101.32	100.07	100.07	1.24	95.66
1803-ACM-208 C	Ind. Motor	Cab ACM-208 C	1,0NALN3	0.2	0.0	101.32	100.07	100.07	1.24	95.66
HEATER-2 (WGC 1803-K-1 02)	Ind. Motor	Cab Heather-2 K102	1,0NALN4	0.0	0.0	101.32	101.26	101.26	0.06	101.09
1803-PM-210 B	Ind. Motor	Cab PM-210 B	1,0NCUN3	0.0	0.0	101.32	101.05	101.05	0.27	90.75
1803-PM-201 B	Ind. Motor	Cab PM-201 B	1,0NALN3	0.0	0.0	101.32	101.10	101.10	0.22	91.09
1803-ACM-201 C2	Ind. Motor	Cab ACM-201 C2	1,0NALN3	0.5	0.1	101.21	99.97	99.97	1.25	95.35
1803-ACM-201 E2	Ind. Motor	Cab ACM-201 E2	1,0NALN3	0.4	0.1	101.21	100.27	100.27	0.94	96.77
1803-ACM-201 A2	Ind. Motor	Cab ACM-201 A2	1,0NALN3	0.5	0.1	101.21	99.91	99.91	1.31	95.07
1803-ACM-201 F2	Ind. Motor	Cab ACM-201 F2	1,0NALN3	0.4	0.1	101.21	100.03	100.03	1.18	95.66
1803-ACM-201 H2	Ind. Motor	Cab ACM-201 H2	1,0NALN3	0.5	0.1	101.52	100.24	100.24	1.28	95.48
1803-ACM-201 K2	Ind. Motor	Cab ACM-201 K2	1,0NALN3	0.8	0.1	101.52	99.58	99.58	1.94	92.90
1803-ACM-201 P2	Ind. Motor	Cab ACM-201 P2	1,0NALN3	0.9	0.1	101.52	99.33	99.33	2.19	91.79
1803-ACM-201 R2	Ind. Motor	Cab ACM-201 R2	1,0NALN3	0.9	0.1	101.52	99.15	99.15	2.37	91.04
1803-ACM-201 M2	Ind. Motor	Cab ACM-201 M2	1,0NALN3	0.8	0.1	101.52	99.49	99.49	2.03	92.50
1803-ACM-207 C2	Ind. Motor	Cab ACM-207 C2	1,0NALN3	0.3	0.0	101.28	99.71	99.71	1.56	94.79
1803-ACM-207 B1	Ind. Motor	Cab ACM-207 B1	1,0NALN3	0.2	0.0	101.28	100.18	100.18	1.10	96.49
1803-ACM-207 A2	Ind. Motor	Cab ACM-207 A2	1,0NALN3	0.3	0.0	101.28	99.75	99.75	1.53	94.93
1803-ACM-601 A	Ind. Motor	Cab ACM-601 A	1,0NCUN3	0.2	0.0	101.28	95.71	95.71	5.57	76.83
1803-ACM-204 B1	Ind. Motor	Cab ACM-204 B1	1,0NALN3	0.7	0.1	101.28	99.55	99.55	1.72	94.59
1803-ACM-204 D1	Ind. Motor	Cab ACM-204 D1	1,0NALN3	0.7	0.1	101.28	99.51	99.51	1.77	94.43

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Equipment Cable and Overload Heater Losses Summary Report

Connected Load		Cable /Overload Heater		Losses		% Voltage			% Vd	% Vst
						Terminal on				
ID	Type	ID	Library	kW	kvar	Bus	Bus kV	Load kV	Operating	Starting
1803-ACM-207 C1	Ind. Motor	Cab ACM-207 C1	1,0NALN3	0.3	0.0	101.28	99.79	99.79	1.49	95.08
1803-ACM-202 B1	Ind. Motor	Cab ACM-202 B1	1,0NCUN3	0.1	0.0	101.28	99.94	99.94	1.34	94.25
1803-ACM-204 D2	Ind. Motor	Cab ACM-204 D2	1,0NALN3	0.7	0.1	101.28	99.46	99.46	1.82	95.40
1803-ACM-204 B2	Ind. Motor	Cab ACM-204 B2	1,0NALN3	0.7	0.1	101.28	99.46	99.46	1.82	94.24
1803-ACM-205 B1	Ind. Motor	Cab ACM-205 B1	1,0NALN3	0.2	0.0	101.74	100.64	100.64	1.10	96.88
1803-ACM-205 D1	Ind. Motor	Cab ACM-205 D1	1,0NALN3	0.2	0.0	101.74	100.61	100.61	1.13	96.77
1803-ACM-205 F1	Ind. Motor	Cab ACM-205 F1	1,0NALN3	0.2	0.0	101.74	100.59	100.59	1.15	96.66
1803-ACM-205 H1	Ind. Motor	Cab ACM-205 H1	1,0NALN3	0.2	0.0	101.74	100.56	100.56	1.18	96.53
1803-ACM-205 B2	Ind. Motor	Cab ACM-205 B2	1,0NALN3	0.2	0.0	101.74	100.83	100.83	0.92	97.46
1803-ACM-205 D2	Ind. Motor	Cab ACM-205 D2	1,0NALN3	0.2	0.0	101.74	100.53	100.53	1.22	96.40
1803-ACM-205 F2	Ind. Motor	Cab ACM-205 F2	1,0NALN3	0.2	0.0	101.74	100.50	100.50	1.24	96.28
1803-ACM-205 H2	Ind. Motor	Cab ACM-205 H2	1,0NALN3	0.3	0.1	101.74	100.38	100.38	1.36	95.78
1803-X-107-P-002 B	Ind. Motor	Cab X-107-P-002 B	1,0NALN3	0.0	0.0	101.71	101.67	101.67	0.04	99.97
1803-X-107-P-007 B	Ind. Motor	Cab X-107-P-007 B	1,0NALN3	0.0	0.0	101.71	101.67	101.67	0.04	99.62
1803-X-107-P-001 B	Ind. Motor	Cab X-107-P-001 B	1,0NCUS3	0.0	0.0	101.71	101.62	101.62	0.08	96.89
1803-X-107-P-005 B	Ind. Motor	Cab X-107-P-005 B	1,0NCUN3	0.0	0.0	101.71	101.62	101.62	0.08	96.89
1803-X-107-P-006 B	Ind. Motor	Cab X-107-P-006 B	1,0NCUN3	0.0	0.0	101.71	101.52	101.52	0.19	92.44
1803-X-106 B	Ind. Motor	Cab X-106 B	1,0NALN3	0.0	0.0	101.71	101.51	101.51	0.20	92.93
1803-X-205-P-007 B	Ind. Motor	Cab X-205-P-007B	1,0NALN3	0.0	0.0	96.32	96.07	92.08	0.25	87.76
1803-X-205-P-011 B	Ind. Motor	Cab X-205-P-011 B	1,0NCUN3	0.0	0.0	96.32	96.06	92.06	0.27	86.63
1803-X-208-P-014 A	Ind. Motor	Cab X-205-P-014 A	1,0NALN3	1.4	0.5	96.32	93.74	89.85	2.58	87.34
1803-X-208-P-XX3	Ind. Motor	Cab X-208-P-XX3	1,0NCUN3	0.9	0.0	96.32	90.45	86.69	5.87	78.25
1803-X-205-P-012 B	Ind. Motor	Cab X-205-P-012 B	1,0NCUN3	0.0	0.0	96.32	96.12	92.12	0.20	88.50
1803-X-205-P-008 B	Ind. Motor	Cab X-205-P-008 B	1,0NCUN3	0.0	0.0	96.32	96.06	92.06	0.27	86.63
1803-X-205-P-005 A	Ind. Motor	Cab X-205-P-005 A	1,0NALN3	0.3	0.1	96.32	94.72	90.78	1.60	90.57
1803-X-205-P-004 A	Ind. Motor	Cab X-205-P-004 A	1,0NALN3	0.3	0.1	96.32	94.72	90.78	1.60	90.57
1803-X-205-P-003 B	Ind. Motor	Cab X-205-P-003 B	1,0NCUN3	0.0	0.0	96.32	96.06	92.06	0.27	86.63
1803-X-205-P-002 B	Ind. Motor	Cab X-205-P-002 B	1,0NALN3	0.0	0.0	96.32	96.13	92.13	0.20	89.39
1803-X-205-P-001 B	Ind. Motor	Cab X-205-P-001 B	1,0NALN3	0.0	0.0	96.32	96.13	92.13	0.20	89.39
XZV-2301-2	Ind. Motor	Cab XZV-2301-2	1,0NCUN3	0.0	0.0	96.32	96.28	92.28	0.04	95.80
HV-2201-2	Ind. Motor	Cab HV-2201-2	1,0NCUN3	0.0	0.0	96.32	96.28	92.28	0.04	95.80
HV-1401-2	Ind. Motor	Cab HV-1401-2	1,0NCUN3	0.0	0.0	96.32	96.28	92.28	0.04	95.80
HV-1601-2	Ind. Motor	Cab HV-1601-2	1,0NCUN3	0.0	0.0	96.32	96.28	92.28	0.04	95.80
1803-PM-217 A	Ind. Motor	Cab PM-217 A	1,0NALN3	3.4	1.0	101.66	99.40	95.27	2.26	94.31
1803-PM-224 B	Ind. Motor	Cab PM-224 B	1,0NALN3	0.0	0.0	101.66	101.58	97.35	0.09	98.00
1803-PM-102 B	Ind. Motor	Cab PM-102 B	1,0NALN3	0.0	0.0	101.66	101.43	97.21	0.23	94.25

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Engineer:	Study Case: LF Contingen	Revision:	Base
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Equipment Cable and Overload Heater Losses Summary Report

Connected Load		Cable /Overload Heater		Losses		% Voltage			% Vd	% Vst
						Bus	Terminal on Bus kV	Load kV		
ID	Type	ID	Library	kW	kvar	Bus	Bus kV	Load kV	Operating	Starting
1803-PM-206 A	Ind. Motor	Cab PM-206 A	1,0NALN3	4.4	1.6	101.66	98.76	94.66	2.90	91.72
1803-PM-207 B	Ind. Motor	Cab PM-207 B	1,0NALN3	0.0	0.0	101.66	101.49	97.27	0.18	95.78
OXTM-B	Ind. Motor	Cab OXTMB	1,0NALN3	1.1	0.3	101.66	100.37	96.20	1.30	97.44
1803-PM-218 B	Ind. Motor	Cab PM-218 B	1,0NALN3	0.0	0.0	102.01	101.68	97.46	0.33	89.02
1803-PM-215 B	Ind. Motor	Cab PM-215 B	1,0NALN3	0.0	0.0	102.01	101.78	97.55	0.23	91.67
1803-X-107-P-003 B	Ind. Motor	Cab X-107-P-003 B	1,0NALN3	0.0	0.0	102.01	101.92	97.69	0.09	98.48
1803-PM-216 A	Ind. Motor	Cab PM-216 A	1,0NALN3	3.2	0.8	102.01	99.45	95.31	2.56	92.41
1803-PM-219 A	Ind. Motor	Cab PM-219 A	1,0NALN3	5.2	1.9	102.01	98.76	94.65	3.25	88.78
1803-X-107-P-004 B	Ind. Motor	Cab X-107-P-004 B	1,0NALN3	0.8	0.4	102.01	101.16	96.96	0.85	97.82
1803-X-107-P-003 C	Ind. Motor	Cab X-107-P-003 C	1,0NALN3	1.3	0.4	102.01	101.12	96.92	0.89	98.48
1803-X-205-P-010 B	Ind. Motor	Cab X-205-P-010 B	1,0NALN3	0.1	0.0	96.59	96.20	92.20	0.39	85.00
1803-PM-203 B	Ind. Motor	Cab PM-203 B	1,0NALN3	0.0	0.0	96.59	96.24	92.24	0.34	83.76
1803-X-205-P-006 A	Ind. Motor	Cab X-205-P-006 A	1,0NALN3	2.0	1.0	96.59	94.61	90.67	1.98	89.47
1803-PM-212 A	Ind. Motor	Cab PM-212 A	1,0NALN3	1.8	0.7	96.59	94.52	90.60	2.06	89.71
1803-PM-209 A	Ind. Motor	Cab PM-209 A	1,0NALN3	3.6	1.1	96.59	94.26	90.34	2.33	88.41
1803-PM-225 B	Ind. Motor	Cab PM-225 B	1,0NALN3	0.0	0.0	96.59	96.59	92.57	0.00	96.54
1803-PM-220 B	Ind. Motor	Cab PM-220 B	1,0NALN3	0.0	0.0	96.59	96.47	92.46	0.12	91.84
1803-ACM-201 A1	Ind. Motor	Cab ACM-201 A1	1,0NALN3	0.5	0.1	100.00	98.68	98.68	1.32	93.93
1803-ACM-202 A1	Ind. Motor	Cab ACM-202 A1	1,0NCUN3	0.1	0.0	100.00	98.64	98.64	1.36	93.06
1803-ACM-201 B1	Ind. Motor	Cab ACM-201 B1	1,0NALN3	0.5	0.1	100.00	98.68	98.68	1.32	93.93
1803-ACM-201 C1	Ind. Motor	Cab ACM-201 C1	1,0NALN3	0.5	0.1	100.00	98.68	98.68	1.32	93.93
1803-ACM-201 D1	Ind. Motor	Cab ACM-201 D1	1,0NALN3	0.3	0.1	100.00	99.11	99.11	0.89	95.88
1803-ACM-201 D2	Ind. Motor	Cab ACM-201 D2	1,0NALN3	0.4	0.1	100.00	99.05	99.05	0.95	95.61
1803-ACM-201 E1	Ind. Motor	Cab ACM-201 E1	1,0NALN3	0.3	0.1	100.00	99.11	99.11	0.89	95.88
1803-ACM-201 F1	Ind. Motor	Cab ACM-201 F1	1,0NALN3	0.4	0.1	100.00	98.98	98.98	1.02	95.29
1803-ACM-201 G1	Ind. Motor	Cab ACM-201 G1	1,0NALN3	0.4	0.1	100.00	98.98	98.98	1.02	95.29
1803-ACM-201 H1	Ind. Motor	Cab ACM-201 H1	1,0NALN3	0.5	0.1	100.00	98.81	98.81	1.19	94.51
1803-ACM-201 J1	Ind. Motor	Cab ACM-201 J1	1,0NALN3	0.5	0.1	100.00	98.74	98.74	1.26	94.24
1803-ACM-201 K1	Ind. Motor	Cab ACM-201 K1	1,0NALN3	0.5	0.1	100.00	98.70	98.70	1.30	94.05
1803-ACM-201 L1	Ind. Motor	Cab ACM-201 L1	1,0NALN3	0.5	0.1	100.00	98.63	98.63	1.37	93.74
1803-ACM-201 M1	Ind. Motor	Cab ACM-201 M1	1,0NALN3	0.8	0.1	100.00	98.03	98.03	1.97	91.51
1803-ACM-201 N1	Ind. Motor	Cab ACM-201 N1	1,0NALN3	0.9	0.1	100.00	97.86	97.86	2.14	90.76
1803-ACM-201 P1	Ind. Motor	Cab ACM-201 P1	1,0NALN3	0.9	0.1	100.00	97.86	97.86	2.14	90.76
1803-ACM-201 Q1	Ind. Motor	Cab ACM-201 Q1	1,0NALN3	0.9	0.1	100.00	97.68	97.68	2.32	90.02
1803-ACM-201 R1	Ind. Motor	Cab ACM-201 R1	1,0NALN3	0.9	0.1	100.00	97.68	97.68	2.32	90.02
044-NON UPS DB-1	St. Load	Cab NON UPS DB 1	1,0NALN4	0.4	0.1	96.42	95.36	95.36	1.06	0.00

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Equipment Cable and Overload Heater Losses Summary Report

Connected Load		Cable /Overload Heater		Losses		% Voltage			% Vd	% Vst
						Terminal on				
ID	Type	ID	Library	kW	kvar	Bus	Bus kV	Load kV	Operating	Starting
044-NON UPS DB-2	St. Load	Cab NON UPS DB 2	1,0NALN4	0.3	0.0	96.42	95.44	91.47	0.97	0.00
1803-K-105-F-1	St. Load	Cab 1803-K-105-F-1	1,0NALN4	0.0	0.0	101.71	101.65	101.65	0.05	0.00
1803-K-105-F-2	St. Load	Cab 1803-K-105-F-2	1,0NALN4	0.0	0.0	101.71	101.65	101.65	0.05	0.00
1803-K-105-P-3 (1)	St. Load	Cab 1803-K-105-P-3 (1)	1,0NALN4	0.0	0.0	101.71	101.70	101.70	0.01	0.00
1803-K-105-P-4 (1)	St. Load	Cab 1803-K-105-P-4 (1)	1,0NALN4	0.0	0.0	101.71	101.71	101.71	0.00	0.00
1803-K-201-F-1	St. Load	Cab 1803-K-201-F-1	1,0NALN4	0.0	0.0	101.71	101.65	101.65	0.05	0.00
1803-K-201-P-3 (1)	St. Load	Cab 1803-K-201-P-3 (1)	1,0NALN4	0.0	0.0	101.71	101.70	101.70	0.01	0.00
1803-K-201-P-4 (1)	St. Load	Cab 1803-K-201-P-4 (1)	1,0NALN4			101.71	101.71	101.71	0.00	0.00
1803-WO-101	St. Load	Cab 1803-WO-101	1,0NCUN4	0.0	0.0	96.42	96.33	92.33	0.08	0.00
1803-WO-102	St. Load	Cab 1803-WO-102	1,0NCUN4	0.0	0.0	96.42	96.31	92.31	0.10	0.00
1803-WO-103	St. Load	Cab 1803-WO-103	1,0NCUN4	0.0	0.0	96.42	96.19	92.19	0.23	0.00
1803-WO-104	St. Load	Cab 1803-WO-104	1,0NCUN4	0.0	0.0	96.42	96.09	92.09	0.33	0.00
1803-WO-105	St. Load	Cab 1803-WO-105	1,0NCUN3	0.0	0.0	96.42	96.19	92.20	0.22	0.00
1803-WO-106	St. Load	Cab 1803-WO-106	1,0NCUN4	0.0	0.0	96.42	96.07	92.08	0.34	0.00
1803-WO-107	St. Load	Cab 1803-WO-107	1,0NCUN4	0.0	0.0	96.42	96.13	92.14	0.28	0.00
1803-WO-108	St. Load	Cab 1803-WO-108	1,0NCUN4	0.0	0.0	96.42	96.19	92.20	0.22	0.00
1803-WO-109	St. Load	Cab 1803-WO-109	1,0NCUN4	0.0	0.0	96.42	96.13	92.14	0.28	0.00
1803-WO-110	St. Load	Cab 1803-WO-110	1,0NCUN4	0.0	0.0	96.42	95.87	91.88	0.55	0.00
1803-WO-111	St. Load	Cab 1803-WO-111	1,0NCUN4	0.0	0.0	96.42	96.10	92.10	0.32	0.00
1803-WO-112	St. Load	Cab 1803-WO-112	1,0NCUN4	0.0	0.0	96.42	96.18	92.18	0.24	0.00
1803-X-109	St. Load	Cab 1803-X-109	1,0NCUN3	0.0	0.0	96.38	95.99	92.00	0.39	0.00
1803-X-206	St. Load	Cab 1803-X-206	1,0NCUN3	0.2	0.0	96.38	95.38	91.42	1.00	0.00
HB-001	St. Load	Cab HB-001	1,0NALN4	0.0	0.0	96.38	96.22	92.22	0.16	0.00
IGV INLET MAB	St. Load	Cab IGV INLET MAB	1,0NALN4	0.0	0.0	101.71	101.65	101.65	0.05	0.00
TRS-101 A	St. Load	Cab TRS-101 A	1,0NALN4	0.0	0.0	96.38	96.33	92.33	0.05	0.00
TRS-101 B	St. Load	Cab TRS-101 B	1,0NALN4	0.0	0.0	96.38	96.34	92.33	0.04	0.00
TRS-102 A	St. Load	Cab TRS-102 A	1,0NALN4	0.0	0.0	96.38	96.34	92.34	0.04	0.00
TRS-102 B	St. Load	Cab TRS-102 B	1,0NALN4	0.0	0.0	96.38	96.34	92.34	0.04	0.00
TRS-103 A	St. Load	Cab TRS-103 A	1,0NALN4	0.0	0.0	96.38	96.33	92.33	0.05	0.00
TRS-103 B	St. Load	Cab TRS-103 B	1,0NALN4	0.0	0.0	96.38	96.34	92.34	0.04	0.00
TRS-104 A	St. Load	Cab TRS-104 A	1,0NALN4	0.0	0.0	96.38	96.33	92.33	0.05	0.00
TRS-104 B	St. Load	Cab TRS-104 B	1,0NALN4	0.0	0.0	96.38	96.32	92.32	0.06	0.00
TRS-105 A	St. Load	Cab TRS-105 A	1,0NALN4	0.0	0.0	96.38	96.34	92.34	0.04	0.00
TRS-105 B	St. Load	Cab TRS-105 B	1,0NALN4	0.0	0.0	96.38	96.34	92.34	0.04	0.00
TRS-105 C	St. Load	Cab TRS-105 C	1,0NALN4	0.0	0.0	96.38	96.37	92.37	0.00	0.00
TRS-106 A	St. Load	Cab TRS-106 A	1,0NALN4	0.0	0.0	96.38	96.32	92.32	0.06	0.00

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Equipment Cable and Overload Heater Losses Summary Report

Connected Load		Cable /Overload Heater		Losses		% Voltage			% Vd	% Vst
						Terminal on				
ID	Type	ID	Library	kW	kvar	Bus	Bus kV	Load kV	Operating	Starting
UCP MAB	St. Load	Cab UCP MAB	1,0NALN4	0.0	0.0	101.71	101.65	101.65	0.05	0.00
UCP WGC	St. Load	Cab UCP WGC	1,0NALN4	0.0	0.0	101.71	101.65	101.65	0.05	0.00
1803-MOV-2305	MOV	Cab MOV-2305	0,5NCUN1			101.71	101.71	101.71	0.00	0.00
1803-MOV-2306	MOV	Cab MOV-2306	1,0NCUN3			101.71	101.71	101.71	0.00	0.00
1803-MOV-4001	MOV	Cab MOV-4001	1,0MCUN3			101.71	101.71	101.71	0.00	0.00
1803-MOV-5801	MOV	Cab MOV-5801	1,0NCUN3			101.71	101.71	101.71	0.00	0.00
1803-MOV-5802	MOV	Cab MOV-5802	1,0NCUN3			101.71	101.71	101.71	0.00	0.00
1803-MOV-5803	MOV	Cab MOV-5803	1,0NCUN3			101.71	101.71	101.71	0.00	0.00
1803-MOV-5804	MOV	Cab MOV-5804	1,0MCUN3			101.71	101.71	101.71	0.00	0.00
1803-X-106-MOV A	MOV	Cab X-106-MOV A	1,0NALN3			101.71	101.71	101.71	0.00	0.00
1803-X-106-MOV B	MOV	Cab X-106-MOV B	1,0NALN3			101.71	101.71	101.71	0.00	0.00
1803-X-106-MOV C	MOV	Cab X-106-MOV C	1,0NALN3			101.71	101.71	101.71	0.00	0.00
044-CB-101A	Capacitor	Cab CB-101A	6,6NALS1	0.1	0.2	110.09	110.09	110.09	-0.01	0.00
044-CB-101B	Capacitor	Cab CB-101B	6,6NALS1	0.1	0.2	110.09	110.09	110.09	-0.01	0.00

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Alert Summary Report

	% Alert Settings	
	<u>Critical</u>	<u>Marginal</u>
<u>Loading</u>		
Bus	100.0	95.0
Cable / Busway	100.0	95.0
Reactor	100.0	95.0
Line	100.0	95.0
Transformer	100.0	95.0
Panel	100.0	95.0
Protective Device	100.0	95.0
Generator	100.0	95.0
Inverter/Charger	100.0	95.0
<u>Bus Voltage</u>		
OverVoltage	105.0	102.0
UnderVoltage	95.0	98.0
<u>Generator Excitation</u>		
OverExcited (Q Max.)	100.0	95.0
UnderExcited (Q Min.)	100.0	

Critical Report

Device ID	Type	Condition	Rating/Limit	Unit	Operating	% Operating	Phase Type
Bus 1 UPS101A	Bus	Under Voltage	0.433	kV	0.401	92.6	3-Phase
Bus 1 UPS101C	Bus	Under Voltage	0.433	kV	0.401	92.6	3-Phase
Bus 1 UPS102A	Bus	Under Voltage	0.433	kV	0.401	92.6	3-Phase
Bus 1 UPS102C	Bus	Under Voltage	0.433	kV	0.401	92.6	3-Phase
Bus Prim TR-107A	Bus	Under Voltage	0.433	kV	0.400	92.4	3-Phase
Bus Prim TR-107B	Bus	Under Voltage	0.433	kV	0.401	92.6	3-Phase
Bus to CB-101A	Bus	Over Voltage	6.600	kV	7.266	110.1	3-Phase
Bus to CB-101B	Bus	Over Voltage	6.600	kV	7.266	110.1	3-Phase
BUS to HVAC-1	Bus	Under Voltage	0.433	kV	0.399	92.1	3-Phase
BUS to HVAC-2	Bus	Under Voltage	0.433	kV	0.399	92.1	3-Phase
VFD-ACM 201 A1	VFD	Overload	41.736	Amp	47.033	112.7	3-Phase
VFD-ACM B1	VFD	Overload	41.736	Amp	47.033	112.7	3-Phase
VFD-ACM C1	VFD	Overload	41.736	Amp	47.033	112.7	3-Phase
VFD-ACM D1	VFD	Overload	41.736	Amp	46.802	112.1	3-Phase
VFD-ACM D2	VFD	Overload	41.736	Amp	46.834	112.2	3-Phase

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Critical Report

Device ID	Type	Condition	Rating/Limit	Unit	Operating	% Operating	Phase Type
VFD-ACM E1	VFD	Overload	41.736	Amp	46.802	112.1	3-Phase
VFD-ACM F1	VFD	Overload	41.736	Amp	46.871	112.3	3-Phase
VFD-ACM G1	VFD	Overload	41.736	Amp	46.871	112.3	3-Phase
VFD-ACM H1	VFD	Overload	41.736	Amp	46.963	112.5	3-Phase
VFD-ACM J1	VFD	Overload	41.736	Amp	46.996	112.6	3-Phase
VFD-ACM K1	VFD	Overload	31.123	Amp	46.877	150.6	3-Phase
VFD-ACM K1	VFD	OverCurrent	46.684	Amp	52.860	113.2	3-Phase
VFD-ACM L1	VFD	Overload	41.736	Amp	46.914	112.4	3-Phase
VFD-ACM M1	VFD	Overload	41.736	Amp	47.264	113.2	3-Phase
VFD-ACM N1	VFD	Overload	41.736	Amp	47.363	113.5	3-Phase
VFD-ACM P1	VFD	Overload	41.736	Amp	47.362	113.5	3-Phase
VFD-ACM Q1	VFD	Overload	41.736	Amp	47.463	113.7	3-Phase
VFD-ACM R1	VFD	Overload	41.736	Amp	47.462	113.7	3-Phase

Marginal Report

Device ID	Type	Condition	Rating/Limit	Unit	Operating	% Operating	Phase Type
044-TR-102 A	Transformer	Overload	2500.000	kVA	2490.998	99.6	3-Phase
044-TR-104 A	Transformer	Overload	2500.000	kVA	2492.927	99.7	3-Phase
044-TR-109 A	Transformer	Overload	7875.000	kVA	7668.248	97.4	3-Phase
BUS 044-ELDB-107	Bus	Under Voltage	0.415	kV	0.403	97.0	3-Phase
BUS 044-ELDB-111	Bus	Under Voltage	0.415	kV	0.404	97.4	3-Phase
BUS 044-ELDB-115	Bus	Under Voltage	0.415	kV	0.405	97.5	3-Phase
BUS 044-EPGCC-101	Bus	Over Voltage	0.415	kV	0.432	104.1	3-Phase
BUS 044-LDB-116	Bus	Under Voltage	0.415	kV	0.407	98.0	3-Phase
BUS 044-LDB-117	Bus	Under Voltage	0.415	kV	0.407	98.0	3-Phase
Bus 5 UPS101A	Bus	Over Voltage	0.191	kV	0.200	104.6	3-Phase
Bus 5 UPS101C	Bus	Over Voltage	0.191	kV	0.200	104.6	3-Phase
BUS A 044-ASB-101	Bus	Under Voltage	0.415	kV	0.400	96.4	3-Phase
BUS A 044-ASB-102	Bus	Under Voltage	0.415	kV	0.400	96.4	3-Phase
BUS A 044-HT6-101	Bus	Over Voltage	6.600	kV	6.858	103.9	3-Phase
BUS A 044-MCC-102	Bus	Overload	800.000	Amp	763.330	95.4	3-Phase
BUS A 044-MCC-103	Bus	Overload	800.000	Amp	783.575	97.9	3-Phase
BUS A 044-MCC-107	Bus	Under Voltage	0.415	kV	0.400	96.3	3-Phase
BUS A 044-MLDB-101	Bus	Over Voltage	0.415	kV	0.424	102.2	3-Phase
BUS A 044-PMCC-102	Bus	Over Voltage	0.415	kV	0.423	102.0	3-Phase
BUS A 044-PMCC-103	Bus	Under Voltage	0.415	kV	0.401	96.6	3-Phase

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Marginal Report

Device ID	Type	Condition	Rating/Limit	Unit	Operating	% Operating	Phase Type
BUS B 044-ASB-101	Bus	Under Voltage	0.415	kV	0.400	96.4	3-Phase
BUS B 044-ASB-102	Bus	Under Voltage	0.415	kV	0.400	96.4	3-Phase
BUS B 044-HT6-101	Bus	Over Voltage	6.600	kV	6.858	103.9	3-Phase
BUS B 044-MCC-107	Bus	Under Voltage	0.415	kV	0.400	96.3	3-Phase
BUS B 044-MLDB-101	Bus	Over Voltage	0.415	kV	0.424	102.2	3-Phase
BUS B 044-PMCC-102	Bus	Over Voltage	0.415	kV	0.423	102.0	3-Phase
BUS B 044-PMCC-103	Bus	Under Voltage	0.415	kV	0.401	96.6	3-Phase
BUS HVAC EPMCC	Bus	Over Voltage	0.415	kV	0.425	102.4	3-Phase
Bus Prim TR-102A	Bus	Over Voltage	6.600	kV	6.856	103.9	3-Phase
Bus Prim TR-102B	Bus	Over Voltage	6.600	kV	6.858	103.9	3-Phase
Bus Prim TR-103A	Bus	Over Voltage	6.600	kV	6.857	103.9	3-Phase
Bus Prim TR-103B	Bus	Over Voltage	6.600	kV	6.858	103.9	3-Phase
Bus Prim TR-104A	Bus	Over Voltage	6.600	kV	6.858	103.9	3-Phase
Bus Prim TR-104B	Bus	Over Voltage	6.600	kV	6.858	103.9	3-Phase
Bus Prim TR-105A	Bus	Over Voltage	6.600	kV	6.858	103.9	3-Phase
Bus Prim TR-105B	Bus	Over Voltage	6.600	kV	6.858	103.9	3-Phase
Bus Prim TR-105C	Bus	Over Voltage	6.600	kV	6.858	103.9	3-Phase
Bus Prim TR-108A	Bus	Under Voltage	0.415	kV	0.401	96.6	3-Phase
Bus to Charger-DCDB101B	Bus	Over Voltage	0.415	kV	0.432	104.0	3-Phase
Cab HVAC-1	Cable	Overload	711.437	Amp	701.930	98.7	3-Phase
Cab HVAC-2	Cable	Overload	711.437	Amp	701.930	98.7	3-Phase

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SUMMARY OF TOTAL GENERATION, LOADING & DEMAND

	kW	kvar	kVA	% PF
Source (Swing Buses):	23366.0	9553.5	25243.6	92.56 Lagging
Source (Non-Swing Buses):	0.0	0.0	0.0	
Total Demand:	23366.0	9553.5	25243.6	92.56 Lagging
Total Motor Load:	19988.6	11724.9	23173.7	86.26 Lagging
Total Static Load:	3129.1	-4112.5	5167.6	60.55 Leading
Total Constant I Load:	0.0	0.0	0.0	
Total Generic Load:	0.0	0.0	0.0	
Apparent Losses:	248.3	1941.1		
System Mismatch:	0.0	0.0		

Number of Iterations: 1

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LOAD FLOW REPORT

Bus		Voltage		Generation		Load		Load Flow					XFMR	
ID	kV	kV	Ang.	kW	kvar	kW	kvar	ID	kW	kvar	Amp	%PF	%Tap	
*Bus 2 UPS101A	0.110	0.110	0.0	0.0	0.0	0.0	0.0	Bus 3 UPS101A	0.000	0.000	0.0	0.0		
*Bus 2 UPS101C	0.110	0.110	0.0	10.6	1.9	0.0	0.0	Bus 3 UPS101C	10.623	1.941	56.7	98.4		
*Bus 2 UPS102A	0.110	0.110	0.0	0.0	0.0	0.0	0.0	Bus 3 UPS102A	0.000	0.000	0.0	0.0		
*Bus 2 UPS102C	0.110	0.110	0.0	10.6	1.9	0.0	0.0	Bus 3 UPS102C	10.623	1.941	56.7	98.4		
Bus 3 UPS101A	0.191	0.191	0.0	0.0	0.0	0.0	0.0	Bus 2 UPS101A	0.000	0.000	0.0	0.0		
Bus 3 UPS101C	0.191	0.165	-10.4	0.0	0.0	9.3	0.0	Bus 2 UPS101C	-9.329	0.000	32.6	100.0		
Bus 3 UPS102A	0.191	0.191	0.0	0.0	0.0	0.0	0.0	Bus 2 UPS102A	0.000	0.000	0.0	0.0		
Bus 3 UPS102C	0.191	0.165	-10.4	0.0	0.0	9.3	0.0	Bus 2 UPS102C	-9.329	0.000	32.6	100.0		
Bus 4 UPS101A	0.433	0.427	-2.9	0.0	0.0	0.0	0.0	BUS 044-EPMCC-101	-13.446	-0.028	18.2	100.0		
								Bus 5 UPS101A	13.446	0.028	18.2	100.0	-5.000	
Bus 4 UPS101C	0.433	0.428	-2.9	0.0	0.0	0.0	0.0	BUS 044-EPMCC-101	0.000	0.000	0.0	0.0		
								Bus 5 UPS101C	0.000	0.000	0.0	0.0	-5.000	
Bus 4 UPS102A	0.433	0.426	-2.9	0.0	0.0	0.0	0.0	BUS 044-EPMCC-101	-12.102	0.000	16.4	100.0		
								Bus 5 UPS102A	12.102	0.000	16.4	100.0		
Bus 4 UPS102C	0.433	0.428	-2.9	0.0	0.0	0.0	0.0	BUS 044-EPMCC-101	0.000	0.000	0.0	0.0		
								Bus 5 UPS102C	0.000	0.000	0.0	0.0		
Bus 5 UPS101A	0.191	0.198	-3.1	0.0	0.0	13.4	0.0	Bus 4 UPS101A	-13.427	0.000	39.2	100.0		
Bus 5 UPS101C	0.191	0.199	-2.9	0.0	0.0	0.0	0.0	Bus 4 UPS101C	0.000	0.000	0.0	0.0		
Bus 5 UPS102A	0.191	0.188	-2.9	0.0	0.0	12.1	0.0	Bus 4 UPS102A	-12.102	0.000	37.2	100.0		
Bus 5 UPS102C	0.191	0.189	-2.9	0.0	0.0	0.0	0.0	Bus 4 UPS102C	0.000	0.000	0.0	0.0		
BUS 044-ELDB-101	0.415	0.412	-3.8	0.0	0.0	2.0	0.0	BUS B EMLDB-101	-1.969	0.000	2.8	100.0		
BUS 044-ELDB-102	0.415	0.408	-3.8	0.0	0.0	1.9	0.0	BUS B EMLDB-101	-1.936	0.000	2.7	100.0		
BUS 044-ELDB-103	0.415	0.410	-3.8	0.0	0.0	2.0	0.0	BUS A 044-EMLDB-101	-1.954	0.000	2.8	100.0		
BUS 044-ELDB-104	0.415	0.404	-3.8	0.0	0.0	3.8	0.0	BUS A 044-EMLDB-101	-3.794	0.000	5.4	100.0		
BUS 044-ELDB-105	0.415	0.410	-3.8	0.0	0.0	2.0	0.0	BUS B EMLDB-101	-1.950	0.000	2.7	100.0		
BUS 044-ELDB-106	0.415	0.411	-3.8	0.0	0.0	2.0	0.0	BUS A 044-EMLDB-101	-1.961	0.000	2.8	100.0		
BUS 044-ELDB-107	0.415	0.399	-3.9	0.0	0.0	1.8	0.0	BUS A 044-EMLDB-101	-1.847	0.000	2.7	100.0		
BUS 044-ELDB-108	0.415	0.405	-3.8	0.0	0.0	1.9	0.0	BUS B EMLDB-101	-1.905	0.000	2.7	100.0		
BUS 044-ELDB-109	0.415	0.409	-3.8	0.0	0.0	1.9	0.0	BUS A 044-EMLDB-101	-1.944	0.000	2.7	100.0		
BUS 044-ELDB-110	0.415	0.407	-3.8	0.0	0.0	1.9	0.0	BUS B EMLDB-101	-1.924	0.000	2.7	100.0		
BUS 044-ELDB-111	0.415	0.400	-3.9	0.0	0.0	1.9	0.0	BUS A 044-EMLDB-101	-1.862	0.000	2.7	100.0		

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Bus		Voltage		Generation		Load		Load Flow				XFMR	
ID	kV	kV	Ang.	kW	kvar	kW	kvar	ID	kW	kvar	Amp	%PF	%Tap
BUS 044-ELDB-112	0.415	0.407	-3.8	0.0	0.0	1.9	0.0	BUS B EMLDB-101	-1.924	0.000	2.7	100.0	
BUS 044-ELDB-113	0.415	0.407	-3.8	0.0	0.0	1.9	0.0	BUS A 044-EMLDB-101	-1.924	0.000	2.7	100.0	
BUS 044-ELDB-114	0.415	0.405	-3.8	0.0	0.0	1.9	0.0	BUS B EMLDB-101	-1.905	0.000	2.7	100.0	
BUS 044-ELDB-115	0.415	0.401	-3.9	0.0	0.0	1.9	0.0	BUS A 044-EMLDB-101	-1.866	0.000	2.7	100.0	
BUS 044-EPMCC-101	0.415	0.428	-2.9	0.0	0.0	452.1	230.7	Bus 4 UPS102A	12.159	0.008	16.4	100.0	
								Bus 4 UPS101A	13.482	0.041	18.2	100.0	
								Bus 4 UPS101C	0.000	0.000	0.0	0.0	
								Bus to Charger-DCDB101B	16.221	7.850	24.3	90.0	
								Bus Prim TR-108B	48.669	0.861	65.7	100.0	
								Bus to Charger-DCDB102	36.147	17.454	54.1	90.1	
								BUS HVAC EPMCC	143.215	69.335	214.6	90.0	
								Bus 4 UPS102C	0.000	0.000	0.0	0.0	
BUS 044-HT6-102	6.900	6.797	-1.3	0.0	0.0	558.6	238.7	Bus Prim TR-105C	-721.989	-326.279	1068.6	91.1	
								Bus Sec TR-106A	724.494	351.255	68.4	90.0	
BUS 044-HT11-101	11.000	10.985	0.0	0.0	0.0	1061.9	658.1	BUS Emergency Supply	-1283.103	-589.910	120.0	90.9	
								Bus Prim TR-106A	-2348.799	-1285.703	140.7	87.7	
BUS 044-LDB-106	0.415	0.403	-4.0	0.0	0.0	2.8	0.0	BUS A 044-MLDB-102	1286.879	627.584	75.3	89.9	
BUS 044-LDB-107	0.415	0.404	-4.0	0.0	0.0	4.7	0.0	BUS B 044-MLDB-102	-2.831	0.000	4.1	100.0	
BUS 044-LDB-108	0.415	0.404	-4.0	0.0	0.0	4.7	0.0	BUS B 044-MLDB-102	-4.744	0.000	6.8	100.0	
BUS 044-LDB-116	0.415	0.404	-4.0	0.0	0.0	4.7	0.0	BUS A 044-MLDB-102	-4.744	0.000	6.8	100.0	
BUS 044-LDB-117	0.415	0.403	-4.0	0.0	0.0	2.1	0.0	BUS A 044-MLDB-102	-2.074	0.000	3.0	100.0	
BUS 044-LDB-117	0.415	0.403	-4.0	0.0	0.0	2.1	0.0	BUS B 044-MLDB-102	-2.074	0.000	3.0	100.0	
BUS A 044-EMLDB-101	0.415	0.413	-3.8	0.0	0.0	0.0	0.0	BUS 044-ELDB-103	2.102	0.000	3.0	100.0	
								BUS 044-ELDB-104	-2.074	0.000	3.0	100.0	
								BUS 044-ELDB-106	1.970	0.000	2.8	100.0	
								BUS 044-ELDB-107	3.881	0.001	5.4	100.0	
								BUS 044-ELDB-109	1.973	0.000	2.8	100.0	
								BUS 044-ELDB-111	1.915	0.001	2.7	100.0	
								BUS 044-ELDB-113	1.965	0.000	2.7	100.0	
								BUS 044-ELDB-115	1.923	0.001	2.7	100.0	
BUS A 044-MLDB-102	0.415	0.408	-4.0	0.0	0.0	0.0	0.0	BUS 044-ELDB-113	1.955	0.000	2.7	100.0	
								BUS 044-ELDB-115	1.925	0.001	2.7	100.0	
BUS A 044-MLDB-102	0.415	0.408	-4.0	0.0	0.0	0.0	0.0	BUS B EMLDB-101	-17.506	-0.004	24.4	100.0	
								BUS 044-LDB-116	2.102	0.000	3.0	100.0	
BUS A 044-MLDB-102	0.415	0.408	-4.0	0.0	0.0	0.0	0.0	BUS 044-LDB-106	2.868	0.000	4.1	100.0	

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ID	kV	kV	Ang.	kW	kvar	kW	kvar	ID	kW	kvar	Amp	%PF	%Tap								
BUS B 044-MLDB-102	0.415	0.408	-4.0	0.0	0.0	0.0	0.0	BUS 044-LDB-108	4.794	0.001	6.8	100.0									
								BUS B 044-MLDB-102	-9.765	-0.001	13.8	100.0									
								BUS 044-LDB-107	4.794	0.001	6.8	100.0									
								BUS 044-LDB-117	2.102	0.000	3.0	100.0									
								BUS B EMLDB-101	-16.662	-0.002	23.5	100.0									
BUS B EMLDB-101	0.415	0.413	-3.8	0.0	0.0	0.0	0.0	BUS A 044-MLDB-102	9.765	0.001	13.8	100.0									
								BUS 044-ELDB-101	1.977	0.000	2.8	100.0									
								BUS 044-ELDB-102	1.961	0.000	2.7	100.0									
								BUS 044-ELDB-105	1.968	0.000	2.7	100.0									
								BUS 044-ELDB-108	1.945	0.000	2.7	100.0									
								BUS 044-ELDB-110	1.955	0.000	2.7	100.0									
								BUS 044-ELDB-112	1.955	0.000	2.7	100.0									
								BUS 044-ELDB-114	1.945	0.000	2.7	100.0									
								BUS B 044-MLDB-102	16.864	0.051	23.5	100.0									
								Bus Prim TR-108B	-48.074	-0.057	67.1	100.0									
*BUS Emergency Supply	11.000	11.000	0.0	2351.2	1288.9	0.0	0.0	BUS A 044-EMLDB-101	17.506	0.004	24.4	100.0									
								BUS 044-HT11-101	2351.245	1288.865	140.7	87.7									
								BUS HVAC EPMCC	0.415	0.421	-2.9	0.0	0.0	140.9	68.2	BUS 044-EPMCC-101	-140.867	-68.225	214.6	90.0	
								Bus Prim TR-105C	6.600	6.796	-1.3	0.0	0.0	0.0	0.0	BUS 044-HT6-102	-724.485	-351.244	68.4	90.0	
																BUS 044-EPMCC-101	724.485	351.244	68.4	90.0	2.500
								Bus Prim TR-106A	11.000	10.985	0.0	0.0	0.0	0.0	0.0	BUS 044-HT11-101	-1286.869	-627.570	75.3	89.9	
																Bus Sec TR-106A	1286.869	627.570	75.3	89.9	
								Bus Prim TR-108B	0.433	0.427	-2.9	0.0	0.0	0.0	0.0	BUS 044-EPMCC-101	-48.590	-0.832	65.7	100.0	
																BUS B EMLDB-101	48.590	0.832	65.7	100.0	-2.000
								Bus Sec TR-106A	6.900	6.797	-1.3	0.0	0.0	0.0	0.0	Bus Prim TR-106A	-1283.103	-589.910	120.0	90.9	
																BUS 044-HT6-102	1283.103	589.910	120.0	90.9	
Bus to Charger-DCDB101B	0.415	0.428	-2.9	0.0	0.0	16.2	7.8	BUS 044-EPMCC-101	-16.200	-7.846	24.3	90.0									
Bus to Charger-DCDB102	0.433	0.427	-2.8	0.0	0.0	36.0	17.4	BUS 044-EPMCC-101	-36.000	-17.436	54.1	90.0									
044-UPS-101A	0.110	0.110	0.0	0.0	0.0	0.0	0.0	Bus 2 UPS101A	0.000	0.000	0.0	0.0									
044-UPS-101C	0.110	0.110	0.0	10.6	1.9	0.0	0.0	Bus 2 UPS101C	10.623	1.941	56.7	98.4									
044-UPS-102A	0.110	0.110	0.0	0.0	0.0	0.0	0.0	Bus 2 UPS102A	0.000	0.000	0.0	0.0									
044-UPS-102C	0.110	0.110	0.0	10.6	1.9	0.0	0.0	Bus 2 UPS102C	10.623	1.941	56.7	98.4									

* Indicates a voltage regulated bus (voltage controlled or swing type machine connected to it)

Indicates a bus with a load mismatch of more than 0.1 MVA

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Bus Loading Summary Report

Bus			Directly Connected Load								Total Bus Load			
			Constant kVA		Constant Z		Constant I		Generic		kVA	% PF	Amp	Percent Loading
ID	kV	Rated Amp	kW	kvar	kW	kvar	kW	kvar	kW	kvar				
BUS Grid Power A	33.000													
BUS Grid Power B	33.000													
Bus 2 UPS101A	0.110													
Bus 2 UPS101C	0.110										10.799	98.4	56.7	
Bus 2 UPS102A	0.110													
Bus 2 UPS102C	0.110										10.799	98.4	56.7	
Bus 3 UPS101A	0.191													
Bus 3 UPS101C	0.191				9.329						9.329	100.0	32.6	
Bus 3 UPS102A	0.191													
Bus 3 UPS102C	0.191				9.329						9.329	100.0	32.6	
Bus 4 UPS101A	0.433										13.446	100.0	18.2	
Bus 4 UPS101C	0.433												-	
Bus 4 UPS102A	0.433										12.102	100.0	16.4	
Bus 4 UPS102C	0.433												-	
Bus 5 UPS101A	0.191				13.427						13.427	100.0	39.2	
Bus 5 UPS101C	0.191												-	
Bus 5 UPS102A	0.191				12.102						12.102	100.0	37.2	
Bus 5 UPS102C	0.191												-	
BUS 044-ELDB-101	0.415				1.969						1.969	100.0	2.8	
BUS 044-ELDB-102	0.415				1.936						1.936	100.0	2.7	
BUS 044-ELDB-103	0.415				1.954						1.954	100.0	2.8	
BUS 044-ELDB-104	0.415				3.794						3.794	100.0	5.4	
BUS 044-ELDB-105	0.415				1.950						1.950	100.0	2.7	
BUS 044-ELDB-106	0.415				1.961						1.961	100.0	2.8	
BUS 044-ELDB-107	0.415				1.847						1.847	100.0	2.7	
BUS 044-ELDB-108	0.415				1.905						1.905	100.0	2.7	
BUS 044-ELDB-109	0.415				1.944						1.944	100.0	2.7	
BUS 044-ELDB-110	0.415				1.924						1.924	100.0	2.7	
BUS 044-ELDB-111	0.415				1.862						1.862	100.0	2.7	
BUS 044-ELDB-112	0.415				1.924						1.924	100.0	2.7	
BUS 044-ELDB-113	0.415				1.924						1.924	100.0	2.7	
BUS 044-ELDB-114	0.415				1.905						1.905	100.0	2.7	
BUS 044-ELDB-115	0.415				1.866						1.866	100.0	2.7	
BUS 044-EPMCC-101	0.415	3150.0	424.183	213.431	27.913	17.299					792.292	91.1	1068.6	33.9
BUS 044-HT6-102	6.900	630.0	558.608	238.655							1412.213	90.9	120.0	19.0
BUS 044-HT11-101	11.000	630.0	850.000	526.783	211.920	131.336					2677.665	87.7	140.7	22.3
BUS 044-LDB-106	0.415				2.831						2.831	100.0	4.1	
BUS 044-LDB-107	0.415				4.744						4.744	100.0	6.8	
BUS 044-LDB-108	0.415				4.744						4.744	100.0	6.8	

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Bus			Directly Connected Load								Total Bus Load			
			Constant kVA		Constant Z		Constant I		Generic		kVA	% PF	Amp	Percent Loading
ID	kV	Rated Amp	kW	kvar	kW	kvar	kW	kvar	kW	kvar				
BUS 044-LDB-116	0.415				2.074						2.074	100.0	3.0	
BUS 044-LDB-117	0.415				2.074						2.074	100.0	3.0	
BUS A 044-EMLDB-101	0.415										17.506	100.0	24.4	
BUS A 044-MLDB-102	0.415										9.765	100.0	13.8	
BUS B 044-MLDB-102	0.415										16.662	100.0	23.5	
BUS B EMLDB-101	0.415										48.074	100.0	67.1	
BUS Emergency Supply	11.000										2681.329	87.7	140.7	
BUS HVAC EPMCC	0.415		112.032	54.260	28.835	13.966					156.519	90.0	214.6	
Bus Prim TR-105C	6.600										805.140	90.0	68.4	
Bus Prim TR-106A	11.000										1431.738	89.9	75.3	
Bus Prim TR-108B	0.433										48.597	100.0	65.7	
Bus Sec TR-106A	6.900										1412.213	90.9	120.0	
Bus to Charger-DCDB101B	0.415		16.200	7.846							18.000	90.0	24.3	
Bus to Charger-DCDB102	0.433		36.000	17.436							40.000	90.0	54.1	

* Indicates operating load of a bus exceeds the bus critical limit (100.0% of the Continuous Ampere rating).
Indicates operating load of a bus exceeds the bus marginal limit (95.0% of the Continuous Ampere rating).

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Branch Loading Summary Report

CKT / Branch		Busway / Cable & Reactor			Transformer				
ID	Type	Ampacity (Amp)	Loading Amp	%	Capability (kVA)	Loading (input)		Loading (output)	
						kVA	%	kVA	%
Cab 1 EPMCC to UPS102	Cable	104.29	16.40	15.72					
Cab 1 EPMCC101 to UPS101	Cable	300.78	18.18	6.05					
Cab 2 EPMCC101 to UPS101	Cable	300.78	0.00	0.00					
Cab 044-ELDB-101	Cable	27.94	2.76	9.88					
Cab 044-ELDB-102	Cable	27.94	2.74	9.80					
Cab 044-ELDB-103	Cable	27.94	2.75	9.85					
Cab 044-ELDB-104	Cable	27.94	5.42	19.40					
Cab 044-ELDB-105	Cable	27.94	2.75	9.84					
Cab 044-ELDB-106	Cable	27.94	2.75	9.86					
Cab 044-ELDB-107	Cable	27.94	2.67	9.57					
Cab 044-ELDB-108	Cable	27.94	2.72	9.72					
Cab 044-ELDB-109	Cable	27.94	2.74	9.82					
Cab 044-ELDB-110	Cable	27.94	2.73	9.77					
Cab 044-ELDB-111	Cable	27.94	2.69	9.61					
Cab 044-ELDB-112	Cable	27.94	2.73	9.77					
Cab 044-ELDB-113	Cable	27.94	2.73	9.77					
Cab 044-ELDB-114	Cable	55.87	2.72	4.86					
Cab 044-ELDB-115	Cable	27.94	2.69	9.62					
Cab 044-ELDB-116	Cable	27.94	2.97	10.64					
Cab 044-LDB-106	Cable	27.94	4.05	14.51					
Cab 044-LDB-107	Cable	27.94	6.78	24.26					
Cab 044-LDB-108	Cable	27.94	6.78	24.26					
Cab 044-LDB-117	Cable	27.94	2.97	10.64					
Cab Emergency to HT11	Cable	1352.13	140.73	10.41					
Cab EMLDB to MLDB102	Cable	684.43	23.55	3.44					
Cab EPMCC101 to DC101B	Cable	196.48	24.30	12.37					
Cab EPMCC101 to TR108B	Cable	300.78	65.65	21.83					
Cab EPMCC101-DC102	Cable	162.03	54.14	33.41					
Cab HT11 to TR106A	Cable	1352.13	75.25	5.57					
Cab HT602 to TR105C	Cable	1352.13	68.40	5.06					
Cab to HVAC MCC	Cable	711.44	214.60	30.16					
Cable 2 EPMCC to UPS102	Cable	104.29	0.00	0.00					
044-TR-105 C	Transformer				1600.0	805.1	50.3	792.3	49.5

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CKT / Branch		Busway / Cable & Reactor			Transformer				
ID	Type	Ampacity (Amp)	Loading Amp	%	Capability (kVA)	Loading (input)		Loading (output)	
						kVA	%	kVA	%
044-TR-106 A	Transformer				3937.5	1431.7	36.4	1412.2	35.9
044-TR-108 B	Transformer				100.0	48.6	48.6	48.1	48.1
T UPS101A	Transformer				1.0				
* T UPS101C	Transformer				1.0	10.8	1079.9	9.3	932.9
T UPS102A	Transformer				1.0				
* T UPS102C	Transformer				1.0	10.8	1079.9	9.3	932.9
UPS101-STABILIZER 1	Transformer				200.0	13.4	6.7	13.4	6.7
UPS101-STABILIZER 5	Transformer				200.0				
UPS102-STABILIZER 1	Transformer				200000.0	12.1	0.0	12.1	0.0
UPS102-STABILIZER 2	Transformer				100.0				

* Indicates a branch with operating load exceeding the branch capability.

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Branch Losses Summary Report

Branch ID	From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		Vd % Drop in Vmag
	kw	kvar	kw	kvar	kW	kvar	From	To	
044-TR-105 C	-722.0	-326.3	724.5	351.2	2.5	25.0	103.1	103.0	4.11
044-TR-106 A	1286.9	627.6	-1283.1	-589.9	3.8	37.7	99.9	98.5	1.36
044-TR-108 B	-48.1	-0.1	48.6	0.8	0.5	0.8	99.6	98.7	0.93
Cab 044-ELDB-101	-2.0	0.0	2.0	0.0	0.0	0.0	99.2	99.6	0.42
Cab 044-ELDB-102	-1.9	0.0	2.0	0.0	0.0	0.0	98.4	99.6	1.24
Cab 044-ELDB-103	-2.0	0.0	2.0	0.0	0.0	0.0	98.9	99.6	0.78
Cab 044-ELDB-104	-3.8	0.0	3.9	0.0	0.1	0.0	97.4	99.6	2.24
Cab 044-ELDB-105	-2.0	0.0	2.0	0.0	0.0	0.0	98.8	99.6	0.88
Cab 044-ELDB-106	-2.0	0.0	2.0	0.0	0.0	0.0	99.0	99.6	0.62
Cab 044-ELDB-107	-1.8	0.0	1.9	0.0	0.1	0.0	96.1	99.6	3.52
Cab 044-ELDB-108	-1.9	0.0	1.9	0.0	0.0	0.0	97.6	99.6	2.04
Cab 044-ELDB-109	-1.9	0.0	2.0	0.0	0.0	0.0	98.6	99.6	1.03
Cab 044-ELDB-110	-1.9	0.0	2.0	0.0	0.0	0.0	98.1	99.6	1.54
Cab 044-ELDB-111	-1.9	0.0	1.9	0.0	0.1	0.0	96.5	99.6	3.13
Cab 044-ELDB-112	-1.9	0.0	2.0	0.0	0.0	0.0	98.1	99.6	1.54
Cab 044-ELDB-113	-1.9	0.0	2.0	0.0	0.0	0.0	98.1	99.6	1.54
Cab 044-ELDB-114	-1.9	0.0	1.9	0.0	0.0	0.0	97.6	99.6	2.04
Cab 044-ELDB-115	-1.9	0.0	1.9	0.0	0.1	0.0	96.6	99.6	3.03
Cab 044-ELDB-116	-2.1	0.0	2.1	0.0	0.0	0.0	97.1	98.4	1.34
Cab 044-LDB-106	-2.8	0.0	2.9	0.0	0.0	0.0	97.1	98.4	1.30
Cab 044-LDB-107	-4.7	0.0	4.8	0.0	0.0	0.0	97.4	98.4	1.02
Cab 044-LDB-108	-4.7	0.0	4.8	0.0	0.0	0.0	97.4	98.4	1.02
Cab 044-LDB-117	-2.1	0.0	2.1	0.0	0.0	0.0	97.1	98.4	1.34
Cab 1 EPMCC to UPS102	-12.1	0.0	12.2	0.0	0.1	0.0	98.4	103.1	0.48
Cab 1 EPMCC101 to UPS101	-13.4	0.0	13.5	0.0	0.0	0.0	98.6	103.1	0.28
Cab 2 EPMCC101 to UPS101	0.0	0.0	0.0	0.0			98.9	103.1	
Cab Emergency to HT11	-2348.8	-1285.7	2351.2	1288.9	2.4	3.2	99.9	100.0	0.14
Cab EMLDB to MLDB102	-16.7	0.0	16.9	0.1	0.2	0.0	98.4	99.6	1.20
Cab EPMCC101 to DC101B	16.2	7.8	-16.2	-7.8	0.0	0.0	103.1	103.0	0.12
Cab EPMCC101 to TR108B	48.7	0.9	-48.6	-0.8	0.1	0.0	103.1	98.7	0.17
Cab EPMCC101-DC102	36.1	17.5	-36.0	-17.4	0.1	0.0	103.1	98.5	0.36
Cab HT11 to TR106A	1286.9	627.6	-1286.9	-627.6	0.0	0.0	99.9	99.9	0.00
Cab HT602 to TR105C	724.5	351.3	-724.5	-351.2	0.0	0.0	98.5	103.0	0.00
Cab to HVAC MCC	143.2	69.3	-140.9	-68.2	2.3	1.1	103.1	101.5	1.68

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Branch ID	From-To Bus Flow		To-From Bus Flow		Losses		% Bus Voltage		Vd % Drop in Vmag
	kw	kvar	kw	kvar	kW	kvar	From	To	
Cable 2 EPMCC to UPS102	0.0	0.0	0.0	0.0			98.9	103.1	0.00
T UPS101A	0.0	0.0	0.0	0.0			100.0	100.0	
T UPS101C	10.6	1.9	-9.3	0.0	1.3	1.9	100.0	86.4	13.61
T UPS102A	0.0	0.0	0.0	0.0			100.0	100.0	
T UPS102C	10.6	1.9	-9.3	0.0	1.3	1.9	100.0	86.4	13.61
UPS101-STABILIZER 1	13.4	0.0	-13.4	0.0	0.0	0.0	98.6	103.6	5.05
UPS101-STABILIZER 5	0.0	0.0	0.0	0.0			98.9	104.1	5.20
UPS102-STABILIZER 1	12.1	0.0	-12.1	0.0	0.0	0.0	98.4	98.4	0.00
UPS102-STABILIZER 2	0.0	0.0	0.0	0.0			98.9	98.9	
					15.5	71.7			

* This Transmission Line includes Series Capacitor.

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Equipment Cable and Overload Heater Losses Summary Report

Connected Load		Cable /Overload Heater		Losses		% Voltage			% Vd	% Vst
						Terminal on				
ID	Type	ID	Library	kW	kvar	Bus	Bus kV	Load kV	Operating	Starting
1803-PM-609 B	Ind. Motor	Cab PM-609 B	11NALS3	0.1	0.0	98.50	98.48	102.96	0.02	98.42
1803-PM-609 A	Ind. Motor	Cab PM-609 A	11NALS3	0.1	0.0	98.50	98.48	102.96	0.02	98.42
1803-PM-609 C	Ind. Motor	Cab PM-609 C	11NALS3	0.0	0.0	98.50	98.50	102.98	0.00	98.42
1803-PM-604 A	Ind. Motor	Cab PM-604 A	1,0NALN3	0.1	0.0	103.15	102.40	102.40	0.75	88.53
1803-PM-604 B	Ind. Motor	Cab PM-604 B	1,0NALN3	0.1	0.0	103.15	102.40	98.14	0.75	89.57
1803-PM-608 A	Ind. Motor	Cab PM-608 A	1,0NALN3	3.8	0.7	103.15	97.77	93.70	5.38	78.60
1803-PM-608 B	Ind. Motor	Cab PM-608 B	1,0NALN3	0.0	0.0	103.15	102.64	98.37	0.51	78.60
1803-PM-610 A	Ind. Motor	Cab PM-610 A	1,0NALN3	7.2	2.7	103.15	98.66	94.56	4.48	87.90
1803-PM-610 B	Ind. Motor	Cab PM-610 B	1,0NALN3	0.1	0.0	103.15	102.72	98.45	0.43	85.08
1803-PM-603	Ind. Motor	Cab PM-603	1,0NCUN3	0.1	0.0	103.15	101.87	97.64	1.28	81.21
1803-P-226 S	Ind. Motor	Cab P-226 S	1,0NCUN3	0.0	0.0	103.15	103.09	103.09	0.06	98.49
1803-P-226 A	Ind. Motor	Cab P-226 A	1,0NCUN3	0.0	0.0	103.15	102.50	102.50	0.65	98.49
1803-P-227 S	Ind. Motor	Cab PM-227 A6	1,0NCUN3	0.0	0.0	103.15	103.09	98.80	0.06	98.86
1803-P-227 A	Ind. Motor	Cab PM-227 A	1,0NCUN3	0.0	0.0	103.15	102.50	98.24	0.65	98.62
1803-P-228 S	Ind. Motor	Cab PM-227 A4	1,0NCUN3	0.0	0.0	103.15	103.09	98.80	0.06	98.86
1803-P-228 A	Ind. Motor	Cab PM-227 A2	1,0NCUN3	0.0	0.0	103.15	102.50	98.24	0.65	98.86
1803-P-229 S	Ind. Motor	Cab PM-229 A2	1,0NCUN3	0.0	0.0	103.15	103.09	98.80	0.06	98.86
1803-P-229 A	Ind. Motor	Cab PM-229 A	1,0NCUN3	0.0	0.0	103.15	102.50	98.24	0.65	98.86
1803-P-230 S	Ind. Motor	Cab 1803-PM-230 S	1,0NCUN3	0.0	0.0	103.15	103.09	98.80	0.06	98.86
1803-P-230 A	Ind. Motor	Cab PM-230 A	1,0NCUN3	0.0	0.0	103.15	102.50	98.24	0.65	98.86
1803-P-234 S	Ind. Motor	Cab 1803-PM-234 S	1,0NCUN3	0.0	0.0	103.15	103.09	98.80	0.06	98.86
1803-P-234 A	Ind. Motor	Cab 1803-PM-234 A	1,0NCUN3	0.0	0.0	103.15	102.50	98.24	0.65	98.86
1803-P-233 S	Ind. Motor	Cab 1803-PM-233 S	1,0NCUN3	0.0	0.0	103.15	103.09	98.80	0.06	98.86
1803-P-233 A	Ind. Motor	Cab 1803-PM-233 A	1,0NCUN3	0.0	0.0	103.15	102.50	98.24	0.65	98.86
1803-P-232 S	Ind. Motor	Cab 1803-PM-232 S	1,0NCUN3	0.0	0.0	103.15	103.09	98.80	0.06	98.86
1803-P-232 A	Ind. Motor	Cab 1803-PM-232 A	1,0NCUN3	0.0	0.0	103.15	102.50	98.24	0.65	98.86
1803-P-231 S	Ind. Motor	Cab 1803-PM-231 S	1,0NCUN3	0.0	0.0	103.15	103.09	98.80	0.06	98.86
1803-P-231 A	Ind. Motor	Cab 1803-PM-231 A	1,0NCUN3	0.0	0.0	103.15	102.50	98.24	0.65	98.86
1803-X-105-P-1	Ind. Motor	Cab 1803-X-105-P-1	1,0NCUN3	0.1	0.0	103.15	101.36	97.14	1.79	93.86
1803-X-105-P-2	Ind. Motor	Cab 1803-X-105-P-2	1,0NCUN3	0.1	0.0	103.15	101.36	97.14	1.79	93.86
1803-X-105-FD-1	Ind. Motor	Cab 1803-X-105-FD-1	1,0NCUN3	0.1	0.0	103.15	101.36	97.14	1.79	93.86
1803-X-105-P-5	Ind. Motor	Cab 1803-X-105-P-5	1,0NCUN3	0.1	0.0	103.15	101.36	97.14	1.79	93.86
1803-K-201-P-2	Ind. Motor	Cab 1803-K-201-P-2	1,0NCUN3	0.1	0.0	103.15	100.60	96.41	2.55	90.35
1803-K-201-P-1	Ind. Motor	Cab 1803-K-201-P-1	1,0NCUN3	0.1	0.0	103.15	100.60	96.41	2.55	90.35
St Rotor Turnning (MAB)	Ind. Motor	Cab Rotor Turnning (MAB)	1,0NCUN3	0.0	0.0	103.15	102.66	98.39	0.49	99.69

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Equipment Cable and Overload Heater Losses Summary Report

Connected Load		Cable /Overload Heater		Losses		% Voltage			% Vd	% Vst
						Terminal on				
ID	Type	ID	Library	kW	kvar	Bus	Bus kV	Load kV	Operating	Starting
St Rotor Turning (WGC)	Ind. Motor	Cab St Rotor Turning (WGC	1,0NCUN3	0.0	0.0	103.15	102.46	98.20	0.69	98.32
1803-K-105-P-3 (2)	Ind. Motor	Cab 1803-K-105-P-3 (2)	1,0NCUN3	0.3	0.0	103.15	98.26	94.18	4.89	82.61
1803-K-105-P-4 (2)	Ind. Motor	Cab 1803-K-105-P-4 (2)	1,0NCUN3	0.0	0.0	103.15	102.69	98.42	0.46	82.61
1803-K-201-P-3 (2)	Ind. Motor	Cab 1803-K-201-P-3 (2)	1,0NCUN3	0.3	0.0	103.15	98.26	94.18	4.89	82.61
1803-K-201-P-4 (2)	Ind. Motor	Cab 1803-K-201-P-4 (2)	1,0NCUN3	0.0	0.0	103.15	102.69	98.42	0.46	82.61
1803-K-201-P-5	Ind. Motor	Cab 1803-K-201-P-5	1,0NCUN3	0.1	0.0	103.15	100.60	96.41	2.55	90.35
1803-K-201-FD-1	Ind. Motor	Cab 1803-K-201-FD-1	1,0NCUN3	0.1	0.0	103.15	100.60	96.41	2.55	90.35

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Alert Summary Report

	% Alert Settings	
	<u>Critical</u>	<u>Marginal</u>
<u>Loading</u>		
Bus	100.0	95.0
Cable / Busway	100.0	95.0
Reactor	100.0	95.0
Line	100.0	95.0
Transformer	100.0	95.0
Panel	100.0	95.0
Protective Device	100.0	95.0
Generator	100.0	95.0
Inverter/Charger	100.0	95.0
<u>Bus Voltage</u>		
OverVoltage	105.0	102.0
UnderVoltage	95.0	98.0
<u>Generator Excitation</u>		
OverExcited (Q Max.)	100.0	95.0
UnderExcited (Q Min.)	100.0	

Critical Report

Device ID	Type	Condition	Rating/Limit	Unit	Operating	% Operating	Phase Type
Bus 3 UPS101C	Bus	Under Voltage	0.191	kV	0.165	86.4	3-Phase
Bus 3 UPS102C	Bus	Under Voltage	0.191	kV	0.165	86.4	3-Phase
T UPS101C	Transformer	Overload	1.000	kVA	10.799	1079.9	3-Phase
T UPS102C	Transformer	Overload	1.000	kVA	10.799	1079.9	3-Phase

Marginal Report

Device ID	Type	Condition	Rating/Limit	Unit	Operating	% Operating	Phase Type
BUS 044-ELDB-104	Bus	Under Voltage	0.415	kV	0.404	97.4	3-Phase
BUS 044-ELDB-107	Bus	Under Voltage	0.415	kV	0.399	96.1	3-Phase
BUS 044-ELDB-108	Bus	Under Voltage	0.415	kV	0.405	97.6	3-Phase
BUS 044-ELDB-111	Bus	Under Voltage	0.415	kV	0.400	96.5	3-Phase
BUS 044-ELDB-114	Bus	Under Voltage	0.415	kV	0.405	97.6	3-Phase
BUS 044-ELDB-115	Bus	Under Voltage	0.415	kV	0.401	96.6	3-Phase
BUS 044-EPMCC-101	Bus	Over Voltage	0.415	kV	0.428	103.1	3-Phase
BUS 044-LDB-106	Bus	Under Voltage	0.415	kV	0.403	97.1	3-Phase

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Marginal Report

Device ID	Type	Condition	Rating/Limit	Unit	Operating	% Operating	Phase Type
BUS 044-LDB-107	Bus	Under Voltage	0.415	kV	0.404	97.4	3-Phase
BUS 044-LDB-108	Bus	Under Voltage	0.415	kV	0.404	97.4	3-Phase
BUS 044-LDB-116	Bus	Under Voltage	0.415	kV	0.403	97.1	3-Phase
BUS 044-LDB-117	Bus	Under Voltage	0.415	kV	0.403	97.1	3-Phase
Bus 5 UPS101A	Bus	Over Voltage	0.191	kV	0.198	103.6	3-Phase
Bus 5 UPS101C	Bus	Over Voltage	0.191	kV	0.199	104.1	3-Phase
Bus Prim TR-105C	Bus	Over Voltage	6.600	kV	6.796	103.0	3-Phase
Bus to Charger-DCDB101B	Bus	Over Voltage	0.415	kV	0.428	103.0	3-Phase

SUMMARY OF TOTAL GENERATION, LOADING & DEMAND

	kW	kvar	kVA	% PF
Source (Swing Buses):	2372.5	1292.7	2701.8	87.81 Lagging
Source (Non-Swing Buses):	0.0	0.0	0.0	
Total Demand:	2372.5	1292.7	2701.8	87.81 Lagging
Total Motor Load:	1997.0	1058.4	2260.2	88.36 Lagging
Total Static Load:	360.0	162.6	395.0	91.13 Lagging
Total Constant I Load:	0.0	0.0	0.0	
Total Generic Load:	0.0	0.0	0.0	
Apparent Losses:	15.5	71.7		
System Mismatch:	0.0	0.0		

Number of Iterations: 1

Short-Circuit Summary Report

3-Phase, LG, LL, LLG Fault Currents

Bus		3-Phase Fault			Line-to-Ground Fault				Line-to-Line Fault				*Line-to-Line-to-Ground			
ID	kV	I" k	ip	Ik	I" k	ip	Ib	Ik	I" k	ip	Ib	Ik	I" k	ip	Ib	Ik
BUS 1 to AU-V REVAMP UNIT	33.000	35.889	82.265	34.803	34.104	78.174	34.104	34.104	31.048	71.168	31.048	31.048	35.235	80.766	35.235	35.235
BUS 1 to VDU UNIT	33.000	35.959	82.394	34.803	34.149	78.247	34.149	34.149	31.112	71.289	31.112	31.112	35.299	80.883	35.299	35.299
Bus 1 UPS101A	0.433	10.159	14.693	10.047	5.230	7.565	5.230	5.230	8.800	12.728	8.800	8.800	9.211	13.322	9.211	9.211
Bus 1 UPS101C	0.433	9.968	14.436	9.814	5.186	7.510	5.186	5.186	8.632	12.502	8.632	8.632	9.070	13.135	9.070	9.070
Bus 1 UPS102A	0.433	3.095	4.464	3.095	1.563	2.255	1.563	1.563	2.681	3.867	2.681	2.681	2.751	3.968	2.751	2.751
Bus 1 UPS102C	0.433	3.084	4.449	3.083	1.561	2.251	1.561	1.561	2.672	3.854	2.672	2.672	2.745	3.959	2.745	2.745
Bus 2 HT33	33.000	35.889	82.265	34.803	34.104	78.174	34.104	34.104	31.048	71.168	31.048	31.048	35.235	80.766	35.235	35.235
BUS 2 to AU-V REVAMP UNIT	33.000	35.959	82.394	34.803	34.149	78.247	34.149	34.149	31.112	71.289	31.112	31.112	35.299	80.883	35.299	35.299
BUS 2 to VDU UNIT	33.000	35.889	82.265	34.803	34.104	78.174	34.104	34.104	31.048	71.168	31.048	31.048	35.235	80.766	35.235	35.235
Bus 2 UPS101A	0.110	0.827	1.192	0.827	0.827	1.192	0.827	0.827	0.716	1.033	0.716	0.716	0.827	1.192	0.827	0.827
Bus 2 UPS101C	0.110	0.827	1.192	0.827	0.827	1.192	0.827	0.827	0.716	1.033	0.716	0.716	0.827	1.192	0.827	0.827
Bus 2 UPS102A	0.110	0.827	1.192	0.827	0.827	1.192	0.827	0.827	0.716	1.033	0.716	0.716	0.827	1.192	0.827	0.827
Bus 2 UPS102C	0.110	0.827	1.192	0.827	0.827	1.192	0.827	0.827	0.716	1.033	0.716	0.716	0.827	1.192	0.827	0.827
Bus 3 UPS101A	0.191	0.132	0.197	0.132	0.141	0.211	0.141	0.141	0.114	0.171	0.114	0.114	0.145	0.218	0.145	0.145
Bus 3 UPS101C	0.191	0.132	0.197	0.132	0.141	0.211	0.141	0.141	0.114	0.171	0.114	0.114	0.145	0.218	0.145	0.145
Bus 3 UPS102A	0.191	0.132	0.197	0.132	0.141	0.211	0.141	0.141	0.114	0.171	0.114	0.114	0.145	0.218	0.145	0.145
Bus 3 UPS102C	0.191	0.132	0.197	0.132	0.141	0.211	0.141	0.141	0.114	0.171	0.114	0.114	0.145	0.218	0.145	0.145
Bus 4 UPS101A	0.433	7.122	10.385	7.056	3.770	5.497	3.770	3.770	6.175	9.004	6.175	6.175	6.464	9.426	6.464	6.464
Bus 4 UPS101C	0.433	7.122	10.385	7.056	3.770	5.497	3.770	3.770	6.175	9.004	6.175	6.175	6.464	9.426	6.464	6.464
Bus 4 UPS102A	0.433	4.267	6.155	4.268	1.026	1.480	1.026	1.026	3.699	5.337	3.699	3.699	3.764	5.429	3.764	3.764
Bus 4 UPS102C	0.433	4.267	6.155	4.268	1.026	1.480	1.026	1.026	3.699	5.337	3.699	3.699	3.764	5.429	3.764	3.764
Bus 5 UPS101A	0.191	7.836	11.813	7.773	9.504	14.328	9.504	9.504	6.789	10.234	6.789	6.789	9.520	14.352	9.520	9.520
Bus 5 UPS101C	0.191	7.836	11.813	7.773	9.504	14.328	9.504	9.504	6.789	10.234	6.789	6.789	9.520	14.352	9.520	9.520
Bus 5 UPS102A	0.191	9.669	13.948	9.672	14.516	20.940	14.516	14.516	8.383	12.093	8.383	8.383	16.741	24.150	16.741	16.741
Bus 5 UPS102C	0.191	4.697	6.919	4.681	5.514	8.122	5.514	5.514	4.069	5.994	4.069	4.069	5.661	8.340	5.661	5.661
BUS 044-ELDB-101	0.415	0.718	1.036	0.718	0.621	0.895	0.621	0.621	0.622	0.897	0.622	0.622	0.692	0.999	0.692	0.692
BUS 044-ELDB-102	0.415	0.268	0.386	0.268	0.226	0.327	0.226	0.226	0.232	0.335	0.232	0.232	0.254	0.366	0.254	0.254
BUS 044-ELDB-103	0.415	0.415	0.598	0.415	0.353	0.509	0.353	0.353	0.359	0.518	0.359	0.359	0.395	0.569	0.395	0.395
BUS 044-ELDB-104	0.415	0.291	0.419	0.291	0.246	0.355	0.246	0.246	0.252	0.363	0.252	0.252	0.275	0.397	0.275	0.275
BUS 044-ELDB-105	0.415	0.370	0.533	0.370	0.314	0.453	0.314	0.314	0.320	0.462	0.320	0.320	0.351	0.507	0.351	0.351
BUS 044-ELDB-106	0.415	0.507	0.731	0.507	0.433	0.625	0.433	0.433	0.439	0.633	0.439	0.439	0.484	0.698	0.484	0.484
BUS 044-ELDB-107	0.415	0.095	0.137	0.095	0.080	0.115	0.080	0.080	0.082	0.119	0.082	0.082	0.089	0.129	0.089	0.089
BUS 044-ELDB-108	0.415	0.164	0.237	0.164	0.138	0.199	0.138	0.138	0.142	0.205	0.142	0.142	0.155	0.223	0.155	0.155
BUS 044-ELDB-109	0.415	0.318	0.459	0.318	0.269	0.388	0.269	0.269	0.275	0.397	0.275	0.275	0.301	0.435	0.301	0.301
BUS 044-ELDB-110	0.415	0.217	0.313	0.217	0.183	0.264	0.183	0.183	0.188	0.271	0.188	0.188	0.205	0.295	0.205	0.205
BUS 044-ELDB-111	0.415	0.107	0.155	0.107	0.090	0.130	0.090	0.090	0.093	0.134	0.093	0.093	0.101	0.145	0.101	0.101

3-Phase, LG, LL, LLG Fault Currents

Bus		3-Phase Fault			Line-to-Ground Fault				Line-to-Line Fault				*Line-to-Line-to-Ground			
ID	kV	I"k	ip	Ik	I"k	ip	Ib	Ik	I"k	ip	Ib	Ik	I"k	ip	Ib	Ik
BUS 044-ELDB-112	0.415	0.217	0.313	0.217	0.183	0.264	0.183	0.183	0.188	0.271	0.188	0.188	0.205	0.295	0.205	0.205
BUS 044-ELDB-113	0.415	0.217	0.313	0.217	0.183	0.264	0.183	0.183	0.188	0.271	0.188	0.188	0.205	0.295	0.205	0.205
BUS 044-ELDB-114	0.415	0.164	0.237	0.164	0.138	0.199	0.138	0.138	0.142	0.205	0.142	0.142	0.155	0.223	0.155	0.155
BUS 044-ELDB-115	0.415	0.111	0.160	0.111	0.093	0.134	0.093	0.093	0.096	0.138	0.096	0.096	0.104	0.150	0.104	0.104
BUS 044-EPMCC-101	0.415	36.244	86.751	31.264	35.968	86.090	35.968	35.968	31.243	74.781	31.243	31.243	36.509	87.385	36.509	36.509
BUS 044-HT6-102	6.900	20.882	52.208	17.849	0.439	1.098	0.439	0.439	17.919	44.800	17.919	17.919	18.029	45.075	18.029	18.029
BUS 044-HT11-101	11.000	27.576	61.437	27.201	24.722	55.078	24.722	24.722	23.882	53.206	23.882	23.882	26.474	58.981	26.474	26.474
BUS 044-LDB-101	0.415	0.780	1.126	0.781	0.664	0.958	0.664	0.664	0.676	0.975	0.676	0.676	0.745	1.074	0.745	0.745
BUS 044-LDB-102	0.415	0.435	0.627	0.435	0.367	0.529	0.367	0.367	0.377	0.543	0.377	0.377	0.411	0.593	0.411	0.411
BUS 044-LDB-103	0.415	0.208	0.300	0.208	0.175	0.252	0.175	0.175	0.180	0.260	0.180	0.180	0.196	0.282	0.196	0.196
BUS 044-LDB-104	0.415	0.300	0.432	0.300	0.252	0.363	0.252	0.252	0.259	0.374	0.259	0.259	0.282	0.407	0.282	0.282
BUS 044-LDB-105	0.415	0.602	0.869	0.602	0.510	0.736	0.510	0.510	0.522	0.752	0.522	0.522	0.572	0.825	0.572	0.572
BUS 044-LDB-106	0.415	0.332	0.480	0.332	0.255	0.368	0.255	0.255	0.288	0.415	0.288	0.288	0.307	0.443	0.307	0.307
BUS 044-LDB-107	0.415	0.554	0.799	0.554	0.407	0.587	0.407	0.407	0.480	0.692	0.480	0.480	0.510	0.735	0.510	0.510
BUS 044-LDB-108	0.415	0.591	0.853	0.591	0.426	0.614	0.426	0.426	0.512	0.739	0.512	0.512	0.539	0.777	0.539	0.539
BUS 044-LDB-109	0.415	0.517	0.746	0.517	0.437	0.630	0.437	0.437	0.448	0.646	0.448	0.448	0.490	0.706	0.490	0.490
BUS 044-LDB-110	0.415	0.351	0.506	0.351	0.296	0.426	0.296	0.296	0.304	0.438	0.304	0.304	0.331	0.478	0.331	0.331
BUS 044-LDB-111	0.415	0.340	0.490	0.340	0.286	0.413	0.286	0.286	0.294	0.425	0.294	0.294	0.321	0.463	0.321	0.321
BUS 044-LDB-112	0.415	0.351	0.506	0.351	0.296	0.426	0.296	0.296	0.304	0.438	0.304	0.304	0.331	0.478	0.331	0.331
BUS 044-LDB-113	0.415	0.221	0.319	0.221	0.186	0.268	0.186	0.186	0.192	0.277	0.192	0.192	0.208	0.301	0.208	0.208
BUS 044-LDB-114	0.415	0.266	0.383	0.266	0.223	0.322	0.223	0.223	0.230	0.332	0.230	0.230	0.250	0.361	0.250	0.250
BUS 044-LDB-115	0.415	0.437	0.630	0.437	0.369	0.532	0.369	0.369	0.378	0.546	0.378	0.378	0.412	0.594	0.412	0.412
BUS 044-LDB-116	0.415	0.248	0.357	0.248	0.194	0.280	0.194	0.194	0.215	0.310	0.215	0.215	0.230	0.331	0.230	0.230
BUS 044-LDB-117	0.415	0.242	0.349	0.242	0.190	0.275	0.190	0.190	0.209	0.302	0.209	0.209	0.224	0.323	0.224	0.224
BUS 044-PDB-101	0.415	0.780	1.125	0.780	0.664	0.957	0.664	0.664	0.676	0.974	0.676	0.676	0.744	1.073	0.744	0.744
BUS 044-PDB-102	0.415	0.535	0.772	0.536	0.453	0.653	0.453	0.453	0.464	0.669	0.464	0.464	0.508	0.732	0.508	0.508
BUS 044-PDB-103	0.415	0.384	0.554	0.384	0.324	0.467	0.324	0.324	0.333	0.480	0.333	0.333	0.363	0.523	0.363	0.363
BUS 044-PDB-104	0.415	0.329	0.474	0.329	0.277	0.399	0.277	0.277	0.285	0.410	0.285	0.285	0.310	0.447	0.310	0.310
BUS 044-PDB-105	0.415	1.015	1.465	1.015	0.870	1.254	0.870	0.870	0.880	1.269	0.880	0.880	0.971	1.401	0.971	0.971
BUS A 044-ASB-101	0.415	39.221	67.873	34.521	29.415	50.904	29.415	29.415	33.689	58.300	33.689	33.689	39.436	68.245	39.436	39.436
BUS A 044-ASB-102	0.415	40.390	73.208	35.317	31.588	57.255	31.588	31.588	34.683	62.864	34.683	34.683	40.852	74.045	40.852	40.852
BUS A 044-EMLDB-101	0.415	3.030	4.936	2.997	3.152	5.134	3.152	3.152	2.623	4.273	2.623	2.623	3.098	5.046	3.098	3.098
BUS A 044-HT6-101	6.600	20.094	50.435	17.162	0.420	1.054	0.420	0.420	17.242	43.275	17.242	17.242	17.347	43.539	17.347	17.347
BUS A 044-HT33-101	33.000	35.959	82.394	34.803	34.149	78.247	34.149	34.149	31.112	71.289	31.112	31.112	35.299	80.883	35.299	35.299
BUS A 044-MCC-101	0.415	40.448	82.615	32.591	34.459	70.383	34.459	34.459	34.121	69.691	34.121	34.121	40.717	83.165	40.717	40.717
BUS A 044-MCC-102	0.415	39.935	81.382	32.591	34.242	69.781	34.242	34.242	33.777	68.832	33.777	33.777	40.262	82.049	40.262	40.262
BUS A 044-MCC-103	0.415	39.438	80.342	32.484	33.644	68.540	33.644	33.644	33.191	67.617	33.191	33.191	39.824	81.129	39.824	39.824
BUS A 044-MCC-104	0.415	40.333	82.382	32.591	34.409	70.283	34.409	34.409	34.039	69.527	34.039	34.039	40.615	82.959	40.615	40.615
BUS A 044-MCC-105	0.415	39.391	80.202	32.484	33.636	68.485	33.636	33.636	33.179	67.556	33.179	33.179	39.797	81.029	39.797	39.797
BUS A 044-MCC-106	0.415	39.384	80.251	32.484	33.637	68.542	33.637	33.637	33.180	67.610	33.180	33.180	39.797	81.095	39.797	39.797

3-Phase, LG, LL, LLG Fault Currents

Bus	3-Phase Fault				Line-to-Ground Fault				Line-to-Line Fault				*Line-to-Line-to-Ground			
ID	kV	I"k	ip	Ik	I"k	ip	Ib	Ik	I"k	ip	Ib	Ik	I"k	ip	Ib	Ik
BUS A 044-MCC-107	0.415	44.816	89.632	37.856	38.139	76.276	38.139	38.139	38.269	76.538	38.269	38.269	45.584	91.167	45.584	45.584
BUS A 044-MLDB-101	0.415	5.662	9.415	5.549	6.008	9.990	6.008	6.008	4.898	8.144	4.898	4.898	5.917	9.838	5.917	5.917
BUS A 044-MLDB-102	0.415	1.793	2.596	1.787	1.021	1.479	1.021	1.021	1.552	2.248	1.552	1.552	1.648	2.387	1.648	1.648
BUS A 044-PMCC-101	0.415	44.919	108.142	35.581	42.958	103.419	42.958	42.958	37.811	91.028	37.811	37.811	44.363	106.802	44.363	44.363
BUS A 044-PMCC-102	0.415	44.204	106.933	35.630	42.398	102.564	42.398	42.398	37.070	89.674	37.070	37.070	43.617	105.512	43.617	43.617
BUS A 044-PMCC-103	0.415	51.235	124.719	42.291	50.342	122.546	50.342	50.342	43.708	106.397	43.708	43.708	51.348	124.993	51.348	51.348
BUS A AU-V REVAMP	6.600	10.459	26.264	8.821	0.315	0.790	0.315	0.315	9.057	22.744	9.057	9.057	9.136	22.941	9.136	9.136
BUS A to VDU UNIT	6.600	10.341	25.903	8.635	0.315	0.788	0.315	0.315	8.955	22.432	8.955	8.955	9.034	22.628	9.034	9.034
BUS B 044-ASB-101	0.415	34.713	61.862	30.170	26.963	48.051	26.963	26.963	29.832	53.164	29.832	29.832	35.146	62.633	35.146	35.146
BUS B 044-ASB-102	0.415	35.576	66.329	30.706	28.654	53.424	28.654	28.654	30.562	56.981	30.562	30.562	36.144	67.390	36.144	36.144
BUS B 044-HT6-101	6.600	19.572	49.435	17.162	0.420	1.061	0.420	0.420	16.773	42.363	16.773	16.773	16.878	42.630	16.878	16.878
BUS B 044-HT33-101	33.000	35.889	82.265	34.803	34.104	78.174	34.104	34.104	31.048	71.168	31.048	31.048	35.235	80.766	35.235	35.235
BUS B 044-MCC-101	0.415	40.586	82.919	32.591	34.464	70.411	34.464	34.464	34.120	69.709	34.120	34.120	40.796	83.348	40.796	40.796
BUS B 044-MCC-102	0.415	40.334	82.252	32.591	34.347	70.042	34.347	34.347	33.937	69.206	33.937	33.937	40.557	82.707	40.557	40.557
BUS B 044-MCC-103	0.415	40.126	81.521	32.484	33.918	68.909	33.918	33.918	33.657	68.377	33.657	33.657	40.356	81.988	40.356	40.356
BUS B 044-MCC-104	0.415	40.479	82.562	32.591	34.420	70.204	34.420	34.420	34.054	69.457	34.054	34.054	40.701	83.015	40.701	40.701
BUS B 044-MCC-105	0.415	39.949	81.041	32.484	33.861	68.691	33.861	33.861	33.569	68.098	33.569	33.569	40.222	81.593	40.222	40.222
BUS B 044-MCC-106	0.415	39.554	80.069	32.484	33.702	68.223	33.702	33.702	33.319	67.448	33.319	33.319	39.881	80.731	39.881	39.881
BUS B 044-MCC-107	0.415	38.754	79.297	32.511	33.625	68.801	33.625	33.625	33.172	67.876	33.172	33.172	39.408	80.634	39.408	39.408
BUS B 044-MLDB-101	0.415	5.651	9.427	5.525	6.000	10.009	6.000	6.000	4.888	8.155	4.888	4.888	5.916	9.870	5.916	5.916
BUS B 044-MLDB-102	0.415	1.428	2.083	1.424	0.901	1.314	0.901	0.901	1.237	1.804	1.237	1.237	1.340	1.954	1.340	1.340
BUS B 044-PMCC-101	0.415	45.114	108.467	35.581	42.966	103.303	42.966	42.966	37.822	90.937	37.822	37.822	44.435	106.834	44.435	44.435
BUS B 044-PMCC-102	0.415	44.921	108.456	35.630	42.769	103.260	42.769	42.769	37.563	90.692	37.563	37.563	44.149	106.592	44.149	44.149
BUS B 044-PMCC-103	0.415	43.413	105.656	35.661	42.441	103.290	42.441	42.441	37.125	90.354	37.125	37.125	43.432	105.701	43.432	43.432
BUS B AU-REVAMP	6.600	10.445	26.232	8.808	0.315	0.790	0.315	0.315	9.045	22.716	9.045	9.045	9.123	22.913	9.123	9.123
BUS B EMLDB-101	0.415	3.030	4.936	2.997	3.152	5.134	3.152	3.152	2.623	4.273	2.623	2.623	3.098	5.046	3.098	3.098
BUS B to VDU UNIT	6.600	11.193	28.118	9.485	0.329	0.826	0.329	0.329	9.693	24.350	9.693	9.693	9.775	24.556	9.775	9.775
BUS Emergency Supply	11.000	35.373	90.508	35.000	35.248	90.187	35.248	35.248	30.634	78.382	30.634	30.634	35.319	90.370	35.319	35.319
BUS Grid Power A	33.000	38.644	98.644	37.500	38.235	97.598	38.235	38.235	33.440	85.358	33.440	33.440	38.471	98.201	38.471	38.471
BUS Grid Power B	33.000	38.578	98.521	37.500	38.188	97.525	38.188	38.188	33.378	85.241	33.378	33.378	38.407	98.085	38.407	38.407
BUS HVAC EPMCC	0.415	12.839	19.865	11.573	7.008	10.843	7.008	7.008	11.134	17.228	11.134	11.134	11.884	18.387	11.884	11.884
Bus Prim TR-101A	33.000	35.897	82.074	34.744	34.062	77.877	34.062	34.062	31.059	71.011	31.059	31.059	35.227	80.542	35.227	35.227
Bus Prim TR-101B	33.000	35.827	81.944	34.744	34.017	77.804	34.017	34.017	30.995	70.890	30.995	30.995	35.163	80.424	35.163	35.163
Bus Prim TR-102A	6.600	19.673	48.689	16.841	0.420	1.039	0.420	0.420	16.881	41.781	16.881	16.881	16.987	42.041	16.987	16.987
Bus Prim TR-102B	6.600	19.176	47.760	16.841	0.420	1.046	0.420	0.420	16.434	40.932	16.434	16.434	16.539	41.194	16.539	16.539
Bus Prim TR-103A	6.600	19.885	49.564	17.004	0.420	1.047	0.420	0.420	17.063	42.529	17.063	17.063	17.168	42.791	17.168	17.168
Bus Prim TR-103B	6.600	19.376	48.602	17.004	0.420	1.054	0.420	0.420	16.605	41.651	16.605	16.605	16.710	41.915	16.710	16.710
Bus Prim TR-104A	6.600	20.024	50.140	17.108	0.420	1.052	0.420	0.420	17.181	43.023	17.181	17.181	17.287	43.286	17.287	17.287
Bus Prim TR-104B	6.600	19.503	49.139	17.106	0.420	1.058	0.420	0.420	16.713	42.111	16.713	16.713	16.819	42.377	16.819	16.819
Bus Prim TR-105A	6.600	19.997	50.029	17.090	0.420	1.051	0.420	0.420	17.159	42.929	17.159	17.159	17.264	43.192	17.264	17.264

3-Phase, LG, LL, LLG Fault Currents

Bus		3-Phase Fault			Line-to-Ground Fault				Line-to-Line Fault				*Line-to-Line-to-Ground			
ID	kV	I"k	ip	Ik	I"k	ip	Ib	Ik	I"k	ip	Ib	Ik	I"k	ip	Ib	Ik
Bus Prim TR-105B	6.600	19.477	49.036	17.090	0.420	1.058	0.420	0.420	16.692	42.024	16.692	16.692	16.798	42.290	16.798	16.798
Bus Prim TR-105C	6.600	19.891	49.599	17.013	0.420	1.047	0.420	0.420	17.069	42.563	17.069	17.069	17.175	42.825	17.175	17.175
Bus Prim TR-106A	11.000	27.477	61.119	27.104	24.604	54.729	24.604	24.604	23.796	52.931	23.796	23.796	26.366	58.649	26.366	26.366
Bus Prim TR-107A	0.433	38.212	71.266	33.715	28.834	53.777	28.834	28.834	32.823	61.216	32.823	32.823	37.411	69.771	37.411	37.411
Bus Prim TR-107B	0.433	33.994	64.957	29.620	26.367	50.384	26.367	26.367	29.214	55.824	29.214	29.214	33.429	63.878	33.429	33.429
Bus Prim TR-108A	0.415	25.641	41.572	23.390	17.002	27.566	17.002	17.002	22.113	35.853	22.113	22.113	24.727	40.091	24.727	24.727
Bus Prim TR-108B	0.433	24.035	39.789	22.397	16.688	27.627	16.688	16.688	20.830	34.484	20.830	20.830	23.478	38.868	23.478	23.478
Bus Prim TR-109A	33.000	30.068	64.380	29.216	26.588	56.928	26.588	26.588	26.017	55.707	26.017	26.017	29.284	62.702	29.284	29.284
Bus Prim TR-109B	33.000	32.789	72.320	31.782	29.951	66.060	29.951	29.951	28.372	62.579	28.372	28.372	31.954	70.479	31.954	31.954
Bus Prim TR-114A	33.000	33.626	73.764	32.581	31.117	68.260	31.117	31.117	29.096	63.827	29.096	29.096	32.609	71.533	32.609	32.609
Bus Prim TR-114B	33.000	32.734	72.229	31.782	29.999	66.195	29.999	29.999	28.321	62.493	28.321	28.321	31.668	69.878	31.668	31.668
Bus Sec TR-106A	6.900	4.482	10.942	4.476	0.326	0.797	0.326	0.326	3.881	9.476	3.881	3.881	3.963	9.674	3.963	3.963
Bus to CB-101A	6.600	3.711	10.061	3.596	0.417	1.130	0.417	0.417	3.208	8.698	3.208	3.208	3.313	8.981	3.313	3.313
Bus to CB-101B	6.600	3.692	10.021	3.596	0.417	1.131	0.417	0.417	3.191	8.660	3.191	3.191	3.296	8.945	3.296	3.296
Bus to Charger-DCDB101A	0.415	15.728	22.746	15.449	8.541	12.352	8.541	8.541	13.628	19.708	13.628	13.628	14.480	20.940	14.480	14.480
Bus to Charger-DCDB101B	0.415	17.902	26.676	17.274	10.736	15.998	10.736	10.736	15.541	23.158	15.541	15.541	17.034	25.382	17.034	17.034
Bus to Charger-DCDB102	0.433	15.136	22.017	14.858	8.611	12.526	8.611	8.611	13.144	19.120	13.144	13.144	14.156	20.591	14.156	14.156
Bus to ext. 1	33.000	35.959	82.394	34.803	34.149	78.247	34.149	34.149	31.112	71.289	31.112	31.112	35.299	80.883	35.299	35.299
Bus to ext. 2	33.000	35.889	82.265	34.803	34.104	78.174	34.104	34.104	31.048	71.168	31.048	31.048	35.235	80.766	35.235	35.235
BUS to HVAC-1	0.433	45.624	91.342	38.165	37.544	75.167	37.544	37.544	39.107	78.294	39.107	39.107	45.890	91.875	45.890	45.890
BUS to HVAC-2	0.433	39.807	81.573	32.938	33.420	68.484	33.420	33.420	34.154	69.989	34.154	34.154	40.068	82.106	40.068	40.068
Bus to TR101A	33.000	35.959	82.394	34.803	34.149	78.247	34.149	34.149	31.112	71.289	31.112	31.112	35.299	80.883	35.299	35.299
Bus to TR101B	33.000	35.889	82.265	34.803	34.104	78.174	34.104	34.104	31.048	71.168	31.048	31.048	35.235	80.766	35.235	35.235
Bus VFD-ACM 201 A1	0.415	0.449	0.817	0.066	0.155	0.282	0.155	0.155	0.267	0.486	0.267	0.267	0.324	0.590	0.324	0.324
Bus VFD-ACM 202 A1	0.415	0.090	0.142	0.066	0.076	0.119	0.076	0.076	0.071	0.111	0.071	0.071	0.088	0.138	0.088	0.088
Bus VFD-ACM B1	0.415	0.449	0.817	0.066	0.155	0.282	0.155	0.155	0.267	0.486	0.267	0.267	0.324	0.590	0.324	0.324
Bus VFD-ACM C1	0.415	0.449	0.817	0.066	0.155	0.282	0.155	0.155	0.267	0.486	0.267	0.267	0.324	0.590	0.324	0.324
Bus VFD-ACM D1	0.415	0.455	0.840	0.066	0.156	0.287	0.156	0.156	0.269	0.496	0.269	0.269	0.327	0.603	0.327	0.327
Bus VFD-ACM D2	0.415	0.454	0.837	0.066	0.156	0.286	0.156	0.156	0.269	0.495	0.269	0.269	0.326	0.601	0.326	0.326
Bus VFD-ACM E1	0.415	0.455	0.840	0.066	0.156	0.287	0.156	0.156	0.269	0.496	0.269	0.269	0.327	0.603	0.327	0.327
Bus VFD-ACM F1	0.415	0.453	0.833	0.066	0.155	0.286	0.155	0.155	0.268	0.493	0.268	0.268	0.326	0.599	0.326	0.326
Bus VFD-ACM G1	0.415	0.453	0.833	0.066	0.155	0.286	0.155	0.155	0.268	0.493	0.268	0.268	0.326	0.599	0.326	0.326
Bus VFD-ACM H1	0.415	0.451	0.824	0.066	0.155	0.283	0.155	0.155	0.268	0.489	0.268	0.268	0.325	0.594	0.325	0.325
Bus VFD-ACM J1	0.415	0.450	0.821	0.066	0.155	0.283	0.155	0.155	0.267	0.488	0.267	0.267	0.325	0.592	0.325	0.325
Bus VFD-ACM K1	0.415	0.440	0.794	0.049	0.124	0.223	0.124	0.124	0.260	0.469	0.260	0.260	0.304	0.549	0.304	0.304
Bus VFD-ACM L1	0.415	0.448	0.815	0.066	0.155	0.281	0.155	0.155	0.267	0.485	0.267	0.267	0.324	0.589	0.324	0.324
Bus VFD-ACM M1	0.415	0.442	0.786	0.066	0.154	0.273	0.154	0.154	0.266	0.473	0.266	0.266	0.322	0.572	0.322	0.322
Bus VFD-ACM N1	0.415	0.440	0.778	0.066	0.154	0.271	0.154	0.154	0.265	0.469	0.265	0.265	0.321	0.567	0.321	0.321
Bus VFD-ACM P1	0.415	0.440	0.778	0.066	0.154	0.271	0.154	0.154	0.265	0.469	0.265	0.265	0.321	0.567	0.321	0.321
Bus VFD-ACM Q1	0.415	0.438	0.770	0.066	0.153	0.270	0.153	0.153	0.265	0.466	0.265	0.265	0.320	0.563	0.320	0.320

3-Phase, LG, LL, LLG Fault Currents

Bus		3-Phase Fault			Line-to-Ground Fault				Line-to-Line Fault				*Line-to-Line-to-Ground			
ID	kV	I"k	ip	Ik	I"k	ip	Ib	Ik	I"k	ip	Ib	Ik	I"k	ip	Ib	Ik
Bus VFD-ACM R1	0.415	0.438	0.770	0.066	0.153	0.270	0.153	0.153	0.265	0.466	0.265	0.265	0.320	0.563	0.320	0.320

All fault currents are in rms kA. Current ip is calculated using Method C.

* LLG fault current is the larger of the two faulted line currents.

Sequence Impedance Summary Report

Bus		Positive Seq. Imp. (ohm)			Negative Seq. Imp. (ohm)			Zero Seq. Imp. (ohm)			Fault Zf (ohm)		
ID	kV	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance
BUS 1 to AU-V REVAMP UNIT	33.000	0.09429	0.57630	0.58396	0.09400	0.57760	0.58520	0.09701	0.66745	0.67447	0.00000	0.00000	0.00000
BUS 1 to VDU UNIT	33.000	0.09446	0.57513	0.58283	0.09404	0.57630	0.58392	0.09701	0.66745	0.67447	0.00000	0.00000	0.00000
Bus 1 UPS101A	0.433	0.02315	0.01149	0.02584	0.02305	0.01165	0.02583	0.09460	0.03021	0.09931	0.00000	0.00000	0.00000
Bus 1 UPS101C	0.433	0.02325	0.01237	0.02633	0.02317	0.01253	0.02634	0.09468	0.03123	0.09970	0.00000	0.00000	0.00000
Bus 1 UPS102A	0.433	0.08301	0.01746	0.08483	0.08291	0.01763	0.08476	0.32970	0.05541	0.33433	0.00000	0.00000	0.00000
Bus 1 UPS102C	0.433	0.08311	0.01834	0.08511	0.08303	0.01850	0.08507	0.32978	0.05643	0.33458	0.00000	0.00000	0.00000
Bus 2 HT33	33.000	0.09429	0.57630	0.58396	0.09400	0.57760	0.58520	0.09701	0.66745	0.67447	0.00000	0.00000	0.00000
BUS 2 to AU-V REVAMP UNIT	33.000	0.09446	0.57513	0.58283	0.09404	0.57630	0.58392	0.09701	0.66745	0.67447	0.00000	0.00000	0.00000
BUS 2 to VDU UNIT	33.000	0.09429	0.57630	0.58396	0.09400	0.57760	0.58520	0.09701	0.66745	0.67447	0.00000	0.00000	0.00000
Bus 2 UPS101A	0.110	0.08067	0.00000	0.08067	0.08067	0.00000	0.08067	0.08067	0.00000	0.08067	0.00000	0.00000	0.00000
Bus 2 UPS101C	0.110	0.08067	0.00000	0.08067	0.08067	0.00000	0.08067	0.08067	0.00000	0.08067	0.00000	0.00000	0.00000
Bus 2 UPS102A	0.110	0.08067	0.00000	0.08067	0.08067	0.00000	0.08067	0.08067	0.00000	0.08067	0.00000	0.00000	0.00000
Bus 2 UPS102C	0.110	0.08067	0.00000	0.08067	0.08067	0.00000	0.08067	0.08067	0.00000	0.08067	0.00000	0.00000	0.00000
Bus 3 UPS101A	0.191	0.64293	0.59958	0.87912	0.64293	0.59958	0.87912	0.39972	0.59958	0.72060	0.00000	0.00000	0.00000
Bus 3 UPS101C	0.191	0.64293	0.59958	0.87912	0.64293	0.59958	0.87912	0.39972	0.59958	0.72060	0.00000	0.00000	0.00000
Bus 3 UPS102A	0.191	0.64293	0.59958	0.87912	0.64293	0.59958	0.87912	0.39972	0.59958	0.72060	0.00000	0.00000	0.00000
Bus 3 UPS102C	0.191	0.64293	0.59958	0.87912	0.64293	0.59958	0.87912	0.39972	0.59958	0.72060	0.00000	0.00000	0.00000
Bus 4 UPS101A	0.433	0.03085	0.02017	0.03686	0.03068	0.02026	0.03677	0.12304	0.05741	0.13577	0.00000	0.00000	0.00000
Bus 4 UPS101C	0.433	0.03085	0.02017	0.03686	0.03068	0.02026	0.03677	0.12304	0.05741	0.13577	0.00000	0.00000	0.00000
Bus 4 UPS102A	0.433	0.05911	0.01703	0.06152	0.05895	0.01712	0.06138	0.64426	0.05741	0.64682	0.00000	0.00000	0.00000
Bus 4 UPS102C	0.433	0.05911	0.01703	0.06152	0.05895	0.01712	0.06138	0.64426	0.05741	0.64682	0.00000	0.00000	0.00000
Bus 5 UPS101A	0.191	0.01061	0.01029	0.01478	0.01057	0.01031	0.01476	0.00396	0.00594	0.00714	0.00000	0.00000	0.00000
Bus 5 UPS101C	0.191	0.01061	0.01029	0.01478	0.01057	0.01031	0.01476	0.00396	0.00594	0.00714	0.00000	0.00000	0.00000
Bus 5 UPS102A	0.191	0.01151	0.00332	0.01198	0.01147	0.00334	0.01195	0.00000	0.00001	0.00001	0.00000	0.00000	0.00000
Bus 5 UPS102C	0.191	0.01942	0.01519	0.02465	0.01939	0.01521	0.02464	0.00792	0.01187	0.01427	0.00000	0.00000	0.00000
BUS 044-ELDB-101	0.415	0.34274	0.07293	0.35041	0.34266	0.07308	0.35037	0.51125	0.07103	0.51616	0.00000	0.00000	0.00000
BUS 044-ELDB-102	0.415	0.93553	0.08101	0.93904	0.93545	0.08116	0.93897	1.45239	0.09103	1.45524	0.00000	0.00000	0.00000
BUS 044-ELDB-103	0.415	0.60209	0.07646	0.60692	0.60201	0.07662	0.60686	0.92300	0.07978	0.92644	0.00000	0.00000	0.00000
BUS 044-ELDB-104	0.415	0.86144	0.08000	0.86514	0.86135	0.08015	0.86508	1.33475	0.08853	1.33768	0.00000	0.00000	0.00000
BUS 044-ELDB-105	0.415	0.67619	0.07747	0.68061	0.67611	0.07763	0.68055	1.04065	0.08228	1.04389	0.00000	0.00000	0.00000
BUS 044-ELDB-106	0.415	0.49094	0.07495	0.49663	0.49086	0.07510	0.49657	0.74654	0.07603	0.75040	0.00000	0.00000	0.00000
BUS 044-ELDB-107	0.415	2.63981	0.10424	2.64187	2.63973	0.10439	2.64180	4.15817	0.14853	4.16082	0.00000	0.00000	0.00000
BUS 044-ELDB-108	0.415	1.52833	0.08909	1.53092	1.52825	0.08924	1.53085	2.39353	0.11103	2.39611	0.00000	0.00000	0.00000
BUS 044-ELDB-109	0.415	0.78734	0.07899	0.79129	0.78726	0.07914	0.79122	1.21711	0.08603	1.22015	0.00000	0.00000	0.00000

Bus		Positive Seq. Imp. (ohm)			Negative Seq. Imp. (ohm)			Zero Seq. Imp. (ohm)			Fault Zf (ohm)		
ID	kV	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance
BUS 044-ELDB-110	0.415	1.15783	0.08404	1.16088	1.15775	0.08419	1.16081	1.80532	0.09853	1.80801	0.00000	0.00000	0.00000
BUS 044-ELDB-111	0.415	2.34342	0.10020	2.34556	2.34334	0.10035	2.34549	3.68760	0.13853	3.69020	0.00000	0.00000	0.00000
BUS 044-ELDB-112	0.415	1.15783	0.08404	1.16088	1.15775	0.08419	1.16081	1.80532	0.09853	1.80801	0.00000	0.00000	0.00000
BUS 044-ELDB-113	0.415	1.15783	0.08404	1.16088	1.15775	0.08419	1.16081	1.80532	0.09853	1.80801	0.00000	0.00000	0.00000
BUS 044-ELDB-114	0.415	1.52833	0.08909	1.53092	1.52825	0.08924	1.53085	2.39353	0.11103	2.39611	0.00000	0.00000	0.00000
BUS 044-ELDB-115	0.415	2.26932	0.09919	2.27149	2.26924	0.09934	2.27141	3.56996	0.13603	3.57255	0.00000	0.00000	0.00000
BUS 044-EPGCC-101	0.415	0.00113	0.00685	0.00694	0.00097	0.00694	0.00701	0.00070	0.00701	0.00704	0.00000	0.00000	0.00000
BUS 044-HT6-102	6.900	0.02185	0.20871	0.20985	0.01936	0.21286	0.21373	29.89000	0.22086	29.89082	0.00000	0.00000	0.00000
BUS 044-HT11-101	11.000	0.04713	0.24891	0.25333	0.04713	0.24891	0.25333	0.06779	0.33429	0.34109	0.00000	0.00000	0.00000
BUS 044-LDB-101	0.415	0.31965	0.04201	0.32240	0.31957	0.04217	0.32234	0.49091	0.04051	0.49258	0.00000	0.00000	0.00000
BUS 044-LDB-102	0.415	0.57646	0.04985	0.57861	0.57637	0.05001	0.57854	0.89843	0.05811	0.90030	0.00000	0.00000	0.00000
BUS 044-LDB-103	0.415	1.20903	0.05390	1.21023	1.20892	0.05409	1.21013	1.90262	0.07051	1.90393	0.00000	0.00000	0.00000
BUS 044-LDB-104	0.415	0.83853	0.04885	0.83995	0.83842	0.04904	0.83985	1.31441	0.05801	1.31569	0.00000	0.00000	0.00000
BUS 044-LDB-105	0.415	0.41511	0.04638	0.41769	0.41502	0.04654	0.41762	0.64232	0.05006	0.64427	0.00000	0.00000	0.00000
BUS 044-LDB-106	0.415	0.75295	0.07599	0.75677	0.75286	0.07615	0.75671	1.43904	0.16376	1.44833	0.00000	0.00000	0.00000
BUS 044-LDB-107	0.415	0.44259	0.10237	0.45428	0.44251	0.10252	0.45423	0.92999	0.18303	0.94783	0.00000	0.00000	0.00000
BUS 044-LDB-108	0.415	0.41950	0.07145	0.42554	0.41942	0.07161	0.42549	0.90965	0.15251	0.92234	0.00000	0.00000	0.00000
BUS 044-LDB-109	0.415	0.48444	0.04764	0.48678	0.48433	0.04783	0.48669	0.75208	0.05351	0.75398	0.00000	0.00000	0.00000
BUS 044-LDB-110	0.415	0.71495	0.05259	0.71688	0.71483	0.05278	0.71678	1.11795	0.06501	1.11984	0.00000	0.00000	0.00000
BUS 044-LDB-111	0.415	0.73800	0.05309	0.73990	0.73788	0.05327	0.73981	1.15453	0.06616	1.15643	0.00000	0.00000	0.00000
BUS 044-LDB-112	0.415	0.71495	0.05259	0.71688	0.71483	0.05278	0.71678	1.11795	0.06501	1.11984	0.00000	0.00000	0.00000
BUS 044-LDB-113	0.415	1.13493	0.05289	1.13616	1.13482	0.05308	1.13606	1.78498	0.06801	1.78628	0.00000	0.00000	0.00000
BUS 044-LDB-114	0.415	0.94526	0.05777	0.94702	0.94517	0.05793	0.94695	1.48382	0.07651	1.48579	0.00000	0.00000	0.00000
BUS 044-LDB-115	0.415	0.57236	0.06564	0.57611	0.57225	0.06583	0.57603	0.89090	0.09351	0.89579	0.00000	0.00000	0.00000
BUS 044-LDB-116	0.415	1.01230	0.07953	1.01541	1.01221	0.07969	1.01534	1.85079	0.17251	1.85881	0.00000	0.00000	0.00000
BUS 044-LDB-117	0.415	1.03539	0.11045	1.04126	1.03531	0.11060	1.04120	1.87113	0.20303	1.88211	0.00000	0.00000	0.00000
BUS 044-PDB-101	0.415	0.31984	0.04178	0.32256	0.31973	0.04197	0.32247	0.49091	0.04051	0.49258	0.00000	0.00000	0.00000
BUS 044-PDB-102	0.415	0.46785	0.04403	0.46992	0.46776	0.04419	0.46985	0.72620	0.04551	0.72762	0.00000	0.00000	0.00000
BUS 044-PDB-103	0.415	0.65329	0.04633	0.65493	0.65317	0.04651	0.65483	1.02030	0.05176	1.02162	0.00000	0.00000	0.00000
BUS 044-PDB-104	0.415	0.76425	0.04807	0.76576	0.76416	0.04823	0.76568	1.19677	0.05551	1.19805	0.00000	0.00000	0.00000
BUS 044-PDB-105	0.415	0.24282	0.04913	0.24774	0.24274	0.04929	0.24769	0.36856	0.05571	0.37275	0.00000	0.00000	0.00000
BUS A 044-ASB-101	0.415	0.00316	0.00558	0.00641	0.00306	0.00576	0.00652	0.01085	0.00781	0.01337	0.00000	0.00000	0.00000
BUS A 044-ASB-102	0.415	0.00269	0.00562	0.00623	0.00259	0.00578	0.00634	0.00892	0.00781	0.01186	0.00000	0.00000	0.00000
BUS A 044-EMLDB-101	0.415	0.04635	0.06889	0.08303	0.04626	0.06904	0.08311	0.04068	0.06103	0.07334	0.00000	0.00000	0.00000
BUS A 044-HT6-101	6.600	0.02109	0.20752	0.20859	0.01860	0.21168	0.21249	29.88876	0.21775	29.88956	0.00000	0.00000	0.00000
BUS A 044-HT33-101	33.000	0.09446	0.57513	0.58283	0.09404	0.57630	0.58392	0.09701	0.66745	0.67447	0.00000	0.00000	0.00000
BUS A 044-MCC-101	0.415	0.00186	0.00593	0.00622	0.00168	0.00633	0.00655	0.00500	0.00790	0.00935	0.00000	0.00000	0.00000

Bus		Positive Seq. Imp. (ohm)			Negative Seq. Imp. (ohm)			Zero Seq. Imp. (ohm)			Fault Zf (ohm)		
ID	kV	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance
BUS A 044-MCC-102	0.415	0.00193	0.00600	0.00630	0.00174	0.00637	0.00660	0.00500	0.00790	0.00935	0.00000	0.00000	0.00000
BUS A 044-MCC-103	0.415	0.00192	0.00608	0.00638	0.00173	0.00653	0.00675	0.00522	0.00799	0.00955	0.00000	0.00000	0.00000
BUS A 044-MCC-104	0.415	0.00187	0.00595	0.00624	0.00169	0.00634	0.00657	0.00500	0.00790	0.00935	0.00000	0.00000	0.00000
BUS A 044-MCC-105	0.415	0.00193	0.00609	0.00639	0.00173	0.00652	0.00675	0.00522	0.00799	0.00955	0.00000	0.00000	0.00000
BUS A 044-MCC-106	0.415	0.00192	0.00609	0.00639	0.00173	0.00652	0.00675	0.00522	0.00799	0.00955	0.00000	0.00000	0.00000
BUS A 044-MCC-107	0.415	0.00177	0.00533	0.00561	0.00169	0.00552	0.00577	0.00514	0.00697	0.00866	0.00000	0.00000	0.00000
BUS A 044-MLDB-101	0.415	0.02344	0.03774	0.04443	0.02333	0.03793	0.04453	0.02034	0.03051	0.03667	0.00000	0.00000	0.00000
BUS A 044-MLDB-102	0.415	0.12311	0.06741	0.14035	0.12302	0.06757	0.14036	0.43908	0.14251	0.46163	0.00000	0.00000	0.00000
BUS A 044-PMCC-101	0.415	0.00086	0.00553	0.00560	0.00066	0.00589	0.00593	0.00046	0.00603	0.00605	0.00000	0.00000	0.00000
BUS A 044-PMCC-102	0.415	0.00084	0.00563	0.00569	0.00062	0.00603	0.00607	0.00046	0.00603	0.00605	0.00000	0.00000	0.00000
BUS A 044-PMCC-103	0.415	0.00068	0.00486	0.00491	0.00058	0.00503	0.00506	0.00039	0.00501	0.00503	0.00000	0.00000	0.00000
BUS A AU-V REVAMP	6.600	0.03463	0.39927	0.40077	0.03461	0.39930	0.40080	39.87147	0.44594	39.87397	0.00000	0.00000	0.00000
BUS A to VDU UNIT	6.600	0.03580	0.40374	0.40532	0.03579	0.40378	0.40536	39.87202	0.45302	39.87459	0.00000	0.00000	0.00000
BUS B 044-ASB-101	0.415	0.00327	0.00647	0.00725	0.00319	0.00663	0.00736	0.01093	0.00883	0.01406	0.00000	0.00000	0.00000
BUS B 044-ASB-102	0.415	0.00279	0.00650	0.00707	0.00271	0.00666	0.00719	0.00900	0.00883	0.01261	0.00000	0.00000	0.00000
BUS B 044-HT6-101	6.600	0.01957	0.21326	0.21416	0.01748	0.21800	0.21870	29.88876	0.21775	29.88956	0.00000	0.00000	0.00000
BUS B 044-HT33-101	33.000	0.09429	0.57630	0.58396	0.09400	0.57760	0.58520	0.09701	0.66745	0.67447	0.00000	0.00000	0.00000
BUS B 044-MCC-101	0.415	0.00185	0.00592	0.00620	0.00167	0.00636	0.00658	0.00500	0.00790	0.00935	0.00000	0.00000	0.00000
BUS B 044-MCC-102	0.415	0.00188	0.00595	0.00624	0.00170	0.00638	0.00661	0.00500	0.00790	0.00935	0.00000	0.00000	0.00000
BUS B 044-MCC-103	0.415	0.00188	0.00598	0.00627	0.00171	0.00646	0.00668	0.00522	0.00799	0.00955	0.00000	0.00000	0.00000
BUS B 044-MCC-104	0.415	0.00187	0.00593	0.00622	0.00168	0.00637	0.00658	0.00500	0.00790	0.00935	0.00000	0.00000	0.00000
BUS B 044-MCC-105	0.415	0.00191	0.00600	0.00630	0.00172	0.00646	0.00669	0.00522	0.00799	0.00955	0.00000	0.00000	0.00000
BUS B 044-MCC-106	0.415	0.00196	0.00605	0.00636	0.00176	0.00649	0.00672	0.00522	0.00799	0.00955	0.00000	0.00000	0.00000
BUS B 044-MCC-107	0.415	0.00188	0.00621	0.00649	0.00181	0.00639	0.00664	0.00522	0.00799	0.00955	0.00000	0.00000	0.00000
BUS B 044-MLDB-101	0.415	0.02325	0.03797	0.04452	0.02317	0.03813	0.04462	0.02034	0.03051	0.03667	0.00000	0.00000	0.00000
BUS B 044-MLDB-102	0.415	0.14620	0.09833	0.17619	0.14612	0.09848	0.17621	0.45942	0.17303	0.49092	0.00000	0.00000	0.00000
BUS B 044-PMCC-101	0.415	0.00086	0.00551	0.00558	0.00065	0.00591	0.00595	0.00046	0.00603	0.00605	0.00000	0.00000	0.00000
BUS B 044-PMCC-102	0.415	0.00082	0.00554	0.00560	0.00061	0.00597	0.00600	0.00046	0.00603	0.00605	0.00000	0.00000	0.00000
BUS B 044-PMCC-103	0.415	0.00078	0.00574	0.00580	0.00070	0.00590	0.00594	0.00046	0.00603	0.00605	0.00000	0.00000	0.00000
BUS B AU-REVAMP	6.600	0.03462	0.39982	0.40131	0.03461	0.39986	0.40136	39.87147	0.44594	39.87397	0.00000	0.00000	0.00000
BUS B EMLDB-101	0.415	0.04635	0.06889	0.08303	0.04626	0.06904	0.08311	0.04068	0.06103	0.07334	0.00000	0.00000	0.00000
BUS B to VDU UNIT	6.600	0.03225	0.37307	0.37447	0.03224	0.37311	0.37450	38.13700	0.41448	38.13925	0.00000	0.00000	0.00000
BUS Emergency Supply	11.000	0.01423	0.19698	0.19749	0.01423	0.19698	0.19749	0.01422	0.19909	0.19960	0.00000	0.00000	0.00000
BUS Grid Power A	33.000	0.04063	0.54080	0.54232	0.04009	0.54173	0.54321	0.03982	0.55745	0.55888	0.00000	0.00000	0.00000
BUS Grid Power B	33.000	0.04030	0.54177	0.54326	0.03985	0.54283	0.54429	0.03982	0.55745	0.55888	0.00000	0.00000	0.00000
BUS HVAC EPMCC	0.415	0.01338	0.01432	0.01960	0.01322	0.01439	0.01954	0.05810	0.03781	0.06932	0.00000	0.00000	0.00000
Bus Prim TR-101A	33.000	0.09572	0.57593	0.58383	0.09531	0.57711	0.58493	0.09864	0.66995	0.67718	0.00000	0.00000	0.00000

Bus		Positive Seq. Imp. (ohm)			Negative Seq. Imp. (ohm)			Zero Seq. Imp. (ohm)			Fault Zf (ohm)		
ID	kV	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance
Bus Prim TR-101B	33.000	0.09556	0.57711	0.58496	0.09527	0.57842	0.58621	0.09864	0.66995	0.67718	0.00000	0.00000	0.00000
Bus Prim TR-102A	6.600	0.02385	0.21172	0.21306	0.02136	0.21595	0.21700	29.89328	0.22909	29.89416	0.00000	0.00000	0.00000
Bus Prim TR-102B	6.600	0.02233	0.21745	0.21859	0.02024	0.22227	0.22319	29.89328	0.22909	29.89416	0.00000	0.00000	0.00000
Bus Prim TR-103A	6.600	0.02245	0.20959	0.21079	0.01996	0.21378	0.21471	29.89097	0.22329	29.89181	0.00000	0.00000	0.00000
Bus Prim TR-103B	6.600	0.02092	0.21531	0.21633	0.01883	0.22010	0.22090	29.89097	0.22329	29.89181	0.00000	0.00000	0.00000
Bus Prim TR-104A	6.600	0.02154	0.20822	0.20933	0.01905	0.21238	0.21323	29.88950	0.21961	29.89031	0.00000	0.00000	0.00000
Bus Prim TR-104B	6.600	0.02005	0.21399	0.21492	0.01795	0.21873	0.21947	29.88953	0.21969	29.89034	0.00000	0.00000	0.00000
Bus Prim TR-105A	6.600	0.02172	0.20848	0.20961	0.01922	0.21264	0.21350	29.88977	0.22027	29.89058	0.00000	0.00000	0.00000
Bus Prim TR-105B	6.600	0.02021	0.21425	0.21520	0.01811	0.21899	0.21974	29.88977	0.22027	29.89058	0.00000	0.00000	0.00000
Bus Prim TR-105C	6.600	0.02238	0.20953	0.21073	0.01989	0.21368	0.21461	29.89084	0.22296	29.89167	0.00000	0.00000	0.00000
Bus Prim TR-106A	11.000	0.04766	0.24974	0.25425	0.04766	0.24974	0.25425	0.06863	0.33640	0.34333	0.00000	0.00000	0.00000
Bus Prim TR-107A	0.433	0.00271	0.00631	0.00687	0.00261	0.00648	0.00698	0.00876	0.01061	0.01376	0.00000	0.00000	0.00000
Bus Prim TR-107B	0.433	0.00281	0.00719	0.00772	0.00273	0.00735	0.00784	0.00884	0.01163	0.01461	0.00000	0.00000	0.00000
Bus Prim TR-108A	0.415	0.00573	0.00796	0.00981	0.00565	0.00812	0.00989	0.02085	0.01443	0.02536	0.00000	0.00000	0.00000
Bus Prim TR-108B	0.433	0.00609	0.00907	0.01092	0.00592	0.00916	0.01091	0.02109	0.01541	0.02612	0.00000	0.00000	0.00000
Bus Prim TR-109A	33.000	0.15564	0.67942	0.69702	0.15534	0.68072	0.69822	0.29465	0.92575	0.97152	0.00000	0.00000	0.00000
Bus Prim TR-109B	33.000	0.12523	0.62679	0.63917	0.12481	0.62796	0.64024	0.19583	0.79660	0.82032	0.00000	0.00000	0.00000
Bus Prim TR-114A	33.000	0.12523	0.61055	0.62326	0.12481	0.61172	0.62433	0.14689	0.75889	0.77298	0.00000	0.00000	0.00000
Bus Prim TR-114B	33.000	0.12503	0.62792	0.64025	0.12474	0.62922	0.64147	0.14689	0.80080	0.81417	0.00000	0.00000	0.00000
Bus Sec TR-106A	6.900	0.10612	0.97198	0.97776	0.10612	0.97198	0.97776	39.95155	1.00608	39.96421	0.00000	0.00000	0.00000
Bus to CB-101A	6.600	0.03595	1.12891	1.12948	0.03346	1.13306	1.13355	29.90363	1.13913	29.92531	0.00000	0.00000	0.00000
Bus to CB-101B	6.600	0.03444	1.13464	1.13516	0.03234	1.13938	1.13984	29.90363	1.13913	29.92531	0.00000	0.00000	0.00000
Bus to Charger-DCDB101A	0.415	0.01440	0.00696	0.01600	0.01430	0.00713	0.01598	0.05527	0.01341	0.05688	0.00000	0.00000	0.00000
Bus to Charger-DCDB101B	0.415	0.01075	0.00905	0.01405	0.01058	0.00914	0.01399	0.04042	0.01541	0.04325	0.00000	0.00000	0.00000
Bus to Charger-DCDB102	0.433	0.01486	0.00895	0.01734	0.01469	0.00904	0.01725	0.05559	0.01541	0.05768	0.00000	0.00000	0.00000
Bus to ext. 1	33.000	0.09446	0.57513	0.58283	0.09404	0.57630	0.58392	0.09701	0.66745	0.67447	0.00000	0.00000	0.00000
Bus to ext. 2	33.000	0.09429	0.57630	0.58396	0.09400	0.57760	0.58520	0.09701	0.66745	0.67447	0.00000	0.00000	0.00000
BUS to HVAC-1	0.433	0.00179	0.00547	0.00575	0.00169	0.00562	0.00587	0.00560	0.00781	0.00961	0.00000	0.00000	0.00000
BUS to HVAC-2	0.433	0.00187	0.00632	0.00659	0.00179	0.00648	0.00672	0.00568	0.00883	0.01050	0.00000	0.00000	0.00000
Bus to TR101A	33.000	0.09446	0.57513	0.58283	0.09404	0.57630	0.58392	0.09701	0.66745	0.67447	0.00000	0.00000	0.00000
Bus to TR101B	33.000	0.09429	0.57630	0.58396	0.09400	0.57760	0.58520	0.09701	0.66745	0.67447	0.00000	0.00000	0.00000
Bus VFD-ACM 201 A1	0.415	0.31869	0.46085	0.56031	0.52310	0.93565	1.07195	3.82733	0.00000	3.82733	0.00000	0.00000	0.00000
Bus VFD-ACM 202 A1	0.415	2.69999	0.67283	2.78256	3.27748	0.73371	3.35861	3.82733	0.00000	3.82733	0.00000	0.00000	0.00000
Bus VFD-ACM B1	0.415	0.31869	0.46085	0.56031	0.52310	0.93565	1.07195	3.82733	0.00000	3.82733	0.00000	0.00000	0.00000
Bus VFD-ACM C1	0.415	0.31869	0.46085	0.56031	0.52310	0.93565	1.07195	3.82733	0.00000	3.82733	0.00000	0.00000	0.00000
Bus VFD-ACM D1	0.415	0.30449	0.46127	0.55271	0.51041	0.93986	1.06951	3.82733	0.00000	3.82733	0.00000	0.00000	0.00000
Bus VFD-ACM D2	0.415	0.30649	0.46121	0.55376	0.51219	0.93927	1.06984	3.82733	0.00000	3.82733	0.00000	0.00000	0.00000

Bus		Positive Seq. Imp. (ohm)			Negative Seq. Imp. (ohm)			Zero Seq. Imp. (ohm)			Fault Zf (ohm)		
ID	kV	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance
Bus VFD-ACM E1	0.415	0.30449	0.46127	0.55271	0.51041	0.93986	1.06951	3.82733	0.00000	3.82733	0.00000	0.00000	0.00000
Bus VFD-ACM F1	0.415	0.30876	0.46114	0.55497	0.51423	0.93859	1.07023	3.82733	0.00000	3.82733	0.00000	0.00000	0.00000
Bus VFD-ACM G1	0.415	0.30876	0.46114	0.55497	0.51423	0.93859	1.07023	3.82733	0.00000	3.82733	0.00000	0.00000	0.00000
Bus VFD-ACM H1	0.415	0.31444	0.46098	0.55801	0.51930	0.93691	1.07120	3.82733	0.00000	3.82733	0.00000	0.00000	0.00000
Bus VFD-ACM J1	0.415	0.31643	0.46092	0.55908	0.52108	0.93632	1.07155	3.82733	0.00000	3.82733	0.00000	0.00000	0.00000
Bus VFD-ACM K1	0.415	0.30967	0.48051	0.57165	0.47669	1.00026	1.10804	5.13254	0.00000	5.13254	0.00000	0.00000	0.00000
Bus VFD-ACM L1	0.415	0.32010	0.46081	0.56108	0.52437	0.93523	1.07220	3.82733	0.00000	3.82733	0.00000	0.00000	0.00000
Bus VFD-ACM M1	0.415	0.33986	0.45614	0.56883	0.54094	0.92569	1.07216	3.82733	0.00000	3.82733	0.00000	0.00000	0.00000
Bus VFD-ACM N1	0.415	0.34553	0.45561	0.57182	0.54592	0.92370	1.07296	3.82733	0.00000	3.82733	0.00000	0.00000	0.00000
Bus VFD-ACM P1	0.415	0.34553	0.45561	0.57182	0.54592	0.92370	1.07296	3.82733	0.00000	3.82733	0.00000	0.00000	0.00000
Bus VFD-ACM Q1	0.415	0.35118	0.45509	0.57484	0.55089	0.92171	1.07379	3.82733	0.00000	3.82733	0.00000	0.00000	0.00000
Bus VFD-ACM R1	0.415	0.35118	0.45509	0.57484	0.55089	0.92171	1.07379	3.82733	0.00000	3.82733	0.00000	0.00000	0.00000

Short-Circuit Summary Report

3-Phase, LG, LL, LLG Fault Currents

Bus		3-Phase Fault			Line-to-Ground Fault				Line-to-Line Fault				*Line-to-Line-to-Ground			
ID	kV	I" k	ip	Ik	I" k	ip	Ib	Ik	I" k	ip	Ib	Ik	I" k	ip	Ib	Ik
BUS 1 to AU-V REVAMP UNIT	33.000	36.757	84.310	34.803	34.616	79.399	34.616	34.616	31.789	72.915	31.789	31.789	35.948	82.455	35.948	35.948
BUS 1 to VDU UNIT	33.000	36.757	84.310	34.803	34.616	79.399	34.616	34.616	31.789	72.915	31.789	31.789	35.948	82.455	35.948	35.948
Bus 1 UPS101A	0.433	10.247	14.811	10.037	5.241	7.575	5.241	5.241	8.875	12.827	8.875	8.875	9.253	13.374	9.253	9.253
Bus 1 UPS101C	0.433	10.247	14.811	10.037	5.241	7.575	5.241	5.241	8.875	12.827	8.875	8.875	9.253	13.374	9.253	9.253
Bus 1 UPS102A	0.433	3.097	4.467	3.094	1.563	2.255	1.563	1.563	2.683	3.870	2.683	2.683	2.750	3.966	2.750	2.750
Bus 1 UPS102C	0.433	3.097	4.467	3.094	1.563	2.255	1.563	1.563	2.683	3.870	2.683	2.683	2.750	3.966	2.750	2.750
Bus 2 HT33	33.000	36.757	84.310	34.803	34.616	79.399	34.616	34.616	31.789	72.915	31.789	31.789	35.948	82.455	35.948	35.948
BUS 2 to AU-V REVAMP UNIT	33.000	36.757	84.310	34.803	34.616	79.399	34.616	34.616	31.789	72.915	31.789	31.789	35.948	82.455	35.948	35.948
BUS 2 to VDU UNIT	33.000	36.757	84.310	34.803	34.616	79.399	34.616	34.616	31.789	72.915	31.789	31.789	35.948	82.455	35.948	35.948
Bus 2 UPS101A	0.110	0.827	1.192	0.827	0.827	1.192	0.827	0.827	0.716	1.033	0.716	0.716	0.827	1.192	0.827	0.827
Bus 2 UPS101C	0.110	0.827	1.192	0.827	0.827	1.192	0.827	0.827	0.716	1.033	0.716	0.716	0.827	1.192	0.827	0.827
Bus 2 UPS102A	0.110	0.827	1.192	0.827	0.827	1.192	0.827	0.827	0.716	1.033	0.716	0.716	0.827	1.192	0.827	0.827
Bus 2 UPS102C	0.110	0.827	1.192	0.827	0.827	1.192	0.827	0.827	0.716	1.033	0.716	0.716	0.827	1.192	0.827	0.827
Bus 3 UPS101A	0.191	0.132	0.197	0.132	0.141	0.211	0.141	0.141	0.114	0.171	0.114	0.114	0.145	0.218	0.145	0.145
Bus 3 UPS101C	0.191	0.132	0.197	0.132	0.141	0.211	0.141	0.141	0.114	0.171	0.114	0.114	0.145	0.218	0.145	0.145
Bus 3 UPS102A	0.191	0.132	0.197	0.132	0.141	0.211	0.141	0.141	0.114	0.171	0.114	0.114	0.145	0.218	0.145	0.145
Bus 3 UPS102C	0.191	0.132	0.197	0.132	0.141	0.211	0.141	0.141	0.114	0.171	0.114	0.114	0.145	0.218	0.145	0.145
Bus 4 UPS101A	0.433	7.126	10.389	7.050	3.770	5.497	3.770	3.770	6.178	9.008	6.178	6.178	6.466	9.428	6.466	6.466
Bus 4 UPS101C	0.433	7.126	10.389	7.050	3.770	5.497	3.770	3.770	6.178	9.008	6.178	6.178	6.466	9.428	6.466	6.466
Bus 4 UPS102A	0.433	4.268	6.156	4.267	1.026	1.480	1.026	1.026	3.700	5.337	3.700	3.700	3.764	5.430	3.764	3.764
Bus 4 UPS102C	0.433	4.268	6.156	4.267	1.026	1.480	1.026	1.026	3.700	5.337	3.700	3.700	3.764	5.430	3.764	3.764
Bus 5 UPS101A	0.191	8.264	12.490	8.192	9.915	14.986	9.915	9.915	7.159	10.821	7.159	7.159	9.911	14.981	9.911	9.911
Bus 5 UPS101C	0.191	8.264	12.490	8.192	9.915	14.986	9.915	9.915	7.159	10.821	7.159	7.159	9.911	14.981	9.911	9.911
Bus 5 UPS102A	0.191	9.670	13.950	9.669	14.518	20.943	14.518	14.518	8.384	12.094	8.384	8.384	16.744	24.154	16.744	16.744
Bus 5 UPS102C	0.191	4.698	6.920	4.680	5.514	8.123	5.514	5.514	4.069	5.995	4.069	4.069	5.662	8.341	5.662	5.662
BUS 044-ELDB-101	0.415	0.727	1.048	0.727	0.627	0.904	0.627	0.627	0.629	0.908	0.629	0.629	0.700	1.010	0.700	0.700
BUS 044-ELDB-102	0.415	0.269	0.388	0.269	0.227	0.328	0.227	0.227	0.233	0.336	0.233	0.233	0.254	0.367	0.254	0.254
BUS 044-ELDB-103	0.415	0.417	0.602	0.417	0.355	0.512	0.355	0.355	0.361	0.521	0.361	0.361	0.397	0.573	0.397	0.397
BUS 044-ELDB-104	0.415	0.292	0.421	0.292	0.247	0.356	0.247	0.247	0.253	0.365	0.253	0.253	0.276	0.399	0.276	0.276
BUS 044-ELDB-105	0.415	0.372	0.536	0.372	0.315	0.455	0.315	0.315	0.322	0.464	0.322	0.322	0.353	0.509	0.353	0.353
BUS 044-ELDB-106	0.415	0.511	0.737	0.511	0.436	0.629	0.436	0.436	0.442	0.638	0.442	0.442	0.488	0.704	0.488	0.488
BUS 044-ELDB-107	0.415	0.095	0.138	0.095	0.080	0.115	0.080	0.080	0.083	0.119	0.083	0.083	0.090	0.129	0.090	0.090
BUS 044-ELDB-108	0.415	0.165	0.238	0.165	0.139	0.200	0.139	0.139	0.143	0.206	0.143	0.143	0.155	0.224	0.155	0.155
BUS 044-ELDB-109	0.415	0.319	0.461	0.320	0.270	0.390	0.270	0.270	0.277	0.399	0.277	0.277	0.303	0.437	0.303	0.303
BUS 044-ELDB-110	0.415	0.217	0.314	0.217	0.183	0.264	0.183	0.183	0.188	0.272	0.188	0.188	0.205	0.296	0.205	0.205
BUS 044-ELDB-111	0.415	0.107	0.155	0.107	0.090	0.130	0.090	0.090	0.093	0.134	0.093	0.093	0.101	0.146	0.101	0.101

3-Phase, LG, LL, LLG Fault Currents

Bus		3-Phase Fault			Line-to-Ground Fault				Line-to-Line Fault				*Line-to-Line-to-Ground			
ID	kV	I"k	ip	Ik	I"k	ip	Ib	Ik	I"k	ip	Ib	Ik	I"k	ip	Ib	Ik
BUS 044-ELDB-112	0.415	0.217	0.314	0.217	0.183	0.264	0.183	0.183	0.188	0.272	0.188	0.188	0.205	0.296	0.205	0.205
BUS 044-ELDB-113	0.415	0.217	0.314	0.217	0.183	0.264	0.183	0.183	0.188	0.272	0.188	0.188	0.205	0.296	0.205	0.205
BUS 044-ELDB-114	0.415	0.165	0.238	0.165	0.139	0.200	0.139	0.139	0.143	0.206	0.143	0.143	0.155	0.224	0.155	0.155
BUS 044-ELDB-115	0.415	0.111	0.160	0.111	0.093	0.134	0.093	0.093	0.096	0.139	0.096	0.096	0.104	0.150	0.104	0.104
BUS 044-EPMCC-101	0.415	36.428	87.059	31.068	36.077	86.221	36.077	36.077	31.385	75.007	31.385	31.385	36.666	87.630	36.666	36.666
BUS 044-HT6-102	6.900	23.108	56.868	17.849	0.439	1.081	0.439	0.439	19.712	48.512	19.712	19.712	19.823	48.784	19.823	19.823
BUS 044-HT11-101	11.000	27.576	61.437	27.201	24.722	55.078	24.722	24.722	23.882	53.206	23.882	23.882	26.474	58.981	26.474	26.474
BUS 044-LDB-101	0.415	0.780	1.126	0.781	0.664	0.958	0.664	0.664	0.676	0.975	0.676	0.676	0.744	1.073	0.744	0.744
BUS 044-LDB-102	0.415	0.435	0.627	0.435	0.367	0.529	0.367	0.367	0.377	0.543	0.377	0.377	0.411	0.593	0.411	0.411
BUS 044-LDB-103	0.415	0.208	0.300	0.208	0.175	0.252	0.175	0.175	0.180	0.260	0.180	0.180	0.195	0.282	0.195	0.195
BUS 044-LDB-104	0.415	0.300	0.432	0.300	0.252	0.363	0.252	0.252	0.259	0.374	0.259	0.259	0.282	0.407	0.282	0.282
BUS 044-LDB-105	0.415	0.602	0.869	0.603	0.510	0.736	0.510	0.510	0.522	0.753	0.522	0.522	0.571	0.824	0.571	0.571
BUS 044-LDB-106	0.415	0.323	0.466	0.323	0.249	0.360	0.249	0.249	0.280	0.403	0.280	0.280	0.298	0.429	0.298	0.298
BUS 044-LDB-107	0.415	0.559	0.806	0.559	0.409	0.591	0.409	0.409	0.484	0.699	0.484	0.484	0.514	0.742	0.514	0.514
BUS 044-LDB-108	0.415	0.559	0.806	0.559	0.409	0.591	0.409	0.409	0.484	0.699	0.484	0.484	0.514	0.742	0.514	0.514
BUS 044-LDB-109	0.415	0.517	0.746	0.517	0.437	0.630	0.437	0.437	0.448	0.646	0.448	0.448	0.489	0.706	0.489	0.489
BUS 044-LDB-110	0.415	0.351	0.506	0.351	0.296	0.426	0.296	0.296	0.304	0.439	0.304	0.304	0.331	0.477	0.331	0.331
BUS 044-LDB-111	0.415	0.340	0.491	0.340	0.286	0.413	0.286	0.286	0.295	0.425	0.295	0.295	0.321	0.462	0.321	0.321
BUS 044-LDB-112	0.415	0.351	0.506	0.351	0.296	0.426	0.296	0.296	0.304	0.439	0.304	0.304	0.331	0.477	0.331	0.331
BUS 044-LDB-113	0.415	0.221	0.319	0.222	0.186	0.268	0.186	0.186	0.192	0.277	0.192	0.192	0.208	0.300	0.208	0.208
BUS 044-LDB-114	0.415	0.266	0.383	0.266	0.223	0.322	0.223	0.223	0.230	0.332	0.230	0.230	0.250	0.361	0.250	0.250
BUS 044-LDB-115	0.415	0.437	0.630	0.437	0.369	0.532	0.369	0.369	0.378	0.546	0.378	0.378	0.411	0.594	0.411	0.411
BUS 044-LDB-116	0.415	0.243	0.350	0.243	0.191	0.275	0.191	0.191	0.210	0.303	0.210	0.210	0.224	0.324	0.224	0.224
BUS 044-LDB-117	0.415	0.243	0.350	0.243	0.191	0.275	0.191	0.191	0.210	0.303	0.210	0.210	0.224	0.324	0.224	0.224
BUS 044-PDB-101	0.415	0.780	1.126	0.781	0.664	0.958	0.664	0.664	0.676	0.975	0.676	0.676	0.744	1.073	0.744	0.744
BUS 044-PDB-102	0.415	0.535	0.772	0.536	0.453	0.653	0.453	0.453	0.464	0.669	0.464	0.464	0.507	0.732	0.507	0.507
BUS 044-PDB-103	0.415	0.384	0.554	0.384	0.324	0.467	0.324	0.324	0.333	0.480	0.333	0.333	0.363	0.523	0.363	0.363
BUS 044-PDB-104	0.415	0.329	0.474	0.329	0.277	0.399	0.277	0.277	0.285	0.410	0.285	0.285	0.310	0.447	0.310	0.310
BUS 044-PDB-105	0.415	1.016	1.466	1.016	0.870	1.255	0.870	0.870	0.880	1.270	0.880	0.880	0.970	1.400	0.970	0.970
BUS A 044-ASB-101	0.415	42.735	71.734	34.314	30.412	51.049	30.412	30.412	36.571	61.388	36.571	36.571	41.961	70.434	41.961	41.961
BUS A 044-ASB-102	0.415	44.272	77.657	35.096	32.839	57.603	32.839	32.839	37.867	66.422	37.867	37.867	43.682	76.621	43.682	43.682
BUS A 044-EMLDB-101	0.415	3.251	5.310	3.219	3.398	5.549	3.398	3.398	2.816	4.598	2.816	2.816	3.332	5.442	3.332	3.332
BUS A 044-HT6-101	6.600	22.252	54.988	17.162	0.420	1.038	0.420	0.420	18.980	46.902	18.980	18.980	19.085	47.163	19.085	19.085
BUS A 044-HT33-101	33.000	36.757	84.310	34.803	34.616	79.399	34.616	34.616	31.789	72.915	31.789	31.789	35.948	82.455	35.948	35.948
BUS A 044-MCC-101	0.415	47.984	93.939	32.377	37.359	73.139	37.359	37.359	39.621	77.566	39.621	39.621	46.263	90.569	46.263	46.263
BUS A 044-MCC-102	0.415	47.096	91.843	32.377	37.029	72.210	37.029	37.029	39.020	76.093	39.020	39.020	45.495	88.721	45.495	45.495
BUS A 044-MCC-103	0.415	46.612	90.943	32.273	36.365	70.951	36.365	36.365	38.314	74.753	38.314	38.314	45.057	87.910	45.057	45.057
BUS A 044-MCC-104	0.415	47.726	93.288	32.377	37.267	72.844	37.267	37.267	39.453	77.116	39.453	39.453	46.045	90.002	46.045	46.045
BUS A 044-MCC-105	0.415	46.354	90.264	32.273	36.302	70.690	36.302	36.302	38.204	74.394	38.204	38.204	44.885	87.403	44.885	44.885
BUS A 044-MCC-106	0.415	45.894	89.257	32.273	36.146	70.299	36.146	36.146	37.925	73.758	37.925	37.925	44.516	86.575	44.516	44.516

3-Phase, LG, LL, LLG Fault Currents

Bus		3-Phase Fault			Line-to-Ground Fault				Line-to-Line Fault				*Line-to-Line-to-Ground			
ID	kV	I"k	ip	Ik	I"k	ip	Ib	Ik	I"k	ip	Ib	Ik	I"k	ip	Ib	Ik
BUS A 044-MCC-107	0.415	50.412	97.503	37.597	40.422	78.182	40.422	40.422	42.745	82.673	42.745	42.745	49.794	96.308	49.794	49.794
BUS A 044-MLDB-101	0.415	5.785	9.567	5.597	6.098	10.083	6.098	6.098	5.002	8.272	5.002	5.002	6.003	9.927	6.003	6.003
BUS A 044-MLDB-102	0.415	1.472	2.146	1.469	0.918	1.337	0.918	0.918	1.275	1.859	1.275	1.275	1.378	2.009	1.378	1.378
BUS A 044-PMCC-101	0.415	54.171	125.151	35.323	47.698	110.196	47.698	47.698	44.519	102.850	44.519	44.519	51.774	119.612	51.774	51.774
BUS A 044-PMCC-102	0.415	53.235	123.815	35.374	46.989	109.287	46.989	46.989	43.474	101.113	43.474	43.474	50.714	117.951	50.714	50.714
BUS A 044-PMCC-103	0.415	58.771	138.807	41.962	54.787	129.399	54.787	54.787	49.745	117.491	49.745	49.745	57.876	136.695	57.876	57.876
BUS A AU-V REVAMP	6.600	12.093	30.300	8.821	0.315	0.789	0.315	0.315	10.472	26.239	10.472	10.472	10.550	26.436	10.550	10.550
BUS A to VDU UNIT	6.600	12.045	30.112	8.635	0.315	0.787	0.315	0.315	10.431	26.077	10.431	10.431	10.509	26.273	10.509	10.509
BUS B 044-ASB-101	0.415	42.735	71.734	34.314	30.412	51.049	30.412	30.412	36.571	61.388	36.571	36.571	41.961	70.434	41.961	41.961
BUS B 044-ASB-102	0.415	44.272	77.657	35.096	32.839	57.603	32.839	32.839	37.867	66.422	37.867	37.867	43.682	76.621	43.682	43.682
BUS B 044-HT6-101	6.600	22.252	54.988	17.162	0.420	1.038	0.420	0.420	18.980	46.902	18.980	18.980	19.085	47.163	19.085	19.085
BUS B 044-HT33-101	33.000	36.757	84.310	34.803	34.616	79.399	34.616	34.616	31.789	72.915	31.789	31.789	35.948	82.455	35.948	35.948
BUS B 044-MCC-101	0.415	47.984	93.939	32.377	37.359	73.139	37.359	37.359	39.621	77.566	39.621	39.621	46.263	90.569	46.263	46.263
BUS B 044-MCC-102	0.415	47.096	91.843	32.377	37.029	72.210	37.029	37.029	39.020	76.093	39.020	39.020	45.495	88.721	45.495	45.495
BUS B 044-MCC-103	0.415	46.612	90.943	32.273	36.365	70.951	36.365	36.365	38.314	74.753	38.314	38.314	45.057	87.910	45.057	45.057
BUS B 044-MCC-104	0.415	47.726	93.288	32.377	37.267	72.844	37.267	37.267	39.453	77.116	39.453	39.453	46.045	90.002	46.045	46.045
BUS B 044-MCC-105	0.415	46.354	90.264	32.273	36.302	70.690	36.302	36.302	38.204	74.394	38.204	38.204	44.885	87.403	44.885	44.885
BUS B 044-MCC-106	0.415	45.894	89.257	32.273	36.146	70.299	36.146	36.146	37.925	73.758	37.925	37.925	44.516	86.575	44.516	44.516
BUS B 044-MCC-107	0.415	50.412	97.503	37.597	40.422	78.182	40.422	40.422	42.745	82.673	42.745	42.745	49.794	96.308	49.794	49.794
BUS B 044-MLDB-101	0.415	5.785	9.567	5.597	6.098	10.083	6.098	6.098	5.002	8.272	5.002	5.002	6.003	9.927	6.003	6.003
BUS B 044-MLDB-102	0.415	1.472	2.146	1.469	0.918	1.337	0.918	0.918	1.275	1.859	1.275	1.275	1.378	2.009	1.378	1.378
BUS B 044-PMCC-101	0.415	54.171	125.151	35.323	47.698	110.196	47.698	47.698	44.519	102.850	44.519	44.519	51.774	119.612	51.774	51.774
BUS B 044-PMCC-102	0.415	53.235	123.815	35.374	46.989	109.287	46.989	46.989	43.474	101.113	43.474	43.474	50.714	117.951	50.714	50.714
BUS B 044-PMCC-103	0.415	58.771	138.807	41.962	54.787	129.399	54.787	54.787	49.745	117.491	49.745	49.745	57.876	136.695	57.876	57.876
BUS B AU-REVAMP	6.600	12.093	30.300	8.821	0.315	0.789	0.315	0.315	10.472	26.239	10.472	10.472	10.550	26.436	10.550	10.550
BUS B EMLDB-101	0.415	3.251	5.310	3.219	3.398	5.549	3.398	3.398	2.816	4.598	2.816	2.816	3.332	5.442	3.332	3.332
BUS B to VDU UNIT	6.600	12.045	30.112	8.635	0.315	0.787	0.315	0.315	10.431	26.077	10.431	10.431	10.509	26.273	10.509	10.509
BUS Emergency Supply	11.000	35.373	90.508	35.000	35.248	90.187	35.248	35.248	30.634	78.382	30.634	30.634	35.319	90.370	35.319	35.319
BUS Grid Power A	33.000	39.437	100.527	37.500	38.739	98.747	38.739	38.739	34.112	86.953	34.112	34.112	39.136	99.758	39.136	39.136
BUS Grid Power B	33.000	37.500	96.041	37.500	37.500	96.041	37.500	37.500	32.476	83.174	32.476	32.476	37.500	96.041	37.500	37.500
BUS HVAC EPMCC	0.415	12.852	19.878	11.552	7.010	10.842	7.010	7.010	11.145	17.237	11.145	11.145	11.893	18.393	11.893	11.893
Bus Prim TR-101A	33.000	36.694	83.980	34.744	34.527	79.021	34.527	34.527	31.734	72.630	31.734	31.734	35.875	82.106	35.875	35.875
Bus Prim TR-101B	33.000	36.690	83.964	34.744	34.525	79.010	34.525	34.525	31.732	72.616	31.732	31.732	35.873	82.094	35.873	35.873
Bus Prim TR-102A	6.600	21.751	52.978	16.841	0.420	1.023	0.420	0.420	18.556	45.195	18.556	18.556	18.661	45.452	18.661	18.661
Bus Prim TR-102B	6.600	21.702	52.833	16.841	0.420	1.022	0.420	0.420	18.519	45.085	18.519	18.519	18.625	45.342	18.625	18.625
Bus Prim TR-103A	6.600	22.003	53.984	17.004	0.420	1.030	0.420	0.420	18.769	46.048	18.769	18.769	18.875	46.307	18.875	18.875
Bus Prim TR-103B	6.600	21.980	53.914	17.004	0.420	1.030	0.420	0.420	18.752	45.996	18.752	18.752	18.858	46.255	18.858	18.858
Bus Prim TR-104A	6.600	22.167	54.645	17.108	0.420	1.035	0.420	0.420	18.909	46.612	18.909	18.909	19.014	46.873	19.014	19.014
Bus Prim TR-104B	6.600	22.156	54.608	17.106	0.420	1.035	0.420	0.420	18.899	46.581	18.899	18.899	19.005	46.842	19.005	19.005
Bus Prim TR-105A	6.600	22.132	54.505	17.090	0.420	1.034	0.420	0.420	18.879	46.494	18.879	18.879	18.984	46.754	18.984	18.984

3-Phase, LG, LL, LLG Fault Currents

Bus		3-Phase Fault			Line-to-Ground Fault				Line-to-Line Fault				*Line-to-Line-to-Ground			
ID	kV	I"k	ip	Ik	I"k	ip	Ib	Ik	I"k	ip	Ib	Ik	I"k	ip	Ib	Ik
Bus Prim TR-105B	6.600	22.128	54.494	17.090	0.420	1.034	0.420	0.420	18.876	46.486	18.876	18.876	18.981	46.746	18.981	18.981
Bus Prim TR-105C	6.600	22.001	53.993	17.013	0.420	1.031	0.420	0.420	18.770	46.063	18.770	18.770	18.875	46.322	18.875	18.875
Bus Prim TR-106A	11.000	27.477	61.119	27.104	24.604	54.729	24.604	24.604	23.796	52.931	23.796	23.796	26.366	58.649	26.366	26.366
Bus Prim TR-107A	0.433	41.617	75.330	33.521	29.919	54.156	29.919	29.919	35.612	64.462	35.612	35.612	39.891	72.205	39.891	39.891
Bus Prim TR-107B	0.433	41.617	75.330	33.521	29.919	54.156	29.919	29.919	35.612	64.462	35.612	35.612	39.891	72.205	39.891	39.891
Bus Prim TR-108A	0.415	29.276	45.652	25.627	18.145	28.295	18.145	18.145	25.213	39.316	25.213	25.213	27.616	43.063	27.616	27.616
Bus Prim TR-108B	0.433	24.099	39.851	22.310	16.704	27.621	16.704	16.704	20.880	34.527	20.880	20.880	23.522	38.897	23.522	23.522
Bus Prim TR-109A	33.000	30.740	65.844	29.216	26.931	57.685	26.931	26.931	26.593	56.960	26.593	26.593	29.850	63.938	29.850	29.850
Bus Prim TR-109B	33.000	33.402	73.621	31.782	30.282	66.745	30.282	30.282	28.891	63.680	28.891	28.891	32.458	71.542	32.458	32.458
Bus Prim TR-114A	33.000	34.351	75.406	32.581	31.520	69.192	31.520	31.520	29.712	65.222	29.712	29.712	33.200	72.879	33.200	33.200
Bus Prim TR-114B	33.000	33.402	73.621	31.782	30.366	66.930	30.366	30.366	28.891	63.680	28.891	28.891	32.229	71.037	32.229	32.229
Bus Sec TR-106A	6.900	4.482	10.942	4.476	0.326	0.797	0.326	0.326	3.881	9.476	3.881	3.881	3.963	9.674	3.963	3.963
Bus to CB-101A	6.600	3.779	10.230	3.596	0.417	1.129	0.417	0.417	3.264	8.835	3.264	3.264	3.369	9.119	3.369	3.369
Bus to CB-101B	6.600	3.779	10.230	3.596	0.417	1.129	0.417	0.417	3.264	8.835	3.264	3.264	3.369	9.119	3.369	3.369
Bus to Charger-DCDB101B	0.415	17.930	26.705	17.229	10.740	15.997	10.740	10.740	15.563	23.179	15.563	15.563	17.051	25.396	17.051	17.051
Bus to Charger-DCDB102	0.433	15.151	22.035	14.832	8.613	12.527	8.613	8.613	13.156	19.133	13.156	13.156	14.164	20.599	14.164	14.164
Bus to ext. 1	33.000	36.757	84.310	34.803	34.616	79.399	34.616	34.616	31.789	72.915	31.789	31.789	35.948	82.455	35.948	35.948
Bus to ext. 2	33.000	36.757	84.310	34.803	34.616	79.399	34.616	34.616	31.789	72.915	31.789	31.789	35.948	82.455	35.948	35.948
BUS to HVAC-1	0.433	50.594	97.888	37.912	39.442	76.311	39.442	39.442	43.154	83.494	43.154	43.154	49.576	95.918	49.576	49.576
BUS to HVAC-2	0.433	50.594	97.888	37.912	39.442	76.311	39.442	39.442	43.154	83.494	43.154	43.154	49.576	95.918	49.576	49.576
Bus to TR101A	33.000	36.757	84.310	34.803	34.616	79.399	34.616	34.616	31.789	72.915	31.789	31.789	35.948	82.455	35.948	35.948
Bus to TR101B	33.000	36.757	84.310	34.803	34.616	79.399	34.616	34.616	31.789	72.915	31.789	31.789	35.948	82.455	35.948	35.948
Bus VFD-ACM 201 A1	0.415	0.449	0.817	0.066	0.155	0.282	0.155	0.155	0.267	0.486	0.267	0.267	0.324	0.590	0.324	0.324
Bus VFD-ACM 202 A1	0.415	0.090	0.142	0.066	0.076	0.119	0.076	0.076	0.071	0.111	0.071	0.071	0.088	0.138	0.088	0.088
Bus VFD-ACM B1	0.415	0.449	0.817	0.066	0.155	0.282	0.155	0.155	0.267	0.486	0.267	0.267	0.324	0.590	0.324	0.324
Bus VFD-ACM C1	0.415	0.449	0.817	0.066	0.155	0.282	0.155	0.155	0.267	0.486	0.267	0.267	0.324	0.590	0.324	0.324
Bus VFD-ACM D1	0.415	0.455	0.840	0.066	0.156	0.287	0.156	0.156	0.269	0.496	0.269	0.269	0.327	0.603	0.327	0.327
Bus VFD-ACM D2	0.415	0.454	0.837	0.066	0.156	0.286	0.156	0.156	0.269	0.495	0.269	0.269	0.326	0.601	0.326	0.326
Bus VFD-ACM E1	0.415	0.455	0.840	0.066	0.156	0.287	0.156	0.156	0.269	0.496	0.269	0.269	0.327	0.603	0.327	0.327
Bus VFD-ACM F1	0.415	0.453	0.833	0.066	0.155	0.286	0.155	0.155	0.268	0.493	0.268	0.268	0.326	0.599	0.326	0.326
Bus VFD-ACM G1	0.415	0.453	0.833	0.066	0.155	0.286	0.155	0.155	0.268	0.493	0.268	0.268	0.326	0.599	0.326	0.326
Bus VFD-ACM H1	0.415	0.451	0.824	0.066	0.155	0.283	0.155	0.155	0.268	0.489	0.268	0.268	0.325	0.594	0.325	0.325
Bus VFD-ACM J1	0.415	0.450	0.821	0.066	0.155	0.283	0.155	0.155	0.267	0.488	0.267	0.267	0.325	0.592	0.325	0.325
Bus VFD-ACM K1	0.415	0.440	0.794	0.049	0.124	0.223	0.124	0.124	0.260	0.469	0.260	0.260	0.304	0.549	0.304	0.304
Bus VFD-ACM L1	0.415	0.448	0.815	0.066	0.155	0.281	0.155	0.155	0.267	0.485	0.267	0.267	0.324	0.589	0.324	0.324
Bus VFD-ACM M1	0.415	0.442	0.786	0.066	0.154	0.273	0.154	0.154	0.266	0.473	0.266	0.266	0.322	0.572	0.322	0.322
Bus VFD-ACM N1	0.415	0.440	0.778	0.066	0.154	0.271	0.154	0.154	0.265	0.469	0.265	0.265	0.321	0.567	0.321	0.321
Bus VFD-ACM P1	0.415	0.440	0.778	0.066	0.154	0.271	0.154	0.154	0.265	0.469	0.265	0.265	0.321	0.567	0.321	0.321
Bus VFD-ACM Q1	0.415	0.438	0.770	0.066	0.153	0.270	0.153	0.153	0.265	0.466	0.265	0.265	0.320	0.563	0.320	0.320
Bus VFD-ACM R1	0.415	0.438	0.770	0.066	0.153	0.270	0.153	0.153	0.265	0.466	0.265	0.265	0.320	0.563	0.320	0.320

All fault currents are in rms kA. Current ip is calculated using Method C.

* LLG fault current is the larger of the two faulted line currents.

Sequence Impedance Summary Report

Bus		Positive Seq. Imp. (ohm)			Negative Seq. Imp. (ohm)			Zero Seq. Imp. (ohm)			Fault Zf (ohm)		
ID	kV	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance
BUS 1 to AU-V REVAMP UNIT	33.000	0.09186	0.56273	0.57017	0.09152	0.56436	0.57173	0.09701	0.66745	0.67447	0.00000	0.00000	0.00000
BUS 1 to VDU UNIT	33.000	0.09186	0.56273	0.57017	0.09152	0.56436	0.57173	0.09701	0.66745	0.67447	0.00000	0.00000	0.00000
Bus 1 UPS101A	0.433	0.02321	0.01084	0.02562	0.02310	0.01106	0.02561	0.09460	0.03021	0.09931	0.00000	0.00000	0.00000
Bus 1 UPS101C	0.433	0.02321	0.01084	0.02562	0.02310	0.01106	0.02561	0.09460	0.03021	0.09931	0.00000	0.00000	0.00000
Bus 1 UPS102A	0.433	0.08307	0.01682	0.08476	0.08297	0.01703	0.08470	0.32970	0.05541	0.33433	0.00000	0.00000	0.00000
Bus 1 UPS102C	0.433	0.08307	0.01682	0.08476	0.08297	0.01703	0.08470	0.32970	0.05541	0.33433	0.00000	0.00000	0.00000
Bus 2 HT33	33.000	0.09186	0.56273	0.57017	0.09152	0.56436	0.57173	0.09701	0.66745	0.67447	0.00000	0.00000	0.00000
BUS 2 to AU-V REVAMP UNIT	33.000	0.09186	0.56273	0.57017	0.09152	0.56436	0.57173	0.09701	0.66745	0.67447	0.00000	0.00000	0.00000
BUS 2 to VDU UNIT	33.000	0.09186	0.56273	0.57017	0.09152	0.56436	0.57173	0.09701	0.66745	0.67447	0.00000	0.00000	0.00000
Bus 2 UPS101A	0.110	0.08067	0.00000	0.08067	0.08067	0.00000	0.08067	0.08067	0.00000	0.08067	0.00000	0.00000	0.00000
Bus 2 UPS101C	0.110	0.08067	0.00000	0.08067	0.08067	0.00000	0.08067	0.08067	0.00000	0.08067	0.00000	0.00000	0.00000
Bus 2 UPS102A	0.110	0.08067	0.00000	0.08067	0.08067	0.00000	0.08067	0.08067	0.00000	0.08067	0.00000	0.00000	0.00000
Bus 2 UPS102C	0.110	0.08067	0.00000	0.08067	0.08067	0.00000	0.08067	0.08067	0.00000	0.08067	0.00000	0.00000	0.00000
Bus 3 UPS101A	0.191	0.64293	0.59958	0.87912	0.64293	0.59958	0.87912	0.39972	0.59958	0.72060	0.00000	0.00000	0.00000
Bus 3 UPS101C	0.191	0.64293	0.59958	0.87912	0.64293	0.59958	0.87912	0.39972	0.59958	0.72060	0.00000	0.00000	0.00000
Bus 3 UPS102A	0.191	0.64293	0.59958	0.87912	0.64293	0.59958	0.87912	0.39972	0.59958	0.72060	0.00000	0.00000	0.00000
Bus 3 UPS102C	0.191	0.64293	0.59958	0.87912	0.64293	0.59958	0.87912	0.39972	0.59958	0.72060	0.00000	0.00000	0.00000
Bus 4 UPS101A	0.433	0.03085	0.02013	0.03684	0.03068	0.02023	0.03675	0.12304	0.05741	0.13577	0.00000	0.00000	0.00000
Bus 4 UPS101C	0.433	0.03085	0.02013	0.03684	0.03068	0.02023	0.03675	0.12304	0.05741	0.13577	0.00000	0.00000	0.00000
Bus 4 UPS102A	0.433	0.05911	0.01699	0.06151	0.05895	0.01709	0.06138	0.64426	0.05741	0.64682	0.00000	0.00000	0.00000
Bus 4 UPS102C	0.433	0.05911	0.01699	0.06151	0.05895	0.01709	0.06138	0.64426	0.05741	0.64682	0.00000	0.00000	0.00000
Bus 5 UPS101A	0.191	0.00996	0.00985	0.01401	0.00993	0.00987	0.01400	0.00396	0.00594	0.00714	0.00000	0.00000	0.00000
Bus 5 UPS101C	0.191	0.00996	0.00985	0.01401	0.00993	0.00987	0.01400	0.00396	0.00594	0.00714	0.00000	0.00000	0.00000
Bus 5 UPS102A	0.191	0.01151	0.00331	0.01197	0.01147	0.00333	0.01195	0.00000	0.00001	0.00001	0.00000	0.00000	0.00000
Bus 5 UPS102C	0.191	0.01942	0.01518	0.02465	0.01939	0.01520	0.02463	0.00792	0.01187	0.01427	0.00000	0.00000	0.00000
BUS 044-ELDB-101	0.415	0.33936	0.06839	0.34618	0.33921	0.06849	0.34605	0.50794	0.06606	0.51222	0.00000	0.00000	0.00000
BUS 044-ELDB-102	0.415	0.93215	0.07647	0.93528	0.93200	0.07657	0.93514	1.44908	0.08606	1.45164	0.00000	0.00000	0.00000
BUS 044-ELDB-103	0.415	0.59871	0.07193	0.60301	0.59855	0.07202	0.60287	0.91969	0.07481	0.92273	0.00000	0.00000	0.00000
BUS 044-ELDB-104	0.415	0.85805	0.07546	0.86137	0.85790	0.07556	0.86122	1.33144	0.08356	1.33406	0.00000	0.00000	0.00000
BUS 044-ELDB-105	0.415	0.67281	0.07294	0.67675	0.67265	0.07303	0.67661	1.03733	0.07731	1.04021	0.00000	0.00000	0.00000
BUS 044-ELDB-106	0.415	0.48756	0.07041	0.49262	0.48741	0.07051	0.49248	0.74323	0.07106	0.74662	0.00000	0.00000	0.00000
BUS 044-ELDB-107	0.415	2.63643	0.09970	2.63832	2.63628	0.09980	2.63817	4.15486	0.14356	4.15734	0.00000	0.00000	0.00000
BUS 044-ELDB-108	0.415	1.52495	0.08455	1.52729	1.52479	0.08465	1.52714	2.39022	0.10606	2.39257	0.00000	0.00000	0.00000
BUS 044-ELDB-109	0.415	0.78395	0.07445	0.78748	0.78380	0.07455	0.78734	1.21380	0.08106	1.21650	0.00000	0.00000	0.00000

Bus		Positive Seq. Imp. (ohm)			Negative Seq. Imp. (ohm)			Zero Seq. Imp. (ohm)			Fault Zf (ohm)		
ID	kV	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance
BUS 044-ELDB-110	0.415	1.15445	0.07950	1.15718	1.15430	0.07960	1.15704	1.80201	0.09356	1.80444	0.00000	0.00000	0.00000
BUS 044-ELDB-111	0.415	2.34004	0.09566	2.34199	2.33988	0.09576	2.34184	3.68429	0.13356	3.68671	0.00000	0.00000	0.00000
BUS 044-ELDB-112	0.415	1.15445	0.07950	1.15718	1.15430	0.07960	1.15704	1.80201	0.09356	1.80444	0.00000	0.00000	0.00000
BUS 044-ELDB-113	0.415	1.15445	0.07950	1.15718	1.15430	0.07960	1.15704	1.80201	0.09356	1.80444	0.00000	0.00000	0.00000
BUS 044-ELDB-114	0.415	1.52495	0.08455	1.52729	1.52479	0.08465	1.52714	2.39022	0.10606	2.39257	0.00000	0.00000	0.00000
BUS 044-ELDB-115	0.415	2.26594	0.09465	2.26791	2.26578	0.09475	2.26776	3.56665	0.13106	3.56905	0.00000	0.00000	0.00000
BUS 044-EPGCC-101	0.415	0.00114	0.00681	0.00691	0.00097	0.00691	0.00698	0.00070	0.00701	0.00704	0.00000	0.00000	0.00000
BUS 044-HT6-102	6.900	0.02234	0.18832	0.18964	0.01977	0.19441	0.19541	29.89000	0.22086	29.89082	0.00000	0.00000	0.00000
BUS 044-HT11-101	11.000	0.04713	0.24891	0.25333	0.04713	0.24891	0.25333	0.06779	0.33429	0.34109	0.00000	0.00000	0.00000
BUS 044-LDB-101	0.415	0.31976	0.04072	0.32234	0.31964	0.04096	0.32226	0.49091	0.04051	0.49258	0.00000	0.00000	0.00000
BUS 044-LDB-102	0.415	0.57656	0.04856	0.57860	0.57645	0.04880	0.57851	0.89843	0.05811	0.90030	0.00000	0.00000	0.00000
BUS 044-LDB-103	0.415	1.20895	0.05284	1.21010	1.20883	0.05308	1.21000	1.90262	0.07051	1.90393	0.00000	0.00000	0.00000
BUS 044-LDB-104	0.415	0.83845	0.04779	0.83981	0.83834	0.04803	0.83971	1.31441	0.05801	1.31569	0.00000	0.00000	0.00000
BUS 044-LDB-105	0.415	0.41521	0.04510	0.41765	0.41510	0.04533	0.41757	0.64232	0.05006	0.64427	0.00000	0.00000	0.00000
BUS 044-LDB-106	0.415	0.77266	0.10238	0.77941	0.77251	0.10247	0.77927	1.45607	0.18931	1.46832	0.00000	0.00000	0.00000
BUS 044-LDB-107	0.415	0.43921	0.09783	0.44998	0.43906	0.09793	0.44985	0.92668	0.17806	0.94363	0.00000	0.00000	0.00000
BUS 044-LDB-108	0.415	0.43921	0.09783	0.44998	0.43906	0.09793	0.44985	0.92668	0.17806	0.94363	0.00000	0.00000	0.00000
BUS 044-LDB-109	0.415	0.48436	0.04658	0.48660	0.48425	0.04682	0.48651	0.75208	0.05351	0.75398	0.00000	0.00000	0.00000
BUS 044-LDB-110	0.415	0.71486	0.05153	0.71672	0.71475	0.05177	0.71662	1.11795	0.06501	1.11984	0.00000	0.00000	0.00000
BUS 044-LDB-111	0.415	0.73791	0.05203	0.73974	0.73780	0.05226	0.73965	1.15453	0.06616	1.15643	0.00000	0.00000	0.00000
BUS 044-LDB-112	0.415	0.71486	0.05153	0.71672	0.71475	0.05177	0.71662	1.11795	0.06501	1.11984	0.00000	0.00000	0.00000
BUS 044-LDB-113	0.415	1.13485	0.05183	1.13603	1.13473	0.05207	1.13593	1.78498	0.06801	1.78628	0.00000	0.00000	0.00000
BUS 044-LDB-114	0.415	0.94536	0.05648	0.94705	0.94525	0.05672	0.94695	1.48382	0.07651	1.48579	0.00000	0.00000	0.00000
BUS 044-LDB-115	0.415	0.57228	0.06458	0.57591	0.57217	0.06482	0.57583	0.89090	0.09351	0.89579	0.00000	0.00000	0.00000
BUS 044-LDB-116	0.415	1.03201	0.10591	1.03743	1.03185	0.10601	1.03728	1.86782	0.19806	1.87829	0.00000	0.00000	0.00000
BUS 044-LDB-117	0.415	1.03201	0.10591	1.03743	1.03185	0.10601	1.03728	1.86782	0.19806	1.87829	0.00000	0.00000	0.00000
BUS 044-PDB-101	0.415	0.31976	0.04072	0.32234	0.31964	0.04096	0.32226	0.49091	0.04051	0.49258	0.00000	0.00000	0.00000
BUS 044-PDB-102	0.415	0.46795	0.04274	0.46990	0.46784	0.04298	0.46981	0.72620	0.04551	0.72762	0.00000	0.00000	0.00000
BUS 044-PDB-103	0.415	0.65320	0.04527	0.65477	0.65309	0.04550	0.65467	1.02030	0.05176	1.02162	0.00000	0.00000	0.00000
BUS 044-PDB-104	0.415	0.76435	0.04678	0.76578	0.76424	0.04702	0.76568	1.19677	0.05551	1.19805	0.00000	0.00000	0.00000
BUS 044-PDB-105	0.415	0.24293	0.04784	0.24759	0.24281	0.04808	0.24753	0.36856	0.05571	0.37275	0.00000	0.00000	0.00000
BUS A 044-ASB-101	0.415	0.00321	0.00493	0.00589	0.00311	0.00516	0.00603	0.01085	0.00781	0.01337	0.00000	0.00000	0.00000
BUS A 044-ASB-102	0.415	0.00276	0.00497	0.00568	0.00265	0.00519	0.00583	0.00892	0.00781	0.01186	0.00000	0.00000	0.00000
BUS A 044-EMLDB-101	0.415	0.04296	0.06435	0.07738	0.04281	0.06445	0.07737	0.03737	0.05606	0.06737	0.00000	0.00000	0.00000
BUS A 044-HT6-101	6.600	0.02158	0.18713	0.18837	0.01901	0.19323	0.19416	29.88876	0.21775	29.88956	0.00000	0.00000	0.00000
BUS A 044-HT33-101	33.000	0.09186	0.56273	0.57017	0.09152	0.56436	0.57173	0.09701	0.66745	0.67447	0.00000	0.00000	0.00000
BUS A 044-MCC-101	0.415	0.00187	0.00490	0.00524	0.00166	0.00552	0.00576	0.00500	0.00790	0.00935	0.00000	0.00000	0.00000

Bus		Positive Seq. Imp. (ohm)			Negative Seq. Imp. (ohm)			Zero Seq. Imp. (ohm)			Fault Zf (ohm)		
ID	kV	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance
BUS A 044-MCC-102	0.415	0.00195	0.00497	0.00534	0.00174	0.00557	0.00583	0.00500	0.00790	0.00935	0.00000	0.00000	0.00000
BUS A 044-MCC-103	0.415	0.00192	0.00504	0.00540	0.00171	0.00573	0.00598	0.00522	0.00799	0.00955	0.00000	0.00000	0.00000
BUS A 044-MCC-104	0.415	0.00189	0.00492	0.00527	0.00168	0.00553	0.00578	0.00500	0.00790	0.00935	0.00000	0.00000	0.00000
BUS A 044-MCC-105	0.415	0.00195	0.00506	0.00543	0.00172	0.00573	0.00599	0.00522	0.00799	0.00955	0.00000	0.00000	0.00000
BUS A 044-MCC-106	0.415	0.00200	0.00510	0.00548	0.00176	0.00575	0.00602	0.00522	0.00799	0.00955	0.00000	0.00000	0.00000
BUS A 044-MCC-107	0.415	0.00180	0.00465	0.00499	0.00172	0.00491	0.00521	0.00514	0.00697	0.00866	0.00000	0.00000	0.00000
BUS A 044-MLDB-101	0.415	0.02336	0.03668	0.04349	0.02325	0.03692	0.04363	0.02034	0.03051	0.03667	0.00000	0.00000	0.00000
BUS A 044-MLDB-102	0.415	0.14282	0.09379	0.17086	0.14266	0.09389	0.17078	0.45611	0.16806	0.48608	0.00000	0.00000	0.00000
BUS A 044-PMCC-101	0.415	0.00095	0.00455	0.00464	0.00070	0.00510	0.00515	0.00046	0.00603	0.00605	0.00000	0.00000	0.00000
BUS A 044-PMCC-102	0.415	0.00091	0.00464	0.00473	0.00065	0.00526	0.00530	0.00046	0.00603	0.00605	0.00000	0.00000	0.00000
BUS A 044-PMCC-103	0.415	0.00074	0.00422	0.00428	0.00064	0.00443	0.00448	0.00039	0.00501	0.00503	0.00000	0.00000	0.00000
BUS A AU-V REVAMP	6.600	0.03053	0.34528	0.34662	0.03053	0.34532	0.34666	39.87147	0.44594	39.87397	0.00000	0.00000	0.00000
BUS A to VDU UNIT	6.600	0.03127	0.34658	0.34799	0.03126	0.34662	0.34802	39.87202	0.45302	39.87459	0.00000	0.00000	0.00000
BUS B 044-ASB-101	0.415	0.00321	0.00493	0.00589	0.00311	0.00516	0.00603	0.01085	0.00781	0.01337	0.00000	0.00000	0.00000
BUS B 044-ASB-102	0.415	0.00276	0.00497	0.00568	0.00265	0.00519	0.00583	0.00892	0.00781	0.01186	0.00000	0.00000	0.00000
BUS B 044-HT6-101	6.600	0.02158	0.18713	0.18837	0.01901	0.19323	0.19416	29.88876	0.21775	29.88956	0.00000	0.00000	0.00000
BUS B 044-HT33-101	33.000	0.09186	0.56273	0.57017	0.09152	0.56436	0.57173	0.09701	0.66745	0.67447	0.00000	0.00000	0.00000
BUS B 044-MCC-101	0.415	0.00187	0.00490	0.00524	0.00166	0.00552	0.00576	0.00500	0.00790	0.00935	0.00000	0.00000	0.00000
BUS B 044-MCC-102	0.415	0.00195	0.00497	0.00534	0.00174	0.00557	0.00583	0.00500	0.00790	0.00935	0.00000	0.00000	0.00000
BUS B 044-MCC-103	0.415	0.00192	0.00504	0.00540	0.00171	0.00573	0.00598	0.00522	0.00799	0.00955	0.00000	0.00000	0.00000
BUS B 044-MCC-104	0.415	0.00189	0.00492	0.00527	0.00168	0.00553	0.00578	0.00500	0.00790	0.00935	0.00000	0.00000	0.00000
BUS B 044-MCC-105	0.415	0.00195	0.00506	0.00543	0.00172	0.00573	0.00599	0.00522	0.00799	0.00955	0.00000	0.00000	0.00000
BUS B 044-MCC-106	0.415	0.00200	0.00510	0.00548	0.00176	0.00575	0.00602	0.00522	0.00799	0.00955	0.00000	0.00000	0.00000
BUS B 044-MCC-107	0.415	0.00180	0.00465	0.00499	0.00172	0.00491	0.00521	0.00514	0.00697	0.00866	0.00000	0.00000	0.00000
BUS B 044-MLDB-101	0.415	0.02336	0.03668	0.04349	0.02325	0.03692	0.04363	0.02034	0.03051	0.03667	0.00000	0.00000	0.00000
BUS B 044-MLDB-102	0.415	0.14282	0.09379	0.17086	0.14266	0.09389	0.17078	0.45611	0.16806	0.48608	0.00000	0.00000	0.00000
BUS B 044-PMCC-101	0.415	0.00095	0.00455	0.00464	0.00070	0.00510	0.00515	0.00046	0.00603	0.00605	0.00000	0.00000	0.00000
BUS B 044-PMCC-102	0.415	0.00091	0.00464	0.00473	0.00065	0.00526	0.00530	0.00046	0.00603	0.00605	0.00000	0.00000	0.00000
BUS B 044-PMCC-103	0.415	0.00074	0.00422	0.00428	0.00064	0.00443	0.00448	0.00039	0.00501	0.00503	0.00000	0.00000	0.00000
BUS B AU-REVAMP	6.600	0.03053	0.34528	0.34662	0.03053	0.34532	0.34666	39.87147	0.44594	39.87397	0.00000	0.00000	0.00000
BUS B EMLDB-101	0.415	0.04296	0.06435	0.07738	0.04281	0.06445	0.07737	0.03737	0.05606	0.06737	0.00000	0.00000	0.00000
BUS B to VDU UNIT	6.600	0.03127	0.34658	0.34799	0.03126	0.34662	0.34802	39.87202	0.45302	39.87459	0.00000	0.00000	0.00000
BUS Emergency Supply	11.000	0.01423	0.19698	0.19749	0.01423	0.19698	0.19749	0.01422	0.19909	0.19960	0.00000	0.00000	0.00000
BUS Grid Power A	33.000	0.04035	0.52989	0.53142	0.03981	0.53122	0.53271	0.03982	0.55745	0.55888	0.00000	0.00000	0.00000
BUS Grid Power B	33.000	0.03982	0.55745	0.55888	0.03982	0.55745	0.55888	0.03982	0.55745	0.55888	0.00000	0.00000	0.00000
BUS HVAC EPMCC	0.415	0.01338	0.01429	0.01957	0.01322	0.01436	0.01953	0.05810	0.03781	0.06932	0.00000	0.00000	0.00000
Bus Prim TR-101A	33.000	0.09310	0.56351	0.57115	0.09277	0.56515	0.57272	0.09864	0.66995	0.67718	0.00000	0.00000	0.00000

Bus		Positive Seq. Imp. (ohm)			Negative Seq. Imp. (ohm)			Zero Seq. Imp. (ohm)			Fault Zf (ohm)		
ID	kV	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance
Bus Prim TR-101B	33.000	0.09316	0.56356	0.57121	0.09282	0.56519	0.57276	0.09864	0.66995	0.67718	0.00000	0.00000	0.00000
Bus Prim TR-102A	6.600	0.02427	0.19117	0.19270	0.02171	0.19737	0.19856	29.89328	0.22909	29.89416	0.00000	0.00000	0.00000
Bus Prim TR-102B	6.600	0.02443	0.19159	0.19314	0.02186	0.19769	0.19889	29.89328	0.22909	29.89416	0.00000	0.00000	0.00000
Bus Prim TR-103A	6.600	0.02290	0.18911	0.19050	0.02034	0.19527	0.19633	29.89097	0.22329	29.89181	0.00000	0.00000	0.00000
Bus Prim TR-103B	6.600	0.02297	0.18931	0.19070	0.02040	0.19541	0.19647	29.89097	0.22329	29.89181	0.00000	0.00000	0.00000
Bus Prim TR-104A	6.600	0.02202	0.18780	0.18909	0.01946	0.19391	0.19488	29.88950	0.21961	29.89031	0.00000	0.00000	0.00000
Bus Prim TR-104B	6.600	0.02207	0.18789	0.18918	0.01950	0.19399	0.19497	29.88953	0.21969	29.89034	0.00000	0.00000	0.00000
Bus Prim TR-105A	6.600	0.02221	0.18809	0.18939	0.01964	0.19419	0.19518	29.88977	0.22027	29.89058	0.00000	0.00000	0.00000
Bus Prim TR-105B	6.600	0.02221	0.18812	0.18943	0.01964	0.19422	0.19521	29.88977	0.22027	29.89058	0.00000	0.00000	0.00000
Bus Prim TR-105C	6.600	0.02287	0.18914	0.19052	0.02030	0.19524	0.19629	29.89084	0.22296	29.89167	0.00000	0.00000	0.00000
Bus Prim TR-106A	11.000	0.04766	0.24974	0.25425	0.04766	0.24974	0.25425	0.06863	0.33640	0.34333	0.00000	0.00000	0.00000
Bus Prim TR-107A	0.433	0.00277	0.00567	0.00631	0.00267	0.00588	0.00646	0.00876	0.01061	0.01376	0.00000	0.00000	0.00000
Bus Prim TR-107B	0.433	0.00277	0.00567	0.00631	0.00267	0.00588	0.00646	0.00876	0.01061	0.01376	0.00000	0.00000	0.00000
Bus Prim TR-108A	0.415	0.00569	0.00644	0.00859	0.00559	0.00665	0.00869	0.02077	0.01341	0.02473	0.00000	0.00000	0.00000
Bus Prim TR-108B	0.433	0.00609	0.00903	0.01089	0.00592	0.00913	0.01088	0.02109	0.01541	0.02612	0.00000	0.00000	0.00000
Bus Prim TR-109A	33.000	0.15224	0.66456	0.68177	0.15190	0.66618	0.68328	0.29465	0.92575	0.97152	0.00000	0.00000	0.00000
Bus Prim TR-109B	33.000	0.12323	0.61523	0.62745	0.12290	0.61686	0.62898	0.19583	0.79660	0.82032	0.00000	0.00000	0.00000
Bus Prim TR-114A	33.000	0.12221	0.59774	0.61011	0.12187	0.59937	0.61164	0.14689	0.75889	0.77298	0.00000	0.00000	0.00000
Bus Prim TR-114B	33.000	0.12323	0.61523	0.62745	0.12290	0.61686	0.62898	0.14689	0.80080	0.81417	0.00000	0.00000	0.00000
Bus Sec TR-106A	6.900	0.10612	0.97198	0.97776	0.10612	0.97198	0.97776	39.95155	1.00608	39.96421	0.00000	0.00000	0.00000
Bus to CB-101A	6.600	0.03644	1.10851	1.10911	0.03387	1.11461	1.11512	29.90363	1.13913	29.92531	0.00000	0.00000	0.00000
Bus to CB-101B	6.600	0.03644	1.10851	1.10911	0.03387	1.11461	1.11512	29.90363	1.13913	29.92531	0.00000	0.00000	0.00000
Bus to Charger-DCDB101B	0.415	0.01075	0.00902	0.01403	0.01058	0.00912	0.01397	0.04042	0.01541	0.04325	0.00000	0.00000	0.00000
Bus to Charger-DCDB102	0.433	0.01486	0.00891	0.01732	0.01469	0.00901	0.01723	0.05559	0.01541	0.05768	0.00000	0.00000	0.00000
Bus to ext. 1	33.000	0.09186	0.56273	0.57017	0.09152	0.56436	0.57173	0.09701	0.66745	0.67447	0.00000	0.00000	0.00000
Bus to ext. 2	33.000	0.09186	0.56273	0.57017	0.09152	0.56436	0.57173	0.09701	0.66745	0.67447	0.00000	0.00000	0.00000
BUS to HVAC-1	0.433	0.00187	0.00484	0.00519	0.00176	0.00505	0.00535	0.00560	0.00781	0.00961	0.00000	0.00000	0.00000
BUS to HVAC-2	0.433	0.00187	0.00484	0.00519	0.00176	0.00505	0.00535	0.00560	0.00781	0.00961	0.00000	0.00000	0.00000
Bus to TR101A	33.000	0.09186	0.56273	0.57017	0.09152	0.56436	0.57173	0.09701	0.66745	0.67447	0.00000	0.00000	0.00000
Bus to TR101B	33.000	0.09186	0.56273	0.57017	0.09152	0.56436	0.57173	0.09701	0.66745	0.67447	0.00000	0.00000	0.00000
Bus VFD-ACM 201 A1	0.415	0.31869	0.46085	0.56031	0.52310	0.93565	1.07195	3.82733	0.00000	3.82733	0.00000	0.00000	0.00000
Bus VFD-ACM 202 A1	0.415	2.69999	0.67283	2.78256	3.27748	0.73371	3.35861	3.82733	0.00000	3.82733	0.00000	0.00000	0.00000
Bus VFD-ACM B1	0.415	0.31869	0.46085	0.56031	0.52310	0.93565	1.07195	3.82733	0.00000	3.82733	0.00000	0.00000	0.00000
Bus VFD-ACM C1	0.415	0.31869	0.46085	0.56031	0.52310	0.93565	1.07195	3.82733	0.00000	3.82733	0.00000	0.00000	0.00000
Bus VFD-ACM D1	0.415	0.30449	0.46127	0.55271	0.51041	0.93986	1.06951	3.82733	0.00000	3.82733	0.00000	0.00000	0.00000
Bus VFD-ACM D2	0.415	0.30649	0.46121	0.55376	0.51219	0.93927	1.06984	3.82733	0.00000	3.82733	0.00000	0.00000	0.00000
Bus VFD-ACM E1	0.415	0.30449	0.46127	0.55271	0.51041	0.93986	1.06951	3.82733	0.00000	3.82733	0.00000	0.00000	0.00000

Bus		Positive Seq. Imp. (ohm)			Negative Seq. Imp. (ohm)			Zero Seq. Imp. (ohm)			Fault Zf (ohm)		
ID	kV	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance
Bus VFD-ACM F1	0.415	0.30876	0.46114	0.55497	0.51423	0.93859	1.07023	3.82733	0.00000	3.82733	0.00000	0.00000	0.00000
Bus VFD-ACM G1	0.415	0.30876	0.46114	0.55497	0.51423	0.93859	1.07023	3.82733	0.00000	3.82733	0.00000	0.00000	0.00000
Bus VFD-ACM H1	0.415	0.31444	0.46098	0.55801	0.51930	0.93691	1.07120	3.82733	0.00000	3.82733	0.00000	0.00000	0.00000
Bus VFD-ACM J1	0.415	0.31643	0.46092	0.55908	0.52108	0.93632	1.07155	3.82733	0.00000	3.82733	0.00000	0.00000	0.00000
Bus VFD-ACM K1	0.415	0.30967	0.48051	0.57165	0.47669	1.00026	1.10804	5.13254	0.00000	5.13254	0.00000	0.00000	0.00000
Bus VFD-ACM L1	0.415	0.32010	0.46081	0.56108	0.52437	0.93523	1.07220	3.82733	0.00000	3.82733	0.00000	0.00000	0.00000
Bus VFD-ACM M1	0.415	0.33986	0.45614	0.56883	0.54094	0.92569	1.07216	3.82733	0.00000	3.82733	0.00000	0.00000	0.00000
Bus VFD-ACM N1	0.415	0.34553	0.45561	0.57182	0.54592	0.92370	1.07296	3.82733	0.00000	3.82733	0.00000	0.00000	0.00000
Bus VFD-ACM P1	0.415	0.34553	0.45561	0.57182	0.54592	0.92370	1.07296	3.82733	0.00000	3.82733	0.00000	0.00000	0.00000
Bus VFD-ACM Q1	0.415	0.35118	0.45509	0.57484	0.55089	0.92171	1.07379	3.82733	0.00000	3.82733	0.00000	0.00000	0.00000
Bus VFD-ACM R1	0.415	0.35118	0.45509	0.57484	0.55089	0.92171	1.07379	3.82733	0.00000	3.82733	0.00000	0.00000	0.00000

Short-Circuit Summary Report

3-Phase, LG, LL, LLG Fault Currents

Bus		3-Phase Fault			Line-to-Ground Fault				Line-to-Line Fault				*Line-to-Line-to-Ground			
ID	kV	I"k	ip	Ik	I"k	ip	Ib	Ik	I"k	ip	Ib	Ik	I"k	ip	Ib	Ik
Bus 2 UPS101A	0.110	0.827	1.192	0.827	0.827	1.192	0.827	0.827	0.716	1.033	0.716	0.716	0.827	1.192	0.827	0.827
Bus 2 UPS101C	0.110	0.827	1.192	0.827	0.827	1.192	0.827	0.827	0.716	1.033	0.716	0.716	0.827	1.192	0.827	0.827
Bus 2 UPS102A	0.110	0.827	1.192	0.827	0.827	1.192	0.827	0.827	0.716	1.033	0.716	0.716	0.827	1.192	0.827	0.827
Bus 2 UPS102C	0.110	0.827	1.192	0.827	0.827	1.192	0.827	0.827	0.716	1.033	0.716	0.716	0.827	1.192	0.827	0.827
Bus 3 UPS101A	0.191	0.132	0.197	0.132	0.141	0.211	0.141	0.141	0.114	0.171	0.114	0.114	0.145	0.218	0.145	0.145
Bus 3 UPS101C	0.191	0.132	0.197	0.132	0.141	0.211	0.141	0.141	0.114	0.171	0.114	0.114	0.145	0.218	0.145	0.145
Bus 3 UPS102A	0.191	0.132	0.197	0.132	0.141	0.211	0.141	0.141	0.114	0.171	0.114	0.114	0.145	0.218	0.145	0.145
Bus 3 UPS102C	0.191	0.132	0.197	0.132	0.141	0.211	0.141	0.141	0.114	0.171	0.114	0.114	0.145	0.218	0.145	0.145
Bus 4 UPS101A	0.433	6.824	10.000	6.682	3.719	5.450	3.719	3.719	5.921	8.676	5.921	5.921	6.252	9.161	6.252	6.252
Bus 4 UPS101C	0.433	6.824	10.000	6.682	3.719	5.450	3.719	3.719	5.921	8.676	5.921	5.921	6.252	9.161	6.252	6.252
Bus 4 UPS102A	0.433	4.190	6.045	4.180	1.024	1.477	1.024	1.024	3.635	5.244	3.635	3.635	3.707	5.348	3.707	3.707
Bus 4 UPS102C	0.433	4.190	6.045	4.180	1.024	1.477	1.024	1.024	3.635	5.244	3.635	3.635	3.707	5.348	3.707	3.707
Bus 5 UPS101A	0.191	7.632	11.563	7.512	9.301	14.091	9.301	9.301	6.614	10.021	6.614	6.614	9.284	14.065	9.284	9.284
Bus 5 UPS101C	0.191	7.632	11.563	7.512	9.301	14.091	9.301	9.301	6.614	10.021	6.614	6.614	9.284	14.065	9.284	9.284
Bus 5 UPS102A	0.191	9.495	13.698	9.472	14.263	20.577	14.263	14.263	8.237	11.883	8.237	8.237	16.439	23.716	16.439	16.439
Bus 5 UPS102C	0.191	4.635	6.841	4.602	5.454	8.050	5.454	5.454	4.016	5.927	4.016	4.016	5.586	8.244	5.586	5.586
BUS 044-ELDB-101	0.415	0.724	1.045	0.724	0.626	0.903	0.626	0.626	0.627	0.905	0.627	0.627	0.699	1.009	0.699	0.699
BUS 044-ELDB-102	0.415	0.269	0.388	0.269	0.227	0.328	0.227	0.227	0.233	0.336	0.233	0.233	0.254	0.367	0.254	0.254
BUS 044-ELDB-103	0.415	0.416	0.601	0.417	0.354	0.511	0.354	0.354	0.361	0.520	0.361	0.361	0.397	0.572	0.397	0.397
BUS 044-ELDB-104	0.415	0.292	0.421	0.292	0.247	0.356	0.247	0.247	0.253	0.365	0.253	0.253	0.276	0.399	0.276	0.276
BUS 044-ELDB-105	0.415	0.371	0.535	0.371	0.315	0.455	0.315	0.315	0.322	0.464	0.322	0.322	0.353	0.509	0.353	0.353
BUS 044-ELDB-106	0.415	0.510	0.735	0.510	0.435	0.628	0.435	0.435	0.441	0.637	0.441	0.441	0.487	0.703	0.487	0.487
BUS 044-ELDB-107	0.415	0.095	0.138	0.095	0.080	0.115	0.080	0.080	0.083	0.119	0.083	0.083	0.090	0.129	0.090	0.090
BUS 044-ELDB-108	0.415	0.165	0.237	0.165	0.139	0.200	0.139	0.139	0.143	0.206	0.143	0.143	0.155	0.224	0.155	0.155
BUS 044-ELDB-109	0.415	0.319	0.460	0.319	0.270	0.390	0.270	0.270	0.276	0.399	0.276	0.276	0.303	0.437	0.303	0.303
BUS 044-ELDB-110	0.415	0.217	0.313	0.217	0.183	0.264	0.183	0.183	0.188	0.271	0.188	0.188	0.205	0.296	0.205	0.205
BUS 044-ELDB-111	0.415	0.107	0.155	0.107	0.090	0.130	0.090	0.090	0.093	0.134	0.093	0.093	0.101	0.146	0.101	0.101
BUS 044-ELDB-112	0.415	0.217	0.313	0.217	0.183	0.264	0.183	0.183	0.188	0.271	0.188	0.188	0.205	0.296	0.205	0.205
BUS 044-ELDB-113	0.415	0.217	0.313	0.217	0.183	0.264	0.183	0.183	0.188	0.271	0.188	0.188	0.205	0.296	0.205	0.205
BUS 044-ELDB-114	0.415	0.165	0.237	0.165	0.139	0.200	0.139	0.139	0.143	0.206	0.143	0.143	0.155	0.224	0.155	0.155
BUS 044-ELDB-115	0.415	0.111	0.160	0.111	0.093	0.134	0.093	0.093	0.096	0.139	0.096	0.096	0.104	0.150	0.104	0.104
BUS 044-EPMCC-101	0.415	27.817	65.378	22.752	29.948	70.387	29.948	29.948	23.979	56.357	23.979	23.979	29.545	69.438	29.545	29.545
BUS 044-HT6-102	6.900	5.093	12.181	4.476	0.326	0.781	0.326	0.326	4.410	10.547	4.410	4.410	4.491	10.740	4.491	4.491
BUS 044-HT11-101	11.000	27.924	62.150	27.201	24.907	55.434	24.907	24.907	24.182	53.820	24.182	24.182	26.754	59.547	26.754	26.754
BUS 044-LDB-106	0.415	0.322	0.465	0.322	0.249	0.359	0.249	0.249	0.279	0.403	0.279	0.279	0.297	0.429	0.297	0.297
BUS 044-LDB-107	0.415	0.558	0.804	0.558	0.409	0.590	0.409	0.409	0.483	0.697	0.483	0.483	0.513	0.741	0.513	0.513
BUS 044-LDB-108	0.415	0.558	0.804	0.558	0.409	0.590	0.409	0.409	0.483	0.697	0.483	0.483	0.513	0.741	0.513	0.513

3-Phase, LG, LL, LLG Fault Currents

Bus		3-Phase Fault			Line-to-Ground Fault				Line-to-Line Fault				*Line-to-Line-to-Ground			
ID	kV	I"k	ip	Ik	I"k	ip	Ib	Ik	I"k	ip	Ib	Ik	I"k	ip	Ib	Ik
BUS 044-LDB-116	0.415	0.242	0.349	0.242	0.191	0.275	0.191	0.191	0.210	0.303	0.210	0.210	0.224	0.323	0.224	0.224
BUS 044-LDB-117	0.415	0.242	0.349	0.242	0.191	0.275	0.191	0.191	0.210	0.303	0.210	0.210	0.224	0.323	0.224	0.224
BUS A 044-EMLDB-101	0.415	3.155	5.181	3.100	3.328	5.464	3.328	3.328	2.733	4.488	2.733	2.733	3.260	5.354	3.260	3.260
BUS A 044-MLDB-102	0.415	1.456	2.124	1.450	0.914	1.333	0.914	0.914	1.261	1.840	1.261	1.261	1.367	1.994	1.367	1.367
BUS B 044-MLDB-102	0.415	1.456	2.124	1.450	0.914	1.333	0.914	0.914	1.261	1.840	1.261	1.261	1.367	1.994	1.367	1.367
BUS B EMLDB-101	0.415	3.155	5.181	3.100	3.328	5.464	3.328	3.328	2.733	4.488	2.733	2.733	3.260	5.354	3.260	3.260
BUS Emergency Supply	11.000	35.709	91.192	35.000	35.470	90.580	35.470	35.470	30.925	78.974	30.925	30.925	35.620	90.964	35.620	35.620
BUS Grid Power A	33.000	37.500	96.041	37.500	37.500	96.041	37.500	37.500	32.476	83.174	32.476	32.476	37.500	96.041	37.500	37.500
BUS Grid Power B	33.000	37.500	96.041	37.500	37.500	96.041	37.500	37.500	32.476	83.174	32.476	32.476	37.500	96.041	37.500	37.500
BUS HVAC EPMCC	0.415	11.855	18.684	10.371	6.829	10.762	6.829	6.829	10.287	16.213	10.287	10.287	11.135	17.549	11.135	11.135
Bus Prim TR-105C	6.600	4.867	11.634	4.277	0.312	0.746	0.312	0.312	4.214	10.074	4.214	4.214	4.292	10.259	4.292	4.292
Bus Prim TR-106A	11.000	27.825	61.833	27.104	24.788	55.085	24.788	24.788	24.096	53.546	24.096	24.096	26.647	59.216	26.647	26.647
Bus Prim TR-108B	0.433	20.282	34.792	18.035	15.476	26.548	15.476	15.476	17.579	30.155	17.579	17.579	20.438	35.060	20.438	20.438
Bus Sec TR-106A	6.900	5.093	12.181	4.476	0.326	0.781	0.326	0.326	4.410	10.547	4.410	4.410	4.491	10.740	4.491	4.491
Bus to Charger-DCDB101B	0.415	15.883	24.201	14.774	10.306	15.704	10.306	10.306	13.797	21.023	13.797	13.797	15.504	23.625	15.504	15.504
Bus to Charger-DCDB102	0.433	13.866	20.377	13.251	8.380	12.315	8.380	8.380	12.053	17.712	12.053	12.053	13.249	19.469	13.249	13.249

All fault currents are in rms kA. Current ip is calculated using Method C.

* LLG fault current is the larger of the two faulted line currents.

Sequence Impedance Summary Report

Bus		Positive Seq. Imp. (ohm)			Negative Seq. Imp. (ohm)			Zero Seq. Imp. (ohm)			Fault Zf (ohm)		
ID	kV	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance
Bus 2 UPS101A	0.110	0.08067	0.00000	0.08067	0.08067	0.00000	0.08067	0.08067	0.00000	0.08067	0.00000	0.00000	0.00000
Bus 2 UPS101C	0.110	0.08067	0.00000	0.08067	0.08067	0.00000	0.08067	0.08067	0.00000	0.08067	0.00000	0.00000	0.00000
Bus 2 UPS102A	0.110	0.08067	0.00000	0.08067	0.08067	0.00000	0.08067	0.08067	0.00000	0.08067	0.00000	0.00000	0.00000
Bus 2 UPS102C	0.110	0.08067	0.00000	0.08067	0.08067	0.00000	0.08067	0.08067	0.00000	0.08067	0.00000	0.00000	0.00000
Bus 3 UPS101A	0.191	0.64293	0.59958	0.87912	0.64293	0.59958	0.87912	0.39972	0.59958	0.72060	0.00000	0.00000	0.00000
Bus 3 UPS101C	0.191	0.64293	0.59958	0.87912	0.64293	0.59958	0.87912	0.39972	0.59958	0.72060	0.00000	0.00000	0.00000
Bus 3 UPS102A	0.191	0.64293	0.59958	0.87912	0.64293	0.59958	0.87912	0.39972	0.59958	0.72060	0.00000	0.00000	0.00000
Bus 3 UPS102C	0.191	0.64293	0.59958	0.87912	0.64293	0.59958	0.87912	0.39972	0.59958	0.72060	0.00000	0.00000	0.00000
Bus 4 UPS101A	0.433	0.03141	0.02220	0.03847	0.03114	0.02234	0.03833	0.12304	0.05741	0.13577	0.00000	0.00000	0.00000
Bus 4 UPS101C	0.433	0.03141	0.02220	0.03847	0.03114	0.02234	0.03833	0.12304	0.05741	0.13577	0.00000	0.00000	0.00000
Bus 4 UPS102A	0.433	0.05968	0.01906	0.06265	0.05941	0.01920	0.06243	0.64426	0.05741	0.64682	0.00000	0.00000	0.00000
Bus 4 UPS102C	0.433	0.05968	0.01906	0.06265	0.05941	0.01920	0.06243	0.64426	0.05741	0.64682	0.00000	0.00000	0.00000
Bus 5 UPS101A	0.191	0.01073	0.01072	0.01517	0.01067	0.01075	0.01515	0.00396	0.00594	0.00714	0.00000	0.00000	0.00000
Bus 5 UPS101C	0.191	0.01073	0.01072	0.01517	0.01067	0.01075	0.01515	0.00396	0.00594	0.00714	0.00000	0.00000	0.00000
Bus 5 UPS102A	0.191	0.01162	0.00372	0.01219	0.01156	0.00374	0.01215	0.00000	0.00001	0.00001	0.00000	0.00000	0.00000
Bus 5 UPS102C	0.191	0.01953	0.01558	0.02498	0.01948	0.01561	0.02496	0.00792	0.01187	0.01427	0.00000	0.00000	0.00000
BUS 044-ELDB-101	0.415	0.34013	0.07072	0.34740	0.33987	0.07085	0.34718	0.50794	0.06606	0.51222	0.00000	0.00000	0.00000
BUS 044-ELDB-102	0.415	0.93292	0.07880	0.93624	0.93266	0.07893	0.93600	1.44908	0.08606	1.45164	0.00000	0.00000	0.00000
BUS 044-ELDB-103	0.415	0.59947	0.07425	0.60406	0.59922	0.07438	0.60382	0.91969	0.07481	0.92273	0.00000	0.00000	0.00000
BUS 044-ELDB-104	0.415	0.85882	0.07779	0.86234	0.85856	0.07792	0.86209	1.33144	0.08356	1.33406	0.00000	0.00000	0.00000
BUS 044-ELDB-105	0.415	0.67357	0.07526	0.67776	0.67332	0.07539	0.67752	1.03733	0.07731	1.04021	0.00000	0.00000	0.00000
BUS 044-ELDB-106	0.415	0.48833	0.07274	0.49371	0.48807	0.07287	0.49348	0.74323	0.07106	0.74662	0.00000	0.00000	0.00000
BUS 044-ELDB-107	0.415	2.63720	0.10203	2.63917	2.63694	0.10216	2.63892	4.15486	0.14356	4.15734	0.00000	0.00000	0.00000
BUS 044-ELDB-108	0.415	1.52571	0.08688	1.52818	1.52546	0.08701	1.52794	2.39022	0.10606	2.39257	0.00000	0.00000	0.00000
BUS 044-ELDB-109	0.415	0.78472	0.07678	0.78847	0.78447	0.07691	0.78823	1.21380	0.08106	1.21650	0.00000	0.00000	0.00000
BUS 044-ELDB-110	0.415	1.15522	0.08183	1.15811	1.15496	0.08196	1.15787	1.80201	0.09356	1.80444	0.00000	0.00000	0.00000
BUS 044-ELDB-111	0.415	2.34080	0.09799	2.34285	2.34055	0.09812	2.34260	3.68429	0.13356	3.68671	0.00000	0.00000	0.00000
BUS 044-ELDB-112	0.415	1.15522	0.08183	1.15811	1.15496	0.08196	1.15787	1.80201	0.09356	1.80444	0.00000	0.00000	0.00000
BUS 044-ELDB-113	0.415	1.15522	0.08183	1.15811	1.15496	0.08196	1.15787	1.80201	0.09356	1.80444	0.00000	0.00000	0.00000
BUS 044-ELDB-114	0.415	1.52571	0.08688	1.52818	1.52546	0.08701	1.52794	2.39022	0.10606	2.39257	0.00000	0.00000	0.00000
BUS 044-ELDB-115	0.415	2.26670	0.09698	2.26878	2.26645	0.09711	2.26853	3.56665	0.13106	3.56905	0.00000	0.00000	0.00000
BUS 044-EPMCC-101	0.415	0.00170	0.00888	0.00904	0.00143	0.00902	0.00913	0.00070	0.00701	0.00704	0.00000	0.00000	0.00000
BUS 044-HT6-102	6.900	0.12046	0.85195	0.86043	0.11318	0.85319	0.86067	39.95155	1.00608	39.96421	0.00000	0.00000	0.00000
BUS 044-HT11-101	11.000	0.04701	0.24572	0.25018	0.04683	0.24578	0.25020	0.06779	0.33429	0.34109	0.00000	0.00000	0.00000

Bus		Positive Seq. Imp. (ohm)			Negative Seq. Imp. (ohm)			Zero Seq. Imp. (ohm)			Fault Zf (ohm)		
ID	kV	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance	Resistance	Reactance	Impedance
BUS 044-LDB-106	0.415	0.77343	0.10470	0.78048	0.77317	0.10483	0.78024	1.45607	0.18931	1.46832	0.00000	0.00000	0.00000
BUS 044-LDB-107	0.415	0.43998	0.10016	0.45124	0.43972	0.10029	0.45101	0.92668	0.17806	0.94363	0.00000	0.00000	0.00000
BUS 044-LDB-108	0.415	0.43998	0.10016	0.45124	0.43972	0.10029	0.45101	0.92668	0.17806	0.94363	0.00000	0.00000	0.00000
BUS 044-LDB-116	0.415	1.03277	0.10824	1.03843	1.03252	0.10837	1.03819	1.86782	0.19806	1.87829	0.00000	0.00000	0.00000
BUS 044-LDB-117	0.415	1.03277	0.10824	1.03843	1.03252	0.10837	1.03819	1.86782	0.19806	1.87829	0.00000	0.00000	0.00000
BUS A 044-EMLDB-101	0.415	0.04373	0.06668	0.07974	0.04347	0.06681	0.07971	0.03737	0.05606	0.06737	0.00000	0.00000	0.00000
BUS A 044-MLDB-102	0.415	0.14358	0.09612	0.17278	0.14333	0.09625	0.17264	0.45611	0.16806	0.48608	0.00000	0.00000	0.00000
BUS B 044-MLDB-102	0.415	0.14358	0.09612	0.17278	0.14333	0.09625	0.17264	0.45611	0.16806	0.48608	0.00000	0.00000	0.00000
BUS B EMLDB-101	0.415	0.04373	0.06668	0.07974	0.04347	0.06681	0.07971	0.03737	0.05606	0.06737	0.00000	0.00000	0.00000
BUS Emergency Supply	11.000	0.01461	0.19509	0.19563	0.01449	0.19510	0.19564	0.01422	0.19909	0.19960	0.00000	0.00000	0.00000
BUS Grid Power A	33.000	0.03982	0.55745	0.55888	0.03982	0.55745	0.55888	0.03982	0.55745	0.55888	0.00000	0.00000	0.00000
BUS Grid Power B	33.000	0.03982	0.55745	0.55888	0.03982	0.55745	0.55888	0.03982	0.55745	0.55888	0.00000	0.00000	0.00000
BUS HVAC EPMCC	0.415	0.01373	0.01618	0.02122	0.01348	0.01628	0.02114	0.05810	0.03781	0.06932	0.00000	0.00000	0.00000
Bus Prim TR-105C	6.600	0.12097	0.85266	0.86120	0.11367	0.85392	0.86145	39.95238	1.00818	39.96510	0.00000	0.00000	0.00000
Bus Prim TR-106A	11.000	0.04753	0.24653	0.25107	0.04734	0.24659	0.25110	0.06863	0.33640	0.34333	0.00000	0.00000	0.00000
Bus Prim TR-108B	0.433	0.00665	0.01110	0.01294	0.00638	0.01124	0.01292	0.02109	0.01541	0.02612	0.00000	0.00000	0.00000
Bus Sec TR-106A	6.900	0.12046	0.85195	0.86043	0.11318	0.85319	0.86067	39.95155	1.00608	39.96421	0.00000	0.00000	0.00000
Bus to Charger-DCDB101B	0.415	0.01131	0.01109	0.01584	0.01104	0.01122	0.01575	0.04042	0.01541	0.04325	0.00000	0.00000	0.00000
Bus to Charger-DCDB102	0.433	0.01542	0.01098	0.01893	0.01515	0.01112	0.01879	0.05559	0.01541	0.05768	0.00000	0.00000	0.00000

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System Harmonics Bus Information

Bus		Voltage Distortion								
ID	kV	Fund. %	RMS %	ASUM %	THD %	TIF	TIHD %	TSHD %	THDG %	THDS %
BUS 1 to AU-V REVAMP UNIT	33.000	99.92	99.92	99.94	0.01	0.47	0.00	0.00	0.01	0.01
BUS 1 to VDU UNIT	33.000	99.91	99.91	99.94	0.01	0.54	0.00	0.00	0.01	0.01
Bus 1 UPS101A	0.433	94.24	94.24	94.71	0.17	3.88	0.00	0.00	0.16	0.16
Bus 1 UPS101C	0.433	99.30	99.30	99.64	0.11	2.24	0.00	0.00	0.11	0.11
Bus 1 UPS102A	0.433	93.30	93.30	93.91	0.23	4.19	0.00	0.00	0.23	0.23
Bus 1 UPS102C	0.433	98.43	98.43	98.93	0.19	2.83	0.00	0.00	0.19	0.19
Bus 2 HT33	33.000	99.92	99.92	99.94	0.01	0.47	0.00	0.00	0.01	0.01
BUS 2 to AU-V REVAMP UNIT	33.000	99.91	99.91	99.94	0.01	0.54	0.00	0.00	0.01	0.01
BUS 2 to VDU UNIT	33.000	99.92	99.92	99.94	0.01	0.47	0.00	0.00	0.01	0.01
Bus 2 UPS101A	0.110	100.00	100.01	102.25	1.00	19.46	0.00	0.00	1.01	1.01
Bus 2 UPS101C	0.110	100.00	100.01	102.25	1.00	19.46	0.00	0.00	1.01	1.01
Bus 2 UPS102A	0.110	100.00	100.01	102.25	1.00	19.46	0.00	0.00	1.01	1.01
Bus 2 UPS102C	0.110	100.00	100.01	102.25	1.00	19.46	0.00	0.00	1.01	1.01
Bus 3 UPS101A	0.191	86.39	86.39	86.57	0.12	1.30	0.00	0.00	0.12	0.12
Bus 3 UPS101C	0.191	86.39	86.39	86.57	0.12	1.30	0.00	0.00	0.12	0.12
Bus 3 UPS102A	0.191	86.39	86.39	86.57	0.12	1.30	0.00	0.00	0.12	0.12
Bus 3 UPS102C	0.191	86.39	86.39	86.57	0.12	1.30	0.00	0.00	0.12	0.12
Bus 4 UPS101A	0.433	99.68	99.68	100.73	0.40	8.85	0.00	0.00	0.40	0.40
Bus 4 UPS101C	0.433	99.68	99.68	100.73	0.40	8.85	0.00	0.00	0.40	0.40
Bus 4 UPS102A	0.433	99.68	99.68	100.73	0.40	8.85	0.00	0.00	0.40	0.40
Bus 4 UPS102C	0.433	99.68	99.68	100.73	0.40	8.85	0.00	0.00	0.40	0.40
Bus 5 UPS101A	0.191	104.93	104.93	106.02	0.40	8.85	0.00	0.00	0.40	0.40
Bus 5 UPS101C	0.191	104.93	104.93	106.02	0.40	8.85	0.00	0.00	0.40	0.40
Bus 5 UPS102A	0.191	99.68	99.68	100.71	0.40	8.85	0.00	0.00	0.40	0.40
Bus 5 UPS102C	0.191	99.68	99.68	100.71	0.40	8.85	0.00	0.00	0.40	0.40
BUS 044-ELDB-101	0.415	101.78	101.78	101.96	0.07	1.23	0.00	0.00	0.07	0.07
BUS 044-ELDB-102	0.415	100.93	100.93	101.11	0.07	1.23	0.00	0.00	0.07	0.07
BUS 044-ELDB-103	0.415	101.41	101.41	101.59	0.07	1.23	0.00	0.00	0.07	0.07
BUS 044-ELDB-104	0.415	99.90	99.90	100.08	0.07	1.23	0.00	0.00	0.07	0.07
BUS 044-ELDB-105	0.415	101.30	101.30	101.48	0.07	1.23	0.00	0.00	0.07	0.07
BUS 044-ELDB-106	0.415	101.56	101.56	101.74	0.07	1.23	0.00	0.00	0.07	0.07
BUS 044-ELDB-107	0.415	98.59	98.59	98.76	0.07	1.22	0.00	0.00	0.07	0.07
BUS 044-ELDB-108	0.415	100.11	100.11	100.28	0.07	1.23	0.00	0.00	0.07	0.07
BUS 044-ELDB-109	0.415	101.14	101.14	101.32	0.07	1.23	0.00	0.00	0.07	0.07

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Bus		Voltage Distortion								
ID	kV	Fund. %	RMS %	ASUM %	THD %	TIF	TIHD %	TSHD %	THDG %	THDS %
BUS 044-ELDB-110	0.415	100.62	100.62	100.80	0.07	1.23	0.00	0.00	0.07	0.07
BUS 044-ELDB-111	0.415	98.99	98.99	99.17	0.07	1.22	0.00	0.00	0.07	0.07
BUS 044-ELDB-112	0.415	100.62	100.62	100.80	0.07	1.23	0.00	0.00	0.07	0.07
BUS 044-ELDB-113	0.415	100.62	100.62	100.80	0.07	1.23	0.00	0.00	0.07	0.07
BUS 044-ELDB-114	0.415	100.11	100.11	100.28	0.07	1.23	0.00	0.00	0.07	0.07
BUS 044-ELDB-115	0.415	99.09	99.09	99.27	0.07	1.22	0.00	0.00	0.07	0.07
BUS 044-EPMCC-101	0.415	104.00	104.01	105.10	0.40	8.85	0.00	0.00	0.40	0.40
BUS 044-HT6-102	6.900	99.36	99.36	99.74	0.13	3.76	0.00	0.00	0.14	0.14
BUS 044-HT11-101	11.000	99.93	99.93	99.93	0	0.42	0.00	0.00	0.00	0.00
BUS 044-LDB-101	0.415	104.40	104.40	104.60	0.07	1.37	0.00	0.00	0.08	0.08
BUS 044-LDB-102	0.415	103.05	103.05	103.24	0.07	1.36	0.00	0.00	0.08	0.08
BUS 044-LDB-103	0.415	102.44	102.44	102.76	0.13	2.70	0.00	0.00	0.13	0.13
BUS 044-LDB-104	0.415	103.23	103.23	103.55	0.12	2.70	0.00	0.00	0.13	0.13
BUS 044-LDB-105	0.415	104.19	104.19	104.39	0.08	1.36	0.00	0.00	0.08	0.08
BUS 044-LDB-106	0.415	102.94	102.94	103.13	0.07	1.36	0.00	0.00	0.08	0.08
BUS 044-LDB-107	0.415	100.64	100.64	100.81	0.08	1.23	0.00	0.00	0.07	0.07
BUS 044-LDB-108	0.415	103.23	103.23	103.43	0.08	1.36	0.00	0.00	0.08	0.08
BUS 044-LDB-109	0.415	103.33	103.33	103.65	0.13	2.70	0.00	0.00	0.13	0.13
BUS 044-LDB-110	0.415	102.51	102.51	102.83	0.13	2.70	0.00	0.00	0.13	0.13
BUS 044-LDB-111	0.415	102.43	102.43	102.74	0.12	2.70	0.00	0.00	0.13	0.13
BUS 044-LDB-112	0.415	102.51	102.51	102.83	0.13	2.70	0.00	0.00	0.13	0.13
BUS 044-LDB-113	0.415	101.05	101.05	101.36	0.13	2.69	0.00	0.00	0.13	0.13
BUS 044-LDB-114	0.415	101.75	101.75	101.94	0.07	1.36	0.00	0.00	0.08	0.08
BUS 044-LDB-115	0.415	103.41	103.41	103.73	0.13	2.71	0.00	0.00	0.13	0.13
BUS 044-LDB-116	0.415	102.89	102.89	103.09	0.07	1.36	0.00	0.00	0.08	0.08
BUS 044-LDB-117	0.415	100.30	100.30	100.48	0.07	1.23	0.00	0.00	0.07	0.07
BUS 044-PDB-101	0.415	104.14	104.14	104.46	0.13	2.71	0.00	0.00	0.13	0.13
BUS 044-PDB-102	0.415	103.75	103.76	103.95	0.08	1.36	0.00	0.00	0.08	0.08
BUS 044-PDB-103	0.415	103.18	103.18	103.50	0.12	2.70	0.00	0.00	0.13	0.13
BUS 044-PDB-104	0.415	102.90	102.90	103.10	0.07	1.36	0.00	0.00	0.08	0.08
BUS 044-PDB-105	0.415	101.90	101.90	102.09	0.07	1.36	0.00	0.00	0.08	0.08
BUS A 044-ASB-101	0.415	98.55	98.55	98.95	0.15	3.75	0.00	0.00	0.15	0.15
BUS A 044-ASB-102	0.415	98.61	98.61	99.02	0.15	3.75	0.00	0.00	0.15	0.15
BUS A 044-EMLDB-101	0.415	102.20	102.20	102.38	0.07	1.23	0.00	0.00	0.07	0.07
BUS A 044-HT6-101	6.600	103.88	103.88	104.28	0.13	3.76	0.00	0.00	0.14	0.14
BUS A 044-HT33-101	33.000	99.91	99.91	99.94	0.01	0.54	0.00	0.00	0.01	0.01
BUS A 044-MCC-101	0.415	103.46	103.47	106.06	0.95	22.36	0.00	0.00	0.95	0.95

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BUS A 044-MCC-102	0.415	103.40	103.40	106.19	1.02	23.62	0.00	0.00	1.02	1.02
BUS A 044-MCC-103	0.415	103.57	103.57	105.83	0.84	17.25	0.00	0.00	0.84	0.84
BUS A 044-MCC-104	0.415	103.43	103.43	106.05	0.95	22.79	0.00	0.00	0.95	0.95
BUS A 044-MCC-105	0.415	103.69	103.69	105.78	0.78	16.11	0.00	0.00	0.78	0.78
BUS A 044-MCC-106	0.415	103.62	103.62	105.71	0.78	16.10	0.00	0.00	0.78	0.78
BUS A 044-MCC-107	0.415	98.55	98.55	98.95	0.15	3.74	0.00	0.00	0.15	0.15
BUS A 044-MLDB-101	0.415	105.01	105.01	105.34	0.13	2.72	0.00	0.00	0.13	0.13
BUS A 044-MLDB-102	0.415	104.31	104.31	104.51	0.08	1.36	0.00	0.00	0.08	0.08
BUS A 044-PMCC-101	0.415	103.64	103.64	106.25	0.95	22.40	0.00	0.00	0.95	0.95
BUS A 044-PMCC-102	0.415	103.84	103.84	105.93	0.78	16.11	0.00	0.00	0.78	0.78
BUS A 044-PMCC-103	0.415	98.70	98.70	99.11	0.15	3.75	0.00	0.00	0.15	0.15
BUS A AU-V REVAMP	6.600	101.72	101.72	101.75	0	0.48	0.00	0.00	0.01	0.01
BUS A to VDU UNIT	6.600	101.64	101.64	101.66	0.02	0.44	0.00	0.00	0.01	0.01
BUS B 044-ASB-101	0.415	103.89	103.89	104.17	0.08	1.97	0.00	0.00	0.09	0.09
BUS B 044-ASB-102	0.415	103.87	103.87	104.14	0.08	1.97	0.00	0.00	0.09	0.09
BUS B 044-HT6-101	6.600	104.34	104.34	104.65	0.11	2.55	0.00	0.00	0.11	0.11
BUS B 044-HT33-101	33.000	99.92	99.92	99.94	0.01	0.47	0.00	0.00	0.01	0.01
BUS B 044-MCC-101	0.415	103.79	103.79	105.76	0.73	14.86	0.00	0.00	0.73	0.73
BUS B 044-MCC-102	0.415	103.74	103.75	105.87	0.79	15.96	0.00	0.00	0.79	0.79
BUS B 044-MCC-103	0.415	103.89	103.90	105.56	0.62	12.39	0.00	0.00	0.62	0.62
BUS B 044-MCC-104	0.415	103.78	103.78	105.75	0.73	14.88	0.00	0.00	0.73	0.73
BUS B 044-MCC-105	0.415	104.02	104.02	105.55	0.57	11.54	0.00	0.00	0.57	0.57
BUS B 044-MCC-106	0.415	104.06	104.06	105.59	0.57	11.52	0.00	0.00	0.57	0.57
BUS B 044-MCC-107	0.415	103.83	103.83	104.11	0.09	1.97	0.00	0.00	0.09	0.09
BUS B 044-MLDB-101	0.415	105.06	105.06	105.26	0.08	1.37	0.00	0.00	0.08	0.08
BUS B 044-MLDB-102	0.415	101.69	101.69	101.87	0.07	1.23	0.00	0.00	0.07	0.07
BUS B 044-PMCC-101	0.415	103.99	104.00	105.96	0.73	14.89	0.00	0.00	0.73	0.73
BUS B 044-PMCC-102	0.415	104.16	104.16	105.70	0.57	11.54	0.00	0.00	0.57	0.57
BUS B 044-PMCC-103	0.415	103.96	103.96	104.23	0.08	1.98	0.00	0.00	0.09	0.09
BUS B AU-REVAMP	6.600	101.73	101.73	101.75	0.01	0.44	0.00	0.00	0.01	0.01
BUS B EMLDB-101	0.415	102.20	102.20	102.38	0.07	1.23	0.00	0.00	0.07	0.07
BUS B to VDU UNIT	6.600	97.27	97.27	97.30	0	0.48	0.00	0.00	0.01	0.01
BUS Emergency Supply	11.000	100.00	100.00	100.00	0	0.42	0.00	0.00	0.00	0.00
BUS Grid Power A	33.000	100.00	100.00	100.03	0	0.53	0.00	0.00	0.01	0.01
BUS Grid Power B	33.000	100.00	100.00	100.02	0	0.46	0.00	0.00	0.01	0.01
BUS HVAC EPMCC	0.415	102.33	102.33	103.39	0.40	8.75	0.00	0.00	0.40	0.40
Bus Prim TR-101A	33.000	99.90	99.90	99.94	0	0.54	0.00	0.00	0.01	0.01

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Bus Prim TR-101B	33.000	99.91	99.91	99.94	0.01	0.47	0.00	0.00	0.01	0.01
Bus Prim TR-102A	6.600	103.87	103.87	104.27	0.14	3.81	0.00	0.00	0.14	0.14
Bus Prim TR-102B	6.600	104.33	104.33	104.64	0.11	2.58	0.00	0.00	0.11	0.11
Bus Prim TR-103A	6.600	103.87	103.87	104.27	0.13	3.78	0.00	0.00	0.14	0.14
Bus Prim TR-103B	6.600	104.34	104.34	104.65	0.11	2.56	0.00	0.00	0.11	0.11
Bus Prim TR-104A	6.600	103.88	103.88	104.27	0.13	3.76	0.00	0.00	0.14	0.14
Bus Prim TR-104B	6.600	104.34	104.34	104.65	0.11	2.55	0.00	0.00	0.11	0.11
Bus Prim TR-105A	6.600	103.88	103.88	104.28	0.13	3.77	0.00	0.00	0.14	0.14
Bus Prim TR-105B	6.600	104.34	104.34	104.65	0.11	2.55	0.00	0.00	0.11	0.11
Bus Prim TR-105C	6.600	103.88	103.88	104.28	0.13	3.76	0.00	0.00	0.14	0.14
Bus Prim TR-106A	11.000	99.93	99.93	99.93	0	0.42	0.00	0.00	0.00	0.00
Bus Prim TR-107A	0.433	94.53	94.53	94.92	0.15	3.75	0.00	0.00	0.15	0.15
Bus Prim TR-107B	0.433	99.56	99.56	99.82	0.09	1.97	0.00	0.00	0.09	0.09
Bus Prim TR-108A	0.415	103.82	103.82	104.09	0.09	1.98	0.00	0.00	0.09	0.09
Bus Prim TR-108B	0.433	99.68	99.68	100.73	0.40	8.85	0.00	0.00	0.40	0.40
Bus Prim TR-109A	33.000	99.87	99.87	99.90	0	0.47	0.00	0.00	0.01	0.01
Bus Prim TR-109B	33.000	99.89	99.89	99.92	0.01	0.54	0.00	0.00	0.01	0.01
Bus Prim TR-114A	33.000	99.89	99.89	99.92	0.01	0.54	0.00	0.00	0.01	0.01
Bus Prim TR-114B	33.000	99.90	99.90	99.92	0	0.47	0.00	0.00	0.01	0.01
Bus Sec TR-106A	6.900	99.93	99.93	99.93	0	0.42	0.00	0.00	0.00	0.00
Bus to CB-101A	6.600	110.06	110.06	110.31	0.18	0.54	0.00	0.00	0.18	0.18
Bus to CB-101B	6.600	110.55	110.55	110.77	0.16	0.50	0.00	0.00	0.16	0.16
Bus to Charger-DCDB101A	0.415	98.49	98.49	98.99	0.18	4.45	0.00	0.00	0.18	0.18
Bus to Charger-DCDB101B	0.415	103.86	103.86	105.06	0.44	9.56	0.00	0.00	0.44	0.44
Bus to Charger-DCDB102	0.433	99.25	99.25	100.56	0.50	10.54	0.00	0.00	0.50	0.50
Bus to ext. 1	33.000	99.91	99.91	99.94	0.01	0.54	0.00	0.00	0.01	0.01
Bus to ext. 2	33.000	99.92	99.92	99.94	0.01	0.47	0.00	0.00	0.01	0.01
BUS to HVAC-1	0.433	94.13	94.13	94.51	0.15	3.74	0.00	0.00	0.15	0.15
BUS to HVAC-2	0.433	99.18	99.18	99.44	0.08	1.97	0.00	0.00	0.09	0.09
Bus to TR101A	33.000	99.91	99.91	99.94	0.01	0.54	0.00	0.00	0.01	0.01
Bus to TR101B	33.000	99.92	99.92	99.94	0.01	0.47	0.00	0.00	0.01	0.01
Cab to VFD-ACM L1~	0.453	95.24	95.24	96.77	0.62	12.44	0.00	0.00	0.62	0.62
Cab to VFD-ACM P1~	0.453	95.24	95.24	96.77	0.62	12.44	0.00	0.00	0.62	0.62
Cab to VFD-ACM R1~	0.453	95.24	95.24	96.77	0.62	12.44	0.00	0.00	0.62	0.62
Cab VFD-ACM 201 A1~	0.453	94.78	94.79	97.35	1.02	23.61	0.00	0.00	1.02	1.02
Cab VFD-ACM 202 A1~	0.453	94.81	94.82	97.22	0.95	22.84	0.00	0.00	0.95	0.95
Cab VFD-ACM B1~	0.453	94.78	94.79	97.35	1.03	23.67	0.00	0.00	1.03	1.03

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Cab VFD-ACM C1~	0.453	95.10	95.10	97.05	0.80	16.01	0.00	0.00	0.80	0.80
Cab VFD-ACM D1~	0.453	94.78	94.79	97.35	1.03	23.67	0.00	0.00	1.03	1.03
Cab VFD-ACM D2~	0.453	94.78	94.79	97.35	1.03	23.67	0.00	0.00	1.03	1.03
Cab VFD-ACM E1~	0.453	95.10	95.10	97.05	0.80	16.01	0.00	0.00	0.80	0.80
Cab VFD-ACM F1~	0.453	94.78	94.79	97.35	1.03	23.67	0.00	0.00	1.03	1.03
Cab VFD-ACM G1~	0.453	95.10	95.10	97.05	0.80	16.01	0.00	0.00	0.80	0.80
Cab VFD-ACM H1~	0.453	94.78	94.79	97.35	1.03	23.67	0.00	0.00	1.03	1.03
Cab VFD-ACM J1~	0.453	95.10	95.10	97.05	0.80	16.01	0.00	0.00	0.80	0.80
Cab VFD-ACM K1~	0.453	94.94	94.94	97.02	0.84	17.29	0.00	0.00	0.84	0.84
Cab VFD-ACM M1~	0.453	94.94	94.94	97.02	0.85	17.30	0.00	0.00	0.84	0.84
Cab VFD-ACM N1~	0.453	94.94	94.94	97.02	0.85	17.30	0.00	0.00	0.84	0.84
Cab VFD-ACM Q1~	0.453	94.94	94.94	97.02	0.85	17.30	0.00	0.00	0.84	0.84

* Indicates THD (Total Harmonic Distortion) Exceeds the Limit.
Indicates IHD (Individual Harmonic Distortion) Exceeds the Limit.

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System Harmonics Branch Information

Bus		Current Distortion											
From Bus ID	To Bus ID	Fund. Amp	RMS Amp	ASUM Amp	THD %	TIF	IT Amp	ITB Amp	ITR Amp	TIHD %	TSHD %	THDG %	THDS %
BUS 1 to AU-V REVAMP UNIT	Bus Prim TR-114B	58.84	58.84	58.85	0.01	0.52	30.35	30.35	0.00	0.00	0.00	0.01	0.01
	BUS B 044-HT33-101	58.84	58.84	58.85	0.01	0.52	30.35	30.35	0.00	0.00	0.00	0.01	0.01
BUS 1 to VDU UNIT	Bus Prim TR-109B	63.17	63.17	63.19	0.01	0.61	38.84	38.84	0.00	0.00	0.00	0.01	0.01
	BUS A 044-HT33-101	63.17	63.17	63.19	0.01	0.61	38.84	38.84	0.00	0.00	0.00	0.01	0.01
Bus 1 UPS101A	BUS A 044-PMCC-103	31.64	31.65	33.20	2.71	18.71	592.30	231.01	545.39	0.00	0.00	2.71	2.71
Bus 1 UPS101C	BUS B 044-PMCC-103	30.03	30.04	31.52	2.72	18.66	560.60	223.70	514.04	0.00	0.00	2.72	2.72
Bus 1 UPS102A	BUS A 044-PMCC-103	33.74	33.75	35.41	2.66	18.93	638.79	292.94	567.66	0.00	0.00	2.66	2.66
Bus 1 UPS102C	BUS B 044-PMCC-103	30.30	30.31	31.77	2.65	18.29	554.43	223.47	507.40	0.00	0.00	2.65	2.65
Bus 2 HT33	BUS Grid Power B	205.61	205.61	206.53	0.23	2.08	426.90	426.90	0.00	0.00	0.00	0.23	0.23
	BUS B 044-HT33-101	205.61	205.61	206.53	0.23	2.08	426.90	426.90	0.00	0.00	0.00	0.23	0.23
BUS 2 to AU-V REVAMP UNIT	Bus Prim TR-114A	55.24	55.24	55.27	0.02	0.98	54.35	54.35	0.00	0.00	0.00	0.02	0.02
	BUS A 044-HT33-101	55.24	55.24	55.27	0.02	0.98	54.35	54.35	0.00	0.00	0.00	0.02	0.02
BUS 2 to VDU UNIT	Bus Prim TR-109A	64.92	64.92	64.93	0.01	0.52	33.54	33.54	0.00	0.00	0.00	0.01	0.01
	BUS B 044-HT33-101	64.92	64.92	64.93	0.01	0.52	33.54	33.54	0.00	0.00	0.00	0.01	0.01
Bus 2 UPS101A	Bus 3 UPS101A	56.68	56.68	56.79	0.12	1.33	75.43	75.43	0.00	0.00	0.00	0.12	0.12
Bus 2 UPS101C	Bus 3 UPS101C	56.68	56.68	56.79	0.12	1.33	75.43	75.43	0.00	0.00	0.00	0.12	0.12
Bus 2 UPS102A	Bus 3 UPS102A	56.68	56.68	56.79	0.12	1.33	75.43	75.43	0.00	0.00	0.00	0.12	0.12
Bus 2 UPS102C	Bus 3 UPS102C	56.68	56.68	56.79	0.12	1.33	75.43	75.43	0.00	0.00	0.00	0.12	0.12
Bus 3 UPS101A	Bus 2 UPS101A	32.64	32.64	32.71	0.12	1.33	43.44	43.44	0.00	0.00	0.00	0.12	0.12
Bus 3 UPS101C	Bus 2 UPS101C	32.64	32.64	32.71	0.12	1.33	43.44	43.44	0.00	0.00	0.00	0.12	0.12
Bus 3 UPS102A	Bus 2 UPS102A	32.64	32.64	32.71	0.12	1.33	43.44	43.44	0.00	0.00	0.00	0.12	0.12
Bus 3 UPS102C	Bus 2 UPS102C	32.64	32.64	32.71	0.12	1.33	43.44	43.44	0.00	0.00	0.00	0.12	0.12
Bus 4 UPS101A	BUS 044-EPMCC-101	0	0	0	0	0	0.00	43.44	0.00	0.00	0.00	0.00	0.00
	Bus 5 UPS101A	0	0.10	0.17	999.99	505.13	52.91	52.91	0.00	0.00	0.00	999.99	999.99
Bus 4 UPS101C	BUS 044-EPMCC-101	0	0	0	0	0	0.00	52.91	0.00	0.00	0.00	0.00	0.00
	Bus 5 UPS101C	0	0.10	0.17	999.99	505.13	52.91	52.91	0.00	0.00	0.00	999.99	999.99
Bus 4 UPS102A	BUS 044-EPMCC-101	0	0	0	0	0	0.00	52.91	0.00	0.00	0.00	0.00	0.00
	Bus 5 UPS102A	0	0	0	0	0	0.00	52.91	0.00	0.00	0.00	0.00	0.00
Bus 4 UPS102C	BUS 044-EPMCC-101	0	0	0	0	0	0.00	52.91	0.00	0.00	0.00	0.00	0.00
	Bus 5 UPS102C	0	0	0	0	0	0.00	52.91	0.00	0.00	0.00	0.00	0.00
Bus 5 UPS101A	Bus 4 UPS101A	0	0.24	0.38	999.99	505.13	119.94	119.94	0.00	0.00	0.00	999.99	999.99
Bus 5 UPS101C	Bus 4 UPS101C	0	0.24	0.38	999.99	505.13	119.94	119.94	0.00	0.00	0.00	999.99	999.99
Bus 5 UPS102A	Bus 4 UPS102A	0	0	0	0	0	0.00	119.94	0.00	0.00	0.00	0.00	0.00
Bus 5 UPS102C	Bus 4 UPS102C	0	0	0	0	0	0.00	119.94	0.00	0.00	0.00	0.00	0.00
BUS 044-ELDB-101	BUS B EMLDB-101	2.83	2.83	2.84	0.07	1.26	3.57	3.57	0.00	0.00	0.00	0.07	0.07
BUS 044-ELDB-102	BUS B EMLDB-101	2.81	2.81	2.81	0.07	1.26	3.54	3.54	0.00	0.00	0.00	0.07	0.07
BUS 044-ELDB-103	BUS A 044-EMLDB-101	2.82	2.82	2.83	0.07	1.26	3.56	3.56	0.00	0.00	0.00	0.07	0.07
BUS 044-ELDB-104	BUS A 044-EMLDB-101	5.56	5.56	5.57	0.07	1.26	6.99	6.99	0.00	0.00	0.00	0.07	0.07
BUS 044-ELDB-105	BUS B EMLDB-101	2.82	2.82	2.82	0.07	1.26	3.55	3.55	0.00	0.00	0.00	0.07	0.07

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BUS 044-ELDB-106	BUS A 044-EMLDB-101	2.83	2.83	2.83	0.07	1.26	3.56	3.56	0.00	0.00	0.00	0.07	0.07
BUS 044-ELDB-107	BUS A 044-EMLDB-101	2.74	2.74	2.75	0.07	1.25	3.44	3.44	0.00	0.00	0.00	0.07	0.07
BUS 044-ELDB-108	BUS B EMLDB-101	2.79	2.79	2.79	0.07	1.26	3.50	3.50	0.00	0.00	0.00	0.07	0.07
BUS 044-ELDB-109	BUS A 044-EMLDB-101	2.81	2.81	2.82	0.07	1.26	3.55	3.55	0.00	0.00	0.00	0.07	0.07
BUS 044-ELDB-110	BUS B EMLDB-101	2.80	2.80	2.80	0.07	1.26	3.52	3.52	0.00	0.00	0.00	0.07	0.07
BUS 044-ELDB-111	BUS A 044-EMLDB-101	2.75	2.75	2.76	0.07	1.25	3.46	3.46	0.00	0.00	0.00	0.07	0.07
BUS 044-ELDB-112	BUS B EMLDB-101	2.80	2.80	2.80	0.07	1.26	3.52	3.52	0.00	0.00	0.00	0.07	0.07
BUS 044-ELDB-113	BUS A 044-EMLDB-101	2.80	2.80	2.80	0.07	1.26	3.52	3.52	0.00	0.00	0.00	0.07	0.07
BUS 044-ELDB-114	BUS B EMLDB-101	2.79	2.79	2.79	0.07	1.26	3.50	3.50	0.00	0.00	0.00	0.07	0.07
BUS 044-ELDB-115	BUS A 044-EMLDB-101	2.76	2.76	2.76	0.07	1.26	3.46	3.46	0.00	0.00	0.00	0.07	0.07
BUS 044-EPGCC-101	Bus 4 UPS102A	0	0	0	0	0	0.00	3.46	0.00	0.00	0.00	0.00	0.00
	Bus 4 UPS101A	0	0	0	0	0	0.00	3.46	0.00	0.00	0.00	0.00	0.00
	Bus 4 UPS101C	0	0	0	0	0	0.00	3.46	0.00	0.00	0.00	0.00	0.00
	Bus to Charger-DCDB101 B	30.14	31.06	43.54	24.86	160.60	4987.59	4987.22	60.88	0.00	0.00	24.86	24.86
	Bus Prim TR-108B	0	0	0	0	0	0.00	4987.22	60.88	0.00	0.00	0.00	0.00
	Bus to Charger-DCDB102	67.17	69.25	97.32	25.09	162.22	11234.56	11233.72	137.30	0.00	0.00	25.09	25.09
	BUS HVAC EPGCC	213.54	213.54	215.62	0.38	8.18	1746.41	1746.35	14.10	0.00	0.00	0.38	0.38
	Bus 4 UPS102C	0	0	0	0	0	0.00	1746.35	14.10	0.00	0.00	0.00	0.00
BUS 044-HT6-102	Bus Prim TR-105A	1043.94	1044.17	1081.71	2.09	12.41	12956.71	12955.31	190.71	0.00	0.00	2.09	2.09
	BUS A 044-HT6-101	56.84	56.84	57.02	0.15	1.76	99.99	99.99	0.00	0.00	0.00	0.15	0.15
	Bus Prim TR-105C	0	0	0	0	0	0.00	99.99	0.00	0.00	0.00	0.00	0.00
BUS 044-HT11-101	BUS Emergency Supply	65.63	65.63	65.63	0	0.50	32.82	32.82	0.00	0.00	0.00	0.00	0.00
	Bus Prim TR-106A	0	0	0	0	0	0.00	32.82	0.00	0.00	0.00	0.00	0.00
BUS 044-LDB-101	BUS B 044-MLDB-101	4.36	4.36	4.37	0.08	1.39	6.07	6.07	0.00	0.00	0.00	0.08	0.08
BUS 044-LDB-102	BUS B 044-MLDB-101	7.17	7.17	7.18	0.08	1.39	9.96	9.96	0.00	0.00	0.00	0.08	0.08
BUS 044-LDB-103	BUS A 044-MLDB-101	4.28	4.28	4.29	0.13	2.71	11.60	11.60	0.00	0.00	0.00	0.13	0.13
BUS 044-LDB-104	BUS A 044-MLDB-101	4.31	4.31	4.32	0.13	2.72	11.71	11.71	0.00	0.00	0.00	0.13	0.13
BUS 044-LDB-105	BUS B 044-MLDB-101	4.35	4.35	4.36	0.08	1.39	6.05	6.05	0.00	0.00	0.00	0.08	0.08
BUS 044-LDB-106	BUS A 044-MLDB-102	4.30	4.30	4.30	0.08	1.39	5.96	5.96	0.00	0.00	0.00	0.08	0.08
BUS 044-LDB-107	BUS B 044-MLDB-102	7.00	7.00	7.01	0.07	1.26	8.81	8.81	0.00	0.00	0.00	0.07	0.07
BUS 044-LDB-108	BUS A 044-MLDB-102	7.18	7.18	7.19	0.08	1.39	9.98	9.98	0.00	0.00	0.00	0.08	0.08
BUS 044-LDB-109	BUS A 044-MLDB-101	7.19	7.19	7.21	0.13	2.72	19.54	19.54	0.00	0.00	0.00	0.13	0.13
BUS 044-LDB-110	BUS A 044-MLDB-101	7.13	7.13	7.15	0.13	2.71	19.35	19.35	0.00	0.00	0.00	0.13	0.13
BUS 044-LDB-111	BUS A 044-MLDB-101	7.13	7.13	7.15	0.13	2.71	19.33	19.33	0.00	0.00	0.00	0.13	0.13
BUS 044-LDB-112	BUS A 044-MLDB-101	7.13	7.13	7.15	0.13	2.71	19.35	19.35	0.00	0.00	0.00	0.13	0.13
BUS 044-LDB-113	BUS A 044-MLDB-101	7.03	7.03	7.05	0.13	2.70	19.01	19.01	0.00	0.00	0.00	0.13	0.13
BUS 044-LDB-114	BUS B 044-MLDB-101	7.08	7.08	7.09	0.08	1.39	9.81	9.81	0.00	0.00	0.00	0.08	0.08
BUS 044-LDB-115	BUS A 044-MLDB-101	5.75	5.75	5.77	0.13	2.72	15.65	15.65	0.00	0.00	0.00	0.13	0.13
BUS 044-LDB-116	BUS A 044-MLDB-102	3.15	3.15	3.16	0.08	1.39	4.37	4.37	0.00	0.00	0.00	0.08	0.08
BUS 044-LDB-117	BUS B 044-MLDB-102	3.07	3.07	3.08	0.07	1.26	3.86	3.86	0.00	0.00	0.00	0.07	0.07
BUS 044-PDB-101	BUS A 044-MLDB-101	5.80	5.80	5.81	0.13	2.72	15.78	15.78	0.00	0.00	0.00	0.13	0.13
BUS 044-PDB-102	BUS B 044-MLDB-101	5.77	5.77	5.78	0.08	1.39	8.03	8.03	0.00	0.00	0.00	0.08	0.08

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BUS 044-PDB-103	BUS A 044-MLDB-101	5.74	5.74	5.76	0.13	2.72	15.61	15.61	0.00	0.00	0.00	0.13	0.13
BUS 044-PDB-104	BUS B 044-MLDB-101	5.73	5.73	5.74	0.08	1.39	7.95	7.95	0.00	0.00	0.00	0.08	0.08
BUS 044-PDB-105	BUS B 044-MLDB-101	28.35	28.35	28.41	0.08	1.39	39.29	39.29	0.00	0.00	0.00	0.08	0.08
BUS A 044-ASB-101	BUS A 044-PMCC-103	119.44	119.44	119.83	0.12	2.97	354.39	353.59	23.87	0.00	0.00	0.12	0.12
BUS A 044-ASB-102	BUS A 044-PMCC-103	86.77	86.77	87.12	0.15	3.75	325.17	324.39	22.39	0.00	0.00	0.15	0.15
BUS A 044-EMLDB-101	BUS 044-ELDB-103	2.82	2.82	2.83	0.07	1.26	3.56	3.56	0.00	0.00	0.00	0.07	0.07
	BUS 044-ELDB-104	5.56	5.56	5.57	0.07	1.26	6.99	6.99	0.00	0.00	0.00	0.07	0.07
	BUS 044-ELDB-106	2.83	2.83	2.83	0.07	1.26	3.56	3.56	0.00	0.00	0.00	0.07	0.07
	BUS 044-ELDB-107	2.74	2.74	2.75	0.07	1.25	3.44	3.44	0.00	0.00	0.00	0.07	0.07
	BUS 044-ELDB-109	2.81	2.81	2.82	0.07	1.26	3.55	3.55	0.00	0.00	0.00	0.07	0.07
	BUS 044-ELDB-111	2.75	2.75	2.76	0.07	1.25	3.46	3.46	0.00	0.00	0.00	0.07	0.07
	BUS 044-ELDB-113	2.80	2.80	2.80	0.07	1.26	3.52	3.52	0.00	0.00	0.00	0.07	0.07
	BUS 044-ELDB-115	2.76	2.76	2.76	0.07	1.26	3.46	3.46	0.00	0.00	0.00	0.07	0.07
	Bus Prim TR-108A	54.77	54.77	54.87	0.07	1.25	68.35	68.35	0.00	0.00	0.00	0.07	0.07
	BUS B EMLDB-101	29.70	29.70	29.79	0.14	1.67	49.60	49.60	0.00	0.00	0.00	0.14	0.14
BUS A 044-HT6-101	BUS 044-HT6-102	56.84	56.84	57.02	0.15	1.76	99.99	99.99	0.00	0.00	0.00	0.15	0.15
	Bus Prim TR-103A	106.13	106.16	110.71	2.48	15.99	1697.36	1697.36	0.00	0.00	0.00	2.48	2.48
	Bus Prim TR-104A	120.96	120.96	121.69	0.38	2.22	268.03	268.03	0.00	0.00	0.00	0.38	0.38
	Bus Prim TR-105A	66.82	66.83	69.19	2.09	12.45	831.91	831.91	0.00	0.00	0.00	2.09	2.09
	Bus Prim TR-102A	114.98	115.03	120.75	2.90	19.65	2260.28	2260.28	0.00	0.00	0.00	2.90	2.90
	Bus Prim TR-101A	562.53	562.54	567.79	0.45	5.01	2820.03	2820.03	0.00	0.00	0.00	0.45	0.45
BUS A 044-HT33-101	Bus to CB-101A	231.07	231.08	234.23	0.93	3.88	897.16	897.16	0.00	0.00	0.00	0.93	0.93
	BUS Grid Power A	230.12	230.12	231.25	0.23	2.80	644.82	644.82	0.00	0.00	0.00	0.23	0.23
	Bus to ext. 1	0	0	0	0	0	0.00	644.82	0.00	0.00	0.00	0.00	0.00
	BUS 2 to AU-V REVAMP UNIT	55.24	55.24	55.27	0.02	0.98	54.35	54.35	0.00	0.00	0.00	0.02	0.02
	BUS 1 to VDU UNIT	63.17	63.17	63.19	0.01	0.61	38.84	38.84	0.00	0.00	0.00	0.01	0.01
	Bus to TR101A	117.62	117.62	118.72	0.45	5.01	589.64	589.64	0.00	0.00	0.00	0.45	0.45
BUS A 044-MCC-101	BUS A 044-PMCC-101	292.93	292.94	298.39	1.04	7.88	2309.56	2309.56	0.00	0.00	0.00	1.04	1.04
BUS A 044-MCC-102	Cab VFD-ACM 201 A1~	51.24	51.51	64.73	10.25	166.04	8552.99	8542.78	417.93	0.00	0.00	10.25	10.25
	Cab VFD-ACM B1~	51.24	52.82	74.16	25.01	161.68	8540.21	8539.57	104.94	0.00	0.00	25.01	25.01
	Cab VFD-ACM D1~	50.96	52.53	73.75	25.00	161.68	8493.03	8492.39	104.36	0.00	0.00	25.00	25.00
	Cab VFD-ACM D2~	51.00	52.57	73.81	25.00	161.68	8499.60	8498.95	104.44	0.00	0.00	25.00	25.00
	Cab VFD-ACM F1~	51.05	52.62	73.87	25.00	161.68	8507.10	8506.46	104.53	0.00	0.00	25.00	25.00
	Cab VFD-ACM H1~	51.16	52.73	74.04	25.01	161.68	8525.97	8525.32	104.76	0.00	0.00	25.01	25.01
	BUS A 044-PMCC-101	412.03	417.05	523.42	15.65	92.76	38683.55	38680.85	456.77	0.00	0.00	15.65	15.65
	BUS A 044-PMCC-102	424.92	427.92	515.34	11.90	78.66	33658.36	33655.71	421.64	0.00	0.00	11.90	11.90
BUS A 044-MCC-103	Cab VFD-ACM K1~	51.14	52.73	74.08	25.09	162.19	8551.48	8550.84	104.66	0.00	0.00	25.09	25.09
	Cab VFD-ACM M1~	51.61	53.21	74.73	25.04	161.92	8615.39	8614.75	105.41	0.00	0.00	25.04	25.04
	Cab VFD-ACM N1~	51.73	53.33	74.90	25.04	161.92	8635.71	8635.07	105.66	0.00	0.00	25.04	25.04
	Cab VFD-ACM Q1~	51.86	53.46	75.08	25.05	161.93	8656.20	8655.55	105.91	0.00	0.00	25.05	25.05
	BUS A 044-MCC-104	16.99	17.17	24.38	14.73	554.07	9513.41	9513.41	8.40	0.00	0.00	14.73	14.73
BUS A 044-MCC-104	BUS A 044-PMCC-101	349.23	349.23	353.81	0.44	23.71	8279.69	8279.68	8.40	0.00	0.00	0.44	0.44

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BUS A 044-MCC-105	BUS A 044-PMCC-102	235.41	235.41	237.39	0.47	3.45	811.33	811.33	0.00	0.00	0.00	0.47	0.47
BUS A 044-MCC-106	BUS A 044-PMCC-102	342.68	342.68	346.34	0.47	7.00	2399.44	2399.35	20.93	0.00	0.00	0.47	0.47
BUS A 044-MCC-107	BUS A 044-PMCC-103	251.16	251.16	251.70	0.11	1.39	348.83	348.83	0.00	0.00	0.00	0.11	0.11
BUS A 044-MLDB-101	BUS 044-LDB-103	4.28	4.28	4.29	0.13	2.71	11.60	11.60	0.00	0.00	0.00	0.13	0.13
	BUS 044-LDB-104	4.31	4.31	4.32	0.13	2.72	11.71	11.71	0.00	0.00	0.00	0.13	0.13
	BUS 044-LDB-109	7.19	7.19	7.21	0.13	2.72	19.54	19.54	0.00	0.00	0.00	0.13	0.13
	BUS 044-LDB-110	7.13	7.13	7.15	0.13	2.71	19.35	19.35	0.00	0.00	0.00	0.13	0.13
	BUS 044-LDB-111	7.13	7.13	7.15	0.13	2.71	19.33	19.33	0.00	0.00	0.00	0.13	0.13
	BUS 044-LDB-112	7.13	7.13	7.15	0.13	2.71	19.35	19.35	0.00	0.00	0.00	0.13	0.13
	BUS 044-LDB-113	7.03	7.03	7.05	0.13	2.70	19.01	19.01	0.00	0.00	0.00	0.13	0.13
	BUS 044-LDB-115	5.75	5.75	5.77	0.13	2.72	15.65	15.65	0.00	0.00	0.00	0.13	0.13
	BUS 044-PDB-101	5.80	5.80	5.81	0.13	2.72	15.78	15.78	0.00	0.00	0.00	0.13	0.13
	BUS 044-PDB-103	5.74	5.74	5.76	0.13	2.72	15.61	15.61	0.00	0.00	0.00	0.13	0.13
	Bus Prim TR-107A	61.48	61.48	61.68	0.14	2.75	168.90	168.90	0.00	0.00	0.00	0.14	0.14
	BUS A 044-MLDB-102	3.15	3.15	3.16	0.08	1.39	4.37	4.37	0.00	0.00	0.00	0.08	0.08
BUS A 044-MLDB-102	BUS 044-LDB-116	4.30	4.30	4.30	0.08	1.39	5.96	5.96	0.00	0.00	0.00	0.08	0.08
	BUS 044-LDB-108	7.18	7.18	7.19	0.08	1.39	9.98	9.98	0.00	0.00	0.00	0.08	0.08
	BUS B 044-MLDB-101	14.63	14.63	14.65	0.08	1.39	20.31	20.31	0.00	0.00	0.00	0.08	0.08
	BUS A 044-MCC-101	292.93	292.94	298.39	1.04	7.88	2309.56	2309.56	0.00	0.00	0.00	1.04	1.04
BUS A 044-PMCC-101	BUS A 044-MCC-102	412.03	417.05	523.42	15.65	92.76	38683.55	38680.85	456.77	0.00	0.00	15.65	15.65
	BUS A 044-MCC-104	349.23	349.23	353.81	0.44	23.71	8279.69	8279.68	8.40	0.00	0.00	0.44	0.44
	Bus Prim TR-102A	1796.44	1797.19	1889.15	2.89	19.57	35167.40	35164.37	461.79	0.00	0.00	2.89	2.89
	BUS A 044-PMCC-102	424.92	427.92	515.34	11.90	78.66	33658.36	33655.71	421.64	0.00	0.00	11.90	11.90
BUS A 044-PMCC-102	BUS A 044-MCC-103	235.41	235.41	237.39	0.47	3.45	811.33	811.33	0.00	0.00	0.00	0.47	0.47
	BUS A 044-MCC-105	342.68	342.68	346.34	0.47	7.00	2399.44	2399.35	20.93	0.00	0.00	0.47	0.47
	BUS A 044-MCC-106	342.68	342.68	346.34	0.47	7.00	2399.44	2399.35	20.93	0.00	0.00	0.47	0.47
	Bus Prim TR-103A	1658.08	1658.59	1731.16	2.48	15.92	26410.75	26407.40	420.71	0.00	0.00	2.48	2.48
BUS A 044-PMCC-103	BUS A 044-ASB-101	119.44	119.44	119.83	0.12	2.97	354.39	353.59	23.87	0.00	0.00	0.12	0.12
	BUS A 044-ASB-102	86.77	86.77	87.12	0.15	3.75	325.17	324.39	22.39	0.00	0.00	0.15	0.15
	BUS A 044-MCC-107	251.16	251.16	251.70	0.11	1.39	348.83	348.83	0.00	0.00	0.00	0.11	0.11
	Bus 1 UPS101A	31.64	31.65	33.20	2.71	18.71	592.30	231.01	545.39	0.00	0.00	2.71	2.71
BUS A 044-PMCC-103	Bus 1 UPS102A	33.74	33.75	35.41	2.66	18.93	638.79	292.94	567.66	0.00	0.00	2.66	2.66
	BUS to HVAC-1	692.12	692.12	694.30	0.12	2.91	2015.94	2011.41	134.95	0.00	0.00	0.12	0.12
	BUS to Charger-DCDB101 A	31.78	32.77	46.05	25.11	162.07	5310.84	5310.46	63.30	0.00	0.00	25.11	25.11
	Bus Prim TR-107A	65.79	65.79	65.99	0.13	2.72	178.64	178.64	0.00	0.00	0.00	0.13	0.13
BUS A AU-V REVAMP	Bus Prim TR-104A	1971.81	1971.83	1985.68	0.38	2.22	4373.17	4320.92	673.98	0.00	0.00	0.38	0.38
	Bus Prim TR-114A	281.43	281.43	281.49	0.01	0.54	151.73	151.73	0.00	0.00	0.00	0.01	0.01
	BUS A to VDU UNIT	315.32	315.32	315.38	0.01	0.52	162.57	162.57	0.00	0.00	0.00	0.01	0.01
	BUS B 044-ASB-101	47.73	47.73	47.85	0.09	1.75	83.74	82.50	14.34	0.00	0.00	0.09	0.09
BUS B 044-ASB-102	BUS B 044-PMCC-103	86.86	86.86	87.09	0.09	1.99	172.93	170.15	30.89	0.00	0.00	0.09	0.09

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BUS B 044-HT6-101	Bus Prim TR-103B	110.95	110.97	114.25	1.71	11.10	1231.29	1231.29	0.00	0.00	0.00	1.71	1.71
	Bus Prim TR-104B	111.77	111.77	111.96	0.08	1.12	125.44	125.44	0.00	0.00	0.00	0.08	0.08
	Bus Prim TR-105B	0	0	0	0	0	0.00	125.44	0.00	0.00	0.00	0.00	0.00
	Bus Prim TR-102B	113.50	113.53	117.93	2.23	14.69	1667.25	1667.25	0.00	0.00	0.00	2.23	2.23
	Bus Prim TR-101B	439.47	439.48	443.88	0.51	4.55	1999.02	1999.02	0.00	0.00	0.00	0.51	0.51
BUS B 044-HT33-101	Bus to CB-101B	232.10	232.11	234.84	0.83	2.82	655.00	655.00	0.00	0.00	0.00	0.83	0.83
	Bus to TR101B	91.89	91.89	92.81	0.51	4.55	417.98	417.98	0.00	0.00	0.00	0.51	0.51
	BUS 1 to AU-V REVAMP UNIT	58.84	58.84	58.85	0.01	0.52	30.35	30.35	0.00	0.00	0.00	0.01	0.01
	Bus to ext. 2	0	0	0	0	0	0.00	30.35	0.00	0.00	0.00	0.00	0.00
	BUS 2 to VDU UNIT	64.92	64.92	64.93	0.01	0.52	33.54	33.54	0.00	0.00	0.00	0.01	0.01
BUS B 044-MCC-101	Bus 2 HT33	205.61	205.61	206.53	0.23	2.08	426.90	426.90	0.00	0.00	0.00	0.23	0.23
	BUS B 044-PMCC-101	338.16	338.17	342.37	0.69	4.95	1675.57	1675.57	0.00	0.00	0.00	0.69	0.69
BUS B 044-MCC-102	Cab VFD-ACM C1~	51.07	52.65	73.95	25.05	161.98	8528.00	8527.36	104.31	0.00	0.00	25.05	25.05
	Cab VFD-ACM E1~	50.79	52.36	73.54	25.05	161.97	8480.98	8480.34	103.74	0.00	0.00	25.05	25.05
	Cab VFD-ACM G1~	50.88	52.45	73.67	25.05	161.97	8495.00	8494.37	103.91	0.00	0.00	25.05	25.05
BUS B 044-MCC-103	Cab VFD-ACM J1~	51.03	52.60	73.88	25.05	161.97	8520.42	8519.78	104.22	0.00	0.00	25.05	25.05
	BUS B 044-PMCC-101	419.43	422.40	508.77	11.91	78.76	33269.51	33266.91	416.18	0.00	0.00	11.91	11.91
	BUS B 044-PMCC-102	429.67	431.32	497.00	8.76	58.13	25072.76	25070.77	315.77	0.00	0.00	8.76	8.76
	Cab to VFD-ACM L1~	51.03	52.61	73.92	25.08	162.20	8533.23	8532.59	104.42	0.00	0.00	25.08	25.08
	Cab to VFD-ACM P1~	51.57	53.17	74.71	25.09	162.21	8624.75	8624.10	105.55	0.00	0.00	25.09	25.09
BUS B 044-MCC-104	Cab to VFD-ACM R1~	51.69	53.29	74.88	25.09	162.21	8645.17	8644.53	105.80	0.00	0.00	25.09	25.09
	BUS B 044-PMCC-101	356.33	356.34	359.14	0.44	3.17	1129.70	1129.70	0.00	0.00	0.00	0.44	0.44
BUS B 044-MCC-105	BUS B 044-PMCC-102	234.64	234.64	236.10	0.35	2.52	592.14	592.14	0.00	0.00	0.00	0.35	0.35
	BUS B 044-PMCC-102	173.82	173.83	176.43	0.67	9.41	1635.57	1635.50	14.75	0.00	0.00	0.67	0.67
	BUS B 044-PMCC-103	198.34	198.34	198.72	0.10	1.00	198.84	198.84	0.00	0.00	0.00	0.10	0.10
BUS B 044-MLDB-101	BUS 044-LDB-101	4.36	4.36	4.37	0.08	1.39	6.07	6.07	0.00	0.00	0.00	0.08	0.08
	BUS 044-LDB-102	7.17	7.17	7.18	0.08	1.39	9.96	9.96	0.00	0.00	0.00	0.08	0.08
	BUS 044-LDB-105	4.35	4.35	4.36	0.08	1.39	6.05	6.05	0.00	0.00	0.00	0.08	0.08
	BUS 044-LDB-114	7.08	7.08	7.09	0.08	1.39	9.81	9.81	0.00	0.00	0.00	0.08	0.08
	BUS 044-PDB-102	5.77	5.77	5.78	0.08	1.39	8.03	8.03	0.00	0.00	0.00	0.08	0.08
BUS B 044-MLDB-102	BUS 044-PDB-104	5.73	5.73	5.74	0.08	1.39	7.95	7.95	0.00	0.00	0.00	0.08	0.08
	BUS 044-PDB-105	28.35	28.35	28.41	0.08	1.39	39.29	39.29	0.00	0.00	0.00	0.08	0.08
	BUS A 044-MLDB-102	14.63	14.63	14.65	0.08	1.39	20.31	20.31	0.00	0.00	0.00	0.08	0.08
	Bus Prim TR-107B	77.43	77.43	77.57	0.07	1.38	106.82	106.82	0.00	0.00	0.00	0.07	0.07
	BUS 044-LDB-107	7.00	7.00	7.01	0.07	1.26	8.81	8.81	0.00	0.00	0.00	0.07	0.07
BUS B 044-PMCC-101	BUS 044-LDB-117	3.07	3.07	3.08	0.07	1.26	3.86	3.86	0.00	0.00	0.00	0.07	0.07
	BUS B EMLDB-101	10.07	10.07	10.09	0.07	1.26	12.67	12.67	0.00	0.00	0.00	0.07	0.07
	BUS B 044-MCC-101	338.16	338.17	342.37	0.69	4.95	1675.57	1675.57	0.00	0.00	0.00	0.69	0.69
	BUS B 044-MCC-102	419.43	422.40	508.77	11.91	78.76	33269.51	33266.91	416.18	0.00	0.00	11.91	11.91
	BUS B 044-MCC-104	356.33	356.34	359.14	0.44	3.17	1129.70	1129.70	0.00	0.00	0.00	0.44	0.44
BUS B 044-MLDB-101	Bus Prim TR-102B	1773.35	1773.79	1843.91	2.22	14.63	25946.14	25942.80	416.18	0.00	0.00	2.22	2.22

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BUS B 044-PMCC-102	BUS B 044-MCC-103	429.67	431.32	497.00	8.76	58.13	25072.76	25070.77	315.77	0.00	0.00	8.76	8.76
	BUS B 044-MCC-105	234.64	234.64	236.10	0.35	2.52	592.14	592.14	0.00	0.00	0.00	0.35	0.35
	BUS B 044-MCC-106	173.82	173.83	176.43	0.67	9.41	1635.57	1635.50	14.75	0.00	0.00	0.67	0.67
	Bus Prim TR-103B	1733.47	1733.72	1786.12	1.70	11.05	19153.27	19150.68	315.15	0.00	0.00	1.70	1.70
BUS B 044-PMCC-103	BUS B 044-ASB-101	47.73	47.73	47.85	0.09	1.75	83.74	82.50	14.34	0.00	0.00	0.09	0.09
	BUS B 044-ASB-102	86.86	86.86	87.09	0.09	1.99	172.93	170.15	30.89	0.00	0.00	0.09	0.09
	BUS B 044-MCC-107	198.34	198.34	198.72	0.10	1.00	198.84	198.84	0.00	0.00	0.00	0.10	0.10
	Bus 1 UPS101C	30.03	30.04	31.52	2.72	18.66	560.60	223.70	514.04	0.00	0.00	2.72	2.72
	Bus 1 UPS102C	30.30	30.31	31.77	2.65	18.29	554.43	223.47	507.40	0.00	0.00	2.65	2.65
	BUS to HVAC-2	670.00	670.01	671.50	0.08	1.69	1134.83	1117.80	195.85	0.00	0.00	0.08	0.08
	Bus Prim TR-108A	54.43	54.43	54.53	0.07	1.26	68.49	68.49	0.00	0.00	0.00	0.07	0.07
	Bus Prim TR-107B	78.82	78.82	78.97	0.08	1.39	109.39	109.39	0.00	0.00	0.00	0.08	0.08
	Bus Prim TR-104B	1746.22	1746.22	1751.38	0.12	1.24	2159.61	1931.10	966.84	0.00	0.00	0.12	0.12
	BUS B AU-REVAMP	281.42	281.42	281.47	0.01	0.52	145.13	145.13	0.00	0.00	0.00	0.01	0.01
BUS B EMLDB-101	BUS 044-ELDB-101	2.83	2.83	2.84	0.07	1.26	3.57	3.57	0.00	0.00	0.00	0.07	0.07
	BUS 044-ELDB-102	2.81	2.81	2.81	0.07	1.26	3.54	3.54	0.00	0.00	0.00	0.07	0.07
	BUS 044-ELDB-105	2.82	2.82	2.82	0.07	1.26	3.55	3.55	0.00	0.00	0.00	0.07	0.07
	BUS 044-ELDB-108	2.79	2.79	2.79	0.07	1.26	3.50	3.50	0.00	0.00	0.00	0.07	0.07
	BUS 044-ELDB-110	2.80	2.80	2.80	0.07	1.26	3.52	3.52	0.00	0.00	0.00	0.07	0.07
	BUS 044-ELDB-112	2.80	2.80	2.80	0.07	1.26	3.52	3.52	0.00	0.00	0.00	0.07	0.07
	BUS 044-ELDB-114	2.79	2.79	2.79	0.07	1.26	3.50	3.50	0.00	0.00	0.00	0.07	0.07
	BUS B 044-MLDB-102	10.07	10.07	10.09	0.07	1.26	12.67	12.67	0.00	0.00	0.00	0.07	0.07
	BUS A 044-EMLDB-101	29.70	29.70	29.79	0.14	1.67	49.60	49.60	0.00	0.00	0.00	0.14	0.14
BUS B to VDU UNIT	Bus Prim TR-109B	324.18	324.18	324.25	0.01	0.54	173.65	173.65	0.00	0.00	0.00	0.01	0.01
BUS Emergency Supply	BUS 044-HT11-101	65.63	65.63	65.63	0	0.50	32.82	32.82	0.00	0.00	0.00	0.00	0.00
BUS Grid Power A	BUS A 044-HT33-101	230.12	230.12	231.25	0.23	2.80	644.82	644.82	0.00	0.00	0.00	0.23	0.23
BUS Grid Power B	Bus 2 HT33	205.61	205.61	206.53	0.23	2.08	426.90	426.90	0.00	0.00	0.00	0.23	0.23
BUS HVAC EPMCC	BUS 044-EPMCC-101	213.54	213.54	215.62	0.38	8.18	1746.41	1746.35	14.10	0.00	0.00	0.38	0.38
Bus Prim TR-101A	Bus to TR101A	117.62	117.62	118.72	0.45	5.01	589.64	589.64	0.00	0.00	0.00	0.45	0.45
	BUS A 044-HT6-101	117.62	117.62	118.72	0.45	5.01	589.64	589.64	0.00	0.00	0.00	0.45	0.45
Bus Prim TR-101B	Bus to TR101B	91.89	91.89	92.81	0.51	4.55	417.98	417.98	0.00	0.00	0.00	0.51	0.51
	BUS B 044-HT6-101	91.89	91.89	92.81	0.51	4.55	417.98	417.98	0.00	0.00	0.00	0.51	0.51
Bus Prim TR-102A	BUS A 044-HT6-101	114.98	115.03	120.75	2.90	19.65	2260.28	2260.28	0.00	0.00	0.00	2.90	2.90
	BUS A 044-PMCC-101	114.98	115.03	120.75	2.89	19.64	2259.58	2259.58	0.00	0.00	0.00	2.89	2.89
Bus Prim TR-102B	BUS B 044-HT6-101	113.50	113.53	117.93	2.23	14.69	1667.25	1667.25	0.00	0.00	0.00	2.23	2.23
	BUS B 044-PMCC-101	113.50	113.53	117.92	2.23	14.68	1666.44	1666.44	0.00	0.00	0.00	2.23	2.23
Bus Prim TR-103A	BUS A 044-HT6-101	106.13	106.16	110.71	2.48	15.99	1697.36	1697.36	0.00	0.00	0.00	2.48	2.48
	BUS A 044-PMCC-102	106.13	106.16	110.70	2.48	15.98	1696.00	1696.00	0.00	0.00	0.00	2.48	2.48
Bus Prim TR-103B	BUS B 044-HT6-101	110.95	110.97	114.25	1.71	11.10	1231.29	1231.29	0.00	0.00	0.00	1.71	1.71
	BUS B 044-PMCC-102	110.95	110.97	114.25	1.71	11.09	1230.68	1230.68	0.00	0.00	0.00	1.71	1.71
Bus Prim TR-104A	BUS A 044-HT6-101	120.96	120.96	121.69	0.38	2.22	268.03	268.03	0.00	0.00	0.00	0.38	0.38
	BUS A 044-PMCC-103	120.96	120.96	121.69	0.38	2.24	270.79	270.79	0.00	0.00	0.00	0.38	0.38

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From Bus ID	To Bus ID	Fund. Amp	RMS Amp	ASUM Amp	THD %	TIF	IT Amp	ITB Amp	ITR Amp	TIHD %	TSHD %	THDG %	THDS %
Bus Prim TR-104B	BUS B 044-HT6-101	111.77	111.77	111.96	0.08	1.12	125.44	125.44	0.00	0.00	0.00	0.08	0.08
	BUS B 044-PMCC-103	111.77	111.77	111.97	0.08	1.15	128.65	128.65	0.00	0.00	0.00	0.08	0.08
	BUS A 044-HT6-101	66.82	66.83	69.19	2.09	12.45	831.91	831.91	0.00	0.00	0.00	2.09	2.09
Bus Prim TR-105A	BUS 044-EPMCC-101	66.82	66.83	69.19	2.08	12.43	831.01	831.01	0.00	0.00	0.00	2.08	2.08
	BUS B 044-HT6-101	0	0	0	0	0	0.00	831.01	0.00	0.00	0.00	0.00	0.00
	BUS 044-HT6-102	0	0	0	0	0	0.00	831.01	0.00	0.00	0.00	0.00	0.00
Bus Prim TR-105C	BUS 044-HT6-102	0	0	0	0	0	0.00	831.01	0.00	0.00	0.00	0.00	0.00
Bus Prim TR-106A	BUS 044-HT11-101	0	0	0	0	0	0.00	831.01	0.00	0.00	0.00	0.00	0.00
	Bus Sec TR-106A	0	0	0	0	0	0.00	831.01	0.00	0.00	0.00	0.00	0.00
Bus Prim TR-107A	BUS A 044-PMCC-103	65.79	65.79	65.99	0.13	2.72	178.64	178.64	0.00	0.00	0.00	0.13	0.13
	BUS A 044-MLDB-101	65.79	65.79	65.97	0.12	2.63	172.73	172.73	0.00	0.00	0.00	0.12	0.12
Bus Prim TR-107B	BUS B 044-PMCC-103	78.82	78.82	78.97	0.08	1.39	109.39	109.39	0.00	0.00	0.00	0.08	0.08
	BUS B 044-MLDB-101	78.82	78.82	78.98	0.09	1.42	112.24	112.24	0.00	0.00	0.00	0.09	0.09
Bus Prim TR-108A	BUS B 044-PMCC-103	54.43	54.43	54.53	0.07	1.26	68.49	68.49	0.00	0.00	0.00	0.07	0.07
	BUS A 044-EMLDB-101	54.43	54.43	54.54	0.09	1.31	71.17	71.17	0.00	0.00	0.00	0.09	0.09
Bus Prim TR-108B	BUS 044-EPMCC-101	0	0	0	0	0	0.00	71.17	0.00	0.00	0.00	0.00	0.00
Bus Prim TR-109A	BUS 2 to VDU UNIT	65.93	65.93	65.94	0.01	0.52	33.99	33.99	0.00	0.00	0.00	0.01	0.01
	BUS A to VDU UNIT	65.93	65.93	65.94	0.01	0.52	33.99	33.99	0.00	0.00	0.00	0.01	0.01
Bus Prim TR-109B	BUS 1 to VDU UNIT	64.84	64.84	64.85	0.01	0.54	34.73	34.73	0.00	0.00	0.00	0.01	0.01
	BUS B to VDU UNIT	64.84	64.84	64.85	0.01	0.54	34.73	34.73	0.00	0.00	0.00	0.01	0.01
Bus Prim TR-114A	BUS 2 to AU-V REVAMP UNIT	58.84	58.84	58.86	0.01	0.54	31.73	31.73	0.00	0.00	0.00	0.01	0.01
	BUS A AU-V REVAMP	58.84	58.84	58.86	0.01	0.54	31.73	31.73	0.00	0.00	0.00	0.01	0.01
Bus Prim TR-114B	BUS 1 to AU-V REVAMP UNIT	58.84	58.84	58.85	0.01	0.52	30.35	30.35	0.00	0.00	0.00	0.01	0.01
	BUS B AU-REVAMP	58.84	58.84	58.85	0.01	0.52	30.35	30.35	0.00	0.00	0.00	0.01	0.01
Bus Sec TR-106A	Bus Prim TR-106A	0	0	0	0	0	0.00	30.35	0.00	0.00	0.00	0.00	0.00
Bus to CB-101A	BUS A 044-HT6-101	231.07	231.08	234.23	0.93	3.88	897.16	897.16	0.00	0.00	0.00	0.93	0.93
Bus to CB-101B	BUS B 044-HT6-101	232.10	232.11	234.84	0.83	2.82	655.00	655.00	0.00	0.00	0.00	0.83	0.83
Bus to Charger-DCDB101 A	BUS A 044-PMCC-103	31.78	32.77	46.05	25.11	162.07	5310.84	5310.46	63.30	0.00	0.00	25.11	25.11
Bus to Charger-DCDB101 B	BUS 044-EPMCC-101	30.14	31.06	43.54	24.86	160.60	4987.59	4987.22	60.88	0.00	0.00	24.86	24.86
Bus to Charger-DCDB102	BUS 044-EPMCC-101	67.17	69.25	97.32	25.09	162.22	11234.56	11233.72	137.30	0.00	0.00	25.09	25.09
Bus to ext. 1	BUS A 044-HT33-101	0	0	0	0	0	0.00	11233.72	137.30	0.00	0.00	0.00	0.00
Bus to ext. 2	BUS B 044-HT33-101	0	0	0	0	0	0.00	11233.72	137.30	0.00	0.00	0.00	0.00
BUS to HVAC-1	BUS A 044-PMCC-103	692.12	692.12	694.30	0.12	2.91	2015.94	2011.41	134.95	0.00	0.00	0.12	0.12
BUS to HVAC-2	BUS B 044-PMCC-103	670.00	670.01	671.50	0.08	1.69	1134.83	1117.80	195.85	0.00	0.00	0.08	0.08
Bus to TR101A	Bus Prim TR-101A	117.62	117.62	118.72	0.45	5.01	589.64	589.64	0.00	0.00	0.00	0.45	0.45
	BUS A 044-HT33-101	117.62	117.62	118.72	0.45	5.01	589.64	589.64	0.00	0.00	0.00	0.45	0.45
Bus to TR101B	Bus Prim TR-101B	91.89	91.89	92.81	0.51	4.55	417.98	417.98	0.00	0.00	0.00	0.51	0.51
	BUS B 044-HT33-101	91.89	91.89	92.81	0.51	4.55	417.98	417.98	0.00	0.00	0.00	0.51	0.51
Cab to VFD-ACM L1~	BUS B 044-MCC-103	51.03	52.61	73.92	25.08	162.20	8533.23	8532.59	104.42	0.00	0.00	25.08	25.08
Cab to VFD-ACM P1~	BUS B 044-MCC-103	51.57	53.17	74.71	25.09	162.21	8624.75	8624.10	105.55	0.00	0.00	25.09	25.09
Cab to VFD-ACM R1~	BUS B 044-MCC-103	51.69	53.29	74.88	25.09	162.21	8645.17	8644.53	105.80	0.00	0.00	25.09	25.09

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Bus		Current Distortion											
From Bus ID	To Bus ID	Fund. Amp	RMS Amp	ASUM Amp	THD %	TIF	IT Amp	ITB Amp	ITR Amp	TIHD %	TSHD %	THDG %	THDS %
Cab VFD-ACM 201 A1~	BUS A 044-MCC-102	51.24	51.51	64.73	10.25	166.04	8552.99	8542.78	417.93	0.00	0.00	10.25	10.25
Cab VFD-ACM 202 A1~	BUS A 044-MCC-104	4.32	4.43	6.09	22.95	148.21	656.24	656.19	8.40	0.00	0.00	22.95	22.95
Cab VFD-ACM B1~	BUS A 044-MCC-102	51.24	52.82	74.16	25.01	161.68	8540.21	8539.57	104.94	0.00	0.00	25.01	25.01
Cab VFD-ACM C1~	BUS B 044-MCC-102	51.07	52.65	73.95	25.05	161.98	8528.00	8527.36	104.31	0.00	0.00	25.05	25.05
Cab VFD-ACM D1~	BUS A 044-MCC-102	50.96	52.53	73.75	25.00	161.68	8493.03	8492.39	104.36	0.00	0.00	25.00	25.00
Cab VFD-ACM D2~	BUS A 044-MCC-102	51.00	52.57	73.81	25.00	161.68	8499.60	8498.95	104.44	0.00	0.00	25.00	25.00
Cab VFD-ACM E1~	BUS B 044-MCC-102	50.79	52.36	73.54	25.05	161.97	8480.98	8480.34	103.74	0.00	0.00	25.05	25.05
Cab VFD-ACM F1~	BUS A 044-MCC-102	51.05	52.62	73.87	25.00	161.68	8507.10	8506.46	104.53	0.00	0.00	25.00	25.00
Cab VFD-ACM G1~	BUS B 044-MCC-102	50.88	52.45	73.67	25.05	161.97	8495.00	8494.37	103.91	0.00	0.00	25.05	25.05
Cab VFD-ACM H1~	BUS A 044-MCC-102	51.16	52.73	74.04	25.01	161.68	8525.97	8525.32	104.76	0.00	0.00	25.01	25.01
Cab VFD-ACM J1~	BUS B 044-MCC-102	51.03	52.60	73.88	25.05	161.97	8520.42	8519.78	104.22	0.00	0.00	25.05	25.05
Cab VFD-ACM K1~	BUS A 044-MCC-103	51.14	52.73	74.08	25.09	162.19	8551.48	8550.84	104.66	0.00	0.00	25.09	25.09
Cab VFD-ACM M1~	BUS A 044-MCC-103	51.61	53.21	74.73	25.04	161.92	8615.39	8614.75	105.41	0.00	0.00	25.04	25.04
Cab VFD-ACM N1~	BUS A 044-MCC-103	51.73	53.33	74.90	25.04	161.92	8635.71	8635.07	105.66	0.00	0.00	25.04	25.04
Cab VFD-ACM Q1~	BUS A 044-MCC-103	51.86	53.46	75.08	25.05	161.93	8656.20	8655.55	105.91	0.00	0.00	25.05	25.05

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Bus Tabulation

Harmonic Voltages (% of Nominal Voltage)

Bus ID:		BUS 044-EPMCC-101															
Nominak kV:		0.415															
Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
2.00	100.00	0.00	3.00	150.00	0.01	4.00	200.00	0.00	5.00	250.00	0.29	6.00	300.00	0.00	7.00	350.00	0.08
8.00	400.00	0.00	9.00	450.00	0.00	10.00	500.00	0.00	11.00	550.00	0.15	12.00	600.00	0.00	13.00	650.00	0.20
14.00	700.00	0.00	15.00	750.00	0.00	17.00	850.00	0.10	19.00	950.00	0.06	23.00	1150.00	0.04	25.00	1250.00	0.04
29.00	1450.00	0.05	31.00	1550.00	0.05												
Bus ID:		BUS 044-HT6-102															
Nominak kV:		6.900															
Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
2.00	100.00	0.00	3.00	150.00	0.00	4.00	200.00	0.00	5.00	250.00	0.08	6.00	300.00	0.00	7.00	350.00	0.03
8.00	400.00	0.00	9.00	450.00	0.00	10.00	500.00	0.00	11.00	550.00	0.05	12.00	600.00	0.00	13.00	650.00	0.07
14.00	700.00	0.00	15.00	750.00	0.00	17.00	850.00	0.04	19.00	950.00	0.03	23.00	1150.00	0.02	25.00	1250.00	0.02
29.00	1450.00	0.02	31.00	1550.00	0.03												
Bus ID:		BUS A 044-HT33-101															
Nominak kV:		33.000															
Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
2.00	100.00	0.00	3.00	150.00	0.00	4.00	200.00	0.00	5.00	250.00	0.01	6.00	300.00	0.00	7.00	350.00	0.00
8.00	400.00	0.00	9.00	450.00	0.00	10.00	500.00	0.00	11.00	550.00	0.00	12.00	600.00	0.00	13.00	650.00	0.01
14.00	700.00	0.00	15.00	750.00	0.00	17.00	850.00	0.00	19.00	950.00	0.00	23.00	1150.00	0.00	25.00	1250.00	0.00
29.00	1450.00	0.00	31.00	1550.00	0.00												
Bus ID:		BUS A 044-HT6-101															
Nominak kV:		6.600															
Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
2.00	100.00	0.00	3.00	150.00	0.00	4.00	200.00	0.00	5.00	250.00	0.08	6.00	300.00	0.00	7.00	350.00	0.03
8.00	400.00	0.00	9.00	450.00	0.00	10.00	500.00	0.00	11.00	550.00	0.05	12.00	600.00	0.00	13.00	650.00	0.07
14.00	700.00	0.00	15.00	750.00	0.00	17.00	850.00	0.04	19.00	950.00	0.03	23.00	1150.00	0.02	25.00	1250.00	0.02
29.00	1450.00	0.02	31.00	1550.00	0.03												
Bus ID:		BUS A 044-MCC-101															
Nominak kV:		0.415															
Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
2.00	100.00	0.00	3.00	150.00	0.02	4.00	200.00	0.00	5.00	250.00	0.73	6.00	300.00	0.00	7.00	350.00	0.25
8.00	400.00	0.00	9.00	450.00	0.01	10.00	500.00	0.00	11.00	550.00	0.27	12.00	600.00	0.00	13.00	650.00	0.35
14.00	700.00	0.01	15.00	750.00	0.00	17.00	850.00	0.22	19.00	950.00	0.20	23.00	1150.00	0.12	25.00	1250.00	0.09

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Bus Tabulation

Harmonic Voltages (% of Nominal Voltage)

Bus ID: BUS A 044-MCC-106
Nominak kV: 0.415

Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
2.00	100.00	0.00	3.00	150.00	0.01	4.00	200.00	0.00	5.00	250.00	0.59	6.00	300.00	0.00	7.00	350.00	0.22
8.00	400.00	0.00	9.00	450.00	0.00	10.00	500.00	0.00	11.00	550.00	0.27	12.00	600.00	0.00	13.00	650.00	0.31
14.00	700.00	0.00	15.00	750.00	0.00	17.00	850.00	0.17	19.00	950.00	0.14	23.00	1150.00	0.09	25.00	1250.00	0.08
29.00	1450.00	0.09	31.00	1550.00	0.10												

Bus ID: BUS A 044-MCC-107
Nominak kV: 0.415

Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
2.00	100.00	0.00	3.00	150.00	0.01	4.00	200.00	0.00	5.00	250.00	0.08	6.00	300.00	0.00	7.00	350.00	0.01
8.00	400.00	0.00	9.00	450.00	0.01	10.00	500.00	0.00	11.00	550.00	0.07	12.00	600.00	0.00	13.00	650.00	0.09
14.00	700.00	0.00	15.00	750.00	0.01	17.00	850.00	0.04	19.00	950.00	0.02	23.00	1150.00	0.02	25.00	1250.00	0.02
29.00	1450.00	0.02	31.00	1550.00	0.02												

Bus ID: BUS A 044-PMCC-101
Nominak kV: 0.415

Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
2.00	100.00	0.00	3.00	150.00	0.02	4.00	200.00	0.00	5.00	250.00	0.74	6.00	300.00	0.00	7.00	350.00	0.25
8.00	400.00	0.00	9.00	450.00	0.01	10.00	500.00	0.00	11.00	550.00	0.27	12.00	600.00	0.00	13.00	650.00	0.35
14.00	700.00	0.01	15.00	750.00	0.00	17.00	850.00	0.22	19.00	950.00	0.20	23.00	1150.00	0.12	25.00	1250.00	0.09
29.00	1450.00	0.14	31.00	1550.00	0.17												

Bus ID: BUS A 044-PMCC-102
Nominak kV: 0.415

Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
2.00	100.00	0.00	3.00	150.00	0.01	4.00	200.00	0.00	5.00	250.00	0.59	6.00	300.00	0.00	7.00	350.00	0.22
8.00	400.00	0.00	9.00	450.00	0.00	10.00	500.00	0.00	11.00	550.00	0.27	12.00	600.00	0.00	13.00	650.00	0.31
14.00	700.00	0.00	15.00	750.00	0.00	17.00	850.00	0.17	19.00	950.00	0.14	23.00	1150.00	0.09	25.00	1250.00	0.08
29.00	1450.00	0.09	31.00	1550.00	0.10												

Bus ID: BUS A 044-PMCC-103
Nominak kV: 0.415

Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
2.00	100.00	0.00	3.00	150.00	0.01	4.00	200.00	0.00	5.00	250.00	0.08	6.00	300.00	0.00	7.00	350.00	0.01
8.00	400.00	0.00	9.00	450.00	0.01	10.00	500.00	0.00	11.00	550.00	0.07	12.00	600.00	0.00	13.00	650.00	0.09
14.00	700.00	0.00	15.00	750.00	0.01	17.00	850.00	0.04	19.00	950.00	0.02	23.00	1150.00	0.02	25.00	1250.00	0.02

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Bus Tabulation

Harmonic Voltages (% of Nominal Voltage)

Bus ID: BUS B 044-MCC-103
Nominak kV: 0.415

Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
2.00	100.00	0.00	3.00	150.00	0.01	4.00	200.00	0.00	5.00	250.00	0.48	6.00	300.00	0.00	7.00	350.00	0.18
8.00	400.00	0.00	9.00	450.00	0.00	11.00	550.00	0.22	12.00	600.00	0.00	13.00	650.00	0.24	14.00	700.00	0.00
15.00	750.00	0.00	17.00	850.00	0.13	19.00	950.00	0.11	23.00	1150.00	0.08	25.00	1250.00	0.06	29.00	1450.00	0.06
31.00	1550.00	0.07															

Bus ID: BUS B 044-MCC-104
Nominak kV: 0.415

Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
2.00	100.00	0.00	3.00	150.00	0.01	4.00	200.00	0.00	5.00	250.00	0.57	6.00	300.00	0.00	7.00	350.00	0.21
8.00	400.00	0.00	9.00	450.00	0.00	11.00	550.00	0.25	12.00	600.00	0.00	13.00	650.00	0.28	14.00	700.00	0.00
15.00	750.00	0.00	17.00	850.00	0.16	19.00	950.00	0.13	23.00	1150.00	0.09	25.00	1250.00	0.07	29.00	1450.00	0.08
31.00	1550.00	0.09															

Bus ID: BUS B 044-MCC-105
Nominak kV: 0.415

Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
2.00	100.00	0.00	3.00	150.00	0.01	4.00	200.00	0.00	5.00	250.00	0.44	6.00	300.00	0.00	7.00	350.00	0.17
8.00	400.00	0.00	9.00	450.00	0.00	11.00	550.00	0.20	12.00	600.00	0.00	13.00	650.00	0.22	14.00	700.00	0.00
15.00	750.00	0.00	17.00	850.00	0.12	19.00	950.00	0.11	23.00	1150.00	0.07	25.00	1250.00	0.06	29.00	1450.00	0.06
31.00	1550.00	0.07															

Bus ID: BUS B 044-MCC-106
Nominak kV: 0.415

Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
2.00	100.00	0.00	3.00	150.00	0.01	4.00	200.00	0.00	5.00	250.00	0.44	6.00	300.00	0.00	7.00	350.00	0.17
8.00	400.00	0.00	9.00	450.00	0.00	11.00	550.00	0.20	12.00	600.00	0.00	13.00	650.00	0.22	14.00	700.00	0.00
15.00	750.00	0.00	17.00	850.00	0.12	19.00	950.00	0.11	23.00	1150.00	0.07	25.00	1250.00	0.06	29.00	1450.00	0.06
31.00	1550.00	0.07															

Bus ID: BUS B 044-MCC-107
Nominak kV: 0.415

Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
2.00	100.00	0.00	3.00	150.00	0.01	4.00	200.00	0.00	5.00	250.00	0.06	6.00	300.00	0.00	7.00	350.00	0.03
8.00	400.00	0.00	9.00	450.00	0.01	11.00	550.00	0.04	12.00	600.00	0.00	13.00	650.00	0.04	14.00	700.00	0.00
15.00	750.00	0.01	17.00	850.00	0.02	19.00	950.00	0.02	23.00	1150.00	0.01	25.00	1250.00	0.01	29.00	1450.00	0.01

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Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
2.00	100.00	0.01	3.00	150.00	0.02	4.00	200.00	0.00	5.00	250.00	0.94	6.00	300.00	0.00
8.00	400.00	0.00	9.00	450.00	0.00	10.00	500.00	0.00	11.00	550.00	0.18	12.00	600.00	0.00
14.00	700.00	0.00	15.00	750.00	0.00	17.00	850.00	0.07	19.00	950.00	0.05	23.00	1150.00	0.03
29.00	1450.00	0.02	31.00	1550.00	0.02									

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Order	Freq.	Mag.	Order	Freq.	Mag.	Order	Freq.	Mag.	Order	Freq.	Mag.	Order	Freq.	Mag.
	Hzz	%		Hz	%		Hz	%		Hz	%		Hz	%
2.00	100.00	0.01	3.00	150.00	0.02	4.00	200.00	0.00	5.00	250.00	0.94	6.00	300.00	0.00
8.00	400.00	0.00	9.00	450.00	0.00	10.00	500.00	0.00	11.00	550.00	0.18	12.00	600.00	0.00
14.00	700.00	0.00	15.00	750.00	0.00	17.00	850.00	0.07	19.00	950.00	0.05	23.00	1150.00	0.03
29.00	1450.00	0.02	31.00	1550.00	0.02							25.00	1250.00	0.02

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% Harmonic Currents (% of Fundamental Current)

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% Harmonic Currents (% of Fundamental Current)

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Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
1	100	100	2	100	100	3	100	100	4	100	100	5	100	100	6	100	100
7	100	100	8	100	100	9	100	100	10	100	100	11	100	100	12	100	100
13	100	100	14	100	100	15	100	100	16	100	100	17	100	100	18	100	100
19	100	100	20	100	100	21	100	100	22	100	100	23	100	100	24	100	100
25	100	100	26	100	100	27	100	100	28	100	100	29	100	100	30	100	100
31	100	100	32	100	100	33	100	100	34	100	100	35	100	100	36	100	100
37	100	100	38	100	100	39	100	100	40	100	100	41	100	100	42	100	100
43	100	100	44	100	100	45	100	100	46	100	100	47	100	100	48	100	100
49	100	100	50	100	100	51	100	100	52	100	100	53	100	100	54	100	100
55	100	100	56	100	100	57	100	100	58	100	100	59	100	100	60	100	100
61	100	100	62	100	100	63	100	100	64	100	100	65	100	100	66	100	100
67	100	100	68	100	100	69	100	100	70	100	100	71	100	100	72	100	100
73	100	100	74	100	100	75	100	100	76	100	100	77	100	100	78	100	100
79	100	100	80	100	100	81	100	100	82	100	100	83	100	100	84	100	100
85	100	100	86	100	100	87	100	100	88	100	100	89	100	100	90	100	100
91	100	100	92	100	100	93	100	100	94	100	100	95	100	100	96	100	100
97	100	100	98	100	100	99	100	100	100	100	100	101	100	100	102	100	100
103	100	100	104	100	100	105	100	100	106	100	100	107	100	100	108	100	100
109	100	100	110	100	100	111	100	100	112	100	100	113	100	100	114	100	100
115	100	100	116	100	100	117	100	100	118	100	100	119	100	100	120	100	100
121	100	100	122	100	100	123	100	100	124	100	100	125	100	100	126	100	100
127	100	100	128	100	100	129	100	100	130	100	100	131	100	100	132	100	100
133	100	100	134	100	100	135	100	100	136	100	100	137	100	100	138	100	100
139	100	100	140	100	100	141	100	100	142	100	100	143	100	100	144	100	100
145	100	100	146	100	100	147	100	100	148	100	100	149	100	100	150	100	100
151	100	100	152	100	100	153	100	100	154	100	100	155	100	100	156	100	100
157	100	100	158	100	100	159	100	100	160	100	100	161	100	100	162		

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Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %	Order	Freq. Hz	Mag. %
1	100	100	2	100	100	3	100	100	4	100	100	5	100	100	6	100	100
7	100	100	8	100	100	9	100	100	10	100	100	11	100	100	12	100	100
13	100	100	14	100	100	15	100	100	16	100	100	17	100	100	18	100	100
19	100	100	20	100	100	21	100	100	22	100	100	23	100	100	24	100	100
25	100	100	26	100	100	27	100	100	28	100	100	29	100	100	30	100	100
31	100	100	32	100	100	33	100	100	34	100	100	35	100	100	36	100	100
37	100	100	38	100	100	39	100	100	40	100	100	41	100	100	42	100	100
43	100	100	44	100	100	45	100	100	46	100	100	47	100	100	48	100	100
49	100	100	50	100	100	51	100	100	52	100	100	53	100	100	54	100	100
55	100	100	56	100	100	57	100	100	58	100	100	59	100	100	60	100	100
61	100	100	62	100	100	63	100	100	64	100	100	65	100	100	66	100	100
67	100	100	68	100	100	69	100	100	70	100	100	71	100	100	72	100	100
73	100	100	74	100	100	75	100	100	76	100	100	77	100	100	78	100	100
79	100	100	80	100	100	81	100	100	82	100	100	83	100	100	84	100	100
85	100	100	86	100	100	87	100	100	88	100	100	89	100	100	90	100	100
91	100	100	92	100	100	93	100	100	94	100	100	95	100	100	96	100	100
97	100	100	98	100	100	99	100	100	100	100	100	101	100	100	102	100	100
103	100	100	104	100	100	105	100	100	106	100	100	107	100	100	108	100	100
109	100	100	110	100	100	111	100	100	112	100	100	113	100	100	114	100	100
115	100	100	116	100	100	117	100	100	118	100	100	119	100	100	120	100	100
121	100	100	122	100	100	123	100	100	124	100	100	125	100	100	126	100	100
127	100	100	128	100	100	129	100	100	130	100	100	131	100	100	132	100	100
133	100	100	134	100	100	135	100	100	136	100	100	137	100	100	138	100	100
139	100	100	140	100	100	141	100	100	142	100	100	143	100	100	144	100	100
145	100	100	146	100	100	147	100	100	148	100	100	149	100	100	150	100	100
151	100	100	152	100	100	153	100	100	154	100	100	155	100	100	156	100	100
157	100	100	158	100	100	159	100	100	160	100	100	161	100	100	162		

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Fundamental Amp.:

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Marginal Alert Report

DeviceID	Type	Alert	Condition	Rating/Limit	Unit	Operating	% Operating	T Begin	Duration
1803-PM-610 A	Motor	Motor Voltage	Under Voltage	0.433	kV	0.355	81.9	0.100	0.000
Bus 1 UPS101A	LV Bus	Bus Voltage	Under Voltage	0.433	kV	0.401	92.6	0.000	11.980
Bus 1 UPS101C	LV Bus	Bus Voltage	Under Voltage	0.433	kV	0.401	92.6	0.000	11.980
Bus 1 UPS102A	LV Bus	Bus Voltage	Under Voltage	0.433	kV	0.401	92.6	0.000	11.980
Bus 1 UPS102C	LV Bus	Bus Voltage	Under Voltage	0.433	kV	0.401	92.6	0.000	11.980
BUS 044-ELDB-104	LV Bus	Bus Voltage	Under Voltage	0.415	kV	0.393	94.7	0.100	0.000
BUS 044-ELDB-107	LV Bus	Bus Voltage	Under Voltage	0.415	kV	0.388	93.4	0.100	0.000
BUS 044-ELDB-108	LV Bus	Bus Voltage	Under Voltage	0.415	kV	0.394	94.9	0.100	0.000
BUS 044-ELDB-111	LV Bus	Bus Voltage	Under Voltage	0.415	kV	0.389	93.8	0.100	0.000
BUS 044-ELDB-114	LV Bus	Bus Voltage	Under Voltage	0.415	kV	0.394	94.9	0.100	0.000
BUS 044-ELDB-115	LV Bus	Bus Voltage	Under Voltage	0.415	kV	0.390	93.9	0.100	0.000
BUS 044-LDB-106	LV Bus	Bus Voltage	Under Voltage	0.415	kV	0.392	94.4	0.100	0.000
BUS 044-LDB-107	LV Bus	Bus Voltage	Under Voltage	0.415	kV	0.393	94.7	0.100	0.000
BUS 044-LDB-108	LV Bus	Bus Voltage	Under Voltage	0.415	kV	0.393	94.7	0.100	0.000
BUS 044-LDB-116	LV Bus	Bus Voltage	Under Voltage	0.415	kV	0.392	94.4	0.100	0.000
BUS 044-LDB-117	LV Bus	Bus Voltage	Under Voltage	0.415	kV	0.392	94.4	0.100	0.000
Bus Prim TR-107A	LV Bus	Bus Voltage	Under Voltage	0.433	kV	0.401	92.5	0.000	11.980
Bus Prim TR-107B	LV Bus	Bus Voltage	Under Voltage	0.433	kV	0.401	92.6	0.000	11.980
BUS to HVAC-1	LV Bus	Bus Voltage	Under Voltage	0.433	kV	0.399	92.2	0.000	11.980
BUS to HVAC-2	LV Bus	Bus Voltage	Under Voltage	0.433	kV	0.399	92.2	0.000	11.980

Switching Motors

Motor				Nameplate						Locked-Roto		Accel. Time (sec.)	
ID	Type	Qty	Connected Bus ID	HP/kW	kV	RPM	FLA	% PF	% Eff	% LRC	% PF	No Load	Full Load
1803-PM-610 A	Ind.	1	BUS 044-EPMCC-101	160.0	0.433	1500	250.7	91.7	92.8	600.00	23.88	0.00	0.00

Motor Acceleration

Induction Motor ID: 1803-PM-610 A

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
0.000	0.00	0.00	0.00	104.53	0.00	0.00	0.020	0.00	0.00	0.00	104.53	0.00	0.00
0.040	0.00	0.00	0.00	104.53	0.00	0.00	0.060	0.00	0.00	0.00	104.53	0.00	0.00
0.080	0.00	0.00	0.00	104.53	0.00	0.00	0.100	491.39	81.90	85.45	100.27	373.43	805.45
0.120	105.31	94.96	99.08	104.04	181.30	78.11	0.140	105.31	94.96	99.08	104.04	181.30	78.11
0.160	105.31	94.96	99.08	104.04	181.30	78.11	0.180	105.31	94.96	99.08	104.04	181.30	78.11

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Induction Motor ID: 1803-PM-610 A

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
0.200	105.31	94.96	99.08	104.04	181.30	78.11	0.220	105.31	94.96	99.08	104.04	181.30	78.11
0.240	105.31	94.96	99.08	104.04	181.30	78.11	0.260	105.31	94.96	99.08	104.04	181.30	78.11
0.280	105.31	94.96	99.08	104.04	181.30	78.11	0.300	105.31	94.96	99.08	104.04	181.30	78.11
0.320	105.31	94.96	99.08	104.04	181.30	78.11	0.340	105.31	94.96	99.08	104.04	181.30	78.11
0.360	105.31	94.96	99.08	104.04	181.30	78.11	0.380	105.31	94.96	99.08	104.04	181.30	78.11
0.400	105.31	94.96	99.08	104.04	181.30	78.11	0.420	105.31	94.96	99.08	104.04	181.30	78.11
0.440	105.31	94.96	99.08	104.04	181.30	78.11	0.460	105.31	94.96	99.08	104.04	181.30	78.11
0.480	105.31	94.96	99.08	104.04	181.30	78.11	0.500	105.31	94.96	99.08	104.04	181.30	78.11
0.520	105.31	94.96	99.08	104.04	181.30	78.11	0.540	105.31	94.96	99.08	104.04	181.30	78.11
0.560	105.31	94.96	99.08	104.04	181.30	78.11	0.580	105.31	94.96	99.08	104.04	181.30	78.11
0.600	105.31	94.96	99.08	104.04	181.30	78.11	0.620	105.31	94.96	99.08	104.04	181.30	78.11
0.640	105.31	94.96	99.08	104.04	181.30	78.11	0.660	105.31	94.96	99.08	104.04	181.30	78.11
0.680	105.31	94.96	99.08	104.04	181.30	78.11	0.700	105.31	94.96	99.08	104.04	181.30	78.11
0.720	105.31	94.96	99.08	104.04	181.30	78.11	0.740	105.31	94.96	99.08	104.04	181.30	78.11
0.760	105.31	94.96	99.08	104.04	181.30	78.11	0.780	105.31	94.96	99.08	104.04	181.30	78.11
0.800	105.31	94.96	99.08	104.04	181.30	78.11	0.820	105.31	94.96	99.08	104.04	181.30	78.11
0.840	105.31	94.96	99.08	104.04	181.30	78.11	0.860	105.31	94.96	99.08	104.04	181.30	78.11
0.880	105.31	94.96	99.08	104.04	181.30	78.11	0.900	105.31	94.96	99.08	104.04	181.30	78.11
0.920	105.31	94.96	99.08	104.04	181.30	78.11	0.940	105.31	94.96	99.08	104.04	181.30	78.11
0.960	105.31	94.96	99.08	104.04	181.30	78.11	0.980	105.31	94.96	99.08	104.04	181.30	78.11
1.000	105.31	94.96	99.08	104.04	181.30	78.11	1.020	105.31	94.96	99.08	104.04	181.30	78.11
1.040	105.31	94.96	99.08	104.04	181.30	78.11	1.060	105.31	94.96	99.08	104.04	181.30	78.11
1.080	105.31	94.96	99.08	104.04	181.30	78.11	1.100	105.31	94.96	99.08	104.04	181.30	78.11
1.120	105.31	94.96	99.08	104.04	181.30	78.11	1.140	105.31	94.96	99.08	104.04	181.30	78.11
1.160	105.31	94.96	99.08	104.04	181.30	78.11	1.180	105.31	94.96	99.08	104.04	181.30	78.11
1.200	105.31	94.96	99.08	104.04	181.30	78.11	1.220	105.31	94.96	99.08	104.04	181.30	78.11
1.240	105.31	94.96	99.08	104.04	181.30	78.11	1.260	105.31	94.96	99.08	104.04	181.30	78.11
1.280	105.31	94.96	99.08	104.04	181.30	78.11	1.300	105.31	94.96	99.08	104.04	181.30	78.11
1.320	105.31	94.96	99.08	104.04	181.30	78.11	1.340	105.31	94.96	99.08	104.04	181.30	78.11
1.360	105.31	94.96	99.08	104.04	181.30	78.11	1.380	105.31	94.96	99.08	104.04	181.30	78.11
1.400	105.31	94.96	99.08	104.04	181.30	78.11	1.420	105.31	94.96	99.08	104.04	181.30	78.11
1.440	105.31	94.96	99.08	104.04	181.30	78.11	1.460	105.31	94.96	99.08	104.04	181.30	78.11
1.480	105.31	94.96	99.08	104.04	181.30	78.11	1.500	105.31	94.96	99.08	104.04	181.30	78.11
1.520	105.31	94.96	99.08	104.04	181.30	78.11	1.540	105.31	94.96	99.08	104.04	181.30	78.11
1.560	105.31	94.96	99.08	104.04	181.30	78.11	1.580	105.31	94.96	99.08	104.04	181.30	78.11
1.600	105.31	94.96	99.08	104.04	181.30	78.11	1.620	105.31	94.96	99.08	104.04	181.30	78.11
1.640	105.31	94.96	99.08	104.04	181.30	78.11	1.660	105.31	94.96	99.08	104.04	181.30	78.11

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Contract:
Engineer:
Filename: TFM

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Induction Motor ID: 1803-PM-610 A

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
1.680	105.31	94.96	99.08	104.04	181.30	78.11	1.700	105.31	94.96	99.08	104.04	181.30	78.11
1.720	105.31	94.96	99.08	104.04	181.30	78.11	1.740	105.31	94.96	99.08	104.04	181.30	78.11
1.760	105.31	94.96	99.08	104.04	181.30	78.11	1.780	105.31	94.96	99.08	104.04	181.30	78.11
1.800	105.31	94.96	99.08	104.04	181.30	78.11	1.820	105.31	94.96	99.08	104.04	181.30	78.11
1.840	105.31	94.96	99.08	104.04	181.30	78.11	1.860	105.31	94.96	99.08	104.04	181.30	78.11
1.880	105.31	94.96	99.08	104.04	181.30	78.11	1.900	105.31	94.96	99.08	104.04	181.30	78.11
1.920	105.31	94.96	99.08	104.04	181.30	78.11	1.940	105.31	94.96	99.08	104.04	181.30	78.11
1.960	105.31	94.96	99.08	104.04	181.30	78.11	1.980	105.31	94.96	99.08	104.04	181.30	78.11
2.000	105.31	94.96	99.08	104.04	181.30	78.11	2.020	105.31	94.96	99.08	104.04	181.30	78.11
2.040	105.31	94.96	99.08	104.04	181.30	78.11	2.060	105.31	94.96	99.08	104.04	181.30	78.11
2.080	105.31	94.96	99.08	104.04	181.30	78.11	2.100	105.31	94.96	99.08	104.04	181.30	78.11
2.120	105.31	94.96	99.08	104.04	181.30	78.11	2.140	105.31	94.96	99.08	104.04	181.30	78.11
2.160	105.31	94.96	99.08	104.04	181.30	78.11	2.180	105.31	94.96	99.08	104.04	181.30	78.11
2.200	105.31	94.96	99.08	104.04	181.30	78.11	2.220	105.31	94.96	99.08	104.04	181.30	78.11
2.240	105.31	94.96	99.08	104.04	181.30	78.11	2.260	105.31	94.96	99.08	104.04	181.30	78.11
2.280	105.31	94.96	99.08	104.04	181.30	78.11	2.300	105.31	94.96	99.08	104.04	181.30	78.11
2.320	105.31	94.96	99.08	104.04	181.30	78.11	2.340	105.31	94.96	99.08	104.04	181.30	78.11
2.360	105.31	94.96	99.08	104.04	181.30	78.11	2.380	105.31	94.96	99.08	104.04	181.30	78.11
2.400	105.31	94.96	99.08	104.04	181.30	78.11	2.420	105.31	94.96	99.08	104.04	181.30	78.11
2.440	105.31	94.96	99.08	104.04	181.30	78.11	2.460	105.31	94.96	99.08	104.04	181.30	78.11
2.480	105.31	94.96	99.08	104.04	181.30	78.11	2.500	105.31	94.96	99.08	104.04	181.30	78.11
2.520	105.31	94.96	99.08	104.04	181.30	78.11	2.540	105.31	94.96	99.08	104.04	181.30	78.11
2.560	105.31	94.96	99.08	104.04	181.30	78.11	2.580	105.31	94.96	99.08	104.04	181.30	78.11
2.600	105.31	94.96	99.08	104.04	181.30	78.11	2.620	105.31	94.96	99.08	104.04	181.30	78.11
2.640	105.31	94.96	99.08	104.04	181.30	78.11	2.660	105.31	94.96	99.08	104.04	181.30	78.11
2.680	105.31	94.96	99.08	104.04	181.30	78.11	2.700	105.31	94.96	99.08	104.04	181.30	78.11
2.720	105.31	94.96	99.08	104.04	181.30	78.11	2.740	105.31	94.96	99.08	104.04	181.30	78.11
2.760	105.31	94.96	99.08	104.04	181.30	78.11	2.780	105.31	94.96	99.08	104.04	181.30	78.11
2.800	105.31	94.96	99.08	104.04	181.30	78.11	2.820	105.31	94.96	99.08	104.04	181.30	78.11
2.840	105.31	94.96	99.08	104.04	181.30	78.11	2.860	105.31	94.96	99.08	104.04	181.30	78.11
2.880	105.31	94.96	99.08	104.04	181.30	78.11	2.900	105.31	94.96	99.08	104.04	181.30	78.11
2.920	105.31	94.96	99.08	104.04	181.30	78.11	2.940	105.31	94.96	99.08	104.04	181.30	78.11
2.960	105.31	94.96	99.08	104.04	181.30	78.11	2.980	105.31	94.96	99.08	104.04	181.30	78.11
3.000	105.31	94.96	99.08	104.04	181.30	78.11	3.020	105.31	94.96	99.08	104.04	181.30	78.11
3.040	105.31	94.96	99.08	104.04	181.30	78.11	3.060	105.31	94.96	99.08	104.04	181.30	78.11
3.080	105.31	94.96	99.08	104.04	181.30	78.11	3.100	105.31	94.96	99.08	104.04	181.30	78.11
3.120	105.31	94.96	99.08	104.04	181.30	78.11	3.140	105.31	94.96	99.08	104.04	181.30	78.11

Project:
Location:
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Study Case: MS EPMCC-101

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Revision: Base
Config.: Contingency

Induction Motor ID: 1803-PM-610 A

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
3.160	105.31	94.96	99.08	104.04	181.30	78.11	3.180	105.31	94.96	99.08	104.04	181.30	78.11
3.200	105.31	94.96	99.08	104.04	181.30	78.11	3.220	105.31	94.96	99.08	104.04	181.30	78.11
3.240	105.31	94.96	99.08	104.04	181.30	78.11	3.260	105.31	94.96	99.08	104.04	181.30	78.11
3.280	105.31	94.96	99.08	104.04	181.30	78.11	3.300	105.31	94.96	99.08	104.04	181.30	78.11
3.320	105.31	94.96	99.08	104.04	181.30	78.11	3.340	105.31	94.96	99.08	104.04	181.30	78.11
3.360	105.31	94.96	99.08	104.04	181.30	78.11	3.380	105.31	94.96	99.08	104.04	181.30	78.11
3.400	105.31	94.96	99.08	104.04	181.30	78.11	3.420	105.31	94.96	99.08	104.04	181.30	78.11
3.440	105.31	94.96	99.08	104.04	181.30	78.11	3.460	105.31	94.96	99.08	104.04	181.30	78.11
3.480	105.31	94.96	99.08	104.04	181.30	78.11	3.500	105.31	94.96	99.08	104.04	181.30	78.11
3.520	105.31	94.96	99.08	104.04	181.30	78.11	3.540	105.31	94.96	99.08	104.04	181.30	78.11
3.560	105.31	94.96	99.08	104.04	181.30	78.11	3.580	105.31	94.96	99.08	104.04	181.30	78.11
3.600	105.31	94.96	99.08	104.04	181.30	78.11	3.620	105.31	94.96	99.08	104.04	181.30	78.11
3.640	105.31	94.96	99.08	104.04	181.30	78.11	3.660	105.31	94.96	99.08	104.04	181.30	78.11
3.680	105.31	94.96	99.08	104.04	181.30	78.11	3.700	105.31	94.96	99.08	104.04	181.30	78.11
3.720	105.31	94.96	99.08	104.04	181.30	78.11	3.740	105.31	94.96	99.08	104.04	181.30	78.11
3.760	105.31	94.96	99.08	104.04	181.30	78.11	3.780	105.31	94.96	99.08	104.04	181.30	78.11
3.800	105.31	94.96	99.08	104.04	181.30	78.11	3.820	105.31	94.96	99.08	104.04	181.30	78.11
3.840	105.31	94.96	99.08	104.04	181.30	78.11	3.860	105.31	94.96	99.08	104.04	181.30	78.11
3.880	105.31	94.96	99.08	104.04	181.30	78.11	3.900	105.31	94.96	99.08	104.04	181.30	78.11
3.920	105.31	94.96	99.08	104.04	181.30	78.11	3.940	105.31	94.96	99.08	104.04	181.30	78.11
3.960	105.31	94.96	99.08	104.04	181.30	78.11	3.980	105.31	94.96	99.08	104.04	181.30	78.11
4.000	105.31	94.96	99.08	104.04	181.30	78.11	4.020	105.31	94.96	99.08	104.04	181.30	78.11
4.040	105.31	94.96	99.08	104.04	181.30	78.11	4.060	105.31	94.96	99.08	104.04	181.30	78.11
4.080	105.31	94.96	99.08	104.04	181.30	78.11	4.100	105.31	94.96	99.08	104.04	181.30	78.11
4.120	105.31	94.96	99.08	104.04	181.30	78.11	4.140	105.31	94.96	99.08	104.04	181.30	78.11
4.160	105.31	94.96	99.08	104.04	181.30	78.11	4.180	105.31	94.96	99.08	104.04	181.30	78.11
4.200	105.31	94.96	99.08	104.04	181.30	78.11	4.220	105.31	94.96	99.08	104.04	181.30	78.11
4.240	105.31	94.96	99.08	104.04	181.30	78.11	4.260	105.31	94.96	99.08	104.04	181.30	78.11
4.280	105.31	94.96	99.08	104.04	181.30	78.11	4.300	105.31	94.96	99.08	104.04	181.30	78.11
4.320	105.31	94.96	99.08	104.04	181.30	78.11	4.340	105.31	94.96	99.08	104.04	181.30	78.11
4.360	105.31	94.96	99.08	104.04	181.30	78.11	4.380	105.31	94.96	99.08	104.04	181.30	78.11
4.400	105.31	94.96	99.08	104.04	181.30	78.11	4.420	105.31	94.96	99.08	104.04	181.30	78.11
4.440	105.31	94.96	99.08	104.04	181.30	78.11	4.460	105.31	94.96	99.08	104.04	181.30	78.11
4.480	105.31	94.96	99.08	104.04	181.30	78.11	4.500	105.31	94.96	99.08	104.04	181.30	78.11
4.520	105.31	94.96	99.08	104.04	181.30	78.11	4.540	105.31	94.96	99.08	104.04	181.30	78.11
4.560	105.31	94.96	99.08	104.04	181.30	78.11	4.580	105.31	94.96	99.08	104.04	181.30	78.11
4.600	105.31	94.96	99.08	104.04	181.30	78.11	4.620	105.31	94.96	99.08	104.04	181.30	78.11

Project:
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Contract:
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Revision: Base
Config.: Contingency

Induction Motor ID: 1803-PM-610 A

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
4.640	105.31	94.96	99.08	104.04	181.30	78.11	4.660	105.31	94.96	99.08	104.04	181.30	78.11
4.680	105.31	94.96	99.08	104.04	181.30	78.11	4.700	105.31	94.96	99.08	104.04	181.30	78.11
4.720	105.31	94.96	99.08	104.04	181.30	78.11	4.740	105.31	94.96	99.08	104.04	181.30	78.11
4.760	105.31	94.96	99.08	104.04	181.30	78.11	4.780	105.31	94.96	99.08	104.04	181.30	78.11
4.800	105.31	94.96	99.08	104.04	181.30	78.11	4.820	105.31	94.96	99.08	104.04	181.30	78.11
4.840	105.31	94.96	99.08	104.04	181.30	78.11	4.860	105.31	94.96	99.08	104.04	181.30	78.11
4.880	105.31	94.96	99.08	104.04	181.30	78.11	4.900	105.31	94.96	99.08	104.04	181.30	78.11
4.920	105.31	94.96	99.08	104.04	181.30	78.11	4.940	105.31	94.96	99.08	104.04	181.30	78.11
4.960	105.31	94.96	99.08	104.04	181.30	78.11	4.980	105.31	94.96	99.08	104.04	181.30	78.11
5.000	105.31	94.96	99.08	104.04	181.30	78.11	5.020	105.31	94.96	99.08	104.04	181.30	78.11
5.040	105.31	94.96	99.08	104.04	181.30	78.11	5.060	105.31	94.96	99.08	104.04	181.30	78.11
5.080	105.31	94.96	99.08	104.04	181.30	78.11	5.100	105.31	94.96	99.08	104.04	181.30	78.11
5.120	105.31	94.96	99.08	104.04	181.30	78.11	5.140	105.31	94.96	99.08	104.04	181.30	78.11
5.160	105.31	94.96	99.08	104.04	181.30	78.11	5.180	105.31	94.96	99.08	104.04	181.30	78.11
5.200	105.31	94.96	99.08	104.04	181.30	78.11	5.220	105.31	94.96	99.08	104.04	181.30	78.11
5.240	105.31	94.96	99.08	104.04	181.30	78.11	5.260	105.31	94.96	99.08	104.04	181.30	78.11
5.280	105.31	94.96	99.08	104.04	181.30	78.11	5.300	105.31	94.96	99.08	104.04	181.30	78.11
5.320	105.31	94.96	99.08	104.04	181.30	78.11	5.340	105.31	94.96	99.08	104.04	181.30	78.11
5.360	105.31	94.96	99.08	104.04	181.30	78.11	5.380	105.31	94.96	99.08	104.04	181.30	78.11
5.400	105.31	94.96	99.08	104.04	181.30	78.11	5.420	105.31	94.96	99.08	104.04	181.30	78.11
5.440	105.31	94.96	99.08	104.04	181.30	78.11	5.460	105.31	94.96	99.08	104.04	181.30	78.11
5.480	105.31	94.96	99.08	104.04	181.30	78.11	5.500	105.31	94.96	99.08	104.04	181.30	78.11
5.520	105.31	94.96	99.08	104.04	181.30	78.11	5.540	105.31	94.96	99.08	104.04	181.30	78.11
5.560	105.31	94.96	99.08	104.04	181.30	78.11	5.580	105.31	94.96	99.08	104.04	181.30	78.11
5.600	105.31	94.96	99.08	104.04	181.30	78.11	5.620	105.31	94.96	99.08	104.04	181.30	78.11
5.640	105.31	94.96	99.08	104.04	181.30	78.11	5.660	105.31	94.96	99.08	104.04	181.30	78.11
5.680	105.31	94.96	99.08	104.04	181.30	78.11	5.700	105.31	94.96	99.08	104.04	181.30	78.11
5.720	105.31	94.96	99.08	104.04	181.30	78.11	5.740	105.31	94.96	99.08	104.04	181.30	78.11
5.760	105.31	94.96	99.08	104.04	181.30	78.11	5.780	105.31	94.96	99.08	104.04	181.30	78.11
5.800	105.31	94.96	99.08	104.04	181.30	78.11	5.820	105.31	94.96	99.08	104.04	181.30	78.11
5.840	105.31	94.96	99.08	104.04	181.30	78.11	5.860	105.31	94.96	99.08	104.04	181.30	78.11
5.880	105.31	94.96	99.08	104.04	181.30	78.11	5.900	105.31	94.96	99.08	104.04	181.30	78.11
5.920	105.31	94.96	99.08	104.04	181.30	78.11	5.940	105.31	94.96	99.08	104.04	181.30	78.11
5.960	105.31	94.96	99.08	104.04	181.30	78.11	5.980	105.31	94.96	99.08	104.04	181.30	78.11
6.000	105.31	94.96	99.08	104.04	181.30	78.11	6.020	105.31	94.96	99.08	104.04	181.30	78.11
6.040	105.31	94.96	99.08	104.04	181.30	78.11	6.060	105.31	94.96	99.08	104.04	181.30	78.11
6.080	105.31	94.96	99.08	104.04	181.30	78.11	6.100	105.31	94.96	99.08	104.04	181.30	78.11

Project:
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Contract:
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Revision: Base
Config.: Contingency

Induction Motor ID: 1803-PM-610 A

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
6.120	105.31	94.96	99.08	104.04	181.30	78.11	6.140	105.31	94.96	99.08	104.04	181.30	78.11
6.160	105.31	94.96	99.08	104.04	181.30	78.11	6.180	105.31	94.96	99.08	104.04	181.30	78.11
6.200	105.31	94.96	99.08	104.04	181.30	78.11	6.220	105.31	94.96	99.08	104.04	181.30	78.11
6.240	105.31	94.96	99.08	104.04	181.30	78.11	6.260	105.31	94.96	99.08	104.04	181.30	78.11
6.280	105.31	94.96	99.08	104.04	181.30	78.11	6.300	105.31	94.96	99.08	104.04	181.30	78.11
6.320	105.31	94.96	99.08	104.04	181.30	78.11	6.340	105.31	94.96	99.08	104.04	181.30	78.11
6.360	105.31	94.96	99.08	104.04	181.30	78.11	6.380	105.31	94.96	99.08	104.04	181.30	78.11
6.400	105.31	94.96	99.08	104.04	181.30	78.11	6.420	105.31	94.96	99.08	104.04	181.30	78.11
6.440	105.31	94.96	99.08	104.04	181.30	78.11	6.460	105.31	94.96	99.08	104.04	181.30	78.11
6.480	105.31	94.96	99.08	104.04	181.30	78.11	6.500	105.31	94.96	99.08	104.04	181.30	78.11
6.520	105.31	94.96	99.08	104.04	181.30	78.11	6.540	105.31	94.96	99.08	104.04	181.30	78.11
6.560	105.31	94.96	99.08	104.04	181.30	78.11	6.580	105.31	94.96	99.08	104.04	181.30	78.11
6.600	105.31	94.96	99.08	104.04	181.30	78.11	6.620	105.31	94.96	99.08	104.04	181.30	78.11
6.640	105.31	94.96	99.08	104.04	181.30	78.11	6.660	105.31	94.96	99.08	104.04	181.30	78.11
6.680	105.31	94.96	99.08	104.04	181.30	78.11	6.700	105.31	94.96	99.08	104.04	181.30	78.11
6.720	105.31	94.96	99.08	104.04	181.30	78.11	6.740	105.31	94.96	99.08	104.04	181.30	78.11
6.760	105.31	94.96	99.08	104.04	181.30	78.11	6.780	105.31	94.96	99.08	104.04	181.30	78.11
6.800	105.31	94.96	99.08	104.04	181.30	78.11	6.820	105.31	94.96	99.08	104.04	181.30	78.11
6.840	105.31	94.96	99.08	104.04	181.30	78.11	6.860	105.31	94.96	99.08	104.04	181.30	78.11
6.880	105.31	94.96	99.08	104.04	181.30	78.11	6.900	105.31	94.96	99.08	104.04	181.30	78.11
6.920	105.31	94.96	99.08	104.04	181.30	78.11	6.940	105.31	94.96	99.08	104.04	181.30	78.11
6.960	105.31	94.96	99.08	104.04	181.30	78.11	6.980	105.31	94.96	99.08	104.04	181.30	78.11
7.000	105.31	94.96	99.08	104.04	181.30	78.11	7.020	105.31	94.96	99.08	104.04	181.30	78.11
7.040	105.31	94.96	99.08	104.04	181.30	78.11	7.060	105.31	94.96	99.08	104.04	181.30	78.11
7.080	105.31	94.96	99.08	104.04	181.30	78.11	7.100	105.31	94.96	99.08	104.04	181.30	78.11
7.120	105.31	94.96	99.08	104.04	181.30	78.11	7.140	105.31	94.96	99.08	104.04	181.30	78.11
7.160	105.31	94.96	99.08	104.04	181.30	78.11	7.180	105.31	94.96	99.08	104.04	181.30	78.11
7.200	105.31	94.96	99.08	104.04	181.30	78.11	7.220	105.31	94.96	99.08	104.04	181.30	78.11
7.240	105.31	94.96	99.08	104.04	181.30	78.11	7.260	105.31	94.96	99.08	104.04	181.30	78.11
7.280	105.31	94.96	99.08	104.04	181.30	78.11	7.300	105.31	94.96	99.08	104.04	181.30	78.11
7.320	105.31	94.96	99.08	104.04	181.30	78.11	7.340	105.31	94.96	99.08	104.04	181.30	78.11
7.360	105.31	94.96	99.08	104.04	181.30	78.11	7.380	105.31	94.96	99.08	104.04	181.30	78.11
7.400	105.31	94.96	99.08	104.04	181.30	78.11	7.420	105.31	94.96	99.08	104.04	181.30	78.11
7.440	105.31	94.96	99.08	104.04	181.30	78.11	7.460	105.31	94.96	99.08	104.04	181.30	78.11
7.480	105.31	94.96	99.08	104.04	181.30	78.11	7.500	105.31	94.96	99.08	104.04	181.30	78.11
7.520	105.31	94.96	99.08	104.04	181.30	78.11	7.540	105.31	94.96	99.08	104.04	181.30	78.11
7.560	105.31	94.96	99.08	104.04	181.30	78.11	7.580	105.31	94.96	99.08	104.04	181.30	78.11

Project:
Location:
Contract:
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Induction Motor ID: 1803-PM-610 A

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
7.600	105.31	94.96	99.08	104.04	181.30	78.11	7.620	105.31	94.96	99.08	104.04	181.30	78.11
7.640	105.31	94.96	99.08	104.04	181.30	78.11	7.660	105.31	94.96	99.08	104.04	181.30	78.11
7.680	105.31	94.96	99.08	104.04	181.30	78.11	7.700	105.31	94.96	99.08	104.04	181.30	78.11
7.720	105.31	94.96	99.08	104.04	181.30	78.11	7.740	105.31	94.96	99.08	104.04	181.30	78.11
7.760	105.31	94.96	99.08	104.04	181.30	78.11	7.780	105.31	94.96	99.08	104.04	181.30	78.11
7.800	105.31	94.96	99.08	104.04	181.30	78.11	7.820	105.31	94.96	99.08	104.04	181.30	78.11
7.840	105.31	94.96	99.08	104.04	181.30	78.11	7.860	105.31	94.96	99.08	104.04	181.30	78.11
7.880	105.31	94.96	99.08	104.04	181.30	78.11	7.900	105.31	94.96	99.08	104.04	181.30	78.11
7.920	105.31	94.96	99.08	104.04	181.30	78.11	7.940	105.31	94.96	99.08	104.04	181.30	78.11
7.960	105.31	94.96	99.08	104.04	181.30	78.11	7.980	105.31	94.96	99.08	104.04	181.30	78.11
8.000	105.31	94.96	99.08	104.04	181.30	78.11	8.020	105.31	94.96	99.08	104.04	181.30	78.11
8.040	105.31	94.96	99.08	104.04	181.30	78.11	8.060	105.31	94.96	99.08	104.04	181.30	78.11
8.080	105.31	94.96	99.08	104.04	181.30	78.11	8.100	105.31	94.96	99.08	104.04	181.30	78.11
8.120	105.31	94.96	99.08	104.04	181.30	78.11	8.140	105.31	94.96	99.08	104.04	181.30	78.11
8.160	105.31	94.96	99.08	104.04	181.30	78.11	8.180	105.31	94.96	99.08	104.04	181.30	78.11
8.200	105.31	94.96	99.08	104.04	181.30	78.11	8.220	105.31	94.96	99.08	104.04	181.30	78.11
8.240	105.31	94.96	99.08	104.04	181.30	78.11	8.260	105.31	94.96	99.08	104.04	181.30	78.11
8.280	105.31	94.96	99.08	104.04	181.30	78.11	8.300	105.31	94.96	99.08	104.04	181.30	78.11
8.320	105.31	94.96	99.08	104.04	181.30	78.11	8.340	105.31	94.96	99.08	104.04	181.30	78.11
8.360	105.31	94.96	99.08	104.04	181.30	78.11	8.380	105.31	94.96	99.08	104.04	181.30	78.11
8.400	105.31	94.96	99.08	104.04	181.30	78.11	8.420	105.31	94.96	99.08	104.04	181.30	78.11
8.440	105.31	94.96	99.08	104.04	181.30	78.11	8.460	105.31	94.96	99.08	104.04	181.30	78.11
8.480	105.31	94.96	99.08	104.04	181.30	78.11	8.500	105.31	94.96	99.08	104.04	181.30	78.11
8.520	105.31	94.96	99.08	104.04	181.30	78.11	8.540	105.31	94.96	99.08	104.04	181.30	78.11
8.560	105.31	94.96	99.08	104.04	181.30	78.11	8.580	105.31	94.96	99.08	104.04	181.30	78.11
8.600	105.31	94.96	99.08	104.04	181.30	78.11	8.620	105.31	94.96	99.08	104.04	181.30	78.11
8.640	105.31	94.96	99.08	104.04	181.30	78.11	8.660	105.31	94.96	99.08	104.04	181.30	78.11
8.680	105.31	94.96	99.08	104.04	181.30	78.11	8.700	105.31	94.96	99.08	104.04	181.30	78.11
8.720	105.31	94.96	99.08	104.04	181.30	78.11	8.740	105.31	94.96	99.08	104.04	181.30	78.11
8.760	105.31	94.96	99.08	104.04	181.30	78.11	8.780	105.31	94.96	99.08	104.04	181.30	78.11
8.800	105.31	94.96	99.08	104.04	181.30	78.11	8.820	105.31	94.96	99.08	104.04	181.30	78.11
8.840	105.31	94.96	99.08	104.04	181.30	78.11	8.860	105.31	94.96	99.08	104.04	181.30	78.11
8.880	105.31	94.96	99.08	104.04	181.30	78.11	8.900	105.31	94.96	99.08	104.04	181.30	78.11
8.920	105.31	94.96	99.08	104.04	181.30	78.11	8.940	105.31	94.96	99.08	104.04	181.30	78.11
8.960	105.31	94.96	99.08	104.04	181.30	78.11	8.980	105.31	94.96	99.08	104.04	181.30	78.11
9.000	105.31	94.96	99.08	104.04	181.30	78.11	9.020	105.31	94.96	99.08	104.04	181.30	78.11
9.040	105.31	94.96	99.08	104.04	181.30	78.11	9.060	105.31	94.96	99.08	104.04	181.30	78.11

Project:
Location:
Contract:
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Study Case: MS EPMCC-101

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SN:
Revision: Base
Config.: Contingency

Induction Motor ID: 1803-PM-610 A

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
9.080	105.31	94.96	99.08	104.04	181.30	78.11	9.100	105.31	94.96	99.08	104.04	181.30	78.11
9.120	105.31	94.96	99.08	104.04	181.30	78.11	9.140	105.31	94.96	99.08	104.04	181.30	78.11
9.160	105.31	94.96	99.08	104.04	181.30	78.11	9.180	105.31	94.96	99.08	104.04	181.30	78.11
9.200	105.31	94.96	99.08	104.04	181.30	78.11	9.220	105.31	94.96	99.08	104.04	181.30	78.11
9.240	105.31	94.96	99.08	104.04	181.30	78.11	9.260	105.31	94.96	99.08	104.04	181.30	78.11
9.280	105.31	94.96	99.08	104.04	181.30	78.11	9.300	105.31	94.96	99.08	104.04	181.30	78.11
9.320	105.31	94.96	99.08	104.04	181.30	78.11	9.340	105.31	94.96	99.08	104.04	181.30	78.11
9.360	105.31	94.96	99.08	104.04	181.30	78.11	9.380	105.31	94.96	99.08	104.04	181.30	78.11
9.400	105.31	94.96	99.08	104.04	181.30	78.11	9.420	105.31	94.96	99.08	104.04	181.30	78.11
9.440	105.31	94.96	99.08	104.04	181.30	78.11	9.460	105.31	94.96	99.08	104.04	181.30	78.11
9.480	105.31	94.96	99.08	104.04	181.30	78.11	9.500	105.31	94.96	99.08	104.04	181.30	78.11
9.520	105.31	94.96	99.08	104.04	181.30	78.11	9.540	105.31	94.96	99.08	104.04	181.30	78.11
9.560	105.31	94.96	99.08	104.04	181.30	78.11	9.580	105.31	94.96	99.08	104.04	181.30	78.11
9.600	105.31	94.96	99.08	104.04	181.30	78.11	9.620	105.31	94.96	99.08	104.04	181.30	78.11
9.640	105.31	94.96	99.08	104.04	181.30	78.11	9.660	105.31	94.96	99.08	104.04	181.30	78.11
9.680	105.31	94.96	99.08	104.04	181.30	78.11	9.700	105.31	94.96	99.08	104.04	181.30	78.11
9.720	105.31	94.96	99.08	104.04	181.30	78.11	9.740	105.31	94.96	99.08	104.04	181.30	78.11
9.760	105.31	94.96	99.08	104.04	181.30	78.11	9.780	105.31	94.96	99.08	104.04	181.30	78.11
9.800	105.31	94.96	99.08	104.04	181.30	78.11	9.820	105.31	94.96	99.08	104.04	181.30	78.11
9.840	105.31	94.96	99.08	104.04	181.30	78.11	9.860	105.31	94.96	99.08	104.04	181.30	78.11
9.880	105.31	94.96	99.08	104.04	181.30	78.11	9.900	105.31	94.96	99.08	104.04	181.30	78.11
9.920	105.31	94.96	99.08	104.04	181.30	78.11	9.940	105.31	94.96	99.08	104.04	181.30	78.11
9.960	105.31	94.96	99.08	104.04	181.30	78.11	9.980	105.31	94.96	99.08	104.04	181.30	78.11
10.000	105.31	94.96	99.08	104.04	181.30	78.11	10.020	105.31	94.96	99.08	104.04	181.30	78.11
10.040	105.31	94.96	99.08	104.04	181.30	78.11	10.060	105.31	94.96	99.08	104.04	181.30	78.11
10.080	105.31	94.96	99.08	104.04	181.30	78.11	10.100	105.31	94.96	99.08	104.04	181.30	78.11
10.120	105.31	94.96	99.08	104.04	181.30	78.11	10.140	105.31	94.96	99.08	104.04	181.30	78.11
10.160	105.31	94.96	99.08	104.04	181.30	78.11	10.180	105.31	94.96	99.08	104.04	181.30	78.11
10.200	105.31	94.96	99.08	104.04	181.30	78.11	10.220	105.31	94.96	99.08	104.04	181.30	78.11
10.240	105.31	94.96	99.08	104.04	181.30	78.11	10.260	105.31	94.96	99.08	104.04	181.30	78.11
10.280	105.31	94.96	99.08	104.04	181.30	78.11	10.300	105.31	94.96	99.08	104.04	181.30	78.11
10.320	105.31	94.96	99.08	104.04	181.30	78.11	10.340	105.31	94.96	99.08	104.04	181.30	78.11
10.360	105.31	94.96	99.08	104.04	181.30	78.11	10.380	105.31	94.96	99.08	104.04	181.30	78.11
10.400	105.31	94.96	99.08	104.04	181.30	78.11	10.420	105.31	94.96	99.08	104.04	181.30	78.11
10.440	105.31	94.96	99.08	104.04	181.30	78.11	10.460	105.31	94.96	99.08	104.04	181.30	78.11
10.480	105.31	94.96	99.08	104.04	181.30	78.11	10.500	105.31	94.96	99.08	104.04	181.30	78.11
10.520	105.31	94.96	99.08	104.04	181.30	78.11	10.540	105.31	94.96	99.08	104.04	181.30	78.11

Project:
Location:
Contract:
Engineer:
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Study Case: MS EPMCC-101

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Revision: Base
Config.: Contingency

Induction Motor ID: 1803-PM-610 A

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
10.560	105.31	94.96	99.08	104.04	181.30	78.11	10.580	105.31	94.96	99.08	104.04	181.30	78.11
10.600	105.31	94.96	99.08	104.04	181.30	78.11	10.620	105.31	94.96	99.08	104.04	181.30	78.11
10.640	105.31	94.96	99.08	104.04	181.30	78.11	10.660	105.31	94.96	99.08	104.04	181.30	78.11
10.680	105.31	94.96	99.08	104.04	181.30	78.11	10.700	105.31	94.96	99.08	104.04	181.30	78.11
10.720	105.31	94.96	99.08	104.04	181.30	78.11	10.740	105.31	94.96	99.08	104.04	181.30	78.11
10.760	105.31	94.96	99.08	104.04	181.30	78.11	10.780	105.31	94.96	99.08	104.04	181.30	78.11
10.800	105.31	94.96	99.08	104.04	181.30	78.11	10.820	105.31	94.96	99.08	104.04	181.30	78.11
10.840	105.31	94.96	99.08	104.04	181.30	78.11	10.860	105.31	94.96	99.08	104.04	181.30	78.11
10.880	105.31	94.96	99.08	104.04	181.30	78.11	10.900	105.31	94.96	99.08	104.04	181.30	78.11
10.920	105.31	94.96	99.08	104.04	181.30	78.11	10.940	105.31	94.96	99.08	104.04	181.30	78.11
10.960	105.31	94.96	99.08	104.04	181.30	78.11	10.980	105.31	94.96	99.08	104.04	181.30	78.11
11.000	105.31	94.96	99.08	104.04	181.30	78.11	11.020	105.31	94.96	99.08	104.04	181.30	78.11
11.040	105.31	94.96	99.08	104.04	181.30	78.11	11.060	105.31	94.96	99.08	104.04	181.30	78.11
11.080	105.31	94.96	99.08	104.04	181.30	78.11	11.100	105.31	94.96	99.08	104.04	181.30	78.11
11.120	105.31	94.96	99.08	104.04	181.30	78.11	11.140	105.31	94.96	99.08	104.04	181.30	78.11
11.160	105.31	94.96	99.08	104.04	181.30	78.11	11.180	105.31	94.96	99.08	104.04	181.30	78.11
11.200	105.31	94.96	99.08	104.04	181.30	78.11	11.220	105.31	94.96	99.08	104.04	181.30	78.11
11.240	105.31	94.96	99.08	104.04	181.30	78.11	11.260	105.31	94.96	99.08	104.04	181.30	78.11
11.280	105.31	94.96	99.08	104.04	181.30	78.11	11.300	105.31	94.96	99.08	104.04	181.30	78.11
11.320	105.31	94.96	99.08	104.04	181.30	78.11	11.340	105.31	94.96	99.08	104.04	181.30	78.11
11.360	105.31	94.96	99.08	104.04	181.30	78.11	11.380	105.31	94.96	99.08	104.04	181.30	78.11
11.400	105.31	94.96	99.08	104.04	181.30	78.11	11.420	105.31	94.96	99.08	104.04	181.30	78.11
11.440	105.31	94.96	99.08	104.04	181.30	78.11	11.460	105.31	94.96	99.08	104.04	181.30	78.11
11.480	105.31	94.96	99.08	104.04	181.30	78.11	11.500	105.31	94.96	99.08	104.04	181.30	78.11
11.520	105.31	94.96	99.08	104.04	181.30	78.11	11.540	105.31	94.96	99.08	104.04	181.30	78.11
11.560	105.31	94.96	99.08	104.04	181.30	78.11	11.580	105.31	94.96	99.08	104.04	181.30	78.11
11.600	105.31	94.96	99.08	104.04	181.30	78.11	11.620	105.31	94.96	99.08	104.04	181.30	78.11
11.640	105.31	94.96	99.08	104.04	181.30	78.11	11.660	105.31	94.96	99.08	104.04	181.30	78.11
11.680	105.31	94.96	99.08	104.04	181.30	78.11	11.700	105.31	94.96	99.08	104.04	181.30	78.11
11.720	105.31	94.96	99.08	104.04	181.30	78.11	11.740	105.31	94.96	99.08	104.04	181.30	78.11
11.760	105.31	94.96	99.08	104.04	181.30	78.11	11.780	105.31	94.96	99.08	104.04	181.30	78.11
11.800	105.31	94.96	99.08	104.04	181.30	78.11	11.820	105.31	94.96	99.08	104.04	181.30	78.11
11.840	105.31	94.96	99.08	104.04	181.30	78.11	11.860	105.31	94.96	99.08	104.04	181.30	78.11
11.880	105.31	94.96	99.08	104.04	181.30	78.11	11.900	105.31	94.96	99.08	104.04	181.30	78.11
11.920	105.31	94.96	99.08	104.04	181.30	78.11	11.940	105.31	94.96	99.08	104.04	181.30	78.11
11.960	105.31	94.96	99.08	104.04	181.30	78.11	11.980	105.31	94.96	99.08	104.04	181.30	78.11
12.000	105.31	94.96	99.08	104.04	181.30	78.11							

Project:
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Study Case: MS HT6-101

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Config.: Contingency

Switching Motors

Motor				Nameplate						Locked-Roto		Accel. Time (sec.)	
ID	Type	Qty	Connected Bus ID	HP/kW	kV	RPM	FLA	% PF	% Eff	% LRC	% PF	No Load	Full Load
1803-PM-205 B	Ind.	1	BUS B 044-HT6-101	480.0	6.600	1500	51.9	85.0	95.2	650.00	17.61	0.00	0.00

Motor Acceleration

Induction Motor ID: 1803-PM-205 B

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
0.000	0.00	0.00	0.00	104.09	0.00	0.00	0.020	0.00	0.00	0.00	104.09	0.00	0.00
0.040	0.00	0.00	0.00	104.09	0.00	0.00	0.060	0.00	0.00	0.00	104.09	0.00	0.00
0.080	0.00	0.00	0.00	104.09	0.00	0.00	0.100	657.37	101.13	101.13	101.38	707.03	3889.30
0.120	96.35	103.79	103.79	103.84	504.47	312.63	0.140	96.35	103.79	103.79	103.84	504.47	312.63
0.160	96.35	103.79	103.79	103.84	504.47	312.63	0.180	96.35	103.79	103.79	103.84	504.47	312.63
0.200	96.35	103.79	103.79	103.84	504.47	312.63	0.220	96.35	103.79	103.79	103.84	504.47	312.63
0.240	96.35	103.79	103.79	103.84	504.47	312.63	0.260	96.35	103.79	103.79	103.84	504.47	312.63
0.280	96.35	103.79	103.79	103.84	504.47	312.63	0.300	96.35	103.79	103.79	103.84	504.47	312.63
0.320	96.35	103.79	103.79	103.84	504.47	312.63	0.340	96.35	103.79	103.79	103.84	504.47	312.63
0.360	96.35	103.79	103.79	103.84	504.47	312.63	0.380	96.35	103.79	103.79	103.84	504.47	312.63
0.400	96.35	103.79	103.79	103.84	504.47	312.63	0.420	96.35	103.79	103.79	103.84	504.47	312.63
0.440	96.35	103.79	103.79	103.84	504.47	312.63	0.460	96.35	103.79	103.79	103.84	504.47	312.63
0.480	96.35	103.79	103.79	103.84	504.47	312.63	0.500	96.35	103.79	103.79	103.84	504.47	312.63
0.520	96.35	103.79	103.79	103.84	504.47	312.63	0.540	96.35	103.79	103.79	103.84	504.47	312.63
0.560	96.35	103.79	103.79	103.84	504.47	312.63	0.580	96.35	103.79	103.79	103.84	504.47	312.63
0.600	96.35	103.79	103.79	103.84	504.47	312.63	0.620	96.35	103.79	103.79	103.84	504.47	312.63
0.640	96.35	103.79	103.79	103.84	504.47	312.63	0.660	96.35	103.79	103.79	103.84	504.47	312.63
0.680	96.35	103.79	103.79	103.84	504.47	312.63	0.700	96.35	103.79	103.79	103.84	504.47	312.63
0.720	96.35	103.79	103.79	103.84	504.47	312.63	0.740	96.35	103.79	103.79	103.84	504.47	312.63
0.760	96.35	103.79	103.79	103.84	504.47	312.63	0.780	96.35	103.79	103.79	103.84	504.47	312.63
0.800	96.35	103.79	103.79	103.84	504.47	312.63	0.820	96.35	103.79	103.79	103.84	504.47	312.63
0.840	96.35	103.79	103.79	103.84	504.47	312.63	0.860	96.35	103.79	103.79	103.84	504.47	312.63
0.880	96.35	103.79	103.79	103.84	504.47	312.63	0.900	96.35	103.79	103.79	103.84	504.47	312.63
0.920	96.35	103.79	103.79	103.84	504.47	312.63	0.940	96.35	103.79	103.79	103.84	504.47	312.63
0.960	96.35	103.79	103.79	103.84	504.47	312.63	0.980	96.35	103.79	103.79	103.84	504.47	312.63
1.000	96.35	103.79	103.79	103.84	504.47	312.63	1.020	96.35	103.79	103.79	103.84	504.47	312.63
1.040	96.35	103.79	103.79	103.84	504.47	312.63	1.060	96.35	103.79	103.79	103.84	504.47	312.63
1.080	96.35	103.79	103.79	103.84	504.47	312.63	1.100	96.35	103.79	103.79	103.84	504.47	312.63
1.120	96.35	103.79	103.79	103.84	504.47	312.63							

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Study Case: MS HT6-101

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Revision: Base
Config.: Contingency

Induction Motor ID: 1803-PM-205 B

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
1.140	96.35	103.79	103.79	103.84	504.47	312.63	1.160	96.35	103.79	103.79	103.84	504.47	312.63
1.180	96.35	103.79	103.79	103.84	504.47	312.63	1.200	96.35	103.79	103.79	103.84	504.47	312.63
1.220	96.35	103.79	103.79	103.84	504.47	312.63	1.240	96.35	103.79	103.79	103.84	504.47	312.63
1.260	96.35	103.79	103.79	103.84	504.47	312.63	1.280	96.35	103.79	103.79	103.84	504.47	312.63
1.300	96.35	103.79	103.79	103.84	504.47	312.63	1.320	96.35	103.79	103.79	103.84	504.47	312.63
1.340	96.35	103.79	103.79	103.84	504.47	312.63	1.360	96.35	103.79	103.79	103.84	504.47	312.63
1.380	96.35	103.79	103.79	103.84	504.47	312.63	1.400	96.35	103.79	103.79	103.84	504.47	312.63
1.420	96.35	103.79	103.79	103.84	504.47	312.63	1.440	96.35	103.79	103.79	103.84	504.47	312.63
1.460	96.35	103.79	103.79	103.84	504.47	312.63	1.480	96.35	103.79	103.79	103.84	504.47	312.63
1.500	96.35	103.79	103.79	103.84	504.47	312.63	1.520	96.35	103.79	103.79	103.84	504.47	312.63
1.540	96.35	103.79	103.79	103.84	504.47	312.63	1.560	96.35	103.79	103.79	103.84	504.47	312.63
1.580	96.35	103.79	103.79	103.84	504.47	312.63	1.600	96.35	103.79	103.79	103.84	504.47	312.63
1.620	96.35	103.79	103.79	103.84	504.47	312.63	1.640	96.35	103.79	103.79	103.84	504.47	312.63
1.660	96.35	103.79	103.79	103.84	504.47	312.63	1.680	96.35	103.79	103.79	103.84	504.47	312.63
1.700	96.35	103.79	103.79	103.84	504.47	312.63	1.720	96.35	103.79	103.79	103.84	504.47	312.63
1.740	96.35	103.79	103.79	103.84	504.47	312.63	1.760	96.35	103.79	103.79	103.84	504.47	312.63
1.780	96.35	103.79	103.79	103.84	504.47	312.63	1.800	96.35	103.79	103.79	103.84	504.47	312.63
1.820	96.35	103.79	103.79	103.84	504.47	312.63	1.840	96.35	103.79	103.79	103.84	504.47	312.63
1.860	96.35	103.79	103.79	103.84	504.47	312.63	1.880	96.35	103.79	103.79	103.84	504.47	312.63
1.900	96.35	103.79	103.79	103.84	504.47	312.63	1.920	96.35	103.79	103.79	103.84	504.47	312.63
1.940	96.35	103.79	103.79	103.84	504.47	312.63	1.960	96.35	103.79	103.79	103.84	504.47	312.63
1.980	96.35	103.79	103.79	103.84	504.47	312.63	2.000	96.35	103.79	103.79	103.84	504.47	312.63
2.020	96.35	103.79	103.79	103.84	504.47	312.63	2.040	96.35	103.79	103.79	103.84	504.47	312.63
2.060	96.35	103.79	103.79	103.84	504.47	312.63	2.080	96.35	103.79	103.79	103.84	504.47	312.63
2.100	96.35	103.79	103.79	103.84	504.47	312.63	2.120	96.35	103.79	103.79	103.84	504.47	312.63
2.140	96.35	103.79	103.79	103.84	504.47	312.63	2.160	96.35	103.79	103.79	103.84	504.47	312.63
2.180	96.35	103.79	103.79	103.84	504.47	312.63	2.200	96.35	103.79	103.79	103.84	504.47	312.63
2.220	96.35	103.79	103.79	103.84	504.47	312.63	2.240	96.35	103.79	103.79	103.84	504.47	312.63
2.260	96.35	103.79	103.79	103.84	504.47	312.63	2.280	96.35	103.79	103.79	103.84	504.47	312.63
2.300	96.35	103.79	103.79	103.84	504.47	312.63	2.320	96.35	103.79	103.79	103.84	504.47	312.63
2.340	96.35	103.79	103.79	103.84	504.47	312.63	2.360	96.35	103.79	103.79	103.84	504.47	312.63
2.380	96.35	103.79	103.79	103.84	504.47	312.63	2.400	96.35	103.79	103.79	103.84	504.47	312.63
2.420	96.35	103.79	103.79	103.84	504.47	312.63	2.440	96.35	103.79	103.79	103.84	504.47	312.63
2.460	96.35	103.79	103.79	103.84	504.47	312.63	2.480	96.35	103.79	103.79	103.84	504.47	312.63
2.500	96.35	103.79	103.79	103.84	504.47	312.63	2.520	96.35	103.79	103.79	103.84	504.47	312.63
2.540	96.35	103.79	103.79	103.84	504.47	312.63	2.560	96.35	103.79	103.79	103.84	504.47	312.63
2.580	96.35	103.79	103.79	103.84	504.47	312.63	2.600	96.35	103.79	103.79	103.84	504.47	312.63

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Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
2.620	96.35	103.79	103.79	103.84	504.47	312.63	2.640	96.35	103.79	103.79	103.84	504.47	312.63
2.660	96.35	103.79	103.79	103.84	504.47	312.63	2.680	96.35	103.79	103.79	103.84	504.47	312.63
2.700	96.35	103.79	103.79	103.84	504.47	312.63	2.720	96.35	103.79	103.79	103.84	504.47	312.63
2.740	96.35	103.79	103.79	103.84	504.47	312.63	2.760	96.35	103.79	103.79	103.84	504.47	312.63
2.780	96.35	103.79	103.79	103.84	504.47	312.63	2.800	96.35	103.79	103.79	103.84	504.47	312.63
2.820	96.35	103.79	103.79	103.84	504.47	312.63	2.840	96.35	103.79	103.79	103.84	504.47	312.63
2.860	96.35	103.79	103.79	103.84	504.47	312.63	2.880	96.35	103.79	103.79	103.84	504.47	312.63
2.900	96.35	103.79	103.79	103.84	504.47	312.63	2.920	96.35	103.79	103.79	103.84	504.47	312.63
2.940	96.35	103.79	103.79	103.84	504.47	312.63	2.960	96.35	103.79	103.79	103.84	504.47	312.63
2.980	96.35	103.79	103.79	103.84	504.47	312.63	3.000	96.35	103.79	103.79	103.84	504.47	312.63
3.020	96.35	103.79	103.79	103.84	504.47	312.63	3.040	96.35	103.79	103.79	103.84	504.47	312.63
3.060	96.35	103.79	103.79	103.84	504.47	312.63	3.080	96.35	103.79	103.79	103.84	504.47	312.63
3.100	96.35	103.79	103.79	103.84	504.47	312.63	3.120	96.35	103.79	103.79	103.84	504.47	312.63
3.140	96.35	103.79	103.79	103.84	504.47	312.63	3.160	96.35	103.79	103.79	103.84	504.47	312.63
3.180	96.35	103.79	103.79	103.84	504.47	312.63	3.200	96.35	103.79	103.79	103.84	504.47	312.63
3.220	96.35	103.79	103.79	103.84	504.47	312.63	3.240	96.35	103.79	103.79	103.84	504.47	312.63
3.260	96.35	103.79	103.79	103.84	504.47	312.63	3.280	96.35	103.79	103.79	103.84	504.47	312.63
3.300	96.35	103.79	103.79	103.84	504.47	312.63	3.320	96.35	103.79	103.79	103.84	504.47	312.63
3.340	96.35	103.79	103.79	103.84	504.47	312.63	3.360	96.35	103.79	103.79	103.84	504.47	312.63
3.380	96.35	103.79	103.79	103.84	504.47	312.63	3.400	96.35	103.79	103.79	103.84	504.47	312.63
3.420	96.35	103.79	103.79	103.84	504.47	312.63	3.440	96.35	103.79	103.79	103.84	504.47	312.63
3.460	96.35	103.79	103.79	103.84	504.47	312.63	3.480	96.35	103.79	103.79	103.84	504.47	312.63
3.500	96.35	103.79	103.79	103.84	504.47	312.63	3.520	96.35	103.79	103.79	103.84	504.47	312.63
3.540	96.35	103.79	103.79	103.84	504.47	312.63	3.560	96.35	103.79	103.79	103.84	504.47	312.63
3.580	96.35	103.79	103.79	103.84	504.47	312.63	3.600	96.35	103.79	103.79	103.84	504.47	312.63
3.620	96.35	103.79	103.79	103.84	504.47	312.63	3.640	96.35	103.79	103.79	103.84	504.47	312.63
3.660	96.35	103.79	103.79	103.84	504.47	312.63	3.680	96.35	103.79	103.79	103.84	504.47	312.63
3.700	96.35	103.79	103.79	103.84	504.47	312.63	3.720	96.35	103.79	103.79	103.84	504.47	312.63
3.740	96.35	103.79	103.79	103.84	504.47	312.63	3.760	96.35	103.79	103.79	103.84	504.47	312.63
3.780	96.35	103.79	103.79	103.84	504.47	312.63	3.800	96.35	103.79	103.79	103.84	504.47	312.63
3.820	96.35	103.79	103.79	103.84	504.47	312.63	3.840	96.35	103.79	103.79	103.84	504.47	312.63
3.860	96.35	103.79	103.79	103.84	504.47	312.63	3.880	96.35	103.79	103.79	103.84	504.47	312.63
3.900	96.35	103.79	103.79	103.84	504.47	312.63	3.920	96.35	103.79	103.79	103.84	504.47	312.63
3.940	96.35	103.79	103.79	103.84	504.47	312.63	3.960	96.35	103.79	103.79	103.84	504.47	312.63
3.980	96.35	103.79	103.79	103.84	504.47	312.63	4.000	96.35	103.79	103.79	103.84	504.47	312.63
4.020	96.35	103.79	103.79	103.84	504.47	312.63	4.040	96.35	103.79	103.79	103.84	504.47	312.63
4.060	96.35	103.79	103.79	103.84	504.47	312.63	4.080	96.35	103.79	103.79	103.84	504.47	312.63

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Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
4.100	96.35	103.79	103.79	103.84	504.47	312.63	4.120	96.35	103.79	103.79	103.84	504.47	312.63
4.140	96.35	103.79	103.79	103.84	504.47	312.63	4.160	96.35	103.79	103.79	103.84	504.47	312.63
4.180	96.35	103.79	103.79	103.84	504.47	312.63	4.200	96.35	103.79	103.79	103.84	504.47	312.63
4.220	96.35	103.79	103.79	103.84	504.47	312.63	4.240	96.35	103.79	103.79	103.84	504.47	312.63
4.260	96.35	103.79	103.79	103.84	504.47	312.63	4.280	96.35	103.79	103.79	103.84	504.47	312.63
4.300	96.35	103.79	103.79	103.84	504.47	312.63	4.320	96.35	103.79	103.79	103.84	504.47	312.63
4.340	96.35	103.79	103.79	103.84	504.47	312.63	4.360	96.35	103.79	103.79	103.84	504.47	312.63
4.380	96.35	103.79	103.79	103.84	504.47	312.63	4.400	96.35	103.79	103.79	103.84	504.47	312.63
4.420	96.35	103.79	103.79	103.84	504.47	312.63	4.440	96.35	103.79	103.79	103.84	504.47	312.63
4.460	96.35	103.79	103.79	103.84	504.47	312.63	4.480	96.35	103.79	103.79	103.84	504.47	312.63
4.500	96.35	103.79	103.79	103.84	504.47	312.63	4.520	96.35	103.79	103.79	103.84	504.47	312.63
4.540	96.35	103.79	103.79	103.84	504.47	312.63	4.560	96.35	103.79	103.79	103.84	504.47	312.63
4.580	96.35	103.79	103.79	103.84	504.47	312.63	4.600	96.35	103.79	103.79	103.84	504.47	312.63
4.620	96.35	103.79	103.79	103.84	504.47	312.63	4.640	96.35	103.79	103.79	103.84	504.47	312.63
4.660	96.35	103.79	103.79	103.84	504.47	312.63	4.680	96.35	103.79	103.79	103.84	504.47	312.63
4.700	96.35	103.79	103.79	103.84	504.47	312.63	4.720	96.35	103.79	103.79	103.84	504.47	312.63
4.740	96.35	103.79	103.79	103.84	504.47	312.63	4.760	96.35	103.79	103.79	103.84	504.47	312.63
4.780	96.35	103.79	103.79	103.84	504.47	312.63	4.800	96.35	103.79	103.79	103.84	504.47	312.63
4.820	96.35	103.79	103.79	103.84	504.47	312.63	4.840	96.35	103.79	103.79	103.84	504.47	312.63
4.860	96.35	103.79	103.79	103.84	504.47	312.63	4.880	96.35	103.79	103.79	103.84	504.47	312.63
4.900	96.35	103.79	103.79	103.84	504.47	312.63	4.920	96.35	103.79	103.79	103.84	504.47	312.63
4.940	96.35	103.79	103.79	103.84	504.47	312.63	4.960	96.35	103.79	103.79	103.84	504.47	312.63
4.980	96.35	103.79	103.79	103.84	504.47	312.63	5.000	96.35	103.79	103.79	103.84	504.47	312.63
5.020	96.35	103.79	103.79	103.84	504.47	312.63	5.040	96.35	103.79	103.79	103.84	504.47	312.63
5.060	96.35	103.79	103.79	103.84	504.47	312.63	5.080	96.35	103.79	103.79	103.84	504.47	312.63
5.100	96.35	103.79	103.79	103.84	504.47	312.63	5.120	96.35	103.79	103.79	103.84	504.47	312.63
5.140	96.35	103.79	103.79	103.84	504.47	312.63	5.160	96.35	103.79	103.79	103.84	504.47	312.63
5.180	96.35	103.79	103.79	103.84	504.47	312.63	5.200	96.35	103.79	103.79	103.84	504.47	312.63
5.220	96.35	103.79	103.79	103.84	504.47	312.63	5.240	96.35	103.79	103.79	103.84	504.47	312.63
5.260	96.35	103.79	103.79	103.84	504.47	312.63	5.280	96.35	103.79	103.79	103.84	504.47	312.63
5.300	96.35	103.79	103.79	103.84	504.47	312.63	5.320	96.35	103.79	103.79	103.84	504.47	312.63
5.340	96.35	103.79	103.79	103.84	504.47	312.63	5.360	96.35	103.79	103.79	103.84	504.47	312.63
5.380	96.35	103.79	103.79	103.84	504.47	312.63	5.400	96.35	103.79	103.79	103.84	504.47	312.63
5.420	96.35	103.79	103.79	103.84	504.47	312.63	5.440	96.35	103.79	103.79	103.84	504.47	312.63
5.460	96.35	103.79	103.79	103.84	504.47	312.63	5.480	96.35	103.79	103.79	103.84	504.47	312.63
5.500	96.35	103.79	103.79	103.84	504.47	312.63	5.520	96.35	103.79	103.79	103.84	504.47	312.63
5.540	96.35	103.79	103.79	103.84	504.47	312.63	5.560	96.35	103.79	103.79	103.84	504.47	312.63

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Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
5.580	96.35	103.79	103.79	103.84	504.47	312.63	5.600	96.35	103.79	103.79	103.84	504.47	312.63
5.620	96.35	103.79	103.79	103.84	504.47	312.63	5.640	96.35	103.79	103.79	103.84	504.47	312.63
5.660	96.35	103.79	103.79	103.84	504.47	312.63	5.680	96.35	103.79	103.79	103.84	504.47	312.63
5.700	96.35	103.79	103.79	103.84	504.47	312.63	5.720	96.35	103.79	103.79	103.84	504.47	312.63
5.740	96.35	103.79	103.79	103.84	504.47	312.63	5.760	96.35	103.79	103.79	103.84	504.47	312.63
5.780	96.35	103.79	103.79	103.84	504.47	312.63	5.800	96.35	103.79	103.79	103.84	504.47	312.63
5.820	96.35	103.79	103.79	103.84	504.47	312.63	5.840	96.35	103.79	103.79	103.84	504.47	312.63
5.860	96.35	103.79	103.79	103.84	504.47	312.63	5.880	96.35	103.79	103.79	103.84	504.47	312.63
5.900	96.35	103.79	103.79	103.84	504.47	312.63	5.920	96.35	103.79	103.79	103.84	504.47	312.63
5.940	96.35	103.79	103.79	103.84	504.47	312.63	5.960	96.35	103.79	103.79	103.84	504.47	312.63
5.980	96.35	103.79	103.79	103.84	504.47	312.63	6.000	96.35	103.79	103.79	103.84	504.47	312.63
6.020	96.35	103.79	103.79	103.84	504.47	312.63	6.040	96.35	103.79	103.79	103.84	504.47	312.63
6.060	96.35	103.79	103.79	103.84	504.47	312.63	6.080	96.35	103.79	103.79	103.84	504.47	312.63
6.100	96.35	103.79	103.79	103.84	504.47	312.63	6.120	96.35	103.79	103.79	103.84	504.47	312.63
6.140	96.35	103.79	103.79	103.84	504.47	312.63	6.160	96.35	103.79	103.79	103.84	504.47	312.63
6.180	96.35	103.79	103.79	103.84	504.47	312.63	6.200	96.35	103.79	103.79	103.84	504.47	312.63
6.220	96.35	103.79	103.79	103.84	504.47	312.63	6.240	96.35	103.79	103.79	103.84	504.47	312.63
6.260	96.35	103.79	103.79	103.84	504.47	312.63	6.280	96.35	103.79	103.79	103.84	504.47	312.63
6.300	96.35	103.79	103.79	103.84	504.47	312.63	6.320	96.35	103.79	103.79	103.84	504.47	312.63
6.340	96.35	103.79	103.79	103.84	504.47	312.63	6.360	96.35	103.79	103.79	103.84	504.47	312.63
6.380	96.35	103.79	103.79	103.84	504.47	312.63	6.400	96.35	103.79	103.79	103.84	504.47	312.63
6.420	96.35	103.79	103.79	103.84	504.47	312.63	6.440	96.35	103.79	103.79	103.84	504.47	312.63
6.460	96.35	103.79	103.79	103.84	504.47	312.63	6.480	96.35	103.79	103.79	103.84	504.47	312.63
6.500	96.35	103.79	103.79	103.84	504.47	312.63	6.520	96.35	103.79	103.79	103.84	504.47	312.63
6.540	96.35	103.79	103.79	103.84	504.47	312.63	6.560	96.35	103.79	103.79	103.84	504.47	312.63
6.580	96.35	103.79	103.79	103.84	504.47	312.63	6.600	96.35	103.79	103.79	103.84	504.47	312.63
6.620	96.35	103.79	103.79	103.84	504.47	312.63	6.640	96.35	103.79	103.79	103.84	504.47	312.63
6.660	96.35	103.79	103.79	103.84	504.47	312.63	6.680	96.35	103.79	103.79	103.84	504.47	312.63
6.700	96.35	103.79	103.79	103.84	504.47	312.63	6.720	96.35	103.79	103.79	103.84	504.47	312.63
6.740	96.35	103.79	103.79	103.84	504.47	312.63	6.760	96.35	103.79	103.79	103.84	504.47	312.63
6.780	96.35	103.79	103.79	103.84	504.47	312.63	6.800	96.35	103.79	103.79	103.84	504.47	312.63
6.820	96.35	103.79	103.79	103.84	504.47	312.63	6.840	96.35	103.79	103.79	103.84	504.47	312.63
6.860	96.35	103.79	103.79	103.84	504.47	312.63	6.880	96.35	103.79	103.79	103.84	504.47	312.63
6.900	96.35	103.79	103.79	103.84	504.47	312.63	6.920	96.35	103.79	103.79	103.84	504.47	312.63
6.940	96.35	103.79	103.79	103.84	504.47	312.63	6.960	96.35	103.79	103.79	103.84	504.47	312.63
6.980	96.35	103.79	103.79	103.84	504.47	312.63	7.000	96.35	103.79	103.79	103.84	504.47	312.63
7.020	96.35	103.79	103.79	103.84	504.47	312.63	7.040	96.35	103.79	103.79	103.84	504.47	312.63

Project:
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Study Case: MS HT6-101

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Revision: Base
Config.: Contingency

Induction Motor ID: 1803-PM-205 B

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
7.060	96.35	103.79	103.79	103.84	504.47	312.63	7.080	96.35	103.79	103.79	103.84	504.47	312.63
7.100	96.35	103.79	103.79	103.84	504.47	312.63	7.120	96.35	103.79	103.79	103.84	504.47	312.63
7.140	96.35	103.79	103.79	103.84	504.47	312.63	7.160	96.35	103.79	103.79	103.84	504.47	312.63
7.180	96.35	103.79	103.79	103.84	504.47	312.63	7.200	96.35	103.79	103.79	103.84	504.47	312.63
7.220	96.35	103.79	103.79	103.84	504.47	312.63	7.240	96.35	103.79	103.79	103.84	504.47	312.63
7.260	96.35	103.79	103.79	103.84	504.47	312.63	7.280	96.35	103.79	103.79	103.84	504.47	312.63
7.300	96.35	103.79	103.79	103.84	504.47	312.63	7.320	96.35	103.79	103.79	103.84	504.47	312.63
7.340	96.35	103.79	103.79	103.84	504.47	312.63	7.360	96.35	103.79	103.79	103.84	504.47	312.63
7.380	96.35	103.79	103.79	103.84	504.47	312.63	7.400	96.35	103.79	103.79	103.84	504.47	312.63
7.420	96.35	103.79	103.79	103.84	504.47	312.63	7.440	96.35	103.79	103.79	103.84	504.47	312.63
7.460	96.35	103.79	103.79	103.84	504.47	312.63	7.480	96.35	103.79	103.79	103.84	504.47	312.63
7.500	96.35	103.79	103.79	103.84	504.47	312.63	7.520	96.35	103.79	103.79	103.84	504.47	312.63
7.540	96.35	103.79	103.79	103.84	504.47	312.63	7.560	96.35	103.79	103.79	103.84	504.47	312.63
7.580	96.35	103.79	103.79	103.84	504.47	312.63	7.600	96.35	103.79	103.79	103.84	504.47	312.63
7.620	96.35	103.79	103.79	103.84	504.47	312.63	7.640	96.35	103.79	103.79	103.84	504.47	312.63
7.660	96.35	103.79	103.79	103.84	504.47	312.63	7.680	96.35	103.79	103.79	103.84	504.47	312.63
7.700	96.35	103.79	103.79	103.84	504.47	312.63	7.720	96.35	103.79	103.79	103.84	504.47	312.63
7.740	96.35	103.79	103.79	103.84	504.47	312.63	7.760	96.35	103.79	103.79	103.84	504.47	312.63
7.780	96.35	103.79	103.79	103.84	504.47	312.63	7.800	96.35	103.79	103.79	103.84	504.47	312.63
7.820	96.35	103.79	103.79	103.84	504.47	312.63	7.840	96.35	103.79	103.79	103.84	504.47	312.63
7.860	96.35	103.79	103.79	103.84	504.47	312.63	7.880	96.35	103.79	103.79	103.84	504.47	312.63
7.900	96.35	103.79	103.79	103.84	504.47	312.63	7.920	96.35	103.79	103.79	103.84	504.47	312.63
7.940	96.35	103.79	103.79	103.84	504.47	312.63	7.960	96.35	103.79	103.79	103.84	504.47	312.63
7.980	96.35	103.79	103.79	103.84	504.47	312.63	8.000	96.35	103.79	103.79	103.84	504.47	312.63
8.020	96.35	103.79	103.79	103.84	504.47	312.63	8.040	96.35	103.79	103.79	103.84	504.47	312.63
8.060	96.35	103.79	103.79	103.84	504.47	312.63	8.080	96.35	103.79	103.79	103.84	504.47	312.63
8.100	96.35	103.79	103.79	103.84	504.47	312.63	8.120	96.35	103.79	103.79	103.84	504.47	312.63
8.140	96.35	103.79	103.79	103.84	504.47	312.63	8.160	96.35	103.79	103.79	103.84	504.47	312.63
8.180	96.35	103.79	103.79	103.84	504.47	312.63	8.200	96.35	103.79	103.79	103.84	504.47	312.63
8.220	96.35	103.79	103.79	103.84	504.47	312.63	8.240	96.35	103.79	103.79	103.84	504.47	312.63
8.260	96.35	103.79	103.79	103.84	504.47	312.63	8.280	96.35	103.79	103.79	103.84	504.47	312.63
8.300	96.35	103.79	103.79	103.84	504.47	312.63	8.320	96.35	103.79	103.79	103.84	504.47	312.63
8.340	96.35	103.79	103.79	103.84	504.47	312.63	8.360	96.35	103.79	103.79	103.84	504.47	312.63
8.380	96.35	103.79	103.79	103.84	504.47	312.63	8.400	96.35	103.79	103.79	103.84	504.47	312.63
8.420	96.35	103.79	103.79	103.84	504.47	312.63	8.440	96.35	103.79	103.79	103.84	504.47	312.63
8.460	96.35	103.79	103.79	103.84	504.47	312.63	8.480	96.35	103.79	103.79	103.84	504.47	312.63
8.500	96.35	103.79	103.79	103.84	504.47	312.63	8.520	96.35	103.79	103.79	103.84	504.47	312.63

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Induction Motor ID: 1803-PM-205 B

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
8.540	96.35	103.79	103.79	103.84	504.47	312.63	8.560	96.35	103.79	103.79	103.84	504.47	312.63
8.580	96.35	103.79	103.79	103.84	504.47	312.63	8.600	96.35	103.79	103.79	103.84	504.47	312.63
8.620	96.35	103.79	103.79	103.84	504.47	312.63	8.640	96.35	103.79	103.79	103.84	504.47	312.63
8.660	96.35	103.79	103.79	103.84	504.47	312.63	8.680	96.35	103.79	103.79	103.84	504.47	312.63
8.700	96.35	103.79	103.79	103.84	504.47	312.63	8.720	96.35	103.79	103.79	103.84	504.47	312.63
8.740	96.35	103.79	103.79	103.84	504.47	312.63	8.760	96.35	103.79	103.79	103.84	504.47	312.63
8.780	96.35	103.79	103.79	103.84	504.47	312.63	8.800	96.35	103.79	103.79	103.84	504.47	312.63
8.820	96.35	103.79	103.79	103.84	504.47	312.63	8.840	96.35	103.79	103.79	103.84	504.47	312.63
8.860	96.35	103.79	103.79	103.84	504.47	312.63	8.880	96.35	103.79	103.79	103.84	504.47	312.63
8.900	96.35	103.79	103.79	103.84	504.47	312.63	8.920	96.35	103.79	103.79	103.84	504.47	312.63
8.940	96.35	103.79	103.79	103.84	504.47	312.63	8.960	96.35	103.79	103.79	103.84	504.47	312.63
8.980	96.35	103.79	103.79	103.84	504.47	312.63	9.000	96.35	103.79	103.79	103.84	504.47	312.63
9.020	96.35	103.79	103.79	103.84	504.47	312.63	9.040	96.35	103.79	103.79	103.84	504.47	312.63
9.060	96.35	103.79	103.79	103.84	504.47	312.63	9.080	96.35	103.79	103.79	103.84	504.47	312.63
9.100	96.35	103.79	103.79	103.84	504.47	312.63	9.120	96.35	103.79	103.79	103.84	504.47	312.63
9.140	96.35	103.79	103.79	103.84	504.47	312.63	9.160	96.35	103.79	103.79	103.84	504.47	312.63
9.180	96.35	103.79	103.79	103.84	504.47	312.63	9.200	96.35	103.79	103.79	103.84	504.47	312.63
9.220	96.35	103.79	103.79	103.84	504.47	312.63	9.240	96.35	103.79	103.79	103.84	504.47	312.63
9.260	96.35	103.79	103.79	103.84	504.47	312.63	9.280	96.35	103.79	103.79	103.84	504.47	312.63
9.300	96.35	103.79	103.79	103.84	504.47	312.63	9.320	96.35	103.79	103.79	103.84	504.47	312.63
9.340	96.35	103.79	103.79	103.84	504.47	312.63	9.360	96.35	103.79	103.79	103.84	504.47	312.63
9.380	96.35	103.79	103.79	103.84	504.47	312.63	9.400	96.35	103.79	103.79	103.84	504.47	312.63
9.420	96.35	103.79	103.79	103.84	504.47	312.63	9.440	96.35	103.79	103.79	103.84	504.47	312.63
9.460	96.35	103.79	103.79	103.84	504.47	312.63	9.480	96.35	103.79	103.79	103.84	504.47	312.63
9.500	96.35	103.79	103.79	103.84	504.47	312.63	9.520	96.35	103.79	103.79	103.84	504.47	312.63
9.540	96.35	103.79	103.79	103.84	504.47	312.63	9.560	96.35	103.79	103.79	103.84	504.47	312.63
9.580	96.35	103.79	103.79	103.84	504.47	312.63	9.600	96.35	103.79	103.79	103.84	504.47	312.63
9.620	96.35	103.79	103.79	103.84	504.47	312.63	9.640	96.35	103.79	103.79	103.84	504.47	312.63
9.660	96.35	103.79	103.79	103.84	504.47	312.63	9.680	96.35	103.79	103.79	103.84	504.47	312.63
9.700	96.35	103.79	103.79	103.84	504.47	312.63	9.720	96.35	103.79	103.79	103.84	504.47	312.63
9.740	96.35	103.79	103.79	103.84	504.47	312.63	9.760	96.35	103.79	103.79	103.84	504.47	312.63
9.780	96.35	103.79	103.79	103.84	504.47	312.63	9.800	96.35	103.79	103.79	103.84	504.47	312.63
9.820	96.35	103.79	103.79	103.84	504.47	312.63	9.840	96.35	103.79	103.79	103.84	504.47	312.63
9.860	96.35	103.79	103.79	103.84	504.47	312.63	9.880	96.35	103.79	103.79	103.84	504.47	312.63
9.900	96.35	103.79	103.79	103.84	504.47	312.63	9.920	96.35	103.79	103.79	103.84	504.47	312.63
9.940	96.35	103.79	103.79	103.84	504.47	312.63	9.960	96.35	103.79	103.79	103.84	504.47	312.63
9.980	96.35	103.79	103.79	103.84	504.47	312.63	10.000	96.35	103.79	103.79	103.84	504.47	312.63

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Study Case: **MS HT6-101**

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Induction Motor ID: 1803-PM-205 B

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
10.020	96.35	103.79	103.79	103.84	504.47	312.63	10.040	96.35	103.79	103.79	103.84	504.47	312.63
10.060	96.35	103.79	103.79	103.84	504.47	312.63	10.080	96.35	103.79	103.79	103.84	504.47	312.63
10.100	96.35	103.79	103.79	103.84	504.47	312.63	10.120	96.35	103.79	103.79	103.84	504.47	312.63
10.140	96.35	103.79	103.79	103.84	504.47	312.63	10.160	96.35	103.79	103.79	103.84	504.47	312.63
10.180	96.35	103.79	103.79	103.84	504.47	312.63	10.200	96.35	103.79	103.79	103.84	504.47	312.63
10.220	96.35	103.79	103.79	103.84	504.47	312.63	10.240	96.35	103.79	103.79	103.84	504.47	312.63
10.260	96.35	103.79	103.79	103.84	504.47	312.63	10.280	96.35	103.79	103.79	103.84	504.47	312.63
10.300	96.35	103.79	103.79	103.84	504.47	312.63	10.320	96.35	103.79	103.79	103.84	504.47	312.63
10.340	96.35	103.79	103.79	103.84	504.47	312.63	10.360	96.35	103.79	103.79	103.84	504.47	312.63
10.380	96.35	103.79	103.79	103.84	504.47	312.63	10.400	96.35	103.79	103.79	103.84	504.47	312.63
10.420	96.35	103.79	103.79	103.84	504.47	312.63	10.440	96.35	103.79	103.79	103.84	504.47	312.63
10.460	96.35	103.79	103.79	103.84	504.47	312.63	10.480	96.35	103.79	103.79	103.84	504.47	312.63
10.500	96.35	103.79	103.79	103.84	504.47	312.63	10.520	96.35	103.79	103.79	103.84	504.47	312.63
10.540	96.35	103.79	103.79	103.84	504.47	312.63	10.560	96.35	103.79	103.79	103.84	504.47	312.63
10.580	96.35	103.79	103.79	103.84	504.47	312.63	10.600	96.35	103.79	103.79	103.84	504.47	312.63
10.620	96.35	103.79	103.79	103.84	504.47	312.63	10.640	96.35	103.79	103.79	103.84	504.47	312.63
10.660	96.35	103.79	103.79	103.84	504.47	312.63	10.680	96.35	103.79	103.79	103.84	504.47	312.63
10.700	96.35	103.79	103.79	103.84	504.47	312.63	10.720	96.35	103.79	103.79	103.84	504.47	312.63
10.740	96.35	103.79	103.79	103.84	504.47	312.63	10.760	96.35	103.79	103.79	103.84	504.47	312.63
10.780	96.35	103.79	103.79	103.84	504.47	312.63	10.800	96.35	103.79	103.79	103.84	504.47	312.63
10.820	96.35	103.79	103.79	103.84	504.47	312.63	10.840	96.35	103.79	103.79	103.84	504.47	312.63
10.860	96.35	103.79	103.79	103.84	504.47	312.63	10.880	96.35	103.79	103.79	103.84	504.47	312.63
10.900	96.35	103.79	103.79	103.84	504.47	312.63	10.920	96.35	103.79	103.79	103.84	504.47	312.63
10.940	96.35	103.79	103.79	103.84	504.47	312.63	10.960	96.35	103.79	103.79	103.84	504.47	312.63
10.980	96.35	103.79	103.79	103.84	504.47	312.63	11.000	96.35	103.79	103.79	103.84	504.47	312.63
11.020	96.35	103.79	103.79	103.84	504.47	312.63	11.040	96.35	103.79	103.79	103.84	504.47	312.63
11.060	96.35	103.79	103.79	103.84	504.47	312.63	11.080	96.35	103.79	103.79	103.84	504.47	312.63
11.100	96.35	103.79	103.79	103.84	504.47	312.63	11.120	96.35	103.79	103.79	103.84	504.47	312.63
11.140	96.35	103.79	103.79	103.84	504.47	312.63	11.160	96.35	103.79	103.79	103.84	504.47	312.63
11.180	96.35	103.79	103.79	103.84	504.47	312.63	11.200	96.35	103.79	103.79	103.84	504.47	312.63
11.220	96.35	103.79	103.79	103.84	504.47	312.63	11.240	96.35	103.79	103.79	103.84	504.47	312.63
11.260	96.35	103.79	103.79	103.84	504.47	312.63	11.280	96.35	103.79	103.79	103.84	504.47	312.63
11.300	96.35	103.79	103.79	103.84	504.47	312.63	11.320	96.35	103.79	103.79	103.84	504.47	312.63
11.340	96.35	103.79	103.79	103.84	504.47	312.63	11.360	96.35	103.79	103.79	103.84	504.47	312.63
11.380	96.35	103.79	103.79	103.84	504.47	312.63	11.400	96.35	103.79	103.79	103.84	504.47	312.63
11.420	96.35	103.79	103.79	103.84	504.47	312.63	11.440	96.35	103.79	103.79	103.84	504.47	312.63
11.460	96.35	103.79	103.79	103.84	504.47	312.63	11.480	96.35	103.79	103.79	103.84	504.47	312.63

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Induction Motor ID: 1803-PM-205 B

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
11.500	96.35	103.79	103.79	103.84	504.47	312.63	11.520	96.35	103.79	103.79	103.84	504.47	312.63
11.540	96.35	103.79	103.79	103.84	504.47	312.63	11.560	96.35	103.79	103.79	103.84	504.47	312.63
11.580	96.35	103.79	103.79	103.84	504.47	312.63	11.600	96.35	103.79	103.79	103.84	504.47	312.63
11.620	96.35	103.79	103.79	103.84	504.47	312.63	11.640	96.35	103.79	103.79	103.84	504.47	312.63
11.660	96.35	103.79	103.79	103.84	504.47	312.63	11.680	96.35	103.79	103.79	103.84	504.47	312.63
11.700	96.35	103.79	103.79	103.84	504.47	312.63	11.720	96.35	103.79	103.79	103.84	504.47	312.63
11.740	96.35	103.79	103.79	103.84	504.47	312.63	11.760	96.35	103.79	103.79	103.84	504.47	312.63
11.780	96.35	103.79	103.79	103.84	504.47	312.63	11.800	96.35	103.79	103.79	103.84	504.47	312.63
11.820	96.35	103.79	103.79	103.84	504.47	312.63	11.840	96.35	103.79	103.79	103.84	504.47	312.63
11.860	96.35	103.79	103.79	103.84	504.47	312.63	11.880	96.35	103.79	103.79	103.84	504.47	312.63
11.900	96.35	103.79	103.79	103.84	504.47	312.63	11.920	96.35	103.79	103.79	103.84	504.47	312.63
11.940	96.35	103.79	103.79	103.84	504.47	312.63	11.960	96.35	103.79	103.79	103.84	504.47	312.63
11.980	96.35	103.79	103.79	103.84	504.47	312.63	12.000	96.35	103.79	103.79	103.84	504.47	312.63

Generator and Power Grid Results

Power Grid ID: CGP ESS-41-2

Time (Sec.)	Current (% FLA)	% Terminal Voltage	MW	Mvar	MVA	% PF	Time (Sec.)	Current (% FLA)	% Terminal Voltage	MW	Mvar	MVA	% PF
0.000	0.00	100.00	0.000	0.000	0.000	0.00	0.020	0.00	100.00	0.000	0.000	0.000	0.00
0.040	0.00	100.00	0.000	0.000	0.000	0.00	0.060	0.00	100.00	0.000	0.000	0.000	0.00
0.080	0.00	100.00	0.000	0.000	0.000	0.00	0.100	0.00	100.00	0.000	0.000	0.000	0.00
0.120	0.00	100.00	0.000	0.000	0.000	0.00	0.140	0.00	100.00	0.000	0.000	0.000	0.00
0.160	0.00	100.00	0.000	0.000	0.000	0.00	0.180	0.00	100.00	0.000	0.000	0.000	0.00
0.200	0.00	100.00	0.000	0.000	0.000	0.00	0.220	0.00	100.00	0.000	0.000	0.000	0.00
0.240	0.00	100.00	0.000	0.000	0.000	0.00	0.260	0.00	100.00	0.000	0.000	0.000	0.00
0.280	0.00	100.00	0.000	0.000	0.000	0.00	0.300	0.00	100.00	0.000	0.000	0.000	0.00
0.320	0.00	100.00	0.000	0.000	0.000	0.00	0.340	0.00	100.00	0.000	0.000	0.000	0.00
0.360	0.00	100.00	0.000	0.000	0.000	0.00	0.380	0.00	100.00	0.000	0.000	0.000	0.00
0.400	0.00	100.00	0.000	0.000	0.000	0.00	0.420	0.00	100.00	0.000	0.000	0.000	0.00
0.440	0.00	100.00	0.000	0.000	0.000	0.00	0.460	0.00	100.00	0.000	0.000	0.000	0.00
0.480	0.00	100.00	0.000	0.000	0.000	0.00	0.500	0.00	100.00	0.000	0.000	0.000	0.00
0.520	0.00	100.00	0.000	0.000	0.000	0.00	0.540	0.00	100.00	0.000	0.000	0.000	0.00
0.560	0.00	100.00	0.000	0.000	0.000	0.00	0.580	0.00	100.00	0.000	0.000	0.000	0.00
0.600	0.00	100.00	0.000	0.000	0.000	0.00	0.620	0.00	100.00	0.000	0.000	0.000	0.00
0.640	0.00	100.00	0.000	0.000	0.000	0.00	0.660	0.00	100.00	0.000	0.000	0.000	0.00
0.680	0.00	100.00	0.000	0.000	0.000	0.00	0.700	0.00	100.00	0.000	0.000	0.000	0.00

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Switching Motors

Motor				Nameplate						Locked-Roto		Accel. Time (sec.)	
ID	Type	Qty	Connected Bus ID	HP/kW	kV	RPM	FLA	% PF	% Eff	% LRC	% PF	No Load	Full Load
1803-PM-609 A	Ind.	1	BUS 044-HT6-102	275.0	6.600	1500	28.1	92.0	93.1	500.00	20.55	0.00	0.00

Motor Acceleration

Induction Motor ID: 1803-PM-609 A

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
0.000	0.00	0.00	0.00	99.47	0.00	0.00	0.020	0.00	0.00	0.00	99.47	0.00	0.00
0.040	0.00	0.00	0.00	99.47	0.00	0.00	0.060	0.00	0.00	0.00	99.47	0.00	0.00
0.080	0.00	0.00	0.00	99.47	0.00	0.00	0.100	513.80	102.76	98.29	98.37	350.37	1661.48
0.120	96.28	103.86	99.35	99.37	295.57	126.28	0.140	96.28	103.86	99.35	99.37	295.57	126.28
0.160	96.28	103.86	99.35	99.37	295.57	126.28	0.180	96.28	103.86	99.35	99.37	295.57	126.28
0.200	96.28	103.86	99.35	99.37	295.57	126.28	0.220	96.28	103.86	99.35	99.37	295.57	126.28
0.240	96.28	103.86	99.35	99.37	295.57	126.28	0.260	96.28	103.86	99.35	99.37	295.57	126.28
0.280	96.28	103.86	99.35	99.37	295.57	126.28	0.300	96.28	103.86	99.35	99.37	295.57	126.28
0.320	96.28	103.86	99.35	99.37	295.57	126.28	0.340	96.28	103.86	99.35	99.37	295.57	126.28
0.360	96.28	103.86	99.35	99.37	295.57	126.28	0.380	96.28	103.86	99.35	99.37	295.57	126.28
0.400	96.28	103.86	99.35	99.37	295.57	126.28	0.420	96.28	103.86	99.35	99.37	295.57	126.28
0.440	96.28	103.86	99.35	99.37	295.57	126.28	0.460	96.28	103.86	99.35	99.37	295.57	126.28
0.480	96.28	103.86	99.35	99.37	295.57	126.28	0.500	96.28	103.86	99.35	99.37	295.57	126.28
0.520	96.28	103.86	99.35	99.37	295.57	126.28	0.540	96.28	103.86	99.35	99.37	295.57	126.28
0.560	96.28	103.86	99.35	99.37	295.57	126.28	0.580	96.28	103.86	99.35	99.37	295.57	126.28
0.600	96.28	103.86	99.35	99.37	295.57	126.28	0.620	96.28	103.86	99.35	99.37	295.57	126.28
0.640	96.28	103.86	99.35	99.37	295.57	126.28	0.660	96.28	103.86	99.35	99.37	295.57	126.28
0.680	96.28	103.86	99.35	99.37	295.57	126.28	0.700	96.28	103.86	99.35	99.37	295.57	126.28
0.720	96.28	103.86	99.35	99.37	295.57	126.28	0.740	96.28	103.86	99.35	99.37	295.57	126.28
0.760	96.28	103.86	99.35	99.37	295.57	126.28	0.780	96.28	103.86	99.35	99.37	295.57	126.28
0.800	96.28	103.86	99.35	99.37	295.57	126.28	0.820	96.28	103.86	99.35	99.37	295.57	126.28
0.840	96.28	103.86	99.35	99.37	295.57	126.28	0.860	96.28	103.86	99.35	99.37	295.57	126.28
0.880	96.28	103.86	99.35	99.37	295.57	126.28	0.900	96.28	103.86	99.35	99.37	295.57	126.28
0.920	96.28	103.86	99.35	99.37	295.57	126.28	0.940	96.28	103.86	99.35	99.37	295.57	126.28
0.960	96.28	103.86	99.35	99.37	295.57	126.28	0.980	96.28	103.86	99.35	99.37	295.57	126.28
1.000	96.28	103.86	99.35	99.37	295.57	126.28	1.020	96.28	103.86	99.35	99.37	295.57	126.28
1.040	96.28	103.86	99.35	99.37	295.57	126.28	1.060	96.28	103.86	99.35	99.37	295.57	126.28
1.080	96.28	103.86	99.35	99.37	295.57	126.28	1.100	96.28	103.86	99.35	99.37	295.57	126.28
1.120	96.28	103.86	99.35	99.37	295.57	126.28							

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Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
1.140	96.28	103.86	99.35	99.37	295.57	126.28	1.160	96.28	103.86	99.35	99.37	295.57	126.28
1.180	96.28	103.86	99.35	99.37	295.57	126.28	1.200	96.28	103.86	99.35	99.37	295.57	126.28
1.220	96.28	103.86	99.35	99.37	295.57	126.28	1.240	96.28	103.86	99.35	99.37	295.57	126.28
1.260	96.28	103.86	99.35	99.37	295.57	126.28	1.280	96.28	103.86	99.35	99.37	295.57	126.28
1.300	96.28	103.86	99.35	99.37	295.57	126.28	1.320	96.28	103.86	99.35	99.37	295.57	126.28
1.340	96.28	103.86	99.35	99.37	295.57	126.28	1.360	96.28	103.86	99.35	99.37	295.57	126.28
1.380	96.28	103.86	99.35	99.37	295.57	126.28	1.400	96.28	103.86	99.35	99.37	295.57	126.28
1.420	96.28	103.86	99.35	99.37	295.57	126.28	1.440	96.28	103.86	99.35	99.37	295.57	126.28
1.460	96.28	103.86	99.35	99.37	295.57	126.28	1.480	96.28	103.86	99.35	99.37	295.57	126.28
1.500	96.28	103.86	99.35	99.37	295.57	126.28	1.520	96.28	103.86	99.35	99.37	295.57	126.28
1.540	96.28	103.86	99.35	99.37	295.57	126.28	1.560	96.28	103.86	99.35	99.37	295.57	126.28
1.580	96.28	103.86	99.35	99.37	295.57	126.28	1.600	96.28	103.86	99.35	99.37	295.57	126.28
1.620	96.28	103.86	99.35	99.37	295.57	126.28	1.640	96.28	103.86	99.35	99.37	295.57	126.28
1.660	96.28	103.86	99.35	99.37	295.57	126.28	1.680	96.28	103.86	99.35	99.37	295.57	126.28
1.700	96.28	103.86	99.35	99.37	295.57	126.28	1.720	96.28	103.86	99.35	99.37	295.57	126.28
1.740	96.28	103.86	99.35	99.37	295.57	126.28	1.760	96.28	103.86	99.35	99.37	295.57	126.28
1.780	96.28	103.86	99.35	99.37	295.57	126.28	1.800	96.28	103.86	99.35	99.37	295.57	126.28
1.820	96.28	103.86	99.35	99.37	295.57	126.28	1.840	96.28	103.86	99.35	99.37	295.57	126.28
1.860	96.28	103.86	99.35	99.37	295.57	126.28	1.880	96.28	103.86	99.35	99.37	295.57	126.28
1.900	96.28	103.86	99.35	99.37	295.57	126.28	1.920	96.28	103.86	99.35	99.37	295.57	126.28
1.940	96.28	103.86	99.35	99.37	295.57	126.28	1.960	96.28	103.86	99.35	99.37	295.57	126.28
1.980	96.28	103.86	99.35	99.37	295.57	126.28	2.000	96.28	103.86	99.35	99.37	295.57	126.28
2.020	96.28	103.86	99.35	99.37	295.57	126.28	2.040	96.28	103.86	99.35	99.37	295.57	126.28
2.060	96.28	103.86	99.35	99.37	295.57	126.28	2.080	96.28	103.86	99.35	99.37	295.57	126.28
2.100	96.28	103.86	99.35	99.37	295.57	126.28	2.120	96.28	103.86	99.35	99.37	295.57	126.28
2.140	96.28	103.86	99.35	99.37	295.57	126.28	2.160	96.28	103.86	99.35	99.37	295.57	126.28
2.180	96.28	103.86	99.35	99.37	295.57	126.28	2.200	96.28	103.86	99.35	99.37	295.57	126.28
2.220	96.28	103.86	99.35	99.37	295.57	126.28	2.240	96.28	103.86	99.35	99.37	295.57	126.28
2.260	96.28	103.86	99.35	99.37	295.57	126.28	2.280	96.28	103.86	99.35	99.37	295.57	126.28
2.300	96.28	103.86	99.35	99.37	295.57	126.28	2.320	96.28	103.86	99.35	99.37	295.57	126.28
2.340	96.28	103.86	99.35	99.37	295.57	126.28	2.360	96.28	103.86	99.35	99.37	295.57	126.28
2.380	96.28	103.86	99.35	99.37	295.57	126.28	2.400	96.28	103.86	99.35	99.37	295.57	126.28
2.420	96.28	103.86	99.35	99.37	295.57	126.28	2.440	96.28	103.86	99.35	99.37	295.57	126.28
2.460	96.28	103.86	99.35	99.37	295.57	126.28	2.480	96.28	103.86	99.35	99.37	295.57	126.28
2.500	96.28	103.86	99.35	99.37	295.57	126.28	2.520	96.28	103.86	99.35	99.37	295.57	126.28
2.540	96.28	103.86	99.35	99.37	295.57	126.28	2.560	96.28	103.86	99.35	99.37	295.57	126.28
2.580	96.28	103.86	99.35	99.37	295.57	126.28	2.600	96.28	103.86	99.35	99.37	295.57	126.28

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Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
2.620	96.28	103.86	99.35	99.37	295.57	126.28	2.640	96.28	103.86	99.35	99.37	295.57	126.28
2.660	96.28	103.86	99.35	99.37	295.57	126.28	2.680	96.28	103.86	99.35	99.37	295.57	126.28
2.700	96.28	103.86	99.35	99.37	295.57	126.28	2.720	96.28	103.86	99.35	99.37	295.57	126.28
2.740	96.28	103.86	99.35	99.37	295.57	126.28	2.760	96.28	103.86	99.35	99.37	295.57	126.28
2.780	96.28	103.86	99.35	99.37	295.57	126.28	2.800	96.28	103.86	99.35	99.37	295.57	126.28
2.820	96.28	103.86	99.35	99.37	295.57	126.28	2.840	96.28	103.86	99.35	99.37	295.57	126.28
2.860	96.28	103.86	99.35	99.37	295.57	126.28	2.880	96.28	103.86	99.35	99.37	295.57	126.28
2.900	96.28	103.86	99.35	99.37	295.57	126.28	2.920	96.28	103.86	99.35	99.37	295.57	126.28
2.940	96.28	103.86	99.35	99.37	295.57	126.28	2.960	96.28	103.86	99.35	99.37	295.57	126.28
2.980	96.28	103.86	99.35	99.37	295.57	126.28	3.000	96.28	103.86	99.35	99.37	295.57	126.28
3.020	96.28	103.86	99.35	99.37	295.57	126.28	3.040	96.28	103.86	99.35	99.37	295.57	126.28
3.060	96.28	103.86	99.35	99.37	295.57	126.28	3.080	96.28	103.86	99.35	99.37	295.57	126.28
3.100	96.28	103.86	99.35	99.37	295.57	126.28	3.120	96.28	103.86	99.35	99.37	295.57	126.28
3.140	96.28	103.86	99.35	99.37	295.57	126.28	3.160	96.28	103.86	99.35	99.37	295.57	126.28
3.180	96.28	103.86	99.35	99.37	295.57	126.28	3.200	96.28	103.86	99.35	99.37	295.57	126.28
3.220	96.28	103.86	99.35	99.37	295.57	126.28	3.240	96.28	103.86	99.35	99.37	295.57	126.28
3.260	96.28	103.86	99.35	99.37	295.57	126.28	3.280	96.28	103.86	99.35	99.37	295.57	126.28
3.300	96.28	103.86	99.35	99.37	295.57	126.28	3.320	96.28	103.86	99.35	99.37	295.57	126.28
3.340	96.28	103.86	99.35	99.37	295.57	126.28	3.360	96.28	103.86	99.35	99.37	295.57	126.28
3.380	96.28	103.86	99.35	99.37	295.57	126.28	3.400	96.28	103.86	99.35	99.37	295.57	126.28
3.420	96.28	103.86	99.35	99.37	295.57	126.28	3.440	96.28	103.86	99.35	99.37	295.57	126.28
3.460	96.28	103.86	99.35	99.37	295.57	126.28	3.480	96.28	103.86	99.35	99.37	295.57	126.28
3.500	96.28	103.86	99.35	99.37	295.57	126.28	3.520	96.28	103.86	99.35	99.37	295.57	126.28
3.540	96.28	103.86	99.35	99.37	295.57	126.28	3.560	96.28	103.86	99.35	99.37	295.57	126.28
3.580	96.28	103.86	99.35	99.37	295.57	126.28	3.600	96.28	103.86	99.35	99.37	295.57	126.28
3.620	96.28	103.86	99.35	99.37	295.57	126.28	3.640	96.28	103.86	99.35	99.37	295.57	126.28
3.660	96.28	103.86	99.35	99.37	295.57	126.28	3.680	96.28	103.86	99.35	99.37	295.57	126.28
3.700	96.28	103.86	99.35	99.37	295.57	126.28	3.720	96.28	103.86	99.35	99.37	295.57	126.28
3.740	96.28	103.86	99.35	99.37	295.57	126.28	3.760	96.28	103.86	99.35	99.37	295.57	126.28
3.780	96.28	103.86	99.35	99.37	295.57	126.28	3.800	96.28	103.86	99.35	99.37	295.57	126.28
3.820	96.28	103.86	99.35	99.37	295.57	126.28	3.840	96.28	103.86	99.35	99.37	295.57	126.28
3.860	96.28	103.86	99.35	99.37	295.57	126.28	3.880	96.28	103.86	99.35	99.37	295.57	126.28
3.900	96.28	103.86	99.35	99.37	295.57	126.28	3.920	96.28	103.86	99.35	99.37	295.57	126.28
3.940	96.28	103.86	99.35	99.37	295.57	126.28	3.960	96.28	103.86	99.35	99.37	295.57	126.28
3.980	96.28	103.86	99.35	99.37	295.57	126.28	4.000	96.28	103.86	99.35	99.37	295.57	126.28
4.020	96.28	103.86	99.35	99.37	295.57	126.28	4.040	96.28	103.86	99.35	99.37	295.57	126.28
4.060	96.28	103.86	99.35	99.37	295.57	126.28	4.080	96.28	103.86	99.35	99.37	295.57	126.28

Project:
Location:
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Study Case: MS HT6-102

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SN:
Revision: Base
Config.: Contingency

Induction Motor ID: 1803-PM-609 A

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
4.100	96.28	103.86	99.35	99.37	295.57	126.28	4.120	96.28	103.86	99.35	99.37	295.57	126.28
4.140	96.28	103.86	99.35	99.37	295.57	126.28	4.160	96.28	103.86	99.35	99.37	295.57	126.28
4.180	96.28	103.86	99.35	99.37	295.57	126.28	4.200	96.28	103.86	99.35	99.37	295.57	126.28
4.220	96.28	103.86	99.35	99.37	295.57	126.28	4.240	96.28	103.86	99.35	99.37	295.57	126.28
4.260	96.28	103.86	99.35	99.37	295.57	126.28	4.280	96.28	103.86	99.35	99.37	295.57	126.28
4.300	96.28	103.86	99.35	99.37	295.57	126.28	4.320	96.28	103.86	99.35	99.37	295.57	126.28
4.340	96.28	103.86	99.35	99.37	295.57	126.28	4.360	96.28	103.86	99.35	99.37	295.57	126.28
4.380	96.28	103.86	99.35	99.37	295.57	126.28	4.400	96.28	103.86	99.35	99.37	295.57	126.28
4.420	96.28	103.86	99.35	99.37	295.57	126.28	4.440	96.28	103.86	99.35	99.37	295.57	126.28
4.460	96.28	103.86	99.35	99.37	295.57	126.28	4.480	96.28	103.86	99.35	99.37	295.57	126.28
4.500	96.28	103.86	99.35	99.37	295.57	126.28	4.520	96.28	103.86	99.35	99.37	295.57	126.28
4.540	96.28	103.86	99.35	99.37	295.57	126.28	4.560	96.28	103.86	99.35	99.37	295.57	126.28
4.580	96.28	103.86	99.35	99.37	295.57	126.28	4.600	96.28	103.86	99.35	99.37	295.57	126.28
4.620	96.28	103.86	99.35	99.37	295.57	126.28	4.640	96.28	103.86	99.35	99.37	295.57	126.28
4.660	96.28	103.86	99.35	99.37	295.57	126.28	4.680	96.28	103.86	99.35	99.37	295.57	126.28
4.700	96.28	103.86	99.35	99.37	295.57	126.28	4.720	96.28	103.86	99.35	99.37	295.57	126.28
4.740	96.28	103.86	99.35	99.37	295.57	126.28	4.760	96.28	103.86	99.35	99.37	295.57	126.28
4.780	96.28	103.86	99.35	99.37	295.57	126.28	4.800	96.28	103.86	99.35	99.37	295.57	126.28
4.820	96.28	103.86	99.35	99.37	295.57	126.28	4.840	96.28	103.86	99.35	99.37	295.57	126.28
4.860	96.28	103.86	99.35	99.37	295.57	126.28	4.880	96.28	103.86	99.35	99.37	295.57	126.28
4.900	96.28	103.86	99.35	99.37	295.57	126.28	4.920	96.28	103.86	99.35	99.37	295.57	126.28
4.940	96.28	103.86	99.35	99.37	295.57	126.28	4.960	96.28	103.86	99.35	99.37	295.57	126.28
4.980	96.28	103.86	99.35	99.37	295.57	126.28	5.000	96.28	103.86	99.35	99.37	295.57	126.28
5.020	96.28	103.86	99.35	99.37	295.57	126.28	5.040	96.28	103.86	99.35	99.37	295.57	126.28
5.060	96.28	103.86	99.35	99.37	295.57	126.28	5.080	96.28	103.86	99.35	99.37	295.57	126.28
5.100	96.28	103.86	99.35	99.37	295.57	126.28	5.120	96.28	103.86	99.35	99.37	295.57	126.28
5.140	96.28	103.86	99.35	99.37	295.57	126.28	5.160	96.28	103.86	99.35	99.37	295.57	126.28
5.180	96.28	103.86	99.35	99.37	295.57	126.28	5.200	96.28	103.86	99.35	99.37	295.57	126.28
5.220	96.28	103.86	99.35	99.37	295.57	126.28	5.240	96.28	103.86	99.35	99.37	295.57	126.28
5.260	96.28	103.86	99.35	99.37	295.57	126.28	5.280	96.28	103.86	99.35	99.37	295.57	126.28
5.300	96.28	103.86	99.35	99.37	295.57	126.28	5.320	96.28	103.86	99.35	99.37	295.57	126.28
5.340	96.28	103.86	99.35	99.37	295.57	126.28	5.360	96.28	103.86	99.35	99.37	295.57	126.28
5.380	96.28	103.86	99.35	99.37	295.57	126.28	5.400	96.28	103.86	99.35	99.37	295.57	126.28
5.420	96.28	103.86	99.35	99.37	295.57	126.28	5.440	96.28	103.86	99.35	99.37	295.57	126.28
5.460	96.28	103.86	99.35	99.37	295.57	126.28	5.480	96.28	103.86	99.35	99.37	295.57	126.28
5.500	96.28	103.86	99.35	99.37	295.57	126.28	5.520	96.28	103.86	99.35	99.37	295.57	126.28
5.540	96.28	103.86	99.35	99.37	295.57	126.28	5.560	96.28	103.86	99.35	99.37	295.57	126.28

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Study Case: MS HT6-102

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Revision: Base
Config.: Contingency

Induction Motor ID: 1803-PM-609 A

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
5.580	96.28	103.86	99.35	99.37	295.57	126.28	5.600	96.28	103.86	99.35	99.37	295.57	126.28
5.620	96.28	103.86	99.35	99.37	295.57	126.28	5.640	96.28	103.86	99.35	99.37	295.57	126.28
5.660	96.28	103.86	99.35	99.37	295.57	126.28	5.680	96.28	103.86	99.35	99.37	295.57	126.28
5.700	96.28	103.86	99.35	99.37	295.57	126.28	5.720	96.28	103.86	99.35	99.37	295.57	126.28
5.740	96.28	103.86	99.35	99.37	295.57	126.28	5.760	96.28	103.86	99.35	99.37	295.57	126.28
5.780	96.28	103.86	99.35	99.37	295.57	126.28	5.800	96.28	103.86	99.35	99.37	295.57	126.28
5.820	96.28	103.86	99.35	99.37	295.57	126.28	5.840	96.28	103.86	99.35	99.37	295.57	126.28
5.860	96.28	103.86	99.35	99.37	295.57	126.28	5.880	96.28	103.86	99.35	99.37	295.57	126.28
5.900	96.28	103.86	99.35	99.37	295.57	126.28	5.920	96.28	103.86	99.35	99.37	295.57	126.28
5.940	96.28	103.86	99.35	99.37	295.57	126.28	5.960	96.28	103.86	99.35	99.37	295.57	126.28
5.980	96.28	103.86	99.35	99.37	295.57	126.28	6.000	96.28	103.86	99.35	99.37	295.57	126.28
6.020	96.28	103.86	99.35	99.37	295.57	126.28	6.040	96.28	103.86	99.35	99.37	295.57	126.28
6.060	96.28	103.86	99.35	99.37	295.57	126.28	6.080	96.28	103.86	99.35	99.37	295.57	126.28
6.100	96.28	103.86	99.35	99.37	295.57	126.28	6.120	96.28	103.86	99.35	99.37	295.57	126.28
6.140	96.28	103.86	99.35	99.37	295.57	126.28	6.160	96.28	103.86	99.35	99.37	295.57	126.28
6.180	96.28	103.86	99.35	99.37	295.57	126.28	6.200	96.28	103.86	99.35	99.37	295.57	126.28
6.220	96.28	103.86	99.35	99.37	295.57	126.28	6.240	96.28	103.86	99.35	99.37	295.57	126.28
6.260	96.28	103.86	99.35	99.37	295.57	126.28	6.280	96.28	103.86	99.35	99.37	295.57	126.28
6.300	96.28	103.86	99.35	99.37	295.57	126.28	6.320	96.28	103.86	99.35	99.37	295.57	126.28
6.340	96.28	103.86	99.35	99.37	295.57	126.28	6.360	96.28	103.86	99.35	99.37	295.57	126.28
6.380	96.28	103.86	99.35	99.37	295.57	126.28	6.400	96.28	103.86	99.35	99.37	295.57	126.28
6.420	96.28	103.86	99.35	99.37	295.57	126.28	6.440	96.28	103.86	99.35	99.37	295.57	126.28
6.460	96.28	103.86	99.35	99.37	295.57	126.28	6.480	96.28	103.86	99.35	99.37	295.57	126.28
6.500	96.28	103.86	99.35	99.37	295.57	126.28	6.520	96.28	103.86	99.35	99.37	295.57	126.28
6.540	96.28	103.86	99.35	99.37	295.57	126.28	6.560	96.28	103.86	99.35	99.37	295.57	126.28
6.580	96.28	103.86	99.35	99.37	295.57	126.28	6.600	96.28	103.86	99.35	99.37	295.57	126.28
6.620	96.28	103.86	99.35	99.37	295.57	126.28	6.640	96.28	103.86	99.35	99.37	295.57	126.28
6.660	96.28	103.86	99.35	99.37	295.57	126.28	6.680	96.28	103.86	99.35	99.37	295.57	126.28
6.700	96.28	103.86	99.35	99.37	295.57	126.28	6.720	96.28	103.86	99.35	99.37	295.57	126.28
6.740	96.28	103.86	99.35	99.37	295.57	126.28	6.760	96.28	103.86	99.35	99.37	295.57	126.28
6.780	96.28	103.86	99.35	99.37	295.57	126.28	6.800	96.28	103.86	99.35	99.37	295.57	126.28
6.820	96.28	103.86	99.35	99.37	295.57	126.28	6.840	96.28	103.86	99.35	99.37	295.57	126.28
6.860	96.28	103.86	99.35	99.37	295.57	126.28	6.880	96.28	103.86	99.35	99.37	295.57	126.28
6.900	96.28	103.86	99.35	99.37	295.57	126.28	6.920	96.28	103.86	99.35	99.37	295.57	126.28
6.940	96.28	103.86	99.35	99.37	295.57	126.28	6.960	96.28	103.86	99.35	99.37	295.57	126.28
6.980	96.28	103.86	99.35	99.37	295.57	126.28	7.000	96.28	103.86	99.35	99.37	295.57	126.28
7.020	96.28	103.86	99.35	99.37	295.57	126.28	7.040	96.28	103.86	99.35	99.37	295.57	126.28

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Study Case: MS HT6-102

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Revision: Base
Config.: Contingency

Induction Motor ID: 1803-PM-609 A

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
7.060	96.28	103.86	99.35	99.37	295.57	126.28	7.080	96.28	103.86	99.35	99.37	295.57	126.28
7.100	96.28	103.86	99.35	99.37	295.57	126.28	7.120	96.28	103.86	99.35	99.37	295.57	126.28
7.140	96.28	103.86	99.35	99.37	295.57	126.28	7.160	96.28	103.86	99.35	99.37	295.57	126.28
7.180	96.28	103.86	99.35	99.37	295.57	126.28	7.200	96.28	103.86	99.35	99.37	295.57	126.28
7.220	96.28	103.86	99.35	99.37	295.57	126.28	7.240	96.28	103.86	99.35	99.37	295.57	126.28
7.260	96.28	103.86	99.35	99.37	295.57	126.28	7.280	96.28	103.86	99.35	99.37	295.57	126.28
7.300	96.28	103.86	99.35	99.37	295.57	126.28	7.320	96.28	103.86	99.35	99.37	295.57	126.28
7.340	96.28	103.86	99.35	99.37	295.57	126.28	7.360	96.28	103.86	99.35	99.37	295.57	126.28
7.380	96.28	103.86	99.35	99.37	295.57	126.28	7.400	96.28	103.86	99.35	99.37	295.57	126.28
7.420	96.28	103.86	99.35	99.37	295.57	126.28	7.440	96.28	103.86	99.35	99.37	295.57	126.28
7.460	96.28	103.86	99.35	99.37	295.57	126.28	7.480	96.28	103.86	99.35	99.37	295.57	126.28
7.500	96.28	103.86	99.35	99.37	295.57	126.28	7.520	96.28	103.86	99.35	99.37	295.57	126.28
7.540	96.28	103.86	99.35	99.37	295.57	126.28	7.560	96.28	103.86	99.35	99.37	295.57	126.28
7.580	96.28	103.86	99.35	99.37	295.57	126.28	7.600	96.28	103.86	99.35	99.37	295.57	126.28
7.620	96.28	103.86	99.35	99.37	295.57	126.28	7.640	96.28	103.86	99.35	99.37	295.57	126.28
7.660	96.28	103.86	99.35	99.37	295.57	126.28	7.680	96.28	103.86	99.35	99.37	295.57	126.28
7.700	96.28	103.86	99.35	99.37	295.57	126.28	7.720	96.28	103.86	99.35	99.37	295.57	126.28
7.740	96.28	103.86	99.35	99.37	295.57	126.28	7.760	96.28	103.86	99.35	99.37	295.57	126.28
7.780	96.28	103.86	99.35	99.37	295.57	126.28	7.800	96.28	103.86	99.35	99.37	295.57	126.28
7.820	96.28	103.86	99.35	99.37	295.57	126.28	7.840	96.28	103.86	99.35	99.37	295.57	126.28
7.860	96.28	103.86	99.35	99.37	295.57	126.28	7.880	96.28	103.86	99.35	99.37	295.57	126.28
7.900	96.28	103.86	99.35	99.37	295.57	126.28	7.920	96.28	103.86	99.35	99.37	295.57	126.28
7.940	96.28	103.86	99.35	99.37	295.57	126.28	7.960	96.28	103.86	99.35	99.37	295.57	126.28
7.980	96.28	103.86	99.35	99.37	295.57	126.28	8.000	96.28	103.86	99.35	99.37	295.57	126.28
8.020	96.28	103.86	99.35	99.37	295.57	126.28	8.040	96.28	103.86	99.35	99.37	295.57	126.28
8.060	96.28	103.86	99.35	99.37	295.57	126.28	8.080	96.28	103.86	99.35	99.37	295.57	126.28
8.100	96.28	103.86	99.35	99.37	295.57	126.28	8.120	96.28	103.86	99.35	99.37	295.57	126.28
8.140	96.28	103.86	99.35	99.37	295.57	126.28	8.160	96.28	103.86	99.35	99.37	295.57	126.28
8.180	96.28	103.86	99.35	99.37	295.57	126.28	8.200	96.28	103.86	99.35	99.37	295.57	126.28
8.220	96.28	103.86	99.35	99.37	295.57	126.28	8.240	96.28	103.86	99.35	99.37	295.57	126.28
8.260	96.28	103.86	99.35	99.37	295.57	126.28	8.280	96.28	103.86	99.35	99.37	295.57	126.28
8.300	96.28	103.86	99.35	99.37	295.57	126.28	8.320	96.28	103.86	99.35	99.37	295.57	126.28
8.340	96.28	103.86	99.35	99.37	295.57	126.28	8.360	96.28	103.86	99.35	99.37	295.57	126.28
8.380	96.28	103.86	99.35	99.37	295.57	126.28	8.400	96.28	103.86	99.35	99.37	295.57	126.28
8.420	96.28	103.86	99.35	99.37	295.57	126.28	8.440	96.28	103.86	99.35	99.37	295.57	126.28
8.460	96.28	103.86	99.35	99.37	295.57	126.28	8.480	96.28	103.86	99.35	99.37	295.57	126.28
8.500	96.28	103.86	99.35	99.37	295.57	126.28	8.520	96.28	103.86	99.35	99.37	295.57	126.28

Project:
Location:
Contract:
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Induction Motor ID: 1803-PM-609 A

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
8.540	96.28	103.86	99.35	99.37	295.57	126.28	8.560	96.28	103.86	99.35	99.37	295.57	126.28
8.580	96.28	103.86	99.35	99.37	295.57	126.28	8.600	96.28	103.86	99.35	99.37	295.57	126.28
8.620	96.28	103.86	99.35	99.37	295.57	126.28	8.640	96.28	103.86	99.35	99.37	295.57	126.28
8.660	96.28	103.86	99.35	99.37	295.57	126.28	8.680	96.28	103.86	99.35	99.37	295.57	126.28
8.700	96.28	103.86	99.35	99.37	295.57	126.28	8.720	96.28	103.86	99.35	99.37	295.57	126.28
8.740	96.28	103.86	99.35	99.37	295.57	126.28	8.760	96.28	103.86	99.35	99.37	295.57	126.28
8.780	96.28	103.86	99.35	99.37	295.57	126.28	8.800	96.28	103.86	99.35	99.37	295.57	126.28
8.820	96.28	103.86	99.35	99.37	295.57	126.28	8.840	96.28	103.86	99.35	99.37	295.57	126.28
8.860	96.28	103.86	99.35	99.37	295.57	126.28	8.880	96.28	103.86	99.35	99.37	295.57	126.28
8.900	96.28	103.86	99.35	99.37	295.57	126.28	8.920	96.28	103.86	99.35	99.37	295.57	126.28
8.940	96.28	103.86	99.35	99.37	295.57	126.28	8.960	96.28	103.86	99.35	99.37	295.57	126.28
8.980	96.28	103.86	99.35	99.37	295.57	126.28	9.000	96.28	103.86	99.35	99.37	295.57	126.28
9.020	96.28	103.86	99.35	99.37	295.57	126.28	9.040	96.28	103.86	99.35	99.37	295.57	126.28
9.060	96.28	103.86	99.35	99.37	295.57	126.28	9.080	96.28	103.86	99.35	99.37	295.57	126.28
9.100	96.28	103.86	99.35	99.37	295.57	126.28	9.120	96.28	103.86	99.35	99.37	295.57	126.28
9.140	96.28	103.86	99.35	99.37	295.57	126.28	9.160	96.28	103.86	99.35	99.37	295.57	126.28
9.180	96.28	103.86	99.35	99.37	295.57	126.28	9.200	96.28	103.86	99.35	99.37	295.57	126.28
9.220	96.28	103.86	99.35	99.37	295.57	126.28	9.240	96.28	103.86	99.35	99.37	295.57	126.28
9.260	96.28	103.86	99.35	99.37	295.57	126.28	9.280	96.28	103.86	99.35	99.37	295.57	126.28
9.300	96.28	103.86	99.35	99.37	295.57	126.28	9.320	96.28	103.86	99.35	99.37	295.57	126.28
9.340	96.28	103.86	99.35	99.37	295.57	126.28	9.360	96.28	103.86	99.35	99.37	295.57	126.28
9.380	96.28	103.86	99.35	99.37	295.57	126.28	9.400	96.28	103.86	99.35	99.37	295.57	126.28
9.420	96.28	103.86	99.35	99.37	295.57	126.28	9.440	96.28	103.86	99.35	99.37	295.57	126.28
9.460	96.28	103.86	99.35	99.37	295.57	126.28	9.480	96.28	103.86	99.35	99.37	295.57	126.28
9.500	96.28	103.86	99.35	99.37	295.57	126.28	9.520	96.28	103.86	99.35	99.37	295.57	126.28
9.540	96.28	103.86	99.35	99.37	295.57	126.28	9.560	96.28	103.86	99.35	99.37	295.57	126.28
9.580	96.28	103.86	99.35	99.37	295.57	126.28	9.600	96.28	103.86	99.35	99.37	295.57	126.28
9.620	96.28	103.86	99.35	99.37	295.57	126.28	9.640	96.28	103.86	99.35	99.37	295.57	126.28
9.660	96.28	103.86	99.35	99.37	295.57	126.28	9.680	96.28	103.86	99.35	99.37	295.57	126.28
9.700	96.28	103.86	99.35	99.37	295.57	126.28	9.720	96.28	103.86	99.35	99.37	295.57	126.28
9.740	96.28	103.86	99.35	99.37	295.57	126.28	9.760	96.28	103.86	99.35	99.37	295.57	126.28
9.780	96.28	103.86	99.35	99.37	295.57	126.28	9.800	96.28	103.86	99.35	99.37	295.57	126.28
9.820	96.28	103.86	99.35	99.37	295.57	126.28	9.840	96.28	103.86	99.35	99.37	295.57	126.28
9.860	96.28	103.86	99.35	99.37	295.57	126.28	9.880	96.28	103.86	99.35	99.37	295.57	126.28
9.900	96.28	103.86	99.35	99.37	295.57	126.28	9.920	96.28	103.86	99.35	99.37	295.57	126.28
9.940	96.28	103.86	99.35	99.37	295.57	126.28	9.960	96.28	103.86	99.35	99.37	295.57	126.28
9.980	96.28	103.86	99.35	99.37	295.57	126.28	10.000	96.28	103.86	99.35	99.37	295.57	126.28

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Study Case: MS HT6-102

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Revision: Base
Config.: Contingency

Induction Motor ID: 1803-PM-609 A

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
10.020	96.28	103.86	99.35	99.37	295.57	126.28	10.040	96.28	103.86	99.35	99.37	295.57	126.28
10.060	96.28	103.86	99.35	99.37	295.57	126.28	10.080	96.28	103.86	99.35	99.37	295.57	126.28
10.100	96.28	103.86	99.35	99.37	295.57	126.28	10.120	96.28	103.86	99.35	99.37	295.57	126.28
10.140	96.28	103.86	99.35	99.37	295.57	126.28	10.160	96.28	103.86	99.35	99.37	295.57	126.28
10.180	96.28	103.86	99.35	99.37	295.57	126.28	10.200	96.28	103.86	99.35	99.37	295.57	126.28
10.220	96.28	103.86	99.35	99.37	295.57	126.28	10.240	96.28	103.86	99.35	99.37	295.57	126.28
10.260	96.28	103.86	99.35	99.37	295.57	126.28	10.280	96.28	103.86	99.35	99.37	295.57	126.28
10.300	96.28	103.86	99.35	99.37	295.57	126.28	10.320	96.28	103.86	99.35	99.37	295.57	126.28
10.340	96.28	103.86	99.35	99.37	295.57	126.28	10.360	96.28	103.86	99.35	99.37	295.57	126.28
10.380	96.28	103.86	99.35	99.37	295.57	126.28	10.400	96.28	103.86	99.35	99.37	295.57	126.28
10.420	96.28	103.86	99.35	99.37	295.57	126.28	10.440	96.28	103.86	99.35	99.37	295.57	126.28
10.460	96.28	103.86	99.35	99.37	295.57	126.28	10.480	96.28	103.86	99.35	99.37	295.57	126.28
10.500	96.28	103.86	99.35	99.37	295.57	126.28	10.520	96.28	103.86	99.35	99.37	295.57	126.28
10.540	96.28	103.86	99.35	99.37	295.57	126.28	10.560	96.28	103.86	99.35	99.37	295.57	126.28
10.580	96.28	103.86	99.35	99.37	295.57	126.28	10.600	96.28	103.86	99.35	99.37	295.57	126.28
10.620	96.28	103.86	99.35	99.37	295.57	126.28	10.640	96.28	103.86	99.35	99.37	295.57	126.28
10.660	96.28	103.86	99.35	99.37	295.57	126.28	10.680	96.28	103.86	99.35	99.37	295.57	126.28
10.700	96.28	103.86	99.35	99.37	295.57	126.28	10.720	96.28	103.86	99.35	99.37	295.57	126.28
10.740	96.28	103.86	99.35	99.37	295.57	126.28	10.760	96.28	103.86	99.35	99.37	295.57	126.28
10.780	96.28	103.86	99.35	99.37	295.57	126.28	10.800	96.28	103.86	99.35	99.37	295.57	126.28
10.820	96.28	103.86	99.35	99.37	295.57	126.28	10.840	96.28	103.86	99.35	99.37	295.57	126.28
10.860	96.28	103.86	99.35	99.37	295.57	126.28	10.880	96.28	103.86	99.35	99.37	295.57	126.28
10.900	96.28	103.86	99.35	99.37	295.57	126.28	10.920	96.28	103.86	99.35	99.37	295.57	126.28
10.940	96.28	103.86	99.35	99.37	295.57	126.28	10.960	96.28	103.86	99.35	99.37	295.57	126.28
10.980	96.28	103.86	99.35	99.37	295.57	126.28	11.000	96.28	103.86	99.35	99.37	295.57	126.28
11.020	96.28	103.86	99.35	99.37	295.57	126.28	11.040	96.28	103.86	99.35	99.37	295.57	126.28
11.060	96.28	103.86	99.35	99.37	295.57	126.28	11.080	96.28	103.86	99.35	99.37	295.57	126.28
11.100	96.28	103.86	99.35	99.37	295.57	126.28	11.120	96.28	103.86	99.35	99.37	295.57	126.28
11.140	96.28	103.86	99.35	99.37	295.57	126.28	11.160	96.28	103.86	99.35	99.37	295.57	126.28
11.180	96.28	103.86	99.35	99.37	295.57	126.28	11.200	96.28	103.86	99.35	99.37	295.57	126.28
11.220	96.28	103.86	99.35	99.37	295.57	126.28	11.240	96.28	103.86	99.35	99.37	295.57	126.28
11.260	96.28	103.86	99.35	99.37	295.57	126.28	11.280	96.28	103.86	99.35	99.37	295.57	126.28
11.300	96.28	103.86	99.35	99.37	295.57	126.28	11.320	96.28	103.86	99.35	99.37	295.57	126.28
11.340	96.28	103.86	99.35	99.37	295.57	126.28	11.360	96.28	103.86	99.35	99.37	295.57	126.28
11.380	96.28	103.86	99.35	99.37	295.57	126.28	11.400	96.28	103.86	99.35	99.37	295.57	126.28
11.420	96.28	103.86	99.35	99.37	295.57	126.28	11.440	96.28	103.86	99.35	99.37	295.57	126.28
11.460	96.28	103.86	99.35	99.37	295.57	126.28	11.480	96.28	103.86	99.35	99.37	295.57	126.28

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Induction Motor ID: 1803-PM-609 A

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
11.500	96.28	103.86	99.35	99.37	295.57	126.28	11.520	96.28	103.86	99.35	99.37	295.57	126.28
11.540	96.28	103.86	99.35	99.37	295.57	126.28	11.560	96.28	103.86	99.35	99.37	295.57	126.28
11.580	96.28	103.86	99.35	99.37	295.57	126.28	11.600	96.28	103.86	99.35	99.37	295.57	126.28
11.620	96.28	103.86	99.35	99.37	295.57	126.28	11.640	96.28	103.86	99.35	99.37	295.57	126.28
11.660	96.28	103.86	99.35	99.37	295.57	126.28	11.680	96.28	103.86	99.35	99.37	295.57	126.28
11.700	96.28	103.86	99.35	99.37	295.57	126.28	11.720	96.28	103.86	99.35	99.37	295.57	126.28
11.740	96.28	103.86	99.35	99.37	295.57	126.28	11.760	96.28	103.86	99.35	99.37	295.57	126.28
11.780	96.28	103.86	99.35	99.37	295.57	126.28	11.800	96.28	103.86	99.35	99.37	295.57	126.28
11.820	96.28	103.86	99.35	99.37	295.57	126.28	11.840	96.28	103.86	99.35	99.37	295.57	126.28
11.860	96.28	103.86	99.35	99.37	295.57	126.28	11.880	96.28	103.86	99.35	99.37	295.57	126.28
11.900	96.28	103.86	99.35	99.37	295.57	126.28	11.920	96.28	103.86	99.35	99.37	295.57	126.28
11.940	96.28	103.86	99.35	99.37	295.57	126.28	11.960	96.28	103.86	99.35	99.37	295.57	126.28
11.980	96.28	103.86	99.35	99.37	295.57	126.28	12.000	96.28	103.86	99.35	99.37	295.57	126.28

Generator and Power Grid Results

Power Grid ID: CGP ESS-41-2

Time (Sec.)	Current (% FLA)	% Terminal Voltage	MW	Mvar	MVA	% PF	Time (Sec.)	Current (% FLA)	% Terminal Voltage	MW	Mvar	MVA	% PF
0.000	0.00	100.00	0.000	0.000	0.000	0.00	0.020	0.00	100.00	0.000	0.000	0.000	0.00
0.040	0.00	100.00	0.000	0.000	0.000	0.00	0.060	0.00	100.00	0.000	0.000	0.000	0.00
0.080	0.00	100.00	0.000	0.000	0.000	0.00	0.100	0.00	100.00	0.000	0.000	0.000	0.00
0.120	0.00	100.00	0.000	0.000	0.000	0.00	0.140	0.00	100.00	0.000	0.000	0.000	0.00
0.160	0.00	100.00	0.000	0.000	0.000	0.00	0.180	0.00	100.00	0.000	0.000	0.000	0.00
0.200	0.00	100.00	0.000	0.000	0.000	0.00	0.220	0.00	100.00	0.000	0.000	0.000	0.00
0.240	0.00	100.00	0.000	0.000	0.000	0.00	0.260	0.00	100.00	0.000	0.000	0.000	0.00
0.280	0.00	100.00	0.000	0.000	0.000	0.00	0.300	0.00	100.00	0.000	0.000	0.000	0.00
0.320	0.00	100.00	0.000	0.000	0.000	0.00	0.340	0.00	100.00	0.000	0.000	0.000	0.00
0.360	0.00	100.00	0.000	0.000	0.000	0.00	0.380	0.00	100.00	0.000	0.000	0.000	0.00
0.400	0.00	100.00	0.000	0.000	0.000	0.00	0.420	0.00	100.00	0.000	0.000	0.000	0.00
0.440	0.00	100.00	0.000	0.000	0.000	0.00	0.460	0.00	100.00	0.000	0.000	0.000	0.00
0.480	0.00	100.00	0.000	0.000	0.000	0.00	0.500	0.00	100.00	0.000	0.000	0.000	0.00
0.520	0.00	100.00	0.000	0.000	0.000	0.00	0.540	0.00	100.00	0.000	0.000	0.000	0.00
0.560	0.00	100.00	0.000	0.000	0.000	0.00	0.580	0.00	100.00	0.000	0.000	0.000	0.00
0.600	0.00	100.00	0.000	0.000	0.000	0.00	0.620	0.00	100.00	0.000	0.000	0.000	0.00
0.640	0.00	100.00	0.000	0.000	0.000	0.00	0.660	0.00	100.00	0.000	0.000	0.000	0.00
0.680	0.00	100.00	0.000	0.000	0.000	0.00	0.700	0.00	100.00	0.000	0.000	0.000	0.00

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Switching Motors

Motor				Nameplate						Locked-Roto		Accel. Time (sec.)	
ID	Type	Qty	Connected Bus ID	HP/kW	kV	RPM	FLA	% PF	% Eff	% LRC	% PF	No Load	Full Load
1803-PM-206 A	Ind.	1	BUS B 044-PMCC-101	150.0	0.433	1500	235.1	91.7	92.8	600.00	24.31	0.00	0.00

Motor Acceleration

Induction Motor ID: **1803-PM-206 A**

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
0.000	0.00	0.00	0.00	102.07	0.00	0.00	0.020	0.00	0.00	0.00	102.07	0.00	0.00
0.040	0.00	0.00	0.00	102.07	0.00	0.00	0.060	0.00	0.00	0.00	102.07	0.00	0.00
0.080	0.00	0.00	0.00	102.07	0.00	0.00	0.100	509.03	84.84	88.52	98.12	310.78	784.82
0.120	106.06	94.28	98.37	101.61	167.18	72.30	0.140	106.06	94.28	98.37	101.61	167.18	72.30
0.160	106.06	94.28	98.37	101.61	167.18	72.30	0.180	106.06	94.28	98.37	101.61	167.18	72.30
0.200	106.06	94.28	98.37	101.61	167.18	72.30	0.220	106.06	94.28	98.37	101.61	167.18	72.30
0.240	106.06	94.28	98.37	101.61	167.18	72.30	0.260	106.06	94.28	98.37	101.61	167.18	72.30
0.280	106.06	94.28	98.37	101.61	167.18	72.30	0.300	106.06	94.28	98.37	101.61	167.18	72.30
0.320	106.06	94.28	98.37	101.61	167.18	72.30	0.340	106.06	94.28	98.37	101.61	167.18	72.30
0.360	106.06	94.28	98.37	101.61	167.18	72.30	0.380	106.06	94.28	98.37	101.61	167.18	72.30
0.400	106.06	94.28	98.37	101.61	167.18	72.30	0.420	106.06	94.28	98.37	101.61	167.18	72.30
0.440	106.06	94.28	98.37	101.61	167.18	72.30	0.460	106.06	94.28	98.37	101.61	167.18	72.30
0.480	106.06	94.28	98.37	101.61	167.18	72.30	0.500	106.06	94.28	98.37	101.61	167.18	72.30
0.520	106.06	94.28	98.37	101.61	167.18	72.30	0.540	106.06	94.28	98.37	101.61	167.18	72.30
0.560	106.06	94.28	98.37	101.61	167.18	72.30	0.580	106.06	94.28	98.37	101.61	167.18	72.30
0.600	106.06	94.28	98.37	101.61	167.18	72.30	0.620	106.06	94.28	98.37	101.61	167.18	72.30
0.640	106.06	94.28	98.37	101.61	167.18	72.30	0.660	106.06	94.28	98.37	101.61	167.18	72.30
0.680	106.06	94.28	98.37	101.61	167.18	72.30	0.700	106.06	94.28	98.37	101.61	167.18	72.30
0.720	106.06	94.28	98.37	101.61	167.18	72.30	0.740	106.06	94.28	98.37	101.61	167.18	72.30
0.760	106.06	94.28	98.37	101.61	167.18	72.30	0.780	106.06	94.28	98.37	101.61	167.18	72.30
0.800	106.06	94.28	98.37	101.61	167.18	72.30	0.820	106.06	94.28	98.37	101.61	167.18	72.30
0.840	106.06	94.28	98.37	101.61	167.18	72.30	0.860	106.06	94.28	98.37	101.61	167.18	72.30
0.880	106.06	94.28	98.37	101.61	167.18	72.30	0.900	106.06	94.28	98.37	101.61	167.18	72.30
0.920	106.06	94.28	98.37	101.61	167.18	72.30	0.940	106.06	94.28	98.37	101.61	167.18	72.30
0.960	106.06	94.28	98.37	101.61	167.18	72.30	0.980	106.06	94.28	98.37	101.61	167.18	72.30
1.000	106.06	94.28	98.37	101.61	167.18	72.30	1.020	106.06	94.28	98.37	101.61	167.18	72.30
1.040	106.06	94.28	98.37	101.61	167.18	72.30	1.060	106.06	94.28	98.37	101.61	167.18	72.30
1.080	106.06	94.28	98.37	101.61	167.18	72.30	1.100	106.06	94.28	98.37	101.61	167.18	72.30
1.120	106.06	94.28	98.37	101.61	167.18	72.30							

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Study Case: MS PMCC-101

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Config.: Contingency

Induction Motor ID: 1803-PM-206 A

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
1.140	106.06	94.28	98.37	101.61	167.18	72.30	1.160	106.06	94.28	98.37	101.61	167.18	72.30
1.180	106.06	94.28	98.37	101.61	167.18	72.30	1.200	106.06	94.28	98.37	101.61	167.18	72.30
1.220	106.06	94.28	98.37	101.61	167.18	72.30	1.240	106.06	94.28	98.37	101.61	167.18	72.30
1.260	106.06	94.28	98.37	101.61	167.18	72.30	1.280	106.06	94.28	98.37	101.61	167.18	72.30
1.300	106.06	94.28	98.37	101.61	167.18	72.30	1.320	106.06	94.28	98.37	101.61	167.18	72.30
1.340	106.06	94.28	98.37	101.61	167.18	72.30	1.360	106.06	94.28	98.37	101.61	167.18	72.30
1.380	106.06	94.28	98.37	101.61	167.18	72.30	1.400	106.06	94.28	98.37	101.61	167.18	72.30
1.420	106.06	94.28	98.37	101.61	167.18	72.30	1.440	106.06	94.28	98.37	101.61	167.18	72.30
1.460	106.06	94.28	98.37	101.61	167.18	72.30	1.480	106.06	94.28	98.37	101.61	167.18	72.30
1.500	106.06	94.28	98.37	101.61	167.18	72.30	1.520	106.06	94.28	98.37	101.61	167.18	72.30
1.540	106.06	94.28	98.37	101.61	167.18	72.30	1.560	106.06	94.28	98.37	101.61	167.18	72.30
1.580	106.06	94.28	98.37	101.61	167.18	72.30	1.600	106.06	94.28	98.37	101.61	167.18	72.30
1.620	106.06	94.28	98.37	101.61	167.18	72.30	1.640	106.06	94.28	98.37	101.61	167.18	72.30
1.660	106.06	94.28	98.37	101.61	167.18	72.30	1.680	106.06	94.28	98.37	101.61	167.18	72.30
1.700	106.06	94.28	98.37	101.61	167.18	72.30	1.720	106.06	94.28	98.37	101.61	167.18	72.30
1.740	106.06	94.28	98.37	101.61	167.18	72.30	1.760	106.06	94.28	98.37	101.61	167.18	72.30
1.780	106.06	94.28	98.37	101.61	167.18	72.30	1.800	106.06	94.28	98.37	101.61	167.18	72.30
1.820	106.06	94.28	98.37	101.61	167.18	72.30	1.840	106.06	94.28	98.37	101.61	167.18	72.30
1.860	106.06	94.28	98.37	101.61	167.18	72.30	1.880	106.06	94.28	98.37	101.61	167.18	72.30
1.900	106.06	94.28	98.37	101.61	167.18	72.30	1.920	106.06	94.28	98.37	101.61	167.18	72.30
1.940	106.06	94.28	98.37	101.61	167.18	72.30	1.960	106.06	94.28	98.37	101.61	167.18	72.30
1.980	106.06	94.28	98.37	101.61	167.18	72.30	2.000	106.06	94.28	98.37	101.61	167.18	72.30
2.020	106.06	94.28	98.37	101.61	167.18	72.30	2.040	106.06	94.28	98.37	101.61	167.18	72.30
2.060	106.06	94.28	98.37	101.61	167.18	72.30	2.080	106.06	94.28	98.37	101.61	167.18	72.30
2.100	106.06	94.28	98.37	101.61	167.18	72.30	2.120	106.06	94.28	98.37	101.61	167.18	72.30
2.140	106.06	94.28	98.37	101.61	167.18	72.30	2.160	106.06	94.28	98.37	101.61	167.18	72.30
2.180	106.06	94.28	98.37	101.61	167.18	72.30	2.200	106.06	94.28	98.37	101.61	167.18	72.30
2.220	106.06	94.28	98.37	101.61	167.18	72.30	2.240	106.06	94.28	98.37	101.61	167.18	72.30
2.260	106.06	94.28	98.37	101.61	167.18	72.30	2.280	106.06	94.28	98.37	101.61	167.18	72.30
2.300	106.06	94.28	98.37	101.61	167.18	72.30	2.320	106.06	94.28	98.37	101.61	167.18	72.30
2.340	106.06	94.28	98.37	101.61	167.18	72.30	2.360	106.06	94.28	98.37	101.61	167.18	72.30
2.380	106.06	94.28	98.37	101.61	167.18	72.30	2.400	106.06	94.28	98.37	101.61	167.18	72.30
2.420	106.06	94.28	98.37	101.61	167.18	72.30	2.440	106.06	94.28	98.37	101.61	167.18	72.30
2.460	106.06	94.28	98.37	101.61	167.18	72.30	2.480	106.06	94.28	98.37	101.61	167.18	72.30
2.500	106.06	94.28	98.37	101.61	167.18	72.30	2.520	106.06	94.28	98.37	101.61	167.18	72.30
2.540	106.06	94.28	98.37	101.61	167.18	72.30	2.560	106.06	94.28	98.37	101.61	167.18	72.30
2.580	106.06	94.28	98.37	101.61	167.18	72.30	2.600	106.06	94.28	98.37	101.61	167.18	72.30

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Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
2.620	106.06	94.28	98.37	101.61	167.18	72.30	2.640	106.06	94.28	98.37	101.61	167.18	72.30
2.660	106.06	94.28	98.37	101.61	167.18	72.30	2.680	106.06	94.28	98.37	101.61	167.18	72.30
2.700	106.06	94.28	98.37	101.61	167.18	72.30	2.720	106.06	94.28	98.37	101.61	167.18	72.30
2.740	106.06	94.28	98.37	101.61	167.18	72.30	2.760	106.06	94.28	98.37	101.61	167.18	72.30
2.780	106.06	94.28	98.37	101.61	167.18	72.30	2.800	106.06	94.28	98.37	101.61	167.18	72.30
2.820	106.06	94.28	98.37	101.61	167.18	72.30	2.840	106.06	94.28	98.37	101.61	167.18	72.30
2.860	106.06	94.28	98.37	101.61	167.18	72.30	2.880	106.06	94.28	98.37	101.61	167.18	72.30
2.900	106.06	94.28	98.37	101.61	167.18	72.30	2.920	106.06	94.28	98.37	101.61	167.18	72.30
2.940	106.06	94.28	98.37	101.61	167.18	72.30	2.960	106.06	94.28	98.37	101.61	167.18	72.30
2.980	106.06	94.28	98.37	101.61	167.18	72.30	3.000	106.06	94.28	98.37	101.61	167.18	72.30
3.020	106.06	94.28	98.37	101.61	167.18	72.30	3.040	106.06	94.28	98.37	101.61	167.18	72.30
3.060	106.06	94.28	98.37	101.61	167.18	72.30	3.080	106.06	94.28	98.37	101.61	167.18	72.30
3.100	106.06	94.28	98.37	101.61	167.18	72.30	3.120	106.06	94.28	98.37	101.61	167.18	72.30
3.140	106.06	94.28	98.37	101.61	167.18	72.30	3.160	106.06	94.28	98.37	101.61	167.18	72.30
3.180	106.06	94.28	98.37	101.61	167.18	72.30	3.200	106.06	94.28	98.37	101.61	167.18	72.30
3.220	106.06	94.28	98.37	101.61	167.18	72.30	3.240	106.06	94.28	98.37	101.61	167.18	72.30
3.260	106.06	94.28	98.37	101.61	167.18	72.30	3.280	106.06	94.28	98.37	101.61	167.18	72.30
3.300	106.06	94.28	98.37	101.61	167.18	72.30	3.320	106.06	94.28	98.37	101.61	167.18	72.30
3.340	106.06	94.28	98.37	101.61	167.18	72.30	3.360	106.06	94.28	98.37	101.61	167.18	72.30
3.380	106.06	94.28	98.37	101.61	167.18	72.30	3.400	106.06	94.28	98.37	101.61	167.18	72.30
3.420	106.06	94.28	98.37	101.61	167.18	72.30	3.440	106.06	94.28	98.37	101.61	167.18	72.30
3.460	106.06	94.28	98.37	101.61	167.18	72.30	3.480	106.06	94.28	98.37	101.61	167.18	72.30
3.500	106.06	94.28	98.37	101.61	167.18	72.30	3.520	106.06	94.28	98.37	101.61	167.18	72.30
3.540	106.06	94.28	98.37	101.61	167.18	72.30	3.560	106.06	94.28	98.37	101.61	167.18	72.30
3.580	106.06	94.28	98.37	101.61	167.18	72.30	3.600	106.06	94.28	98.37	101.61	167.18	72.30
3.620	106.06	94.28	98.37	101.61	167.18	72.30	3.640	106.06	94.28	98.37	101.61	167.18	72.30
3.660	106.06	94.28	98.37	101.61	167.18	72.30	3.680	106.06	94.28	98.37	101.61	167.18	72.30
3.700	106.06	94.28	98.37	101.61	167.18	72.30	3.720	106.06	94.28	98.37	101.61	167.18	72.30
3.740	106.06	94.28	98.37	101.61	167.18	72.30	3.760	106.06	94.28	98.37	101.61	167.18	72.30
3.780	106.06	94.28	98.37	101.61	167.18	72.30	3.800	106.06	94.28	98.37	101.61	167.18	72.30
3.820	106.06	94.28	98.37	101.61	167.18	72.30	3.840	106.06	94.28	98.37	101.61	167.18	72.30
3.860	106.06	94.28	98.37	101.61	167.18	72.30	3.880	106.06	94.28	98.37	101.61	167.18	72.30
3.900	106.06	94.28	98.37	101.61	167.18	72.30	3.920	106.06	94.28	98.37	101.61	167.18	72.30
3.940	106.06	94.28	98.37	101.61	167.18	72.30	3.960	106.06	94.28	98.37	101.61	167.18	72.30
3.980	106.06	94.28	98.37	101.61	167.18	72.30	4.000	106.06	94.28	98.37	101.61	167.18	72.30
4.020	106.06	94.28	98.37	101.61	167.18	72.30	4.040	106.06	94.28	98.37	101.61	167.18	72.30
4.060	106.06	94.28	98.37	101.61	167.18	72.30	4.080	106.06	94.28	98.37	101.61	167.18	72.30

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Revision: Base
Config.: Contingency

Induction Motor ID: 1803-PM-206 A

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
4.100	106.06	94.28	98.37	101.61	167.18	72.30	4.120	106.06	94.28	98.37	101.61	167.18	72.30
4.140	106.06	94.28	98.37	101.61	167.18	72.30	4.160	106.06	94.28	98.37	101.61	167.18	72.30
4.180	106.06	94.28	98.37	101.61	167.18	72.30	4.200	106.06	94.28	98.37	101.61	167.18	72.30
4.220	106.06	94.28	98.37	101.61	167.18	72.30	4.240	106.06	94.28	98.37	101.61	167.18	72.30
4.260	106.06	94.28	98.37	101.61	167.18	72.30	4.280	106.06	94.28	98.37	101.61	167.18	72.30
4.300	106.06	94.28	98.37	101.61	167.18	72.30	4.320	106.06	94.28	98.37	101.61	167.18	72.30
4.340	106.06	94.28	98.37	101.61	167.18	72.30	4.360	106.06	94.28	98.37	101.61	167.18	72.30
4.380	106.06	94.28	98.37	101.61	167.18	72.30	4.400	106.06	94.28	98.37	101.61	167.18	72.30
4.420	106.06	94.28	98.37	101.61	167.18	72.30	4.440	106.06	94.28	98.37	101.61	167.18	72.30
4.460	106.06	94.28	98.37	101.61	167.18	72.30	4.480	106.06	94.28	98.37	101.61	167.18	72.30
4.500	106.06	94.28	98.37	101.61	167.18	72.30	4.520	106.06	94.28	98.37	101.61	167.18	72.30
4.540	106.06	94.28	98.37	101.61	167.18	72.30	4.560	106.06	94.28	98.37	101.61	167.18	72.30
4.580	106.06	94.28	98.37	101.61	167.18	72.30	4.600	106.06	94.28	98.37	101.61	167.18	72.30
4.620	106.06	94.28	98.37	101.61	167.18	72.30	4.640	106.06	94.28	98.37	101.61	167.18	72.30
4.660	106.06	94.28	98.37	101.61	167.18	72.30	4.680	106.06	94.28	98.37	101.61	167.18	72.30
4.700	106.06	94.28	98.37	101.61	167.18	72.30	4.720	106.06	94.28	98.37	101.61	167.18	72.30
4.740	106.06	94.28	98.37	101.61	167.18	72.30	4.760	106.06	94.28	98.37	101.61	167.18	72.30
4.780	106.06	94.28	98.37	101.61	167.18	72.30	4.800	106.06	94.28	98.37	101.61	167.18	72.30
4.820	106.06	94.28	98.37	101.61	167.18	72.30	4.840	106.06	94.28	98.37	101.61	167.18	72.30
4.860	106.06	94.28	98.37	101.61	167.18	72.30	4.880	106.06	94.28	98.37	101.61	167.18	72.30
4.900	106.06	94.28	98.37	101.61	167.18	72.30	4.920	106.06	94.28	98.37	101.61	167.18	72.30
4.940	106.06	94.28	98.37	101.61	167.18	72.30	4.960	106.06	94.28	98.37	101.61	167.18	72.30
4.980	106.06	94.28	98.37	101.61	167.18	72.30	5.000	106.06	94.28	98.37	101.61	167.18	72.30
5.020	106.06	94.28	98.37	101.61	167.18	72.30	5.040	106.06	94.28	98.37	101.61	167.18	72.30
5.060	106.06	94.28	98.37	101.61	167.18	72.30	5.080	106.06	94.28	98.37	101.61	167.18	72.30
5.100	106.06	94.28	98.37	101.61	167.18	72.30	5.120	106.06	94.28	98.37	101.61	167.18	72.30
5.140	106.06	94.28	98.37	101.61	167.18	72.30	5.160	106.06	94.28	98.37	101.61	167.18	72.30
5.180	106.06	94.28	98.37	101.61	167.18	72.30	5.200	106.06	94.28	98.37	101.61	167.18	72.30
5.220	106.06	94.28	98.37	101.61	167.18	72.30	5.240	106.06	94.28	98.37	101.61	167.18	72.30
5.260	106.06	94.28	98.37	101.61	167.18	72.30	5.280	106.06	94.28	98.37	101.61	167.18	72.30
5.300	106.06	94.28	98.37	101.61	167.18	72.30	5.320	106.06	94.28	98.37	101.61	167.18	72.30
5.340	106.06	94.28	98.37	101.61	167.18	72.30	5.360	106.06	94.28	98.37	101.61	167.18	72.30
5.380	106.06	94.28	98.37	101.61	167.18	72.30	5.400	106.06	94.28	98.37	101.61	167.18	72.30
5.420	106.06	94.28	98.37	101.61	167.18	72.30	5.440	106.06	94.28	98.37	101.61	167.18	72.30
5.460	106.06	94.28	98.37	101.61	167.18	72.30	5.480	106.06	94.28	98.37	101.61	167.18	72.30
5.500	106.06	94.28	98.37	101.61	167.18	72.30	5.520	106.06	94.28	98.37	101.61	167.18	72.30
5.540	106.06	94.28	98.37	101.61	167.18	72.30	5.560	106.06	94.28	98.37	101.61	167.18	72.30

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Contract:
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Induction Motor ID: 1803-PM-206 A

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
5.580	106.06	94.28	98.37	101.61	167.18	72.30	5.600	106.06	94.28	98.37	101.61	167.18	72.30
5.620	106.06	94.28	98.37	101.61	167.18	72.30	5.640	106.06	94.28	98.37	101.61	167.18	72.30
5.660	106.06	94.28	98.37	101.61	167.18	72.30	5.680	106.06	94.28	98.37	101.61	167.18	72.30
5.700	106.06	94.28	98.37	101.61	167.18	72.30	5.720	106.06	94.28	98.37	101.61	167.18	72.30
5.740	106.06	94.28	98.37	101.61	167.18	72.30	5.760	106.06	94.28	98.37	101.61	167.18	72.30
5.780	106.06	94.28	98.37	101.61	167.18	72.30	5.800	106.06	94.28	98.37	101.61	167.18	72.30
5.820	106.06	94.28	98.37	101.61	167.18	72.30	5.840	106.06	94.28	98.37	101.61	167.18	72.30
5.860	106.06	94.28	98.37	101.61	167.18	72.30	5.880	106.06	94.28	98.37	101.61	167.18	72.30
5.900	106.06	94.28	98.37	101.61	167.18	72.30	5.920	106.06	94.28	98.37	101.61	167.18	72.30
5.940	106.06	94.28	98.37	101.61	167.18	72.30	5.960	106.06	94.28	98.37	101.61	167.18	72.30
5.980	106.06	94.28	98.37	101.61	167.18	72.30	6.000	106.06	94.28	98.37	101.61	167.18	72.30
6.020	106.06	94.28	98.37	101.61	167.18	72.30	6.040	106.06	94.28	98.37	101.61	167.18	72.30
6.060	106.06	94.28	98.37	101.61	167.18	72.30	6.080	106.06	94.28	98.37	101.61	167.18	72.30
6.100	106.06	94.28	98.37	101.61	167.18	72.30	6.120	106.06	94.28	98.37	101.61	167.18	72.30
6.140	106.06	94.28	98.37	101.61	167.18	72.30	6.160	106.06	94.28	98.37	101.61	167.18	72.30
6.180	106.06	94.28	98.37	101.61	167.18	72.30	6.200	106.06	94.28	98.37	101.61	167.18	72.30
6.220	106.06	94.28	98.37	101.61	167.18	72.30	6.240	106.06	94.28	98.37	101.61	167.18	72.30
6.260	106.06	94.28	98.37	101.61	167.18	72.30	6.280	106.06	94.28	98.37	101.61	167.18	72.30
6.300	106.06	94.28	98.37	101.61	167.18	72.30	6.320	106.06	94.28	98.37	101.61	167.18	72.30
6.340	106.06	94.28	98.37	101.61	167.18	72.30	6.360	106.06	94.28	98.37	101.61	167.18	72.30
6.380	106.06	94.28	98.37	101.61	167.18	72.30	6.400	106.06	94.28	98.37	101.61	167.18	72.30
6.420	106.06	94.28	98.37	101.61	167.18	72.30	6.440	106.06	94.28	98.37	101.61	167.18	72.30
6.460	106.06	94.28	98.37	101.61	167.18	72.30	6.480	106.06	94.28	98.37	101.61	167.18	72.30
6.500	106.06	94.28	98.37	101.61	167.18	72.30	6.520	106.06	94.28	98.37	101.61	167.18	72.30
6.540	106.06	94.28	98.37	101.61	167.18	72.30	6.560	106.06	94.28	98.37	101.61	167.18	72.30
6.580	106.06	94.28	98.37	101.61	167.18	72.30	6.600	106.06	94.28	98.37	101.61	167.18	72.30
6.620	106.06	94.28	98.37	101.61	167.18	72.30	6.640	106.06	94.28	98.37	101.61	167.18	72.30
6.660	106.06	94.28	98.37	101.61	167.18	72.30	6.680	106.06	94.28	98.37	101.61	167.18	72.30
6.700	106.06	94.28	98.37	101.61	167.18	72.30	6.720	106.06	94.28	98.37	101.61	167.18	72.30
6.740	106.06	94.28	98.37	101.61	167.18	72.30	6.760	106.06	94.28	98.37	101.61	167.18	72.30
6.780	106.06	94.28	98.37	101.61	167.18	72.30	6.800	106.06	94.28	98.37	101.61	167.18	72.30
6.820	106.06	94.28	98.37	101.61	167.18	72.30	6.840	106.06	94.28	98.37	101.61	167.18	72.30
6.860	106.06	94.28	98.37	101.61	167.18	72.30	6.880	106.06	94.28	98.37	101.61	167.18	72.30
6.900	106.06	94.28	98.37	101.61	167.18	72.30	6.920	106.06	94.28	98.37	101.61	167.18	72.30
6.940	106.06	94.28	98.37	101.61	167.18	72.30	6.960	106.06	94.28	98.37	101.61	167.18	72.30
6.980	106.06	94.28	98.37	101.61	167.18	72.30	7.000	106.06	94.28	98.37	101.61	167.18	72.30
7.020	106.06	94.28	98.37	101.61	167.18	72.30	7.040	106.06	94.28	98.37	101.61	167.18	72.30

Project:
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Revision: Base
Config.: Contingency

Induction Motor ID: 1803-PM-206 A

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
7.060	106.06	94.28	98.37	101.61	167.18	72.30	7.080	106.06	94.28	98.37	101.61	167.18	72.30
7.100	106.06	94.28	98.37	101.61	167.18	72.30	7.120	106.06	94.28	98.37	101.61	167.18	72.30
7.140	106.06	94.28	98.37	101.61	167.18	72.30	7.160	106.06	94.28	98.37	101.61	167.18	72.30
7.180	106.06	94.28	98.37	101.61	167.18	72.30	7.200	106.06	94.28	98.37	101.61	167.18	72.30
7.220	106.06	94.28	98.37	101.61	167.18	72.30	7.240	106.06	94.28	98.37	101.61	167.18	72.30
7.260	106.06	94.28	98.37	101.61	167.18	72.30	7.280	106.06	94.28	98.37	101.61	167.18	72.30
7.300	106.06	94.28	98.37	101.61	167.18	72.30	7.320	106.06	94.28	98.37	101.61	167.18	72.30
7.340	106.06	94.28	98.37	101.61	167.18	72.30	7.360	106.06	94.28	98.37	101.61	167.18	72.30
7.380	106.06	94.28	98.37	101.61	167.18	72.30	7.400	106.06	94.28	98.37	101.61	167.18	72.30
7.420	106.06	94.28	98.37	101.61	167.18	72.30	7.440	106.06	94.28	98.37	101.61	167.18	72.30
7.460	106.06	94.28	98.37	101.61	167.18	72.30	7.480	106.06	94.28	98.37	101.61	167.18	72.30
7.500	106.06	94.28	98.37	101.61	167.18	72.30	7.520	106.06	94.28	98.37	101.61	167.18	72.30
7.540	106.06	94.28	98.37	101.61	167.18	72.30	7.560	106.06	94.28	98.37	101.61	167.18	72.30
7.580	106.06	94.28	98.37	101.61	167.18	72.30	7.600	106.06	94.28	98.37	101.61	167.18	72.30
7.620	106.06	94.28	98.37	101.61	167.18	72.30	7.640	106.06	94.28	98.37	101.61	167.18	72.30
7.660	106.06	94.28	98.37	101.61	167.18	72.30	7.680	106.06	94.28	98.37	101.61	167.18	72.30
7.700	106.06	94.28	98.37	101.61	167.18	72.30	7.720	106.06	94.28	98.37	101.61	167.18	72.30
7.740	106.06	94.28	98.37	101.61	167.18	72.30	7.760	106.06	94.28	98.37	101.61	167.18	72.30
7.780	106.06	94.28	98.37	101.61	167.18	72.30	7.800	106.06	94.28	98.37	101.61	167.18	72.30
7.820	106.06	94.28	98.37	101.61	167.18	72.30	7.840	106.06	94.28	98.37	101.61	167.18	72.30
7.860	106.06	94.28	98.37	101.61	167.18	72.30	7.880	106.06	94.28	98.37	101.61	167.18	72.30
7.900	106.06	94.28	98.37	101.61	167.18	72.30	7.920	106.06	94.28	98.37	101.61	167.18	72.30
7.940	106.06	94.28	98.37	101.61	167.18	72.30	7.960	106.06	94.28	98.37	101.61	167.18	72.30
7.980	106.06	94.28	98.37	101.61	167.18	72.30	8.000	106.06	94.28	98.37	101.61	167.18	72.30
8.020	106.06	94.28	98.37	101.61	167.18	72.30	8.040	106.06	94.28	98.37	101.61	167.18	72.30
8.060	106.06	94.28	98.37	101.61	167.18	72.30	8.080	106.06	94.28	98.37	101.61	167.18	72.30
8.100	106.06	94.28	98.37	101.61	167.18	72.30	8.120	106.06	94.28	98.37	101.61	167.18	72.30
8.140	106.06	94.28	98.37	101.61	167.18	72.30	8.160	106.06	94.28	98.37	101.61	167.18	72.30
8.180	106.06	94.28	98.37	101.61	167.18	72.30	8.200	106.06	94.28	98.37	101.61	167.18	72.30
8.220	106.06	94.28	98.37	101.61	167.18	72.30	8.240	106.06	94.28	98.37	101.61	167.18	72.30
8.260	106.06	94.28	98.37	101.61	167.18	72.30	8.280	106.06	94.28	98.37	101.61	167.18	72.30
8.300	106.06	94.28	98.37	101.61	167.18	72.30	8.320	106.06	94.28	98.37	101.61	167.18	72.30
8.340	106.06	94.28	98.37	101.61	167.18	72.30	8.360	106.06	94.28	98.37	101.61	167.18	72.30
8.380	106.06	94.28	98.37	101.61	167.18	72.30	8.400	106.06	94.28	98.37	101.61	167.18	72.30
8.420	106.06	94.28	98.37	101.61	167.18	72.30	8.440	106.06	94.28	98.37	101.61	167.18	72.30
8.460	106.06	94.28	98.37	101.61	167.18	72.30	8.480	106.06	94.28	98.37	101.61	167.18	72.30
8.500	106.06	94.28	98.37	101.61	167.18	72.30	8.520	106.06	94.28	98.37	101.61	167.18	72.30

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Config.: Contingency

Induction Motor ID: 1803-PM-206 A

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
8.540	106.06	94.28	98.37	101.61	167.18	72.30	8.560	106.06	94.28	98.37	101.61	167.18	72.30
8.580	106.06	94.28	98.37	101.61	167.18	72.30	8.600	106.06	94.28	98.37	101.61	167.18	72.30
8.620	106.06	94.28	98.37	101.61	167.18	72.30	8.640	106.06	94.28	98.37	101.61	167.18	72.30
8.660	106.06	94.28	98.37	101.61	167.18	72.30	8.680	106.06	94.28	98.37	101.61	167.18	72.30
8.700	106.06	94.28	98.37	101.61	167.18	72.30	8.720	106.06	94.28	98.37	101.61	167.18	72.30
8.740	106.06	94.28	98.37	101.61	167.18	72.30	8.760	106.06	94.28	98.37	101.61	167.18	72.30
8.780	106.06	94.28	98.37	101.61	167.18	72.30	8.800	106.06	94.28	98.37	101.61	167.18	72.30
8.820	106.06	94.28	98.37	101.61	167.18	72.30	8.840	106.06	94.28	98.37	101.61	167.18	72.30
8.860	106.06	94.28	98.37	101.61	167.18	72.30	8.880	106.06	94.28	98.37	101.61	167.18	72.30
8.900	106.06	94.28	98.37	101.61	167.18	72.30	8.920	106.06	94.28	98.37	101.61	167.18	72.30
8.940	106.06	94.28	98.37	101.61	167.18	72.30	8.960	106.06	94.28	98.37	101.61	167.18	72.30
8.980	106.06	94.28	98.37	101.61	167.18	72.30	9.000	106.06	94.28	98.37	101.61	167.18	72.30
9.020	106.06	94.28	98.37	101.61	167.18	72.30	9.040	106.06	94.28	98.37	101.61	167.18	72.30
9.060	106.06	94.28	98.37	101.61	167.18	72.30	9.080	106.06	94.28	98.37	101.61	167.18	72.30
9.100	106.06	94.28	98.37	101.61	167.18	72.30	9.120	106.06	94.28	98.37	101.61	167.18	72.30
9.140	106.06	94.28	98.37	101.61	167.18	72.30	9.160	106.06	94.28	98.37	101.61	167.18	72.30
9.180	106.06	94.28	98.37	101.61	167.18	72.30	9.200	106.06	94.28	98.37	101.61	167.18	72.30
9.220	106.06	94.28	98.37	101.61	167.18	72.30	9.240	106.06	94.28	98.37	101.61	167.18	72.30
9.260	106.06	94.28	98.37	101.61	167.18	72.30	9.280	106.06	94.28	98.37	101.61	167.18	72.30
9.300	106.06	94.28	98.37	101.61	167.18	72.30	9.320	106.06	94.28	98.37	101.61	167.18	72.30
9.340	106.06	94.28	98.37	101.61	167.18	72.30	9.360	106.06	94.28	98.37	101.61	167.18	72.30
9.380	106.06	94.28	98.37	101.61	167.18	72.30	9.400	106.06	94.28	98.37	101.61	167.18	72.30
9.420	106.06	94.28	98.37	101.61	167.18	72.30	9.440	106.06	94.28	98.37	101.61	167.18	72.30
9.460	106.06	94.28	98.37	101.61	167.18	72.30	9.480	106.06	94.28	98.37	101.61	167.18	72.30
9.500	106.06	94.28	98.37	101.61	167.18	72.30	9.520	106.06	94.28	98.37	101.61	167.18	72.30
9.540	106.06	94.28	98.37	101.61	167.18	72.30	9.560	106.06	94.28	98.37	101.61	167.18	72.30
9.580	106.06	94.28	98.37	101.61	167.18	72.30	9.600	106.06	94.28	98.37	101.61	167.18	72.30
9.620	106.06	94.28	98.37	101.61	167.18	72.30	9.640	106.06	94.28	98.37	101.61	167.18	72.30
9.660	106.06	94.28	98.37	101.61	167.18	72.30	9.680	106.06	94.28	98.37	101.61	167.18	72.30
9.700	106.06	94.28	98.37	101.61	167.18	72.30	9.720	106.06	94.28	98.37	101.61	167.18	72.30
9.740	106.06	94.28	98.37	101.61	167.18	72.30	9.760	106.06	94.28	98.37	101.61	167.18	72.30
9.780	106.06	94.28	98.37	101.61	167.18	72.30	9.800	106.06	94.28	98.37	101.61	167.18	72.30
9.820	106.06	94.28	98.37	101.61	167.18	72.30	9.840	106.06	94.28	98.37	101.61	167.18	72.30
9.860	106.06	94.28	98.37	101.61	167.18	72.30	9.880	106.06	94.28	98.37	101.61	167.18	72.30
9.900	106.06	94.28	98.37	101.61	167.18	72.30	9.920	106.06	94.28	98.37	101.61	167.18	72.30
9.940	106.06	94.28	98.37	101.61	167.18	72.30	9.960	106.06	94.28	98.37	101.61	167.18	72.30
9.980	106.06	94.28	98.37	101.61	167.18	72.30	10.000	106.06	94.28	98.37	101.61	167.18	72.30

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Induction Motor ID: 1803-PM-206 A

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
10.020	106.06	94.28	98.37	101.61	167.18	72.30	10.040	106.06	94.28	98.37	101.61	167.18	72.30
10.060	106.06	94.28	98.37	101.61	167.18	72.30	10.080	106.06	94.28	98.37	101.61	167.18	72.30
10.100	106.06	94.28	98.37	101.61	167.18	72.30	10.120	106.06	94.28	98.37	101.61	167.18	72.30
10.140	106.06	94.28	98.37	101.61	167.18	72.30	10.160	106.06	94.28	98.37	101.61	167.18	72.30
10.180	106.06	94.28	98.37	101.61	167.18	72.30	10.200	106.06	94.28	98.37	101.61	167.18	72.30
10.220	106.06	94.28	98.37	101.61	167.18	72.30	10.240	106.06	94.28	98.37	101.61	167.18	72.30
10.260	106.06	94.28	98.37	101.61	167.18	72.30	10.280	106.06	94.28	98.37	101.61	167.18	72.30
10.300	106.06	94.28	98.37	101.61	167.18	72.30	10.320	106.06	94.28	98.37	101.61	167.18	72.30
10.340	106.06	94.28	98.37	101.61	167.18	72.30	10.360	106.06	94.28	98.37	101.61	167.18	72.30
10.380	106.06	94.28	98.37	101.61	167.18	72.30	10.400	106.06	94.28	98.37	101.61	167.18	72.30
10.420	106.06	94.28	98.37	101.61	167.18	72.30	10.440	106.06	94.28	98.37	101.61	167.18	72.30
10.460	106.06	94.28	98.37	101.61	167.18	72.30	10.480	106.06	94.28	98.37	101.61	167.18	72.30
10.500	106.06	94.28	98.37	101.61	167.18	72.30	10.520	106.06	94.28	98.37	101.61	167.18	72.30
10.540	106.06	94.28	98.37	101.61	167.18	72.30	10.560	106.06	94.28	98.37	101.61	167.18	72.30
10.580	106.06	94.28	98.37	101.61	167.18	72.30	10.600	106.06	94.28	98.37	101.61	167.18	72.30
10.620	106.06	94.28	98.37	101.61	167.18	72.30	10.640	106.06	94.28	98.37	101.61	167.18	72.30
10.660	106.06	94.28	98.37	101.61	167.18	72.30	10.680	106.06	94.28	98.37	101.61	167.18	72.30
10.700	106.06	94.28	98.37	101.61	167.18	72.30	10.720	106.06	94.28	98.37	101.61	167.18	72.30
10.740	106.06	94.28	98.37	101.61	167.18	72.30	10.760	106.06	94.28	98.37	101.61	167.18	72.30
10.780	106.06	94.28	98.37	101.61	167.18	72.30	10.800	106.06	94.28	98.37	101.61	167.18	72.30
10.820	106.06	94.28	98.37	101.61	167.18	72.30	10.840	106.06	94.28	98.37	101.61	167.18	72.30
10.860	106.06	94.28	98.37	101.61	167.18	72.30	10.880	106.06	94.28	98.37	101.61	167.18	72.30
10.900	106.06	94.28	98.37	101.61	167.18	72.30	10.920	106.06	94.28	98.37	101.61	167.18	72.30
10.940	106.06	94.28	98.37	101.61	167.18	72.30	10.960	106.06	94.28	98.37	101.61	167.18	72.30
10.980	106.06	94.28	98.37	101.61	167.18	72.30	11.000	106.06	94.28	98.37	101.61	167.18	72.30
11.020	106.06	94.28	98.37	101.61	167.18	72.30	11.040	106.06	94.28	98.37	101.61	167.18	72.30
11.060	106.06	94.28	98.37	101.61	167.18	72.30	11.080	106.06	94.28	98.37	101.61	167.18	72.30
11.100	106.06	94.28	98.37	101.61	167.18	72.30	11.120	106.06	94.28	98.37	101.61	167.18	72.30
11.140	106.06	94.28	98.37	101.61	167.18	72.30	11.160	106.06	94.28	98.37	101.61	167.18	72.30
11.180	106.06	94.28	98.37	101.61	167.18	72.30	11.200	106.06	94.28	98.37	101.61	167.18	72.30
11.220	106.06	94.28	98.37	101.61	167.18	72.30	11.240	106.06	94.28	98.37	101.61	167.18	72.30
11.260	106.06	94.28	98.37	101.61	167.18	72.30	11.280	106.06	94.28	98.37	101.61	167.18	72.30
11.300	106.06	94.28	98.37	101.61	167.18	72.30	11.320	106.06	94.28	98.37	101.61	167.18	72.30
11.340	106.06	94.28	98.37	101.61	167.18	72.30	11.360	106.06	94.28	98.37	101.61	167.18	72.30
11.380	106.06	94.28	98.37	101.61	167.18	72.30	11.400	106.06	94.28	98.37	101.61	167.18	72.30
11.420	106.06	94.28	98.37	101.61	167.18	72.30	11.440	106.06	94.28	98.37	101.61	167.18	72.30
11.460	106.06	94.28	98.37	101.61	167.18	72.30	11.480	106.06	94.28	98.37	101.61	167.18	72.30

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Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
11.500	106.06	94.28	98.37	101.61	167.18	72.30	11.520	106.06	94.28	98.37	101.61	167.18	72.30
11.540	106.06	94.28	98.37	101.61	167.18	72.30	11.560	106.06	94.28	98.37	101.61	167.18	72.30
11.580	106.06	94.28	98.37	101.61	167.18	72.30	11.600	106.06	94.28	98.37	101.61	167.18	72.30
11.620	106.06	94.28	98.37	101.61	167.18	72.30	11.640	106.06	94.28	98.37	101.61	167.18	72.30
11.660	106.06	94.28	98.37	101.61	167.18	72.30	11.680	106.06	94.28	98.37	101.61	167.18	72.30
11.700	106.06	94.28	98.37	101.61	167.18	72.30	11.720	106.06	94.28	98.37	101.61	167.18	72.30
11.740	106.06	94.28	98.37	101.61	167.18	72.30	11.760	106.06	94.28	98.37	101.61	167.18	72.30
11.780	106.06	94.28	98.37	101.61	167.18	72.30	11.800	106.06	94.28	98.37	101.61	167.18	72.30
11.820	106.06	94.28	98.37	101.61	167.18	72.30	11.840	106.06	94.28	98.37	101.61	167.18	72.30
11.860	106.06	94.28	98.37	101.61	167.18	72.30	11.880	106.06	94.28	98.37	101.61	167.18	72.30
11.900	106.06	94.28	98.37	101.61	167.18	72.30	11.920	106.06	94.28	98.37	101.61	167.18	72.30
11.940	106.06	94.28	98.37	101.61	167.18	72.30	11.960	106.06	94.28	98.37	101.61	167.18	72.30
11.980	106.06	94.28	98.37	101.61	167.18	72.30	12.000	106.06	94.28	98.37	101.61	167.18	72.30

Generator and Power Grid Results

Power Grid ID: CGP ESS-41-2

Time (Sec.)	Current (% FLA)	% Terminal Voltage	MW	Mvar	MVA	% PF	Time (Sec.)	Current (% FLA)	% Terminal Voltage	MW	Mvar	MVA	% PF
0.000	0.00	100.00	0.000	0.000	0.000	0.00	0.020	0.00	100.00	0.000	0.000	0.000	0.00
0.040	0.00	100.00	0.000	0.000	0.000	0.00	0.060	0.00	100.00	0.000	0.000	0.000	0.00
0.080	0.00	100.00	0.000	0.000	0.000	0.00	0.100	0.00	100.00	0.000	0.000	0.000	0.00
0.120	0.00	100.00	0.000	0.000	0.000	0.00	0.140	0.00	100.00	0.000	0.000	0.000	0.00
0.160	0.00	100.00	0.000	0.000	0.000	0.00	0.180	0.00	100.00	0.000	0.000	0.000	0.00
0.200	0.00	100.00	0.000	0.000	0.000	0.00	0.220	0.00	100.00	0.000	0.000	0.000	0.00
0.240	0.00	100.00	0.000	0.000	0.000	0.00	0.260	0.00	100.00	0.000	0.000	0.000	0.00
0.280	0.00	100.00	0.000	0.000	0.000	0.00	0.300	0.00	100.00	0.000	0.000	0.000	0.00
0.320	0.00	100.00	0.000	0.000	0.000	0.00	0.340	0.00	100.00	0.000	0.000	0.000	0.00
0.360	0.00	100.00	0.000	0.000	0.000	0.00	0.380	0.00	100.00	0.000	0.000	0.000	0.00
0.400	0.00	100.00	0.000	0.000	0.000	0.00	0.420	0.00	100.00	0.000	0.000	0.000	0.00
0.440	0.00	100.00	0.000	0.000	0.000	0.00	0.460	0.00	100.00	0.000	0.000	0.000	0.00
0.480	0.00	100.00	0.000	0.000	0.000	0.00	0.500	0.00	100.00	0.000	0.000	0.000	0.00
0.520	0.00	100.00	0.000	0.000	0.000	0.00	0.540	0.00	100.00	0.000	0.000	0.000	0.00
0.560	0.00	100.00	0.000	0.000	0.000	0.00	0.580	0.00	100.00	0.000	0.000	0.000	0.00
0.600	0.00	100.00	0.000	0.000	0.000	0.00	0.620	0.00	100.00	0.000	0.000	0.000	0.00
0.640	0.00	100.00	0.000	0.000	0.000	0.00	0.660	0.00	100.00	0.000	0.000	0.000	0.00
0.680	0.00	100.00	0.000	0.000	0.000	0.00	0.700	0.00	100.00	0.000	0.000	0.000	0.00

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Study Case: **MS PMCC-102**

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Switching Motors

Motor				Nameplate						Locked-Roto		Accel. Time (sec.)	
ID	Type	Qty	Connected Bus ID	HP/kW	kV	RPM	FLA	% PF	% Eff	% LRC	% PF	No Load	Full Load
1803-PM-219 A	Ind.	1	BUS B 044-PMCC-102	160.0	0.433	1500	250.7	91.7	92.8	720.00	23.88	0.00	0.00

Motor Acceleration

Induction Motor ID: **1803-PM-219 A**

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
0.000	0.00	0.00	0.00	102.43	0.00	0.00	0.020	0.00	0.00	0.00	102.43	0.00	0.00
0.040	0.00	0.00	0.00	102.43	0.00	0.00	0.060	0.00	0.00	0.00	102.43	0.00	0.00
0.080	0.00	0.00	0.00	102.43	0.00	0.00	0.100	586.58	81.47	85.00	97.67	413.99	945.63
0.120	106.12	94.23	98.32	101.95	178.98	77.26	0.140	106.12	94.23	98.32	101.95	178.98	77.26
0.160	106.12	94.23	98.32	101.95	178.98	77.26	0.180	106.12	94.23	98.32	101.95	178.98	77.26
0.200	106.12	94.23	98.32	101.95	178.98	77.26	0.220	106.12	94.23	98.32	101.95	178.98	77.26
0.240	106.12	94.23	98.32	101.95	178.98	77.26	0.260	106.12	94.23	98.32	101.95	178.98	77.26
0.280	106.12	94.23	98.32	101.95	178.98	77.26	0.300	106.12	94.23	98.32	101.95	178.98	77.26
0.320	106.12	94.23	98.32	101.95	178.98	77.26	0.340	106.12	94.23	98.32	101.95	178.98	77.26
0.360	106.12	94.23	98.32	101.95	178.98	77.26	0.380	106.12	94.23	98.32	101.95	178.98	77.26
0.400	106.12	94.23	98.32	101.95	178.98	77.26	0.420	106.12	94.23	98.32	101.95	178.98	77.26
0.440	106.12	94.23	98.32	101.95	178.98	77.26	0.460	106.12	94.23	98.32	101.95	178.98	77.26
0.480	106.12	94.23	98.32	101.95	178.98	77.26	0.500	106.12	94.23	98.32	101.95	178.98	77.26
0.520	106.12	94.23	98.32	101.95	178.98	77.26	0.540	106.12	94.23	98.32	101.95	178.98	77.26
0.560	106.12	94.23	98.32	101.95	178.98	77.26	0.580	106.12	94.23	98.32	101.95	178.98	77.26
0.600	106.12	94.23	98.32	101.95	178.98	77.26	0.620	106.12	94.23	98.32	101.95	178.98	77.26
0.640	106.12	94.23	98.32	101.95	178.98	77.26	0.660	106.12	94.23	98.32	101.95	178.98	77.26
0.680	106.12	94.23	98.32	101.95	178.98	77.26	0.700	106.12	94.23	98.32	101.95	178.98	77.26
0.720	106.12	94.23	98.32	101.95	178.98	77.26	0.740	106.12	94.23	98.32	101.95	178.98	77.26
0.760	106.12	94.23	98.32	101.95	178.98	77.26	0.780	106.12	94.23	98.32	101.95	178.98	77.26
0.800	106.12	94.23	98.32	101.95	178.98	77.26	0.820	106.12	94.23	98.32	101.95	178.98	77.26
0.840	106.12	94.23	98.32	101.95	178.98	77.26	0.860	106.12	94.23	98.32	101.95	178.98	77.26
0.880	106.12	94.23	98.32	101.95	178.98	77.26	0.900	106.12	94.23	98.32	101.95	178.98	77.26
0.920	106.12	94.23	98.32	101.95	178.98	77.26	0.940	106.12	94.23	98.32	101.95	178.98	77.26
0.960	106.12	94.23	98.32	101.95	178.98	77.26	0.980	106.12	94.23	98.32	101.95	178.98	77.26
1.000	106.12	94.23	98.32	101.95	178.98	77.26	1.020	106.12	94.23	98.32	101.95	178.98	77.26
1.040	106.12	94.23	98.32	101.95	178.98	77.26	1.060	106.12	94.23	98.32	101.95	178.98	77.26
1.080	106.12	94.23	98.32	101.95	178.98	77.26	1.100	106.12	94.23	98.32	101.95	178.98	77.26
1.120	106.12	94.23	98.32	101.95	178.98	77.26							

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Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
1.140	106.12	94.23	98.32	101.95	178.98	77.26	1.160	106.12	94.23	98.32	101.95	178.98	77.26
1.180	106.12	94.23	98.32	101.95	178.98	77.26	1.200	106.12	94.23	98.32	101.95	178.98	77.26
1.220	106.12	94.23	98.32	101.95	178.98	77.26	1.240	106.12	94.23	98.32	101.95	178.98	77.26
1.260	106.12	94.23	98.32	101.95	178.98	77.26	1.280	106.12	94.23	98.32	101.95	178.98	77.26
1.300	106.12	94.23	98.32	101.95	178.98	77.26	1.320	106.12	94.23	98.32	101.95	178.98	77.26
1.340	106.12	94.23	98.32	101.95	178.98	77.26	1.360	106.12	94.23	98.32	101.95	178.98	77.26
1.380	106.12	94.23	98.32	101.95	178.98	77.26	1.400	106.12	94.23	98.32	101.95	178.98	77.26
1.420	106.12	94.23	98.32	101.95	178.98	77.26	1.440	106.12	94.23	98.32	101.95	178.98	77.26
1.460	106.12	94.23	98.32	101.95	178.98	77.26	1.480	106.12	94.23	98.32	101.95	178.98	77.26
1.500	106.12	94.23	98.32	101.95	178.98	77.26	1.520	106.12	94.23	98.32	101.95	178.98	77.26
1.540	106.12	94.23	98.32	101.95	178.98	77.26	1.560	106.12	94.23	98.32	101.95	178.98	77.26
1.580	106.12	94.23	98.32	101.95	178.98	77.26	1.600	106.12	94.23	98.32	101.95	178.98	77.26
1.620	106.12	94.23	98.32	101.95	178.98	77.26	1.640	106.12	94.23	98.32	101.95	178.98	77.26
1.660	106.12	94.23	98.32	101.95	178.98	77.26	1.680	106.12	94.23	98.32	101.95	178.98	77.26
1.700	106.12	94.23	98.32	101.95	178.98	77.26	1.720	106.12	94.23	98.32	101.95	178.98	77.26
1.740	106.12	94.23	98.32	101.95	178.98	77.26	1.760	106.12	94.23	98.32	101.95	178.98	77.26
1.780	106.12	94.23	98.32	101.95	178.98	77.26	1.800	106.12	94.23	98.32	101.95	178.98	77.26
1.820	106.12	94.23	98.32	101.95	178.98	77.26	1.840	106.12	94.23	98.32	101.95	178.98	77.26
1.860	106.12	94.23	98.32	101.95	178.98	77.26	1.880	106.12	94.23	98.32	101.95	178.98	77.26
1.900	106.12	94.23	98.32	101.95	178.98	77.26	1.920	106.12	94.23	98.32	101.95	178.98	77.26
1.940	106.12	94.23	98.32	101.95	178.98	77.26	1.960	106.12	94.23	98.32	101.95	178.98	77.26
1.980	106.12	94.23	98.32	101.95	178.98	77.26	2.000	106.12	94.23	98.32	101.95	178.98	77.26
2.020	106.12	94.23	98.32	101.95	178.98	77.26	2.040	106.12	94.23	98.32	101.95	178.98	77.26
2.060	106.12	94.23	98.32	101.95	178.98	77.26	2.080	106.12	94.23	98.32	101.95	178.98	77.26
2.100	106.12	94.23	98.32	101.95	178.98	77.26	2.120	106.12	94.23	98.32	101.95	178.98	77.26
2.140	106.12	94.23	98.32	101.95	178.98	77.26	2.160	106.12	94.23	98.32	101.95	178.98	77.26
2.180	106.12	94.23	98.32	101.95	178.98	77.26	2.200	106.12	94.23	98.32	101.95	178.98	77.26
2.220	106.12	94.23	98.32	101.95	178.98	77.26	2.240	106.12	94.23	98.32	101.95	178.98	77.26
2.260	106.12	94.23	98.32	101.95	178.98	77.26	2.280	106.12	94.23	98.32	101.95	178.98	77.26
2.300	106.12	94.23	98.32	101.95	178.98	77.26	2.320	106.12	94.23	98.32	101.95	178.98	77.26
2.340	106.12	94.23	98.32	101.95	178.98	77.26	2.360	106.12	94.23	98.32	101.95	178.98	77.26
2.380	106.12	94.23	98.32	101.95	178.98	77.26	2.400	106.12	94.23	98.32	101.95	178.98	77.26
2.420	106.12	94.23	98.32	101.95	178.98	77.26	2.440	106.12	94.23	98.32	101.95	178.98	77.26
2.460	106.12	94.23	98.32	101.95	178.98	77.26	2.480	106.12	94.23	98.32	101.95	178.98	77.26
2.500	106.12	94.23	98.32	101.95	178.98	77.26	2.520	106.12	94.23	98.32	101.95	178.98	77.26
2.540	106.12	94.23	98.32	101.95	178.98	77.26	2.560	106.12	94.23	98.32	101.95	178.98	77.26
2.580	106.12	94.23	98.32	101.95	178.98	77.26	2.600	106.12	94.23	98.32	101.95	178.98	77.26

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Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
2.620	106.12	94.23	98.32	101.95	178.98	77.26	2.640	106.12	94.23	98.32	101.95	178.98	77.26
2.660	106.12	94.23	98.32	101.95	178.98	77.26	2.680	106.12	94.23	98.32	101.95	178.98	77.26
2.700	106.12	94.23	98.32	101.95	178.98	77.26	2.720	106.12	94.23	98.32	101.95	178.98	77.26
2.740	106.12	94.23	98.32	101.95	178.98	77.26	2.760	106.12	94.23	98.32	101.95	178.98	77.26
2.780	106.12	94.23	98.32	101.95	178.98	77.26	2.800	106.12	94.23	98.32	101.95	178.98	77.26
2.820	106.12	94.23	98.32	101.95	178.98	77.26	2.840	106.12	94.23	98.32	101.95	178.98	77.26
2.860	106.12	94.23	98.32	101.95	178.98	77.26	2.880	106.12	94.23	98.32	101.95	178.98	77.26
2.900	106.12	94.23	98.32	101.95	178.98	77.26	2.920	106.12	94.23	98.32	101.95	178.98	77.26
2.940	106.12	94.23	98.32	101.95	178.98	77.26	2.960	106.12	94.23	98.32	101.95	178.98	77.26
2.980	106.12	94.23	98.32	101.95	178.98	77.26	3.000	106.12	94.23	98.32	101.95	178.98	77.26
3.020	106.12	94.23	98.32	101.95	178.98	77.26	3.040	106.12	94.23	98.32	101.95	178.98	77.26
3.060	106.12	94.23	98.32	101.95	178.98	77.26	3.080	106.12	94.23	98.32	101.95	178.98	77.26
3.100	106.12	94.23	98.32	101.95	178.98	77.26	3.120	106.12	94.23	98.32	101.95	178.98	77.26
3.140	106.12	94.23	98.32	101.95	178.98	77.26	3.160	106.12	94.23	98.32	101.95	178.98	77.26
3.180	106.12	94.23	98.32	101.95	178.98	77.26	3.200	106.12	94.23	98.32	101.95	178.98	77.26
3.220	106.12	94.23	98.32	101.95	178.98	77.26	3.240	106.12	94.23	98.32	101.95	178.98	77.26
3.260	106.12	94.23	98.32	101.95	178.98	77.26	3.280	106.12	94.23	98.32	101.95	178.98	77.26
3.300	106.12	94.23	98.32	101.95	178.98	77.26	3.320	106.12	94.23	98.32	101.95	178.98	77.26
3.340	106.12	94.23	98.32	101.95	178.98	77.26	3.360	106.12	94.23	98.32	101.95	178.98	77.26
3.380	106.12	94.23	98.32	101.95	178.98	77.26	3.400	106.12	94.23	98.32	101.95	178.98	77.26
3.420	106.12	94.23	98.32	101.95	178.98	77.26	3.440	106.12	94.23	98.32	101.95	178.98	77.26
3.460	106.12	94.23	98.32	101.95	178.98	77.26	3.480	106.12	94.23	98.32	101.95	178.98	77.26
3.500	106.12	94.23	98.32	101.95	178.98	77.26	3.520	106.12	94.23	98.32	101.95	178.98	77.26
3.540	106.12	94.23	98.32	101.95	178.98	77.26	3.560	106.12	94.23	98.32	101.95	178.98	77.26
3.580	106.12	94.23	98.32	101.95	178.98	77.26	3.600	106.12	94.23	98.32	101.95	178.98	77.26
3.620	106.12	94.23	98.32	101.95	178.98	77.26	3.640	106.12	94.23	98.32	101.95	178.98	77.26
3.660	106.12	94.23	98.32	101.95	178.98	77.26	3.680	106.12	94.23	98.32	101.95	178.98	77.26
3.700	106.12	94.23	98.32	101.95	178.98	77.26	3.720	106.12	94.23	98.32	101.95	178.98	77.26
3.740	106.12	94.23	98.32	101.95	178.98	77.26	3.760	106.12	94.23	98.32	101.95	178.98	77.26
3.780	106.12	94.23	98.32	101.95	178.98	77.26	3.800	106.12	94.23	98.32	101.95	178.98	77.26
3.820	106.12	94.23	98.32	101.95	178.98	77.26	3.840	106.12	94.23	98.32	101.95	178.98	77.26
3.860	106.12	94.23	98.32	101.95	178.98	77.26	3.880	106.12	94.23	98.32	101.95	178.98	77.26
3.900	106.12	94.23	98.32	101.95	178.98	77.26	3.920	106.12	94.23	98.32	101.95	178.98	77.26
3.940	106.12	94.23	98.32	101.95	178.98	77.26	3.960	106.12	94.23	98.32	101.95	178.98	77.26
3.980	106.12	94.23	98.32	101.95	178.98	77.26	4.000	106.12	94.23	98.32	101.95	178.98	77.26
4.020	106.12	94.23	98.32	101.95	178.98	77.26	4.040	106.12	94.23	98.32	101.95	178.98	77.26
4.060	106.12	94.23	98.32	101.95	178.98	77.26	4.080	106.12	94.23	98.32	101.95	178.98	77.26

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Config.: Contingency

Induction Motor ID: 1803-PM-219 A

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
4.100	106.12	94.23	98.32	101.95	178.98	77.26	4.120	106.12	94.23	98.32	101.95	178.98	77.26
4.140	106.12	94.23	98.32	101.95	178.98	77.26	4.160	106.12	94.23	98.32	101.95	178.98	77.26
4.180	106.12	94.23	98.32	101.95	178.98	77.26	4.200	106.12	94.23	98.32	101.95	178.98	77.26
4.220	106.12	94.23	98.32	101.95	178.98	77.26	4.240	106.12	94.23	98.32	101.95	178.98	77.26
4.260	106.12	94.23	98.32	101.95	178.98	77.26	4.280	106.12	94.23	98.32	101.95	178.98	77.26
4.300	106.12	94.23	98.32	101.95	178.98	77.26	4.320	106.12	94.23	98.32	101.95	178.98	77.26
4.340	106.12	94.23	98.32	101.95	178.98	77.26	4.360	106.12	94.23	98.32	101.95	178.98	77.26
4.380	106.12	94.23	98.32	101.95	178.98	77.26	4.400	106.12	94.23	98.32	101.95	178.98	77.26
4.420	106.12	94.23	98.32	101.95	178.98	77.26	4.440	106.12	94.23	98.32	101.95	178.98	77.26
4.460	106.12	94.23	98.32	101.95	178.98	77.26	4.480	106.12	94.23	98.32	101.95	178.98	77.26
4.500	106.12	94.23	98.32	101.95	178.98	77.26	4.520	106.12	94.23	98.32	101.95	178.98	77.26
4.540	106.12	94.23	98.32	101.95	178.98	77.26	4.560	106.12	94.23	98.32	101.95	178.98	77.26
4.580	106.12	94.23	98.32	101.95	178.98	77.26	4.600	106.12	94.23	98.32	101.95	178.98	77.26
4.620	106.12	94.23	98.32	101.95	178.98	77.26	4.640	106.12	94.23	98.32	101.95	178.98	77.26
4.660	106.12	94.23	98.32	101.95	178.98	77.26	4.680	106.12	94.23	98.32	101.95	178.98	77.26
4.700	106.12	94.23	98.32	101.95	178.98	77.26	4.720	106.12	94.23	98.32	101.95	178.98	77.26
4.740	106.12	94.23	98.32	101.95	178.98	77.26	4.760	106.12	94.23	98.32	101.95	178.98	77.26
4.780	106.12	94.23	98.32	101.95	178.98	77.26	4.800	106.12	94.23	98.32	101.95	178.98	77.26
4.820	106.12	94.23	98.32	101.95	178.98	77.26	4.840	106.12	94.23	98.32	101.95	178.98	77.26
4.860	106.12	94.23	98.32	101.95	178.98	77.26	4.880	106.12	94.23	98.32	101.95	178.98	77.26
4.900	106.12	94.23	98.32	101.95	178.98	77.26	4.920	106.12	94.23	98.32	101.95	178.98	77.26
4.940	106.12	94.23	98.32	101.95	178.98	77.26	4.960	106.12	94.23	98.32	101.95	178.98	77.26
4.980	106.12	94.23	98.32	101.95	178.98	77.26	5.000	106.12	94.23	98.32	101.95	178.98	77.26
5.020	106.12	94.23	98.32	101.95	178.98	77.26	5.040	106.12	94.23	98.32	101.95	178.98	77.26
5.060	106.12	94.23	98.32	101.95	178.98	77.26	5.080	106.12	94.23	98.32	101.95	178.98	77.26
5.100	106.12	94.23	98.32	101.95	178.98	77.26	5.120	106.12	94.23	98.32	101.95	178.98	77.26
5.140	106.12	94.23	98.32	101.95	178.98	77.26	5.160	106.12	94.23	98.32	101.95	178.98	77.26
5.180	106.12	94.23	98.32	101.95	178.98	77.26	5.200	106.12	94.23	98.32	101.95	178.98	77.26
5.220	106.12	94.23	98.32	101.95	178.98	77.26	5.240	106.12	94.23	98.32	101.95	178.98	77.26
5.260	106.12	94.23	98.32	101.95	178.98	77.26	5.280	106.12	94.23	98.32	101.95	178.98	77.26
5.300	106.12	94.23	98.32	101.95	178.98	77.26	5.320	106.12	94.23	98.32	101.95	178.98	77.26
5.340	106.12	94.23	98.32	101.95	178.98	77.26	5.360	106.12	94.23	98.32	101.95	178.98	77.26
5.380	106.12	94.23	98.32	101.95	178.98	77.26	5.400	106.12	94.23	98.32	101.95	178.98	77.26
5.420	106.12	94.23	98.32	101.95	178.98	77.26	5.440	106.12	94.23	98.32	101.95	178.98	77.26
5.460	106.12	94.23	98.32	101.95	178.98	77.26	5.480	106.12	94.23	98.32	101.95	178.98	77.26
5.500	106.12	94.23	98.32	101.95	178.98	77.26	5.520	106.12	94.23	98.32	101.95	178.98	77.26
5.540	106.12	94.23	98.32	101.95	178.98	77.26	5.560	106.12	94.23	98.32	101.95	178.98	77.26

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Study Case: MS PMCC-102

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Revision: Base
Config.: Contingency

Induction Motor ID: 1803-PM-219 A

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
5.580	106.12	94.23	98.32	101.95	178.98	77.26	5.600	106.12	94.23	98.32	101.95	178.98	77.26
5.620	106.12	94.23	98.32	101.95	178.98	77.26	5.640	106.12	94.23	98.32	101.95	178.98	77.26
5.660	106.12	94.23	98.32	101.95	178.98	77.26	5.680	106.12	94.23	98.32	101.95	178.98	77.26
5.700	106.12	94.23	98.32	101.95	178.98	77.26	5.720	106.12	94.23	98.32	101.95	178.98	77.26
5.740	106.12	94.23	98.32	101.95	178.98	77.26	5.760	106.12	94.23	98.32	101.95	178.98	77.26
5.780	106.12	94.23	98.32	101.95	178.98	77.26	5.800	106.12	94.23	98.32	101.95	178.98	77.26
5.820	106.12	94.23	98.32	101.95	178.98	77.26	5.840	106.12	94.23	98.32	101.95	178.98	77.26
5.860	106.12	94.23	98.32	101.95	178.98	77.26	5.880	106.12	94.23	98.32	101.95	178.98	77.26
5.900	106.12	94.23	98.32	101.95	178.98	77.26	5.920	106.12	94.23	98.32	101.95	178.98	77.26
5.940	106.12	94.23	98.32	101.95	178.98	77.26	5.960	106.12	94.23	98.32	101.95	178.98	77.26
5.980	106.12	94.23	98.32	101.95	178.98	77.26	6.000	106.12	94.23	98.32	101.95	178.98	77.26
6.020	106.12	94.23	98.32	101.95	178.98	77.26	6.040	106.12	94.23	98.32	101.95	178.98	77.26
6.060	106.12	94.23	98.32	101.95	178.98	77.26	6.080	106.12	94.23	98.32	101.95	178.98	77.26
6.100	106.12	94.23	98.32	101.95	178.98	77.26	6.120	106.12	94.23	98.32	101.95	178.98	77.26
6.140	106.12	94.23	98.32	101.95	178.98	77.26	6.160	106.12	94.23	98.32	101.95	178.98	77.26
6.180	106.12	94.23	98.32	101.95	178.98	77.26	6.200	106.12	94.23	98.32	101.95	178.98	77.26
6.220	106.12	94.23	98.32	101.95	178.98	77.26	6.240	106.12	94.23	98.32	101.95	178.98	77.26
6.260	106.12	94.23	98.32	101.95	178.98	77.26	6.280	106.12	94.23	98.32	101.95	178.98	77.26
6.300	106.12	94.23	98.32	101.95	178.98	77.26	6.320	106.12	94.23	98.32	101.95	178.98	77.26
6.340	106.12	94.23	98.32	101.95	178.98	77.26	6.360	106.12	94.23	98.32	101.95	178.98	77.26
6.380	106.12	94.23	98.32	101.95	178.98	77.26	6.400	106.12	94.23	98.32	101.95	178.98	77.26
6.420	106.12	94.23	98.32	101.95	178.98	77.26	6.440	106.12	94.23	98.32	101.95	178.98	77.26
6.460	106.12	94.23	98.32	101.95	178.98	77.26	6.480	106.12	94.23	98.32	101.95	178.98	77.26
6.500	106.12	94.23	98.32	101.95	178.98	77.26	6.520	106.12	94.23	98.32	101.95	178.98	77.26
6.540	106.12	94.23	98.32	101.95	178.98	77.26	6.560	106.12	94.23	98.32	101.95	178.98	77.26
6.580	106.12	94.23	98.32	101.95	178.98	77.26	6.600	106.12	94.23	98.32	101.95	178.98	77.26
6.620	106.12	94.23	98.32	101.95	178.98	77.26	6.640	106.12	94.23	98.32	101.95	178.98	77.26
6.660	106.12	94.23	98.32	101.95	178.98	77.26	6.680	106.12	94.23	98.32	101.95	178.98	77.26
6.700	106.12	94.23	98.32	101.95	178.98	77.26	6.720	106.12	94.23	98.32	101.95	178.98	77.26
6.740	106.12	94.23	98.32	101.95	178.98	77.26	6.760	106.12	94.23	98.32	101.95	178.98	77.26
6.780	106.12	94.23	98.32	101.95	178.98	77.26	6.800	106.12	94.23	98.32	101.95	178.98	77.26
6.820	106.12	94.23	98.32	101.95	178.98	77.26	6.840	106.12	94.23	98.32	101.95	178.98	77.26
6.860	106.12	94.23	98.32	101.95	178.98	77.26	6.880	106.12	94.23	98.32	101.95	178.98	77.26
6.900	106.12	94.23	98.32	101.95	178.98	77.26	6.920	106.12	94.23	98.32	101.95	178.98	77.26
6.940	106.12	94.23	98.32	101.95	178.98	77.26	6.960	106.12	94.23	98.32	101.95	178.98	77.26
6.980	106.12	94.23	98.32	101.95	178.98	77.26	7.000	106.12	94.23	98.32	101.95	178.98	77.26
7.020	106.12	94.23	98.32	101.95	178.98	77.26	7.040	106.12	94.23	98.32	101.95	178.98	77.26

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Config.: Contingency

Induction Motor ID: 1803-PM-219 A

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
7.060	106.12	94.23	98.32	101.95	178.98	77.26	7.080	106.12	94.23	98.32	101.95	178.98	77.26
7.100	106.12	94.23	98.32	101.95	178.98	77.26	7.120	106.12	94.23	98.32	101.95	178.98	77.26
7.140	106.12	94.23	98.32	101.95	178.98	77.26	7.160	106.12	94.23	98.32	101.95	178.98	77.26
7.180	106.12	94.23	98.32	101.95	178.98	77.26	7.200	106.12	94.23	98.32	101.95	178.98	77.26
7.220	106.12	94.23	98.32	101.95	178.98	77.26	7.240	106.12	94.23	98.32	101.95	178.98	77.26
7.260	106.12	94.23	98.32	101.95	178.98	77.26	7.280	106.12	94.23	98.32	101.95	178.98	77.26
7.300	106.12	94.23	98.32	101.95	178.98	77.26	7.320	106.12	94.23	98.32	101.95	178.98	77.26
7.340	106.12	94.23	98.32	101.95	178.98	77.26	7.360	106.12	94.23	98.32	101.95	178.98	77.26
7.380	106.12	94.23	98.32	101.95	178.98	77.26	7.400	106.12	94.23	98.32	101.95	178.98	77.26
7.420	106.12	94.23	98.32	101.95	178.98	77.26	7.440	106.12	94.23	98.32	101.95	178.98	77.26
7.460	106.12	94.23	98.32	101.95	178.98	77.26	7.480	106.12	94.23	98.32	101.95	178.98	77.26
7.500	106.12	94.23	98.32	101.95	178.98	77.26	7.520	106.12	94.23	98.32	101.95	178.98	77.26
7.540	106.12	94.23	98.32	101.95	178.98	77.26	7.560	106.12	94.23	98.32	101.95	178.98	77.26
7.580	106.12	94.23	98.32	101.95	178.98	77.26	7.600	106.12	94.23	98.32	101.95	178.98	77.26
7.620	106.12	94.23	98.32	101.95	178.98	77.26	7.640	106.12	94.23	98.32	101.95	178.98	77.26
7.660	106.12	94.23	98.32	101.95	178.98	77.26	7.680	106.12	94.23	98.32	101.95	178.98	77.26
7.700	106.12	94.23	98.32	101.95	178.98	77.26	7.720	106.12	94.23	98.32	101.95	178.98	77.26
7.740	106.12	94.23	98.32	101.95	178.98	77.26	7.760	106.12	94.23	98.32	101.95	178.98	77.26
7.780	106.12	94.23	98.32	101.95	178.98	77.26	7.800	106.12	94.23	98.32	101.95	178.98	77.26
7.820	106.12	94.23	98.32	101.95	178.98	77.26	7.840	106.12	94.23	98.32	101.95	178.98	77.26
7.860	106.12	94.23	98.32	101.95	178.98	77.26	7.880	106.12	94.23	98.32	101.95	178.98	77.26
7.900	106.12	94.23	98.32	101.95	178.98	77.26	7.920	106.12	94.23	98.32	101.95	178.98	77.26
7.940	106.12	94.23	98.32	101.95	178.98	77.26	7.960	106.12	94.23	98.32	101.95	178.98	77.26
7.980	106.12	94.23	98.32	101.95	178.98	77.26	8.000	106.12	94.23	98.32	101.95	178.98	77.26
8.020	106.12	94.23	98.32	101.95	178.98	77.26	8.040	106.12	94.23	98.32	101.95	178.98	77.26
8.060	106.12	94.23	98.32	101.95	178.98	77.26	8.080	106.12	94.23	98.32	101.95	178.98	77.26
8.100	106.12	94.23	98.32	101.95	178.98	77.26	8.120	106.12	94.23	98.32	101.95	178.98	77.26
8.140	106.12	94.23	98.32	101.95	178.98	77.26	8.160	106.12	94.23	98.32	101.95	178.98	77.26
8.180	106.12	94.23	98.32	101.95	178.98	77.26	8.200	106.12	94.23	98.32	101.95	178.98	77.26
8.220	106.12	94.23	98.32	101.95	178.98	77.26	8.240	106.12	94.23	98.32	101.95	178.98	77.26
8.260	106.12	94.23	98.32	101.95	178.98	77.26	8.280	106.12	94.23	98.32	101.95	178.98	77.26
8.300	106.12	94.23	98.32	101.95	178.98	77.26	8.320	106.12	94.23	98.32	101.95	178.98	77.26
8.340	106.12	94.23	98.32	101.95	178.98	77.26	8.360	106.12	94.23	98.32	101.95	178.98	77.26
8.380	106.12	94.23	98.32	101.95	178.98	77.26	8.400	106.12	94.23	98.32	101.95	178.98	77.26
8.420	106.12	94.23	98.32	101.95	178.98	77.26	8.440	106.12	94.23	98.32	101.95	178.98	77.26
8.460	106.12	94.23	98.32	101.95	178.98	77.26	8.480	106.12	94.23	98.32	101.95	178.98	77.26
8.500	106.12	94.23	98.32	101.95	178.98	77.26	8.520	106.12	94.23	98.32	101.95	178.98	77.26

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Study Case: MS PMCC-102

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Revision: Base
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Induction Motor ID: 1803-PM-219 A

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
8.540	106.12	94.23	98.32	101.95	178.98	77.26	8.560	106.12	94.23	98.32	101.95	178.98	77.26
8.580	106.12	94.23	98.32	101.95	178.98	77.26	8.600	106.12	94.23	98.32	101.95	178.98	77.26
8.620	106.12	94.23	98.32	101.95	178.98	77.26	8.640	106.12	94.23	98.32	101.95	178.98	77.26
8.660	106.12	94.23	98.32	101.95	178.98	77.26	8.680	106.12	94.23	98.32	101.95	178.98	77.26
8.700	106.12	94.23	98.32	101.95	178.98	77.26	8.720	106.12	94.23	98.32	101.95	178.98	77.26
8.740	106.12	94.23	98.32	101.95	178.98	77.26	8.760	106.12	94.23	98.32	101.95	178.98	77.26
8.780	106.12	94.23	98.32	101.95	178.98	77.26	8.800	106.12	94.23	98.32	101.95	178.98	77.26
8.820	106.12	94.23	98.32	101.95	178.98	77.26	8.840	106.12	94.23	98.32	101.95	178.98	77.26
8.860	106.12	94.23	98.32	101.95	178.98	77.26	8.880	106.12	94.23	98.32	101.95	178.98	77.26
8.900	106.12	94.23	98.32	101.95	178.98	77.26	8.920	106.12	94.23	98.32	101.95	178.98	77.26
8.940	106.12	94.23	98.32	101.95	178.98	77.26	8.960	106.12	94.23	98.32	101.95	178.98	77.26
8.980	106.12	94.23	98.32	101.95	178.98	77.26	9.000	106.12	94.23	98.32	101.95	178.98	77.26
9.020	106.12	94.23	98.32	101.95	178.98	77.26	9.040	106.12	94.23	98.32	101.95	178.98	77.26
9.060	106.12	94.23	98.32	101.95	178.98	77.26	9.080	106.12	94.23	98.32	101.95	178.98	77.26
9.100	106.12	94.23	98.32	101.95	178.98	77.26	9.120	106.12	94.23	98.32	101.95	178.98	77.26
9.140	106.12	94.23	98.32	101.95	178.98	77.26	9.160	106.12	94.23	98.32	101.95	178.98	77.26
9.180	106.12	94.23	98.32	101.95	178.98	77.26	9.200	106.12	94.23	98.32	101.95	178.98	77.26
9.220	106.12	94.23	98.32	101.95	178.98	77.26	9.240	106.12	94.23	98.32	101.95	178.98	77.26
9.260	106.12	94.23	98.32	101.95	178.98	77.26	9.280	106.12	94.23	98.32	101.95	178.98	77.26
9.300	106.12	94.23	98.32	101.95	178.98	77.26	9.320	106.12	94.23	98.32	101.95	178.98	77.26
9.340	106.12	94.23	98.32	101.95	178.98	77.26	9.360	106.12	94.23	98.32	101.95	178.98	77.26
9.380	106.12	94.23	98.32	101.95	178.98	77.26	9.400	106.12	94.23	98.32	101.95	178.98	77.26
9.420	106.12	94.23	98.32	101.95	178.98	77.26	9.440	106.12	94.23	98.32	101.95	178.98	77.26
9.460	106.12	94.23	98.32	101.95	178.98	77.26	9.480	106.12	94.23	98.32	101.95	178.98	77.26
9.500	106.12	94.23	98.32	101.95	178.98	77.26	9.520	106.12	94.23	98.32	101.95	178.98	77.26
9.540	106.12	94.23	98.32	101.95	178.98	77.26	9.560	106.12	94.23	98.32	101.95	178.98	77.26
9.580	106.12	94.23	98.32	101.95	178.98	77.26	9.600	106.12	94.23	98.32	101.95	178.98	77.26
9.620	106.12	94.23	98.32	101.95	178.98	77.26	9.640	106.12	94.23	98.32	101.95	178.98	77.26
9.660	106.12	94.23	98.32	101.95	178.98	77.26	9.680	106.12	94.23	98.32	101.95	178.98	77.26
9.700	106.12	94.23	98.32	101.95	178.98	77.26	9.720	106.12	94.23	98.32	101.95	178.98	77.26
9.740	106.12	94.23	98.32	101.95	178.98	77.26	9.760	106.12	94.23	98.32	101.95	178.98	77.26
9.780	106.12	94.23	98.32	101.95	178.98	77.26	9.800	106.12	94.23	98.32	101.95	178.98	77.26
9.820	106.12	94.23	98.32	101.95	178.98	77.26	9.840	106.12	94.23	98.32	101.95	178.98	77.26
9.860	106.12	94.23	98.32	101.95	178.98	77.26	9.880	106.12	94.23	98.32	101.95	178.98	77.26
9.900	106.12	94.23	98.32	101.95	178.98	77.26	9.920	106.12	94.23	98.32	101.95	178.98	77.26
9.940	106.12	94.23	98.32	101.95	178.98	77.26	9.960	106.12	94.23	98.32	101.95	178.98	77.26
9.980	106.12	94.23	98.32	101.95	178.98	77.26	10.000	106.12	94.23	98.32	101.95	178.98	77.26

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Study Case: MS PMCC-102

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Induction Motor ID: 1803-PM-219 A

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
10.020	106.12	94.23	98.32	101.95	178.98	77.26	10.040	106.12	94.23	98.32	101.95	178.98	77.26
10.060	106.12	94.23	98.32	101.95	178.98	77.26	10.080	106.12	94.23	98.32	101.95	178.98	77.26
10.100	106.12	94.23	98.32	101.95	178.98	77.26	10.120	106.12	94.23	98.32	101.95	178.98	77.26
10.140	106.12	94.23	98.32	101.95	178.98	77.26	10.160	106.12	94.23	98.32	101.95	178.98	77.26
10.180	106.12	94.23	98.32	101.95	178.98	77.26	10.200	106.12	94.23	98.32	101.95	178.98	77.26
10.220	106.12	94.23	98.32	101.95	178.98	77.26	10.240	106.12	94.23	98.32	101.95	178.98	77.26
10.260	106.12	94.23	98.32	101.95	178.98	77.26	10.280	106.12	94.23	98.32	101.95	178.98	77.26
10.300	106.12	94.23	98.32	101.95	178.98	77.26	10.320	106.12	94.23	98.32	101.95	178.98	77.26
10.340	106.12	94.23	98.32	101.95	178.98	77.26	10.360	106.12	94.23	98.32	101.95	178.98	77.26
10.380	106.12	94.23	98.32	101.95	178.98	77.26	10.400	106.12	94.23	98.32	101.95	178.98	77.26
10.420	106.12	94.23	98.32	101.95	178.98	77.26	10.440	106.12	94.23	98.32	101.95	178.98	77.26
10.460	106.12	94.23	98.32	101.95	178.98	77.26	10.480	106.12	94.23	98.32	101.95	178.98	77.26
10.500	106.12	94.23	98.32	101.95	178.98	77.26	10.520	106.12	94.23	98.32	101.95	178.98	77.26
10.540	106.12	94.23	98.32	101.95	178.98	77.26	10.560	106.12	94.23	98.32	101.95	178.98	77.26
10.580	106.12	94.23	98.32	101.95	178.98	77.26	10.600	106.12	94.23	98.32	101.95	178.98	77.26
10.620	106.12	94.23	98.32	101.95	178.98	77.26	10.640	106.12	94.23	98.32	101.95	178.98	77.26
10.660	106.12	94.23	98.32	101.95	178.98	77.26	10.680	106.12	94.23	98.32	101.95	178.98	77.26
10.700	106.12	94.23	98.32	101.95	178.98	77.26	10.720	106.12	94.23	98.32	101.95	178.98	77.26
10.740	106.12	94.23	98.32	101.95	178.98	77.26	10.760	106.12	94.23	98.32	101.95	178.98	77.26
10.780	106.12	94.23	98.32	101.95	178.98	77.26	10.800	106.12	94.23	98.32	101.95	178.98	77.26
10.820	106.12	94.23	98.32	101.95	178.98	77.26	10.840	106.12	94.23	98.32	101.95	178.98	77.26
10.860	106.12	94.23	98.32	101.95	178.98	77.26	10.880	106.12	94.23	98.32	101.95	178.98	77.26
10.900	106.12	94.23	98.32	101.95	178.98	77.26	10.920	106.12	94.23	98.32	101.95	178.98	77.26
10.940	106.12	94.23	98.32	101.95	178.98	77.26	10.960	106.12	94.23	98.32	101.95	178.98	77.26
10.980	106.12	94.23	98.32	101.95	178.98	77.26	11.000	106.12	94.23	98.32	101.95	178.98	77.26
11.020	106.12	94.23	98.32	101.95	178.98	77.26	11.040	106.12	94.23	98.32	101.95	178.98	77.26
11.060	106.12	94.23	98.32	101.95	178.98	77.26	11.080	106.12	94.23	98.32	101.95	178.98	77.26
11.100	106.12	94.23	98.32	101.95	178.98	77.26	11.120	106.12	94.23	98.32	101.95	178.98	77.26
11.140	106.12	94.23	98.32	101.95	178.98	77.26	11.160	106.12	94.23	98.32	101.95	178.98	77.26
11.180	106.12	94.23	98.32	101.95	178.98	77.26	11.200	106.12	94.23	98.32	101.95	178.98	77.26
11.220	106.12	94.23	98.32	101.95	178.98	77.26	11.240	106.12	94.23	98.32	101.95	178.98	77.26
11.260	106.12	94.23	98.32	101.95	178.98	77.26	11.280	106.12	94.23	98.32	101.95	178.98	77.26
11.300	106.12	94.23	98.32	101.95	178.98	77.26	11.320	106.12	94.23	98.32	101.95	178.98	77.26
11.340	106.12	94.23	98.32	101.95	178.98	77.26	11.360	106.12	94.23	98.32	101.95	178.98	77.26
11.380	106.12	94.23	98.32	101.95	178.98	77.26	11.400	106.12	94.23	98.32	101.95	178.98	77.26
11.420	106.12	94.23	98.32	101.95	178.98	77.26	11.440	106.12	94.23	98.32	101.95	178.98	77.26
11.460	106.12	94.23	98.32	101.95	178.98	77.26	11.480	106.12	94.23	98.32	101.95	178.98	77.26

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Induction Motor ID: 1803-PM-219 A

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
11.500	106.12	94.23	98.32	101.95	178.98	77.26	11.520	106.12	94.23	98.32	101.95	178.98	77.26
11.540	106.12	94.23	98.32	101.95	178.98	77.26	11.560	106.12	94.23	98.32	101.95	178.98	77.26
11.580	106.12	94.23	98.32	101.95	178.98	77.26	11.600	106.12	94.23	98.32	101.95	178.98	77.26
11.620	106.12	94.23	98.32	101.95	178.98	77.26	11.640	106.12	94.23	98.32	101.95	178.98	77.26
11.660	106.12	94.23	98.32	101.95	178.98	77.26	11.680	106.12	94.23	98.32	101.95	178.98	77.26
11.700	106.12	94.23	98.32	101.95	178.98	77.26	11.720	106.12	94.23	98.32	101.95	178.98	77.26
11.740	106.12	94.23	98.32	101.95	178.98	77.26	11.760	106.12	94.23	98.32	101.95	178.98	77.26
11.780	106.12	94.23	98.32	101.95	178.98	77.26	11.800	106.12	94.23	98.32	101.95	178.98	77.26
11.820	106.12	94.23	98.32	101.95	178.98	77.26	11.840	106.12	94.23	98.32	101.95	178.98	77.26
11.860	106.12	94.23	98.32	101.95	178.98	77.26	11.880	106.12	94.23	98.32	101.95	178.98	77.26
11.900	106.12	94.23	98.32	101.95	178.98	77.26	11.920	106.12	94.23	98.32	101.95	178.98	77.26
11.940	106.12	94.23	98.32	101.95	178.98	77.26	11.960	106.12	94.23	98.32	101.95	178.98	77.26
11.980	106.12	94.23	98.32	101.95	178.98	77.26	12.000	106.12	94.23	98.32	101.95	178.98	77.26

Generator and Power Grid Results

Power Grid ID: CGP ESS-41-2

Time (Sec.)	Current (% FLA)	% Terminal Voltage	MW	Mvar	MVA	% PF	Time (Sec.)	Current (% FLA)	% Terminal Voltage	MW	Mvar	MVA	% PF
0.000	0.00	100.00	0.000	0.000	0.000	0.00	0.020	0.00	100.00	0.000	0.000	0.000	0.00
0.040	0.00	100.00	0.000	0.000	0.000	0.00	0.060	0.00	100.00	0.000	0.000	0.000	0.00
0.080	0.00	100.00	0.000	0.000	0.000	0.00	0.100	0.00	100.00	0.000	0.000	0.000	0.00
0.120	0.00	100.00	0.000	0.000	0.000	0.00	0.140	0.00	100.00	0.000	0.000	0.000	0.00
0.160	0.00	100.00	0.000	0.000	0.000	0.00	0.180	0.00	100.00	0.000	0.000	0.000	0.00
0.200	0.00	100.00	0.000	0.000	0.000	0.00	0.220	0.00	100.00	0.000	0.000	0.000	0.00
0.240	0.00	100.00	0.000	0.000	0.000	0.00	0.260	0.00	100.00	0.000	0.000	0.000	0.00
0.280	0.00	100.00	0.000	0.000	0.000	0.00	0.300	0.00	100.00	0.000	0.000	0.000	0.00
0.320	0.00	100.00	0.000	0.000	0.000	0.00	0.340	0.00	100.00	0.000	0.000	0.000	0.00
0.360	0.00	100.00	0.000	0.000	0.000	0.00	0.380	0.00	100.00	0.000	0.000	0.000	0.00
0.400	0.00	100.00	0.000	0.000	0.000	0.00	0.420	0.00	100.00	0.000	0.000	0.000	0.00
0.440	0.00	100.00	0.000	0.000	0.000	0.00	0.460	0.00	100.00	0.000	0.000	0.000	0.00
0.480	0.00	100.00	0.000	0.000	0.000	0.00	0.500	0.00	100.00	0.000	0.000	0.000	0.00
0.520	0.00	100.00	0.000	0.000	0.000	0.00	0.540	0.00	100.00	0.000	0.000	0.000	0.00
0.560	0.00	100.00	0.000	0.000	0.000	0.00	0.580	0.00	100.00	0.000	0.000	0.000	0.00
0.600	0.00	100.00	0.000	0.000	0.000	0.00	0.620	0.00	100.00	0.000	0.000	0.000	0.00
0.640	0.00	100.00	0.000	0.000	0.000	0.00	0.660	0.00	100.00	0.000	0.000	0.000	0.00
0.680	0.00	100.00	0.000	0.000	0.000	0.00	0.700	0.00	100.00	0.000	0.000	0.000	0.00

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Switching Motors

Motor				Nameplate						Locked-Roto		Accel. Time (sec.)	
ID	Type	Qty	Connected Bus ID	HP/kW	kV	RPM	FLA	% PF	% Eff	% LRC	% PF	No Load	Full Load
1803-PM-209 A	Ind.	1	BUS B 044-PMCC-103	132.0	0.433	1500	225.7	91.7	85.1	720.00	25.18	0.00	0.00

Motor Acceleration

Induction Motor ID: 1803-PM-209 A

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
0.000	0.00	0.00	0.00	96.16	0.00	0.00	0.020	0.00	0.00	0.00	96.16	0.00	0.00
0.040	0.00	0.00	0.00	96.16	0.00	0.00	0.060	0.00	0.00	0.00	96.16	0.00	0.00
0.080	0.00	0.00	0.00	96.16	0.00	0.00	0.100	580.22	80.59	84.08	91.86	322.62	802.07
0.120	112.11	89.20	93.07	95.69	159.73	69.02	0.140	112.11	89.20	93.07	95.69	159.73	69.02
0.160	112.11	89.20	93.07	95.69	159.73	69.02	0.180	112.11	89.20	93.07	95.69	159.73	69.02
0.200	112.11	89.20	93.07	95.69	159.73	69.02	0.220	112.11	89.20	93.07	95.69	159.73	69.02
0.240	112.11	89.20	93.07	95.69	159.73	69.02	0.260	112.11	89.20	93.07	95.69	159.73	69.02
0.280	112.11	89.20	93.07	95.69	159.73	69.02	0.300	112.11	89.20	93.07	95.69	159.73	69.02
0.320	112.11	89.20	93.07	95.69	159.73	69.02	0.340	112.11	89.20	93.07	95.69	159.73	69.02
0.360	112.11	89.20	93.07	95.69	159.73	69.02	0.380	112.11	89.20	93.07	95.69	159.73	69.02
0.400	112.11	89.20	93.07	95.69	159.73	69.02	0.420	112.11	89.20	93.07	95.69	159.73	69.02
0.440	112.11	89.20	93.07	95.69	159.73	69.02	0.460	112.11	89.20	93.07	95.69	159.73	69.02
0.480	112.11	89.20	93.07	95.69	159.73	69.02	0.500	112.11	89.20	93.07	95.69	159.73	69.02
0.520	112.11	89.20	93.07	95.69	159.73	69.02	0.540	112.11	89.20	93.07	95.69	159.73	69.02
0.560	112.11	89.20	93.07	95.69	159.73	69.02	0.580	112.11	89.20	93.07	95.69	159.73	69.02
0.600	112.11	89.20	93.07	95.69	159.73	69.02	0.620	112.11	89.20	93.07	95.69	159.73	69.02
0.640	112.11	89.20	93.07	95.69	159.73	69.02	0.660	112.11	89.20	93.07	95.69	159.73	69.02
0.680	112.11	89.20	93.07	95.69	159.73	69.02	0.700	112.11	89.20	93.07	95.69	159.73	69.02
0.720	112.11	89.20	93.07	95.69	159.73	69.02	0.740	112.11	89.20	93.07	95.69	159.73	69.02
0.760	112.11	89.20	93.07	95.69	159.73	69.02	0.780	112.11	89.20	93.07	95.69	159.73	69.02
0.800	112.11	89.20	93.07	95.69	159.73	69.02	0.820	112.11	89.20	93.07	95.69	159.73	69.02
0.840	112.11	89.20	93.07	95.69	159.73	69.02	0.860	112.11	89.20	93.07	95.69	159.73	69.02
0.880	112.11	89.20	93.07	95.69	159.73	69.02	0.900	112.11	89.20	93.07	95.69	159.73	69.02
0.920	112.11	89.20	93.07	95.69	159.73	69.02	0.940	112.11	89.20	93.07	95.69	159.73	69.02
0.960	112.11	89.20	93.07	95.69	159.73	69.02	0.980	112.11	89.20	93.07	95.69	159.73	69.02
1.000	112.11	89.20	93.07	95.69	159.73	69.02	1.020	112.11	89.20	93.07	95.69	159.73	69.02
1.040	112.11	89.20	93.07	95.69	159.73	69.02	1.060	112.11	89.20	93.07	95.69	159.73	69.02
1.080	112.11	89.20	93.07	95.69	159.73	69.02	1.100	112.11	89.20	93.07	95.69	159.73	69.02
1.120	112.11	89.20	93.07	95.69	159.73	69.02							

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Induction Motor ID: 1803-PM-209 A

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
1.140	112.11	89.20	93.07	95.69	159.73	69.02	1.160	112.11	89.20	93.07	95.69	159.73	69.02
1.180	112.11	89.20	93.07	95.69	159.73	69.02	1.200	112.11	89.20	93.07	95.69	159.73	69.02
1.220	112.11	89.20	93.07	95.69	159.73	69.02	1.240	112.11	89.20	93.07	95.69	159.73	69.02
1.260	112.11	89.20	93.07	95.69	159.73	69.02	1.280	112.11	89.20	93.07	95.69	159.73	69.02
1.300	112.11	89.20	93.07	95.69	159.73	69.02	1.320	112.11	89.20	93.07	95.69	159.73	69.02
1.340	112.11	89.20	93.07	95.69	159.73	69.02	1.360	112.11	89.20	93.07	95.69	159.73	69.02
1.380	112.11	89.20	93.07	95.69	159.73	69.02	1.400	112.11	89.20	93.07	95.69	159.73	69.02
1.420	112.11	89.20	93.07	95.69	159.73	69.02	1.440	112.11	89.20	93.07	95.69	159.73	69.02
1.460	112.11	89.20	93.07	95.69	159.73	69.02	1.480	112.11	89.20	93.07	95.69	159.73	69.02
1.500	112.11	89.20	93.07	95.69	159.73	69.02	1.520	112.11	89.20	93.07	95.69	159.73	69.02
1.540	112.11	89.20	93.07	95.69	159.73	69.02	1.560	112.11	89.20	93.07	95.69	159.73	69.02
1.580	112.11	89.20	93.07	95.69	159.73	69.02	1.600	112.11	89.20	93.07	95.69	159.73	69.02
1.620	112.11	89.20	93.07	95.69	159.73	69.02	1.640	112.11	89.20	93.07	95.69	159.73	69.02
1.660	112.11	89.20	93.07	95.69	159.73	69.02	1.680	112.11	89.20	93.07	95.69	159.73	69.02
1.700	112.11	89.20	93.07	95.69	159.73	69.02	1.720	112.11	89.20	93.07	95.69	159.73	69.02
1.740	112.11	89.20	93.07	95.69	159.73	69.02	1.760	112.11	89.20	93.07	95.69	159.73	69.02
1.780	112.11	89.20	93.07	95.69	159.73	69.02	1.800	112.11	89.20	93.07	95.69	159.73	69.02
1.820	112.11	89.20	93.07	95.69	159.73	69.02	1.840	112.11	89.20	93.07	95.69	159.73	69.02
1.860	112.11	89.20	93.07	95.69	159.73	69.02	1.880	112.11	89.20	93.07	95.69	159.73	69.02
1.900	112.11	89.20	93.07	95.69	159.73	69.02	1.920	112.11	89.20	93.07	95.69	159.73	69.02
1.940	112.11	89.20	93.07	95.69	159.73	69.02	1.960	112.11	89.20	93.07	95.69	159.73	69.02
1.980	112.11	89.20	93.07	95.69	159.73	69.02	2.000	112.11	89.20	93.07	95.69	159.73	69.02
2.020	112.11	89.20	93.07	95.69	159.73	69.02	2.040	112.11	89.20	93.07	95.69	159.73	69.02
2.060	112.11	89.20	93.07	95.69	159.73	69.02	2.080	112.11	89.20	93.07	95.69	159.73	69.02
2.100	112.11	89.20	93.07	95.69	159.73	69.02	2.120	112.11	89.20	93.07	95.69	159.73	69.02
2.140	112.11	89.20	93.07	95.69	159.73	69.02	2.160	112.11	89.20	93.07	95.69	159.73	69.02
2.180	112.11	89.20	93.07	95.69	159.73	69.02	2.200	112.11	89.20	93.07	95.69	159.73	69.02
2.220	112.11	89.20	93.07	95.69	159.73	69.02	2.240	112.11	89.20	93.07	95.69	159.73	69.02
2.260	112.11	89.20	93.07	95.69	159.73	69.02	2.280	112.11	89.20	93.07	95.69	159.73	69.02
2.300	112.11	89.20	93.07	95.69	159.73	69.02	2.320	112.11	89.20	93.07	95.69	159.73	69.02
2.340	112.11	89.20	93.07	95.69	159.73	69.02	2.360	112.11	89.20	93.07	95.69	159.73	69.02
2.380	112.11	89.20	93.07	95.69	159.73	69.02	2.400	112.11	89.20	93.07	95.69	159.73	69.02
2.420	112.11	89.20	93.07	95.69	159.73	69.02	2.440	112.11	89.20	93.07	95.69	159.73	69.02
2.460	112.11	89.20	93.07	95.69	159.73	69.02	2.480	112.11	89.20	93.07	95.69	159.73	69.02
2.500	112.11	89.20	93.07	95.69	159.73	69.02	2.520	112.11	89.20	93.07	95.69	159.73	69.02
2.540	112.11	89.20	93.07	95.69	159.73	69.02	2.560	112.11	89.20	93.07	95.69	159.73	69.02
2.580	112.11	89.20	93.07	95.69	159.73	69.02	2.600	112.11	89.20	93.07	95.69	159.73	69.02

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Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
2.620	112.11	89.20	93.07	95.69	159.73	69.02	2.640	112.11	89.20	93.07	95.69	159.73	69.02
2.660	112.11	89.20	93.07	95.69	159.73	69.02	2.680	112.11	89.20	93.07	95.69	159.73	69.02
2.700	112.11	89.20	93.07	95.69	159.73	69.02	2.720	112.11	89.20	93.07	95.69	159.73	69.02
2.740	112.11	89.20	93.07	95.69	159.73	69.02	2.760	112.11	89.20	93.07	95.69	159.73	69.02
2.780	112.11	89.20	93.07	95.69	159.73	69.02	2.800	112.11	89.20	93.07	95.69	159.73	69.02
2.820	112.11	89.20	93.07	95.69	159.73	69.02	2.840	112.11	89.20	93.07	95.69	159.73	69.02
2.860	112.11	89.20	93.07	95.69	159.73	69.02	2.880	112.11	89.20	93.07	95.69	159.73	69.02
2.900	112.11	89.20	93.07	95.69	159.73	69.02	2.920	112.11	89.20	93.07	95.69	159.73	69.02
2.940	112.11	89.20	93.07	95.69	159.73	69.02	2.960	112.11	89.20	93.07	95.69	159.73	69.02
2.980	112.11	89.20	93.07	95.69	159.73	69.02	3.000	112.11	89.20	93.07	95.69	159.73	69.02
3.020	112.11	89.20	93.07	95.69	159.73	69.02	3.040	112.11	89.20	93.07	95.69	159.73	69.02
3.060	112.11	89.20	93.07	95.69	159.73	69.02	3.080	112.11	89.20	93.07	95.69	159.73	69.02
3.100	112.11	89.20	93.07	95.69	159.73	69.02	3.120	112.11	89.20	93.07	95.69	159.73	69.02
3.140	112.11	89.20	93.07	95.69	159.73	69.02	3.160	112.11	89.20	93.07	95.69	159.73	69.02
3.180	112.11	89.20	93.07	95.69	159.73	69.02	3.200	112.11	89.20	93.07	95.69	159.73	69.02
3.220	112.11	89.20	93.07	95.69	159.73	69.02	3.240	112.11	89.20	93.07	95.69	159.73	69.02
3.260	112.11	89.20	93.07	95.69	159.73	69.02	3.280	112.11	89.20	93.07	95.69	159.73	69.02
3.300	112.11	89.20	93.07	95.69	159.73	69.02	3.320	112.11	89.20	93.07	95.69	159.73	69.02
3.340	112.11	89.20	93.07	95.69	159.73	69.02	3.360	112.11	89.20	93.07	95.69	159.73	69.02
3.380	112.11	89.20	93.07	95.69	159.73	69.02	3.400	112.11	89.20	93.07	95.69	159.73	69.02
3.420	112.11	89.20	93.07	95.69	159.73	69.02	3.440	112.11	89.20	93.07	95.69	159.73	69.02
3.460	112.11	89.20	93.07	95.69	159.73	69.02	3.480	112.11	89.20	93.07	95.69	159.73	69.02
3.500	112.11	89.20	93.07	95.69	159.73	69.02	3.520	112.11	89.20	93.07	95.69	159.73	69.02
3.540	112.11	89.20	93.07	95.69	159.73	69.02	3.560	112.11	89.20	93.07	95.69	159.73	69.02
3.580	112.11	89.20	93.07	95.69	159.73	69.02	3.600	112.11	89.20	93.07	95.69	159.73	69.02
3.620	112.11	89.20	93.07	95.69	159.73	69.02	3.640	112.11	89.20	93.07	95.69	159.73	69.02
3.660	112.11	89.20	93.07	95.69	159.73	69.02	3.680	112.11	89.20	93.07	95.69	159.73	69.02
3.700	112.11	89.20	93.07	95.69	159.73	69.02	3.720	112.11	89.20	93.07	95.69	159.73	69.02
3.740	112.11	89.20	93.07	95.69	159.73	69.02	3.760	112.11	89.20	93.07	95.69	159.73	69.02
3.780	112.11	89.20	93.07	95.69	159.73	69.02	3.800	112.11	89.20	93.07	95.69	159.73	69.02
3.820	112.11	89.20	93.07	95.69	159.73	69.02	3.840	112.11	89.20	93.07	95.69	159.73	69.02
3.860	112.11	89.20	93.07	95.69	159.73	69.02	3.880	112.11	89.20	93.07	95.69	159.73	69.02
3.900	112.11	89.20	93.07	95.69	159.73	69.02	3.920	112.11	89.20	93.07	95.69	159.73	69.02
3.940	112.11	89.20	93.07	95.69	159.73	69.02	3.960	112.11	89.20	93.07	95.69	159.73	69.02
3.980	112.11	89.20	93.07	95.69	159.73	69.02	4.000	112.11	89.20	93.07	95.69	159.73	69.02
4.020	112.11	89.20	93.07	95.69	159.73	69.02	4.040	112.11	89.20	93.07	95.69	159.73	69.02
4.060	112.11	89.20	93.07	95.69	159.73	69.02	4.080	112.11	89.20	93.07	95.69	159.73	69.02

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Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
4.100	112.11	89.20	93.07	95.69	159.73	69.02	4.120	112.11	89.20	93.07	95.69	159.73	69.02
4.140	112.11	89.20	93.07	95.69	159.73	69.02	4.160	112.11	89.20	93.07	95.69	159.73	69.02
4.180	112.11	89.20	93.07	95.69	159.73	69.02	4.200	112.11	89.20	93.07	95.69	159.73	69.02
4.220	112.11	89.20	93.07	95.69	159.73	69.02	4.240	112.11	89.20	93.07	95.69	159.73	69.02
4.260	112.11	89.20	93.07	95.69	159.73	69.02	4.280	112.11	89.20	93.07	95.69	159.73	69.02
4.300	112.11	89.20	93.07	95.69	159.73	69.02	4.320	112.11	89.20	93.07	95.69	159.73	69.02
4.340	112.11	89.20	93.07	95.69	159.73	69.02	4.360	112.11	89.20	93.07	95.69	159.73	69.02
4.380	112.11	89.20	93.07	95.69	159.73	69.02	4.400	112.11	89.20	93.07	95.69	159.73	69.02
4.420	112.11	89.20	93.07	95.69	159.73	69.02	4.440	112.11	89.20	93.07	95.69	159.73	69.02
4.460	112.11	89.20	93.07	95.69	159.73	69.02	4.480	112.11	89.20	93.07	95.69	159.73	69.02
4.500	112.11	89.20	93.07	95.69	159.73	69.02	4.520	112.11	89.20	93.07	95.69	159.73	69.02
4.540	112.11	89.20	93.07	95.69	159.73	69.02	4.560	112.11	89.20	93.07	95.69	159.73	69.02
4.580	112.11	89.20	93.07	95.69	159.73	69.02	4.600	112.11	89.20	93.07	95.69	159.73	69.02
4.620	112.11	89.20	93.07	95.69	159.73	69.02	4.640	112.11	89.20	93.07	95.69	159.73	69.02
4.660	112.11	89.20	93.07	95.69	159.73	69.02	4.680	112.11	89.20	93.07	95.69	159.73	69.02
4.700	112.11	89.20	93.07	95.69	159.73	69.02	4.720	112.11	89.20	93.07	95.69	159.73	69.02
4.740	112.11	89.20	93.07	95.69	159.73	69.02	4.760	112.11	89.20	93.07	95.69	159.73	69.02
4.780	112.11	89.20	93.07	95.69	159.73	69.02	4.800	112.11	89.20	93.07	95.69	159.73	69.02
4.820	112.11	89.20	93.07	95.69	159.73	69.02	4.840	112.11	89.20	93.07	95.69	159.73	69.02
4.860	112.11	89.20	93.07	95.69	159.73	69.02	4.880	112.11	89.20	93.07	95.69	159.73	69.02
4.900	112.11	89.20	93.07	95.69	159.73	69.02	4.920	112.11	89.20	93.07	95.69	159.73	69.02
4.940	112.11	89.20	93.07	95.69	159.73	69.02	4.960	112.11	89.20	93.07	95.69	159.73	69.02
4.980	112.11	89.20	93.07	95.69	159.73	69.02	5.000	112.11	89.20	93.07	95.69	159.73	69.02
5.020	112.11	89.20	93.07	95.69	159.73	69.02	5.040	112.11	89.20	93.07	95.69	159.73	69.02
5.060	112.11	89.20	93.07	95.69	159.73	69.02	5.080	112.11	89.20	93.07	95.69	159.73	69.02
5.100	112.11	89.20	93.07	95.69	159.73	69.02	5.120	112.11	89.20	93.07	95.69	159.73	69.02
5.140	112.11	89.20	93.07	95.69	159.73	69.02	5.160	112.11	89.20	93.07	95.69	159.73	69.02
5.180	112.11	89.20	93.07	95.69	159.73	69.02	5.200	112.11	89.20	93.07	95.69	159.73	69.02
5.220	112.11	89.20	93.07	95.69	159.73	69.02	5.240	112.11	89.20	93.07	95.69	159.73	69.02
5.260	112.11	89.20	93.07	95.69	159.73	69.02	5.280	112.11	89.20	93.07	95.69	159.73	69.02
5.300	112.11	89.20	93.07	95.69	159.73	69.02	5.320	112.11	89.20	93.07	95.69	159.73	69.02
5.340	112.11	89.20	93.07	95.69	159.73	69.02	5.360	112.11	89.20	93.07	95.69	159.73	69.02
5.380	112.11	89.20	93.07	95.69	159.73	69.02	5.400	112.11	89.20	93.07	95.69	159.73	69.02
5.420	112.11	89.20	93.07	95.69	159.73	69.02	5.440	112.11	89.20	93.07	95.69	159.73	69.02
5.460	112.11	89.20	93.07	95.69	159.73	69.02	5.480	112.11	89.20	93.07	95.69	159.73	69.02
5.500	112.11	89.20	93.07	95.69	159.73	69.02	5.520	112.11	89.20	93.07	95.69	159.73	69.02
5.540	112.11	89.20	93.07	95.69	159.73	69.02	5.560	112.11	89.20	93.07	95.69	159.73	69.02

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Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
5.580	112.11	89.20	93.07	95.69	159.73	69.02	5.600	112.11	89.20	93.07	95.69	159.73	69.02
5.620	112.11	89.20	93.07	95.69	159.73	69.02	5.640	112.11	89.20	93.07	95.69	159.73	69.02
5.660	112.11	89.20	93.07	95.69	159.73	69.02	5.680	112.11	89.20	93.07	95.69	159.73	69.02
5.700	112.11	89.20	93.07	95.69	159.73	69.02	5.720	112.11	89.20	93.07	95.69	159.73	69.02
5.740	112.11	89.20	93.07	95.69	159.73	69.02	5.760	112.11	89.20	93.07	95.69	159.73	69.02
5.780	112.11	89.20	93.07	95.69	159.73	69.02	5.800	112.11	89.20	93.07	95.69	159.73	69.02
5.820	112.11	89.20	93.07	95.69	159.73	69.02	5.840	112.11	89.20	93.07	95.69	159.73	69.02
5.860	112.11	89.20	93.07	95.69	159.73	69.02	5.880	112.11	89.20	93.07	95.69	159.73	69.02
5.900	112.11	89.20	93.07	95.69	159.73	69.02	5.920	112.11	89.20	93.07	95.69	159.73	69.02
5.940	112.11	89.20	93.07	95.69	159.73	69.02	5.960	112.11	89.20	93.07	95.69	159.73	69.02
5.980	112.11	89.20	93.07	95.69	159.73	69.02	6.000	112.11	89.20	93.07	95.69	159.73	69.02
6.020	112.11	89.20	93.07	95.69	159.73	69.02	6.040	112.11	89.20	93.07	95.69	159.73	69.02
6.060	112.11	89.20	93.07	95.69	159.73	69.02	6.080	112.11	89.20	93.07	95.69	159.73	69.02
6.100	112.11	89.20	93.07	95.69	159.73	69.02	6.120	112.11	89.20	93.07	95.69	159.73	69.02
6.140	112.11	89.20	93.07	95.69	159.73	69.02	6.160	112.11	89.20	93.07	95.69	159.73	69.02
6.180	112.11	89.20	93.07	95.69	159.73	69.02	6.200	112.11	89.20	93.07	95.69	159.73	69.02
6.220	112.11	89.20	93.07	95.69	159.73	69.02	6.240	112.11	89.20	93.07	95.69	159.73	69.02
6.260	112.11	89.20	93.07	95.69	159.73	69.02	6.280	112.11	89.20	93.07	95.69	159.73	69.02
6.300	112.11	89.20	93.07	95.69	159.73	69.02	6.320	112.11	89.20	93.07	95.69	159.73	69.02
6.340	112.11	89.20	93.07	95.69	159.73	69.02	6.360	112.11	89.20	93.07	95.69	159.73	69.02
6.380	112.11	89.20	93.07	95.69	159.73	69.02	6.400	112.11	89.20	93.07	95.69	159.73	69.02
6.420	112.11	89.20	93.07	95.69	159.73	69.02	6.440	112.11	89.20	93.07	95.69	159.73	69.02
6.460	112.11	89.20	93.07	95.69	159.73	69.02	6.480	112.11	89.20	93.07	95.69	159.73	69.02
6.500	112.11	89.20	93.07	95.69	159.73	69.02	6.520	112.11	89.20	93.07	95.69	159.73	69.02
6.540	112.11	89.20	93.07	95.69	159.73	69.02	6.560	112.11	89.20	93.07	95.69	159.73	69.02
6.580	112.11	89.20	93.07	95.69	159.73	69.02	6.600	112.11	89.20	93.07	95.69	159.73	69.02
6.620	112.11	89.20	93.07	95.69	159.73	69.02	6.640	112.11	89.20	93.07	95.69	159.73	69.02
6.660	112.11	89.20	93.07	95.69	159.73	69.02	6.680	112.11	89.20	93.07	95.69	159.73	69.02
6.700	112.11	89.20	93.07	95.69	159.73	69.02	6.720	112.11	89.20	93.07	95.69	159.73	69.02
6.740	112.11	89.20	93.07	95.69	159.73	69.02	6.760	112.11	89.20	93.07	95.69	159.73	69.02
6.780	112.11	89.20	93.07	95.69	159.73	69.02	6.800	112.11	89.20	93.07	95.69	159.73	69.02
6.820	112.11	89.20	93.07	95.69	159.73	69.02	6.840	112.11	89.20	93.07	95.69	159.73	69.02
6.860	112.11	89.20	93.07	95.69	159.73	69.02	6.880	112.11	89.20	93.07	95.69	159.73	69.02
6.900	112.11	89.20	93.07	95.69	159.73	69.02	6.920	112.11	89.20	93.07	95.69	159.73	69.02
6.940	112.11	89.20	93.07	95.69	159.73	69.02	6.960	112.11	89.20	93.07	95.69	159.73	69.02
6.980	112.11	89.20	93.07	95.69	159.73	69.02	7.000	112.11	89.20	93.07	95.69	159.73	69.02
7.020	112.11	89.20	93.07	95.69	159.73	69.02	7.040	112.11	89.20	93.07	95.69	159.73	69.02

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Induction Motor ID: 1803-PM-209 A

Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
7.060	112.11	89.20	93.07	95.69	159.73	69.02	7.080	112.11	89.20	93.07	95.69	159.73	69.02
7.100	112.11	89.20	93.07	95.69	159.73	69.02	7.120	112.11	89.20	93.07	95.69	159.73	69.02
7.140	112.11	89.20	93.07	95.69	159.73	69.02	7.160	112.11	89.20	93.07	95.69	159.73	69.02
7.180	112.11	89.20	93.07	95.69	159.73	69.02	7.200	112.11	89.20	93.07	95.69	159.73	69.02
7.220	112.11	89.20	93.07	95.69	159.73	69.02	7.240	112.11	89.20	93.07	95.69	159.73	69.02
7.260	112.11	89.20	93.07	95.69	159.73	69.02	7.280	112.11	89.20	93.07	95.69	159.73	69.02
7.300	112.11	89.20	93.07	95.69	159.73	69.02	7.320	112.11	89.20	93.07	95.69	159.73	69.02
7.340	112.11	89.20	93.07	95.69	159.73	69.02	7.360	112.11	89.20	93.07	95.69	159.73	69.02
7.380	112.11	89.20	93.07	95.69	159.73	69.02	7.400	112.11	89.20	93.07	95.69	159.73	69.02
7.420	112.11	89.20	93.07	95.69	159.73	69.02	7.440	112.11	89.20	93.07	95.69	159.73	69.02
7.460	112.11	89.20	93.07	95.69	159.73	69.02	7.480	112.11	89.20	93.07	95.69	159.73	69.02
7.500	112.11	89.20	93.07	95.69	159.73	69.02	7.520	112.11	89.20	93.07	95.69	159.73	69.02
7.540	112.11	89.20	93.07	95.69	159.73	69.02	7.560	112.11	89.20	93.07	95.69	159.73	69.02
7.580	112.11	89.20	93.07	95.69	159.73	69.02	7.600	112.11	89.20	93.07	95.69	159.73	69.02
7.620	112.11	89.20	93.07	95.69	159.73	69.02	7.640	112.11	89.20	93.07	95.69	159.73	69.02
7.660	112.11	89.20	93.07	95.69	159.73	69.02	7.680	112.11	89.20	93.07	95.69	159.73	69.02
7.700	112.11	89.20	93.07	95.69	159.73	69.02	7.720	112.11	89.20	93.07	95.69	159.73	69.02
7.740	112.11	89.20	93.07	95.69	159.73	69.02	7.760	112.11	89.20	93.07	95.69	159.73	69.02
7.780	112.11	89.20	93.07	95.69	159.73	69.02	7.800	112.11	89.20	93.07	95.69	159.73	69.02
7.820	112.11	89.20	93.07	95.69	159.73	69.02	7.840	112.11	89.20	93.07	95.69	159.73	69.02
7.860	112.11	89.20	93.07	95.69	159.73	69.02	7.880	112.11	89.20	93.07	95.69	159.73	69.02
7.900	112.11	89.20	93.07	95.69	159.73	69.02	7.920	112.11	89.20	93.07	95.69	159.73	69.02
7.940	112.11	89.20	93.07	95.69	159.73	69.02	7.960	112.11	89.20	93.07	95.69	159.73	69.02
7.980	112.11	89.20	93.07	95.69	159.73	69.02	8.000	112.11	89.20	93.07	95.69	159.73	69.02
8.020	112.11	89.20	93.07	95.69	159.73	69.02	8.040	112.11	89.20	93.07	95.69	159.73	69.02
8.060	112.11	89.20	93.07	95.69	159.73	69.02	8.080	112.11	89.20	93.07	95.69	159.73	69.02
8.100	112.11	89.20	93.07	95.69	159.73	69.02	8.120	112.11	89.20	93.07	95.69	159.73	69.02
8.140	112.11	89.20	93.07	95.69	159.73	69.02	8.160	112.11	89.20	93.07	95.69	159.73	69.02
8.180	112.11	89.20	93.07	95.69	159.73	69.02	8.200	112.11	89.20	93.07	95.69	159.73	69.02
8.220	112.11	89.20	93.07	95.69	159.73	69.02	8.240	112.11	89.20	93.07	95.69	159.73	69.02
8.260	112.11	89.20	93.07	95.69	159.73	69.02	8.280	112.11	89.20	93.07	95.69	159.73	69.02
8.300	112.11	89.20	93.07	95.69	159.73	69.02	8.320	112.11	89.20	93.07	95.69	159.73	69.02
8.340	112.11	89.20	93.07	95.69	159.73	69.02	8.360	112.11	89.20	93.07	95.69	159.73	69.02
8.380	112.11	89.20	93.07	95.69	159.73	69.02	8.400	112.11	89.20	93.07	95.69	159.73	69.02
8.420	112.11	89.20	93.07	95.69	159.73	69.02	8.440	112.11	89.20	93.07	95.69	159.73	69.02
8.460	112.11	89.20	93.07	95.69	159.73	69.02	8.480	112.11	89.20	93.07	95.69	159.73	69.02
8.500	112.11	89.20	93.07	95.69	159.73	69.02	8.520	112.11	89.20	93.07	95.69	159.73	69.02

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Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
8.540	112.11	89.20	93.07	95.69	159.73	69.02	8.560	112.11	89.20	93.07	95.69	159.73	69.02
8.580	112.11	89.20	93.07	95.69	159.73	69.02	8.600	112.11	89.20	93.07	95.69	159.73	69.02
8.620	112.11	89.20	93.07	95.69	159.73	69.02	8.640	112.11	89.20	93.07	95.69	159.73	69.02
8.660	112.11	89.20	93.07	95.69	159.73	69.02	8.680	112.11	89.20	93.07	95.69	159.73	69.02
8.700	112.11	89.20	93.07	95.69	159.73	69.02	8.720	112.11	89.20	93.07	95.69	159.73	69.02
8.740	112.11	89.20	93.07	95.69	159.73	69.02	8.760	112.11	89.20	93.07	95.69	159.73	69.02
8.780	112.11	89.20	93.07	95.69	159.73	69.02	8.800	112.11	89.20	93.07	95.69	159.73	69.02
8.820	112.11	89.20	93.07	95.69	159.73	69.02	8.840	112.11	89.20	93.07	95.69	159.73	69.02
8.860	112.11	89.20	93.07	95.69	159.73	69.02	8.880	112.11	89.20	93.07	95.69	159.73	69.02
8.900	112.11	89.20	93.07	95.69	159.73	69.02	8.920	112.11	89.20	93.07	95.69	159.73	69.02
8.940	112.11	89.20	93.07	95.69	159.73	69.02	8.960	112.11	89.20	93.07	95.69	159.73	69.02
8.980	112.11	89.20	93.07	95.69	159.73	69.02	9.000	112.11	89.20	93.07	95.69	159.73	69.02
9.020	112.11	89.20	93.07	95.69	159.73	69.02	9.040	112.11	89.20	93.07	95.69	159.73	69.02
9.060	112.11	89.20	93.07	95.69	159.73	69.02	9.080	112.11	89.20	93.07	95.69	159.73	69.02
9.100	112.11	89.20	93.07	95.69	159.73	69.02	9.120	112.11	89.20	93.07	95.69	159.73	69.02
9.140	112.11	89.20	93.07	95.69	159.73	69.02	9.160	112.11	89.20	93.07	95.69	159.73	69.02
9.180	112.11	89.20	93.07	95.69	159.73	69.02	9.200	112.11	89.20	93.07	95.69	159.73	69.02
9.220	112.11	89.20	93.07	95.69	159.73	69.02	9.240	112.11	89.20	93.07	95.69	159.73	69.02
9.260	112.11	89.20	93.07	95.69	159.73	69.02	9.280	112.11	89.20	93.07	95.69	159.73	69.02
9.300	112.11	89.20	93.07	95.69	159.73	69.02	9.320	112.11	89.20	93.07	95.69	159.73	69.02
9.340	112.11	89.20	93.07	95.69	159.73	69.02	9.360	112.11	89.20	93.07	95.69	159.73	69.02
9.380	112.11	89.20	93.07	95.69	159.73	69.02	9.400	112.11	89.20	93.07	95.69	159.73	69.02
9.420	112.11	89.20	93.07	95.69	159.73	69.02	9.440	112.11	89.20	93.07	95.69	159.73	69.02
9.460	112.11	89.20	93.07	95.69	159.73	69.02	9.480	112.11	89.20	93.07	95.69	159.73	69.02
9.500	112.11	89.20	93.07	95.69	159.73	69.02	9.520	112.11	89.20	93.07	95.69	159.73	69.02
9.540	112.11	89.20	93.07	95.69	159.73	69.02	9.560	112.11	89.20	93.07	95.69	159.73	69.02
9.580	112.11	89.20	93.07	95.69	159.73	69.02	9.600	112.11	89.20	93.07	95.69	159.73	69.02
9.620	112.11	89.20	93.07	95.69	159.73	69.02	9.640	112.11	89.20	93.07	95.69	159.73	69.02
9.660	112.11	89.20	93.07	95.69	159.73	69.02	9.680	112.11	89.20	93.07	95.69	159.73	69.02
9.700	112.11	89.20	93.07	95.69	159.73	69.02	9.720	112.11	89.20	93.07	95.69	159.73	69.02
9.740	112.11	89.20	93.07	95.69	159.73	69.02	9.760	112.11	89.20	93.07	95.69	159.73	69.02
9.780	112.11	89.20	93.07	95.69	159.73	69.02	9.800	112.11	89.20	93.07	95.69	159.73	69.02
9.820	112.11	89.20	93.07	95.69	159.73	69.02	9.840	112.11	89.20	93.07	95.69	159.73	69.02
9.860	112.11	89.20	93.07	95.69	159.73	69.02	9.880	112.11	89.20	93.07	95.69	159.73	69.02
9.900	112.11	89.20	93.07	95.69	159.73	69.02	9.920	112.11	89.20	93.07	95.69	159.73	69.02
9.940	112.11	89.20	93.07	95.69	159.73	69.02	9.960	112.11	89.20	93.07	95.69	159.73	69.02
9.980	112.11	89.20	93.07	95.69	159.73	69.02	10.000	112.11	89.20	93.07	95.69	159.73	69.02

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Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
10.020	112.11	89.20	93.07	95.69	159.73	69.02	10.040	112.11	89.20	93.07	95.69	159.73	69.02
10.060	112.11	89.20	93.07	95.69	159.73	69.02	10.080	112.11	89.20	93.07	95.69	159.73	69.02
10.100	112.11	89.20	93.07	95.69	159.73	69.02	10.120	112.11	89.20	93.07	95.69	159.73	69.02
10.140	112.11	89.20	93.07	95.69	159.73	69.02	10.160	112.11	89.20	93.07	95.69	159.73	69.02
10.180	112.11	89.20	93.07	95.69	159.73	69.02	10.200	112.11	89.20	93.07	95.69	159.73	69.02
10.220	112.11	89.20	93.07	95.69	159.73	69.02	10.240	112.11	89.20	93.07	95.69	159.73	69.02
10.260	112.11	89.20	93.07	95.69	159.73	69.02	10.280	112.11	89.20	93.07	95.69	159.73	69.02
10.300	112.11	89.20	93.07	95.69	159.73	69.02	10.320	112.11	89.20	93.07	95.69	159.73	69.02
10.340	112.11	89.20	93.07	95.69	159.73	69.02	10.360	112.11	89.20	93.07	95.69	159.73	69.02
10.380	112.11	89.20	93.07	95.69	159.73	69.02	10.400	112.11	89.20	93.07	95.69	159.73	69.02
10.420	112.11	89.20	93.07	95.69	159.73	69.02	10.440	112.11	89.20	93.07	95.69	159.73	69.02
10.460	112.11	89.20	93.07	95.69	159.73	69.02	10.480	112.11	89.20	93.07	95.69	159.73	69.02
10.500	112.11	89.20	93.07	95.69	159.73	69.02	10.520	112.11	89.20	93.07	95.69	159.73	69.02
10.540	112.11	89.20	93.07	95.69	159.73	69.02	10.560	112.11	89.20	93.07	95.69	159.73	69.02
10.580	112.11	89.20	93.07	95.69	159.73	69.02	10.600	112.11	89.20	93.07	95.69	159.73	69.02
10.620	112.11	89.20	93.07	95.69	159.73	69.02	10.640	112.11	89.20	93.07	95.69	159.73	69.02
10.660	112.11	89.20	93.07	95.69	159.73	69.02	10.680	112.11	89.20	93.07	95.69	159.73	69.02
10.700	112.11	89.20	93.07	95.69	159.73	69.02	10.720	112.11	89.20	93.07	95.69	159.73	69.02
10.740	112.11	89.20	93.07	95.69	159.73	69.02	10.760	112.11	89.20	93.07	95.69	159.73	69.02
10.780	112.11	89.20	93.07	95.69	159.73	69.02	10.800	112.11	89.20	93.07	95.69	159.73	69.02
10.820	112.11	89.20	93.07	95.69	159.73	69.02	10.840	112.11	89.20	93.07	95.69	159.73	69.02
10.860	112.11	89.20	93.07	95.69	159.73	69.02	10.880	112.11	89.20	93.07	95.69	159.73	69.02
10.900	112.11	89.20	93.07	95.69	159.73	69.02	10.920	112.11	89.20	93.07	95.69	159.73	69.02
10.940	112.11	89.20	93.07	95.69	159.73	69.02	10.960	112.11	89.20	93.07	95.69	159.73	69.02
10.980	112.11	89.20	93.07	95.69	159.73	69.02	11.000	112.11	89.20	93.07	95.69	159.73	69.02
11.020	112.11	89.20	93.07	95.69	159.73	69.02	11.040	112.11	89.20	93.07	95.69	159.73	69.02
11.060	112.11	89.20	93.07	95.69	159.73	69.02	11.080	112.11	89.20	93.07	95.69	159.73	69.02
11.100	112.11	89.20	93.07	95.69	159.73	69.02	11.120	112.11	89.20	93.07	95.69	159.73	69.02
11.140	112.11	89.20	93.07	95.69	159.73	69.02	11.160	112.11	89.20	93.07	95.69	159.73	69.02
11.180	112.11	89.20	93.07	95.69	159.73	69.02	11.200	112.11	89.20	93.07	95.69	159.73	69.02
11.220	112.11	89.20	93.07	95.69	159.73	69.02	11.240	112.11	89.20	93.07	95.69	159.73	69.02
11.260	112.11	89.20	93.07	95.69	159.73	69.02	11.280	112.11	89.20	93.07	95.69	159.73	69.02
11.300	112.11	89.20	93.07	95.69	159.73	69.02	11.320	112.11	89.20	93.07	95.69	159.73	69.02
11.340	112.11	89.20	93.07	95.69	159.73	69.02	11.360	112.11	89.20	93.07	95.69	159.73	69.02
11.380	112.11	89.20	93.07	95.69	159.73	69.02	11.400	112.11	89.20	93.07	95.69	159.73	69.02
11.420	112.11	89.20	93.07	95.69	159.73	69.02	11.440	112.11	89.20	93.07	95.69	159.73	69.02
11.460	112.11	89.20	93.07	95.69	159.73	69.02	11.480	112.11	89.20	93.07	95.69	159.73	69.02

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Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar	Time (s)	Current (% FLA)	% Terminal Voltage		% Bus Voltage	kW	kvar
		kVb Load	kVb Bus						kVb Load	kVb Bus			
11.500	112.11	89.20	93.07	95.69	159.73	69.02	11.520	112.11	89.20	93.07	95.69	159.73	69.02
11.540	112.11	89.20	93.07	95.69	159.73	69.02	11.560	112.11	89.20	93.07	95.69	159.73	69.02
11.580	112.11	89.20	93.07	95.69	159.73	69.02	11.600	112.11	89.20	93.07	95.69	159.73	69.02
11.620	112.11	89.20	93.07	95.69	159.73	69.02	11.640	112.11	89.20	93.07	95.69	159.73	69.02
11.660	112.11	89.20	93.07	95.69	159.73	69.02	11.680	112.11	89.20	93.07	95.69	159.73	69.02
11.700	112.11	89.20	93.07	95.69	159.73	69.02	11.720	112.11	89.20	93.07	95.69	159.73	69.02
11.740	112.11	89.20	93.07	95.69	159.73	69.02	11.760	112.11	89.20	93.07	95.69	159.73	69.02
11.780	112.11	89.20	93.07	95.69	159.73	69.02	11.800	112.11	89.20	93.07	95.69	159.73	69.02
11.820	112.11	89.20	93.07	95.69	159.73	69.02	11.840	112.11	89.20	93.07	95.69	159.73	69.02
11.860	112.11	89.20	93.07	95.69	159.73	69.02	11.880	112.11	89.20	93.07	95.69	159.73	69.02
11.900	112.11	89.20	93.07	95.69	159.73	69.02	11.920	112.11	89.20	93.07	95.69	159.73	69.02
11.940	112.11	89.20	93.07	95.69	159.73	69.02	11.960	112.11	89.20	93.07	95.69	159.73	69.02
11.980	112.11	89.20	93.07	95.69	159.73	69.02	12.000	112.11	89.20	93.07	95.69	159.73	69.02

Generator and Power Grid Results

Power Grid ID: CGP ESS-41-2

Time (Sec.)	Current (% FLA)	% Terminal Voltage	MW	Mvar	MVA	% PF	Time (Sec.)	Current (% FLA)	% Terminal Voltage	MW	Mvar	MVA	% PF
0.000	0.00	100.00	0.000	0.000	0.000	0.00	0.020	0.00	100.00	0.000	0.000	0.000	0.00
0.040	0.00	100.00	0.000	0.000	0.000	0.00	0.060	0.00	100.00	0.000	0.000	0.000	0.00
0.080	0.00	100.00	0.000	0.000	0.000	0.00	0.100	0.00	100.00	0.000	0.000	0.000	0.00
0.120	0.00	100.00	0.000	0.000	0.000	0.00	0.140	0.00	100.00	0.000	0.000	0.000	0.00
0.160	0.00	100.00	0.000	0.000	0.000	0.00	0.180	0.00	100.00	0.000	0.000	0.000	0.00
0.200	0.00	100.00	0.000	0.000	0.000	0.00	0.220	0.00	100.00	0.000	0.000	0.000	0.00
0.240	0.00	100.00	0.000	0.000	0.000	0.00	0.260	0.00	100.00	0.000	0.000	0.000	0.00
0.280	0.00	100.00	0.000	0.000	0.000	0.00	0.300	0.00	100.00	0.000	0.000	0.000	0.00
0.320	0.00	100.00	0.000	0.000	0.000	0.00	0.340	0.00	100.00	0.000	0.000	0.000	0.00
0.360	0.00	100.00	0.000	0.000	0.000	0.00	0.380	0.00	100.00	0.000	0.000	0.000	0.00
0.400	0.00	100.00	0.000	0.000	0.000	0.00	0.420	0.00	100.00	0.000	0.000	0.000	0.00
0.440	0.00	100.00	0.000	0.000	0.000	0.00	0.460	0.00	100.00	0.000	0.000	0.000	0.00
0.480	0.00	100.00	0.000	0.000	0.000	0.00	0.500	0.00	100.00	0.000	0.000	0.000	0.00
0.520	0.00	100.00	0.000	0.000	0.000	0.00	0.540	0.00	100.00	0.000	0.000	0.000	0.00
0.560	0.00	100.00	0.000	0.000	0.000	0.00	0.580	0.00	100.00	0.000	0.000	0.000	0.00
0.600	0.00	100.00	0.000	0.000	0.000	0.00	0.620	0.00	100.00	0.000	0.000	0.000	0.00
0.640	0.00	100.00	0.000	0.000	0.000	0.00	0.660	0.00	100.00	0.000	0.000	0.000	0.00
0.680	0.00	100.00	0.000	0.000	0.000	0.00	0.700	0.00	100.00	0.000	0.000	0.000	0.00