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Technical Specification for Package Units

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1	X	X	X	X			31							
2	X	X	X	X			32							
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1.General

1.1.Introduction

1.2.Definition of Terms

Throughout this document the following words and expressions shall have the meanings hereby assigned to them except where the context otherwise requires:

- **“CLIENT” &/OR OWNER**
- **“BUYER &/OR PURCHASER”**
- **"BUYER REPRESENTATIVE"**
- **“SUPPLIER &/OR CONTRACTOR &/OR VENDOR”** means the firm or company which the contract will be made with.
- **“SUB-SUPPLIER”** means any person or company (other than the supplier) named in the contract for any part of the works.
- **“WORKS”** means all obligations of the Contractor described in the "scope of works" of this document.
- **“PLANT”**
- **“APPROVE”** means approval in writing letter confirmed by buyer.

2.SITE CONDITION

2.1. General Site Location

2-1-1

- Elevation: about 2500 meters above sea level.
- Barometric Pressure: 564.4 mm Hg

2-1-2- Temperature:

- Max. (Summer): 35 C

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- Design Max (indoor and outdoor) 40 C

Min. (Winter): -25 C

- Design Min.(outdoor) -25 C

2-1-3- Relative Humidity:

- Humidity: 30 % @ 33°C

- Max.: 70 %

- Min.: 23 %

For specific indoor area (above open sumps and flotation cells and above thickeners) due to special condition (water evaporation and water spraying) relative humidity shall be considered 100 %.

2-1-4- Wind Condition:

- Max. Wind Velocity already recorded: 100 Km/h

- Prevailing Wind Direction:

- Winter: Between South and South West

- Summer: Between North and North East

- Stormy days per annum: 10

2-1-5- Rainfall:

- Average: 500 mm/a

- Design: 500 mm/a

- Rainfall Intensity: 76 mm/h

2-1-6- Snowfall:

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- Average: 100 mm/a (as water)
- Design Intensity: 150 mm/a (as water)
- Frost Line: 1200 mm below grade

2.2 Site description

2-2-1- Lithology:

The Site lithology consists of colluviums or slope wash overlying a deep volcanic weathering profile.

The Site lithology is summarized in below table:

Unit	Description	Top of Unit (m)	Approx. thickness (m)
1	Colluvium/ Slope wash	Surface	1-3
2	Residual Solids	3	5-10
3	Volcanic Rocks	10	>10

- Seismicity:

SITE is classified as a high hazard zone and the above standard shall be considered during design of all foundation, structures and buildings.

3.OBJECTIVE &SCOPE

This specification covers the minimum requirements for electrical equipment which is furnished as a part of package units for installation. The Supplier shall be responsible for all calculations and design to guarantee component construction and system performance in accordance with this specification, codes, standards, data sheets and drawings.

If national and/or local regulations exist in which some of the requirements may be more stringent than this specification, careful scrutiny shall be carried out to determine

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which combination of requirements will be acceptable as regards to safety, environment, economic and legal aspects. In all cases, Consultant shall be informed of any deviation from the requirements of this specification.

The intent of this specification is to outline the minimum acceptable parameters for the design and construction of the required items. It is not the intent to deviate from good engineering practice. In the absence of a specification, it is to be implied that the best engineering practice will prevail, utilizing first quality materials and workmanship. The equipment supplied by Supplier shall be new and unused and of current manufacture.

4.Codes and Standards

Materials selection, design, manufacturing and testing of the electrical items for packaged units shall comply with the latest editions (including all revisions and addenda current at the time of order placement) of the following codes and standards.

- International Electro-technical Commission (IEC)
- British Standards Institute (BSI)
- American National Standards Institute (ANSI)
- American Petroleum Institute (API)
- The Institution of Electrical and Electronics Engineers (IEEE) & (IEE)
- Association for Electrical, Electronic & Information Technologies (VDE)
- National Electrical Code (NEC)

Note: Electrical equipment shall be designed, manufactured, erected, and installed according to the latest editions of the IEC (International Electro technical Commission) standards.

Minimum requirement for installation shall be follow local codes and norms. In lack of them normal European industrial practice is followed. Other standards that can use in reference, but shall be equivalent with IEC standard, are as below:

BS-IEEE-ANSI-VDE -DIN -ISO -NEMA-NFPA-NACE-API-ISA-NACE

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5. Technical Requirements

5.1. General

All electrical equipment shall be of the type suitable for installation. This specification indicates the electrical requirements for equipment within the boundaries of the packaged units. Each package units shall be supplied with the electrical equipment and components factory installed. Purchaser's field cabling shall terminate directly on the electrical equipment, local control panel or junction and terminal boxes on skid. Junction and terminal boxes shall be grouped in one location at a convenient height wherever possible.

All electrical equipment provide a possible source of fire, ignition and electrical shock to personnel, which due to the limited medical facilities on the installation can have greater consequences than for onshore installations. The design of electrical equipment shall protect against foregoing by all available means of interlock, insulation, enclosure and warning labels. Inspection and acceptance of equipment will depend on the foregoing whether a specific safety feature is specified herein or not.

The package unit shall be designed to minimize the risk of short circuit to ensure personnel and operational safety during all operating conditions, inspections and maintenance.

The environment / atmosphere is extremely dusty, ferrous and corrosive. Initially long periods of equipment standing idle prior to being put to work are involved. The Supplier shall state in his tender the protection / preservation provided for the electrical equipment.

It is of utmost important that failure of items of plant / equipment does not lead to prolong equipment shutdown due to extensive repair work.

The Supplier should aim to exceed the specification in performance and rating rather than just meeting the technical requirements. Where equipment offered exceeds

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specification in rating or performance the Supplier should state so and account will be taken in the bid evaluation.

Total integration and control of plant systems is extremely complex and it is difficult to specify exact performance of electrical control equipment at the initial enquiry stage. It is thus vital that equipment is versatile with respect to modifications being carried out on site with minimum disruption. The foregoing should be achieved by liberal rating of equipment, spare space for mounting devices / terminals, standardization and use of readily available components.

As far as possible, details in this respect will be given on the data sheets.

Prototype or purpose built components will not be acceptable. The Supplier shall state any inherent or design features providing versatile at the time of tender.

Every effort shall be made to minimize vibration.

All screws, studs and terminals shall be proofed against loosening by locknuts, spring washers or purchaser approved devices. Use of shock pulse monitoring of electrical motors shall be considered. If applied, shock pulse probes shall be drilled and mounted by the manufacturer.

5.2.Power Supply Systems

The electrical installation shall be designed for operating at the voltages and frequency stated below. The MV power network shall be resistance earthed and LV power network TN C-S in accordance with IEC 61364-3.

5.3.System Voltages

The following system voltages will be available on the plant:

- 6.6 kV, 50 Hz, Neutral Grounding Resistor
- 400 V, 50 Hz, Three Phases, Solidly earthed neutral
- 230 V, 50 Hz, Single Phase, Solidly earthed neutral

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- 24V DC or 110 V AC UPS un-earthed neutral – for Field Instruments & Solenoid Valves
- 110V DC or 230 V AC UPS Three Phases, Solidly earthed neutral

Any other voltage that will be required for the electrical items of the packaged units shall be provided by supplier itself (Through transformer, rectifier, converter, UPS, etc.).

5.4.Voltage / Frequency Tolerances

The following voltage/frequency tolerances may be encountered on the generation busbars (including transient conditions):

- Voltage: $\pm 10\%$
- Frequency: $\pm 5\%$

Maximum permitted transient voltage drop upon starting and normal running condition of motors is <15% and <5%, respectively. Maximum permitted voltage drop in cables is 2% based on continuous maximum current loading and rated voltage.

5.5.Power Supply

AC power shall be normally be three-phase. Motors up to 250 kW shall be supplied from 400 V- 3Phase. Motors up to 0.4 kW shall be supplied from 230 V-1 Phase or 400 V-3 Phase. Single-phase load shall preferably not exceed 30 Amps.

5.6.Control Power Supply

Control power for low voltage motors shall normally be branched off from the motor's main supply circuits.

Control voltage transformers in Supplier's control panel shall be earthed on the secondary side.

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Any requirements for Supplier's equipment to be supplied from these sources shall be identified by the Supplier if not specified by the Consultant at the time of tender as a special requirement. The supply characteristics shall be agreed with the Consultant to meet individual needs.

5.7.Integral DC Power Pack

DC power packs for control panels shall comprise of 2x100% transformer/rectifier units complete with smoothing circuits and paralleled to DC bus through blocking diodes and fuses.

In the systems where battery back-up is required, batteries of Ni-Cd type shall be used. Batteries shall be maintenance free & shall have vertical terminations. Chargers and batteries shall be matched and be protected to prevent battery cell damage caused by over or under voltage. The charger DC voltage variations (including float and boost charging) shall be within the limits specified by the battery manufacturer.

Battery chargers shall have degree of protection of at least IP42 and RAL 7035 when installed inside control panels.

The chargers shall be provided with DC output fuse in all poles to isolate the charger and load from the battery bank. This equipment shall be located inside the charger enclosure.

The DC charger output switches (MCCB) shall have facilities for being tripped from the PDCS.

The chargers shall as a minimum be provided with the following local alarms:

- AC power supply failure
- Rectifier charger failure
- DC output voltage high
- DC fuse failure

All these alarms shall initiate a common alarm in the central control room. All alarm circuits shall have voltage free normally closed contacts.

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The chargers and battery banks shall be rated as stated on the data sheets.

Note: DC chargers shall be connected to upstream and PDCS/PMS by PROFIBUS DP serial link in order to send & receive the monitoring & control signals.

5.8. Motors

5.8.1.General

All three phase motor starters shall be provided by the Purchaser unless otherwise specified in the material requisition. These shall be mounted in a safe (non-hazardous) area remote from the package unit. If the Supplier has good reasons for mounting motor starters on the package unit, he shall submit these separately priced in the quotation for Purchaser approval. Purchaser reserves the right to nominate the starter manufacturer.

Refer to Technical Specification for LV and MV Motors-Phase 3 document.

5.8.2.Motor Isolation

Where Purchaser's remote starters are employed, each motor shall be provided with a means of isolating the power supply, located within easy reach of the motor. A lock-out stop push-button for this purpose is acceptable. Cabling to this unit shall be from the Motor Control Centre (MCC) and will be the Purchaser's responsibility.

5.8.3Automatic Start Controls

Automatic start controls for motors shall be so designed that in the event of mains AC power failure, the motor will not automatically restart on restoration of power (unless specifically requested in the data sheets).

Motors which shall start and stop automatically based on various package related criteria (e.g. charging hydraulic pump systems) shall in the local control panel have at least one voltage free contact in order to give start and stop signal to the motor starter

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in the MCC. The motor start signal shall be by closed contact, and the motor stop signal by open contact.

5.8.4.Cabling

Under normal circumstances, i.e. motors fed from Purchaser's remote starters, main power and space heaters will be cabled directly to the motors and there will be no requirement for Supplier to supply skid mounted interface junction boxes unless otherwise called for on the data sheets.

5.8.5.Skid Mounted Starters

Where the Supplier intends to supply skid mounted starters, the Purchaser will run cable directly to these units. As such no interposing terminal boxes are required. However, the Supplier shall liaise with the Purchaser regarding the connections. All control signals between equipment e.g. motor starters, contactors and the package unit, for starting and stopping drives, permissive, indicating lamps, etc, shall be voltage-free contacts with a minimum rating of 120 V, 2A, non-inductive unless specified otherwise.

5.9.Cables

5.9.1.General

The Supplier shall provide and install all cabling and signal lines for connection of the various components forming the package unit.

Cable types shall be in accordance with the **Technical Specification for Power and Control Cable** document.

The minimum standard conductor cross-sectional area sizes permitted are detailed below:

- Alarms, protection system and electrical instruments 1.5 mm² (min)

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- Lighting and small power 2.5 mm² (min)
- Motor control circuits 2.5 mm² (min)
- Power Circuits, motor feeders, etc. 2.5 mm² (min) to 300 mm² (max)

Conductor cross sectional areas less than 2.5 mm² shall not be permitted for power and control applications. Only standard sizes shall be allowed.

5.9.2.Special Cabling / Wiring Recommendation

The Supplier shall supply all necessary special cabling / wiring recommendations, e.g. limit in length of the signal circuit cable, signal circuit cable, single point screen earths, limits on circuit parameters on intrinsically safe circuits, etc.

5.9.3.Cable Sizing

The Supplier shall be responsible for the cable voltage-drop, rating, installation, connection and mechanical protection of all cables in this scope. The maximum overall voltage drop for normal operation shall be 3% and during the motor starting shall be <15% at motor's terminals.

Cables shall be sized in a way to withstand the prospective short circuit level where have been installed.

All cables shall be sized in accordance with IEE 16th edition. An ambient temperature of 40°C shall be used as reference temperature unless otherwise stated on the data sheets.

5.9.4.Power and Control Cable Types

Power and control cables shall be constructed and tested in accordance with the requirements in Technical Specification for Power and Control Cable documents as a minimum all cables shall be flame-retardant in accordance with IEC 60332.

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Any cables used for system / equipment which have to be in operation during or after a fire is to be fire resistant according to IEC 60331. Wherever required this will be specified in the data sheets.

All cables with the exception of single core cables shall be provided with an earthing conductor sized in accordance with the IEE requirements. A separate earthing conductor shall be provided for earthing purposes of any equipment.

5.9.5.Internal Wires

Internal wires shall be flame-retardant in accordance with IEC publication 60332-Part 1.

5.10.Cable Installations

Cables shall be installed as generally required in IEE latest edition, Requirements for Electrical Installations.

Cables to skid mounted equipment shall be directly routed without the use of intermediate junction boxes. The skid manufacturer shall install cable trays / ladders for such cables as necessary.

All on-skid cabling shall be carefully routed and cleated into place to avoid stress on cable terminations and mechanical damage. Cable ties shall be plastic coated stainless steel. Cable trays shall be installed in such a way not to obstruct access for operation and maintenance to junction boxes, etc.

Cable trays and ladders shall be made from hot deep galvanized steel.

Medium voltage cables, Low voltage cables and Instrumentation cables shall be installed on separate cable trays.

On-skid cables shall be installed so as to minimize the risk of mechanical damage. Where such risks exist, separate mechanical protection shall be provided. Provisions

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shall also be made to protect the cables from coming into contact with harmful substances.

Cables shall be strapped to tray or rack with Stainless Steel, PVC or EVA (LSOH) covered straps or saddles (plastic ties are not acceptable) and care shall be taken to avoid stress on cable terminations. All bulk items required to install the cables shall be supplied by the supplier e.g. cable lugs, cable straps, saddles, glands, shrouds, markers, etc.

Cable support shall be either ladder rack or tray. Cable support systems shall be mounted to avoid being walked upon. Ladder rack and tray shall be hot deep galvanized steel.

5.10.1. Conduit Installations

Conduit installations shall be avoided. However, where conduit is the only practical way of routing cables, all necessary boxes and sealing compound shall be supplied. The package units in which it is proposed to employ conduit shall be stated at the time of bid. The installation requirements in IEE must be followed.

Conduit installations in Zone 1 areas are not allowed.

5.10.2. Cable Termination Boxes

The Supplier shall provide suitable and approved terminal boxes or termination points for all the Purchaser's cable connections and shall at the time of bid state the size of terminals being provided. Cable entries shall be from the bottom of boxes where possible unless stated otherwise in the unique specification data sheets. The Purchaser's cables will normally be dropped from the overhead cable trays. Supplier should liaise with the Purchaser to ensure that terminal boxes are located as close to the associated tray work as possible.

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Boxes shall be positioned with due consideration of cable minimum bending radius limits and to permit ease of access for cable connections.

Where the Supplier terminate on-skid control cables into control panels or junction boxes the cables cores shall be neatly loomed around the panel such that any core may reach the furthest point of termination.

Gland plates provided for the Purchaser's use shall be separate from those used by the Supplier's cabling such that they may be detached and drilled on site without disconnecting of skid installed cabling. However, drilling shall be done in/on EEx 'd' enclosures.

Where tapped entries are required, they shall be tapped with ISO 1.5mm metric. Sizes shall be stated in the data sheets. The position of the Purchaser's cable entries shall be shown clearly on the general arrangement drawings provided by Supplier and shall be approved by the Purchaser. The Purchaser reserves the right to nominate the junction box Supplier. Gland plates for trefoil cables (single core) shall be of a non-magnetic type material.

Material of all terminal boxes shall be Stainless Steel or other Anti Corrosive Metals with suitable IP protection and hazardous area classification (if any).

5.10.3.Interference

Every reasonable precaution shall be taken to ensure that the instrument signal cables are not subjected to interference.

5.10.4.Cable Glands

Unless otherwise specified the Supplier shall supply cable glands for Purchaser's incoming cables, complete with any necessary locknuts, washers and earth tags. Metric threads shall be used. The Supplier shall indicate in his offer the extent of such a supply.

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The Supplier shall provide cable glands for any on-skid cabling and shall standardize the type of glands as mentioned above.

Cable glands intended for use on EEx 'de' equipment with direct cable entry shall be used for such equipment only. These glands will be off the type EEx-d. Through glands shall be used on all other equipment.

Plastic glands shall be used on all plastic enclosures only and metal type cable glands shall be used for metallic enclosures.

All cable glands shall be provided from the Purchaser's approved Supplier List.

Material of glands shall be selected according to environmental and operating conditions.

Cable glands shall be of the compression type. The use of compound-filled "barrier type" glands is to be kept to a minimum and used only where required by IEC 60079 and with the written permission of the Company / Consultant. The manufacturer and type shall be approved by the Company / Consultant.

5.10.5.Power And Control Terminals

Power and control cable conductor terminations for core sizes up to and including 4 mm² shall be terminated on pressure plate type equipment terminals. For cores greater than 4sq.mm tinned copper compression lugs shall be utilized for terminating the individual cores. For control cabinets and distribution boards, terminals shall as a minimum be 150mm above / below glands.

Individual terminals shall be provided for all conductors. Interconnections of terminals on the same terminal block shall be done by the use of purpose made jumper bars or flexible links. All the spare cores shall be connected to the spare terminals or protective earth bar.

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With the exception of power cable terminal blocks, all terminal blocks shall be provided with a minimum of 20% spare terminals. Field connections shall be terminated on one skid of the terminal blocks.

Circuits and terminals operating at different voltage level and / or performing different functions shall be segregated and marked accordingly.

5.10.6.Cable Conductor Marking / Numbering

Cores of all cables are to be ferruled and numbered in accordance with the wiring diagram provided by the Supplier. The marking shall be applied at all termination points. The ferrules shall be of plastic and of a type requiring disconnection of cable cores to remove the ferrules.

Cable cores shall be identified as follows:

Single core	Black
2 core	Black/Red
3 core	Red/Yellow/Blue
4 core	Red/Yellow/Blue/Black
Above 4 core	Black with White numbers

Note: PE core color for all above mentioned cables (if any) shall be Yellow / Green.

All protective earth markings shall be identified with cable markers fixed with plastic coated stainless-steel ties. Conductor marking material shall meet the requirements as per the approved Supplier list.

5.11.Earthing

All equipment earthing shall be done via separate yellow / green earthing cable.

For EEx 'de' equipment (If Any) having direct cable entry, cables with separate earthing conductors must be used. In such cases, the cable braid shall be terminated in the cable gland (to the armour clamping gland), and the earthing conductor shall be terminated to the protective earth stud/bar inside the enclosure.

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To ensure the requirements for earthing in Hazardous Areas are met, each package unit shall be provided with two welded bosses, easily accessible and at opposite corners of the skid, to allow the user to earth the packaged unit as required.

Luminaires shall be earthed by means of a separate conductor in the cable connecting them to the lighting interface junction box.

The protective earth studs/bars shall be fixed directly to the equipment main enclosure. Protective earth bars shall have a minimum size of 50sq.mm. These bars shall be suitably pre-drilled by the Supplier to allow subsequent termination of the protective earth conductors of all external cables by the Purchaser. Only one termination shall be used for each earthing connection.

Earthing within the package shall be the Supplier's responsibility. The package earthing shall be prepared for connection to the platform earthing system.

5.11.1.Bonding

Parts which are insulated from the steel structure (e.g. HVAC flexible connections, equipment on vibration dampers, etc.) shall be bonded to the steel structure. Bonding of other equipment shall be done only when indicated on appropriate detail drawings. The size of the bonding conductors shall not be less than 25 mm². The color coding of bonding conductors shall be yellow/green.

5.12.Electrical Equipment Enclosures

Within enclosures, separately mounted and screened terminal blocks/strips shall be provided for each voltage level. Terminals for 3-phase supplies shall be phase segregated by installation of barriers, AC terminals over 55V shall be shrouded and fitted with hazard warning labels indicating voltage level.

Gaskets shall be of a rot-proof material i.e., neoprene or synthetic rubber, with resistance to splitting.

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5.12.1.Degree Of Protection

The minimum degree of protection afforded by the electrical equipment enclosures on the packages shall be as a minimum IP55, except for outdoor lighting fixture with IP65 and except for equipment located in switchboard rooms, instrument room and similar rooms At least IP42 shall be specified for such areas. Control Panels shall normally be installed indoor with min. IP42.

For control panels, the minimum protection for electrical equipment inside the enclosure remaining live when enclosure covers/doors are opened shall be IP20.

The following protection classes shall be acceptable as a minimum unless specifically mentioned otherwise:

- IP42 Electrical rooms.
- IP31 HVAC rooms.
- IP55 Outdoor panels.
- IP42 Crusher and conveying systems.
- IP55 Concentrator areas in general.
- IP55 Grinding and thickener areas, local boxes and switches.

5.12.2.Enclosure Material

All enclosures shall be robust sheet steel enclosures with a minimum of 2mm thickness, or "all insulated" enclosures which shall be impact and hydro carbon resistant, anti-static, non-tracking, flame retardant and water resistant. Details shall be provided by Supplier at tender stage. Cast enclosures shall be of Cast Steel or Cast Aluminum.

Any items of equipment/material made of aluminum shall be approved by Purchaser. Detailed installation drawings showing the appropriate measures taken to avoid corrosion shall be submitted to Purchaser for approval in such cases.

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Enclosures for relay boxes, control panels, control stations or other similar equipment shall be constructed from a suitable material to provide a lasting rigid structure. Cover doors shall be hinged gasketed and pad-lockable. Control enclosures over 1.2 meters in height shall have three-point latching mechanisms. Wall mounted equipment shall be provided with external fixing lugs.

5.12.3.Enclosure Ventilation

Where indoor enclosures must be ventilated, as with some air-cooled solid-state power controllers, the minimum enclosure designation shall be at least IP42 with internal assemblies treated and proofed against humidity and dust accumulation. The Supplier shall state how that is achieved e.g. fully tropicalized.

Forced cooling shall be provided by dual 100% fans internally.

5.12.4.Anti Condensation Heaters

The Supplier shall provide anti condensation heaters when required by the Purchaser. Where additional anti-condensation heaters are considered necessary these shall be suitable for 230V, 50 Hz, single-phase or 400V, 50 Hz, 3-phase supply.

5.12.5.Screws, Bolts, Nuts, Etc.

All screws, bolts, nuts, etc. shall be made of stainless steel or anti corrosion metals.

5.12.6.Electrochemical Corrosion

Electrochemical corrosion due to potential differences between dissimilar metals must be taken into account for contact between enclosure/support/structural steel, fastening bolts/enclosure/support and glands/enclosure, etc.

An insulation system shall be provided to prevent galvanic contact between metals with high potential difference. Painting only is not acceptable as such insulation.

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6.Finish (Painting)

- a) In general, painting shall be the manufacturer's standard. This is expected to include a rust inhibiting primer and a minimum of two (2) coats of paint shall be applied to all exterior metal surfaces (which are not galvanized). The total cumulative dry paint film thickness shall not be less than four mils. No lead-based paints or formulas that contain potentially hazardous substances will be allowed.
- b) The colour of the switchgear shall be light gray (RAL 7035), unless specified otherwise in the Data Sheets.
- c) Provide two (2) cans (of minimum 500 ml each) touch-up spray paint.
- d) For painting, please see **Painting Specification** Document.

7.Start / Stop Control Stations

The Supplier shall give details and manufacturer information of the equipment that is intended to supply.

For start / stop pushbuttons, the color green shall be used for motor starting and red color for motor stopping.

For push-button stations and in the MCC's green signal lights shall be used for running indication and red lights for stopped indication.

Supplier control panel ampere meters shall be suitable for 4-20mA transducer supply from a remote source.

All materials to be installed shall be of the approved Suppliers.

8.Electrical Junction Boxes

The Supplier shall give details and Manufacturer information of the equipment it is intended to supply. All junction boxes shall be provided with protective earth terminals sufficiently in size and number for the connection of earthing conductors / cable braids.

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The material used in the junction box enclosures shall preferably be cast iron heavy duty construction stainless steel.

8.1.Protection

The use of fuses shall be avoided as much as possible. MCB's or MCCB's could be used for circuit & devices protection.

8.2.Low Voltage (LV) Motors

LV motors shall be provided with short circuit, overload and earth fault protection as a minimum.

8.3.DC Motors

DC motors (if applied) shall have thermal/magnetic overload protection and DC motors intended for emergency duty (e.g. post lube oil pump) shall have an alarm facility included in their overload protection circuiting.

8.4.Welding Sockets

Welding sockets shall have HRC overcurrent protection and (RCD) earth leakage protection with 30mA instantaneous RCCB trips.

8.5.Lighting

Over current and over load protection shall be by thermal/magnetic lighting type MCB's in all phases/poles.

Note: Just in a wet and high-risk area such as a boiler room; RCBO shall be considered for all lighting and socket feeders. In this area, RCBO (with 30mA as its sensitivity) will be used instead of MCB.

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8.6.Socket Outlets

Over current and over load protection shall be thermal/magnetic motor type MCB's in all phases/poles.

Note: Just in a wet and high-risk area such as a boiler room; RCBO shall be considered for all lighting and socket feeders. In this area, RCBO (with 30mA as its sensitivity) will be used instead of MCB.

8.7.DC Circuits

Over current protection shall be by HRC fuses & MCB's in each pole.

8.8.Heating Elements/Trace Heating (if any)

Heating of hydraulic oil reservoirs, lube oil tanks, etc. shall be done by the use of heating elements. Such elements shall be equipped with thermostats and thermal cut-outs with manual reset.

Heating elements above 3kW shall be fed from a 400V, 3-phase 50Hz power source.

8.9.Trace Heating (If Any)

Equipment, pipes, lines, etc. which are required to be heated by heating elements shall be heated by means of self-limiting trace heating cables. Electrical heat tracing system shall be feed by emergency bus bars.

The trace heating cables shall be fed from 230V, 50Hz distribution boards used for trace heating only. The single-phase loads shall be as equally distributed between the three phases as possible.

Each circuit shall be equipped with earth leakage protection with trip setting of 30mA maximum.

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Maximum load on each circuit shall not exceed 3kW. The maximum rating of the fuses for each circuit shall be 25A. Separate overload protection shall be installed.

The trace heating cables shall be installed in such a way that joints, valves, instruments, etc. can be replaced or maintain without removal or damage to the cables.

The trace heating cables shall be installed strictly according to the manufacturers' installation instructions and installation detail drawings. Only installation material recommended by the trace heating cable manufacturer shall be used.

Appropriate warning labels with text "Electrically Heated" or equivalent labels bearing the circuit numbers of the heating cables shall be posted.

An insulation resistance test between the conductor and the braid shall be performed and recorded before the thermal insulation is applied.

9.Lighting Fixtures

The package Supplier shall provide luminaries when required to do so by the Purchaser. The luminaries shall be of the type specified by the Buyer.

Where the package Supplier is of the opinion that the Company's luminaries are not suitable for the particular application, the Supplier shall offer alternative luminaries for the Company's approval stating:

- The type of luminaire
- Certification details as applicable
- application
- reason for non-acceptability of Purchaser's specified luminaries
- IP degree of protection

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Where applicable, and unless specified otherwise in the requisition, the following minimum lighting levels shall be provided as per doc no. "12002-D-EL-SPC-303-GNL-019".

Through vision gauge glasses shall be illuminated by fluorescent type luminaries. Luminaries in hazardous areas shall be certified EEx de.

The lighting system shall be arranged via junction box at skid edge for connecting to purchaser 230 V AC, 50Hz supply source.

The Supplier shall submit a lighting scheme for the Purchaser approval.

10.Equipment Identification/Marking

Enclosures and internal components shall be marked in accordance with the relevant drawings and project numbering system.

Component numbers shall be in line with component lists.

All labels shall be fixed with stainless steel screws or specifically approved glue.

Trifoliate labels with black characters on a white background shall generally be used.

Warning labels shall be of trifoliate having white characters on a red background.

Stainless steel labels with engraved or embossed text shall be used in especially corrosive areas.

Labels shall generally be fixed to a non-removable part of the installation.

All socket-outlets shall be marked with operating voltage, circuit number and origin distribution board.

Control stations shall be identified by labels on each station. Process designation, origin distribution board and circuit number information shall be included in these labels.

Lighting fixtures and junction boxes shall be marked with labels containing information according to the installation detail drawings and project numbering system.

Miniature circuit breakers, fuse-gear and circuit breakers shall be marked with the number & rated values as indicated on the relevant drawings.

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11. Inspection And Testing

The electrical equipment on the package units shall be subjected to inspection during manufacturing and testing by the Purchaser or his appointed agent. The Supplier shall provide access for such inspection and testing whenever required.

Testing program shall be submitted to the Purchaser prior to testing taking place.

12. Testing

Unless otherwise specified in the relevant documents, testing of the electrical equipment / installation of package units shall consist of routine testing, functional testing and continuity and insulation resistance testing of cables.

For electrical equipment having separate equipment specifications, the testing shall be performed as required in those specifications.

Routine testing shall be executed in accordance with the relevant IEC Publications (the latest issue). Functional testing shall as a minimum include the followings:

- Checking of data and compliance with specifications and data sheets
- Visual check of all equipment items, check of tightness of all joints, glands and terminations.
- Test of protection relays (where applicable).
- Test of all alarm and shutdowns.
- Test of all instruments.
- Test of all controls.

All tests shall be recorded and included in the overall test report.

13. Short Circuit Withstanding Capability

The Packaged unit and its all components shall be able to withstand the thermal and dynamic stresses resulting from the prospective short circuit currents as specified in the relevant documents, without any injury to personnel or damage to the equipment.

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14.Materials List

A material list shall be furnished listing the quantity, rating, type and manufacturer's catalogue number of all equipment of the package unit.

15.Guarantee

The supplier shall replace any damaged equipment resulting from poor workmanship and/or faulty design. The supplier shall also replace any equipment failing under the following conditions:

- Failure of the equipment under pre-commissioning and/or commissioning tests.
- Equipment failure under normal operation in the specified service, shall be provided according to contracts annexes.

The supplier of the equipment under this specification shall guarantee the equipment and shall replace any damaged equipment/parts resulting from poor workmanship or low-quality material and/or faulty design.

1. Attachments

Item	Document Title	Document Number
1	Technical Specification for MV & LV Motors	12002-D-EL-SPC-303-GNL-016
2	Datasheet for MV & LV Motors	12002-D-EL-DSH-303-GNL-038
3	Technical Specification for Power and Control Cable	12002-D-EL-SPC-303-GNL-017
4	Datasheet for Power and Control Cable	12002-D-EL-SPC-GNL-017
5	Technical Specification for Lighting & Power Sockets	12002-D-EL-SPC-303-GNL-019
6	Technical Specification for Electrical Heat Tracing	12002-D-EL-SPC-303-GNL-020