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Packaged Equipment Electrical Requirements

Discipline: Electrical

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1 General & Project Description

As part of the implementation of a strategic investment project, “EuroChem” decided to build a Chemical Complex for the processing of phosphates in the Republic of Kazakhstan. The Project Site is located approx. 25 km west of Zhanatas. This chemical complex will comprise process units and utilities as defined in the following paragraphs, and includes a set of interconnected productions:

Number	Production unit
7G16	Sulfuric Acid Plant (SAP)
7G21	Potassium Sulfate Plant (SOP)
7G25	Di Calcium Phosphate Production Plant (DCP)
7G17	Calcium Chloride (CaCl ₂)
7G02	Offsite & Utilities (O&U)

2 Introduction

This standard covers the minimum requirements for the design, manufacture, inspection/test and supply of PACKAGED EQUIPMENT for the Chemical Complex for Phosphates Processing project.

Project specific data will be detailed in the drawings, data sheets, specifications and other documentation that forms part of any requisition.

3 Supplier Responsibility

3.1 General

Electrical equipment and materials shall be manufactured as safe, reliable and utilizing new. They shall be designed for continuous operation, providing adequate and reliable power supplies.

Supplier shall not make assumptions to replace information not furnished by contractor. In such cases Supplier shall obtain the necessary information from contractor

or other reliable sources. Claims resulting from the lack of knowledge by the Supplier shall not be acceptable.

Materials, which are known to pose a risk to health, must be excluded as far as reasonable practicable. For Electrical equipment and materials, asbestos, or products containing asbestos, shall not be used.

Supplier shall submit a list of all appliances, special tools and accessories that are necessary for the proper installation, operation and maintenance of this equipment.

Supplier shall list and fully describe all deviations from these standard and related specifications. A list shall be retained of all agreed exceptions and deviations for the duration of the purchase order, updated in the event of further concessions being granted, and included in the data dossier.

Supplier may list as an option, equipment or accessories that deviate from this standard, but results in substantial savings to contractor. Such options shall be listed separately in the Supplier proposal. The packaged equipment shall utilize the Supplier's standard component designs selected to meet the requirements of this standard and shall utilize components of the highest quality for material and workmanship.

Manufactory shall consider a methodical phase approach to electrical equipment and materials replacement and installation. This approach shall ensure continuity of supply is maintained and that commissioning time is minimized.

Electrical equipment and materials provided by the supplier shall be in compliance with area classification and meet the requirement.

3.2 Conflicting Requirements

3.2.1 For order of precedence see material requisition.

3.2.2 Any conflicts between the requirements of this standard and the related codes, specifications, data sheets, drawings, requisition, etc., shall be referred in writing to CONTRACTOR for clarification/resolution.

4 Regulations

The following documents are referenced herein and form part of the technical requirements:

4.1 KAZAKHSTAN Standard and code

Electrical equipment and materials shall be in accordance with KAZAKH ORGANIZATION'S PUBLISHED STANDARD requirements and all applicable local rules and regulations, unless specified otherwise.

4.2 International Standards

Packaged plant electrical equipment, shall comply with the latest edition of all relevant IEC/GB publications, supplemented by narrative national specifications, (or their functional equivalents), and including those listed below as a minimum.

GB/T 755	Rotating Electrical Machines - Rating and Performance
GB 18613	Minimum Allowable Values of Energy Efficiency and Values of Efficiency Grades for Motors
GB 50034	Standard for lighting design of buildings
GB 50052	Code for design electric power supply systems
GB 50054	Code for design of low voltage electrical installations
GB 50055	Code for design of electrical distribution of general-purpose utilization equipment
GB 50056	Code for design electrical equipment of electro heat installations
GB 50057	Code for design protection of structures against lightning
GB 50058	Code for design of electrical installations in explosive atmospheres
GB 50650	Code for design protection of petrochemical plant against lightning
GB 3836.1	Explosive Atmospheres - Part 1: Equipment - General Requirements
GB 3836.2	Explosive Atmospheres - Part 2: Equipment Protection by Flameproof Enclosures "d"
GB 3836.3	Explosive Atmospheres - Part 3: Equipment Protection by Increased Safety "e"

GB/T 4026	Basic and safety principles for man-machine interface, marking and identification—Identification of equipment terminals, conductor terminations and conductors
GB/T 4208	Degrees of protection provided by enclosures (IP code)
GB/T 5023.1	Polyvinyl chloride insulated cables of rated voltages up to and including 450/750V - Part 1: General requirements
GB/T 5023.2	Polyvinyl chloride insulated cables of rated voltages up to and including 450/750 V—Part 2: Test methods
GB/T 5023.3	Polyvinyl chloride insulated cables of rated voltages up to and including 450/750V - Part 3: Non-sheathed cables for fixed wiring
GB/T 5023.4	Polyvinyl chloride insulated cables of rated voltages up to and including 450/750V - Part 4: Sheathed cables for fixed wiring
GB/T 5023.5	Polyvinyl chloride insulated cables of rated voltages up to and including 450/750V - Part 5: Flexible cables (cords)
GB 5023.6	Polyvinyl chloride insulated cables of rated voltages up to and including 450/750V Part 6: Lift cables and cables for flexible connections
GB/T 5023.7	Polyvinyl chloride insulated cables of rated voltages up to and including 450/750V - Part 7: Flexible cables screened and unscreened with two or more conductors
GB/T 7251.1	Low-voltage switchgear and controlgear assemblies—Part 1: General rules
GB/T 12666.1	Test method on a single wire or cable under fire conditions - Part 1: Vertical specimen flame test
GB/T 12666.2	Test method on a single wire or cable under fire conditions - Part 2: Horizontal specimen flame test
GB/T 12666.3	Test method on a single wire or cable under fire conditions - Part 3: Slanting specimen flame test
GB/T 12706	Power cables with extruded insulation and their accessories for rated voltages from 1 kV ($U_m=1.2$ kV) up to 35 kV ($U_m=40.5$ kV)
GB/T 14048.1	Low-voltage switchgear and controlgear—Part 1: General rules
GB/T 14048.7	Low-voltage switchgear and controlgear—Part 7-1: Ancillary equipment—Terminal blocks for copper conductors
GB/T 14048.8	Low-voltage switchgear and controlgear—Part 7-2: Ancillary equipment—Protective conductor terminal blocks for copper conductors

GB/T 14048.10	Low-voltage switchgear and controlgear—Part 5-2: Control circuit devices and switching elements—Proximity switches
GB 50171	Erection works of electrical installations Code for construction and acceptance of switchboard outfit, complete cubicle and secondary circuit
GB 50150	Electrical equipment installation engineering-standard for hand-over test of electrical equipment

5 Design

5.1 Environmental Conditions

Material supplied with packaged units shall be suitable for the environmental conditions as stated in the standard PMT-7G02-00-04-001-SPC.

5.2 System of Units

Information and data from Vendor shall be given adopting the metrical system and the SI units.

5.3 Voltage Levels

The voltage levels likely to be seen or utilized on site in Kazakhstan are as follows:

- Medium voltage (MV) power distribution switchboard: 6 kV – 50 Hz
- Power generation: 6 kV – 50 Hz
- Motor ≥ 500 kW: 6 kV – 50 Hz
- Electric motor < 500 kW: 0.4 kV – 50 Hz
- Low-voltage (LV) distribution: 400/230 V – 50 Hz
- Applicable to MV:
 - ✓ Voltage of protective circuits 230V – DC
 - ✓ Voltage of auxiliary circuits 230V – DC
- Applicable to LV switchgear (PMCC, MCC, etc.):

- ✓ Voltage of protective circuits 230V - 50 Hz
- ✓ Voltage of auxiliary circuits 230V – 50 Hz
- ✓ Uninterruptible power supply system (UPS): 400/230 V or 230 V – 50 Hz
- ✓ DC (DCP): 230 VDC
- ✓ CCS (from UPS): 230V – 50 Hz

Grounding Requirements:

- MV system: insulated neutral
- LV system: direct grounding (TN-S system)

Tolerances

- Voltage variation under normal conditions: $\pm 5\%$
- The permissible frequency deviation: ± 0.2 Hz.
- The maximum permissible deviation: ± 0.4 Hz.

5.4 Electrical Design and Operation Requirements

- 5.4.1 All electrical systems shall be completely compatible and shall, when properly installed, provide satisfactory system operations as required by the specific equipment specification.
- 5.4.2 Terminal blocks shall be permanently identified for Contractor's external connections, and be fully rated for the voltage and ampere service involved.
- 5.4.3 All necessary interconnecting wiring between package unit devices shall be installed by vendor prior to shipment.
- 5.4.4 All equipment shall be rated for heavy duty industrial service.
- 5.4.5 No open wiring or exposed live parts shall be allowed. All live parts or equipment subject to arcing shall be guarded by a grounded metal enclosure. Enclosure shall be rated for use in the area of the plant which corresponds.

- 5.4.6 The cases of all instruments, relays and meters furnished by Vendor in a control panel shall be grounded effectively to the panel frame shall be provided with grounding lugs for connection to the Contractor's ground system.
- 5.4.7 All operating devices shall be provided with nameplates showing equipment controlled and the device function. Nameplates shall be of laminated plastic showing black lettering on white background.
- 5.4.8 The minimum degree of protection of enclosures (IP and IK codes respectively as per GB/T 4208 and GB/T 20138) of the electrical equipment and material shall comply with the relevant equipment general specification and/or data sheet and shall be at least:

Item No.	Equipment	Indoor	Outdoor	In explosion Hazardous area
1	Motors	IP 55	IP 55	IP55,Ex
2	Local control panels	IP 55	IP 65	Ex
3	MV switchboards	IP 31/21	NA	Ex
4	LV switchboards	IP 31/21	NA	Ex
5	AC/DC LV switchboards / Distribution boards	IP 31/21	NA	Ex
6	Power transformers/NER	IP 31	IP 55	Ex
7	Fittings and bulk material	IP 55	IP 65	Ex
8	lighting fixture in normal indoor environment	IP 21		IP65,Ex
9	lighting fixture outdoor		IP55	Ex

5.5 Equipment

5.5.1 Motors

As per Specification for Induction Motors ELE-7G02-00-70-010.

5.5.2 Motor Control

1) MV Motor Control

Control for MV motors will be furnished by the Contractor and in general will be by a circuit breaker.

2) LV Motor Starter

- i) In general, LV motor control will be provided by the Contractor in LV motor control centers or local switchboards unless otherwise specified. If the motor starters are to be supplied by the package Vendor, they shall be installed in suitable enclosures or in control panel boards as per 5.5.3.
- ii) Motor starters shall be of the direct on-line starting type suitable for controlling squirrel-cage induction motors.
- iii) Motor starters shall be a combination type having molded case circuit breaker with magnetic release and magnetic contactor. Magnetic contactors shall be electromagnetic type with under voltage release. The magnetic contactors shall be capable of interrupting motor locked-rotor current.
- iv) Ambient temperature compensated triple-pole thermal overload relays shall be employed for 3 phase LV motor overload protection.

5.5.3 Control panel Boards

- a). Where a number of motors or other electrical devices are to be controlled as a unit, a control panel board containing all control items to operate the equipment such as MCCBs or MCBs, contactors, relays, transformers and conversion units shall be supplied. Pushbutton switches, instruments, indicators, etc., shall also be included in this panel board.
- b). The panel boards shall have a complete metal enclosure suitable for the location of the site conditions. The protection degree of the panel board enclosure in each area shall be suitable for the condition of installation.

- c). Suitable removable lifting eyes shall be provided on the top of all panel boards.
- d). Door(s) shall be padlock-able.
- e). Where practical the interior of panel board should be equipped with an illumination lamp, a service socket and a space heater. The lamp shall be easily accessible.
- f). MCB's shall be provided for the protection of all control circuits, and shall be located in a readily accessible position.
- g). Circuit breakers shall be used for incoming and outgoing feeders.
- h). Indicating lamps shall be arranged for easy replacement from the panel front.
- i). Terminal blocks shall be provided for external cable connections.
- j). Both ends of all wires shall be fitted with ferrules or sleeve-type markers with the wire number clearly and durably marked.
- k). Panel boards shall be suitable for the environment where it will be placed.
- l). Potential free contacts for common alarms shall be made available for every panel board.
- m). For outdoor use and / or hazardous area use panel boards shall be provided with threaded cable entries. The cable entry size and thread will be specified by Contractor.
- n). For indoor use panel boards suitable undrilled removable gland plates shall be provided at the bottom of the panels for the termination of compression type cable glands.
- o). Labels shall be provided to identify each item of equipment including switches, relays, fuses, circuit breakers, control relays and similar devices. Nameplates of the panel boards shall be provided at

the front of each panel board. The nameplate and its fixing screw shall be of non-corrodible material.

p). All metallic non-current carrying parts, that are not inherently earthed, shall be bonded together and to the external earthing system. Hinged doors shall be effectively earthed through flexible connections. The panel board shall be provided with two cable lugs to receive 35mm² external copper earthing conductors.

5.5.4 Heating Elements

a). Heating elements for space heating or lube oil heaters, etc., shall be metal clad and shall be provided with thermal enclosures to prevent exposure of live parts.

b). Surface temperatures of heating equipment installed in Hazardous Areas shall not exceed 80 percent of the lowest gas ignition temperature on any surface likely to be exposed to the gas or vapor when continuously energized at the maximum rated ambient temperature. If a temperature controller is not provided, these conditions shall apply when the heater is operated at 120 percent of rated voltage.

c). Anti-condensation Heaters shall be provided to maintain equipment internal temperatures during storage and installation prior to commissioning and whenever equipment is non-operational. Heaters shall be certified and suitable for operation in the specified environment.

5.5.5 DC Equipment

a). All variable speed drives using DC motors shall be complete with AC to DC conversion units LV or HV, three-phase, AC power and silicon controlled rectifiers (SCR) to obtain a variable voltage direct current.

b). The control equipment, in addition to standard components, shall include a properly sized isolation transformer.

c). All electronic power supplies shall have a long time current service rating of 1.25 and a short time current service rating of 1.75, unless otherwise specified.

d). Operating voltage levels shall be selected in accordance with driven equipment kW and torque requirements.

5.5.6 Local Control Stations

In general, local control stations will be provided by the Contractor unless otherwise specified in the requisition. If local control stations are to be supplied by the package Vendor, they shall not be mounted as part of local starter boxes. They shall be suitable enclosures as per 4.5.3.b, and as follows:

- a). The switch shall be lockable.

Standard pushbutton, selection pushbutton and mushroom pushbutton shall be selected according to the requirements of process. Emergency stop pushbutton should be provided if required from process operation.

- b). The different color of the pushbutton shall be used as follow:

- Green use for motor starting
- Red use for motor stopped

- c). Start/stop lamp should be provided, and the lamp should adopt high efficient, long-life and energy saving LED.

- Green for motor running or feeder breaker closed
- Red for motor stopped or feeder breaker open

- d). "Remote-local" change over switch will be provided in case that remote operation is required.

- e). Ammeter on local control station shall be provided for motors equal or above 37kW, and also for the motors required by process.

5.5.7 Pilot Devices

- a). Pilot devices shall be of heavy-duty industrial construction.
- b). Switches activated by temperature, flow, pressure or other functions, including limit switches, furnished by Vendor for control and alarm purposes shall have double pole, throw contacts.

5.5.8 Indicating Lights

- a). Indicating lights shall be of heavy-duty oil-tight construction.
- b). Pilot light color shall be suitable for the service for which the light is required.
- c). Motor stop lights shall be red and motor run lights shall be green.

5.5.9 Junction Boxes

The minimum degree of protection of enclosures shall comply with the relevant requirement in item b of 5.5.3. Junction boxes shall be suitable for surface mounting. Access to terminals shall be via a hinged front door.

Minimum 20% spare terminals shall be provided. All terminals shall include number identification markers and shall be manufactured from polyamide or similar. Terminals shall be sized to suit the cable conductor size but shall not be less than 2.5mm².

Each junction box shall be provided with a 10mm earthing grounding stud which shall have electrical continuity with all cable entries.

Cables shall enter via removable gland plates or threaded entries to suit the required cable glands. Cable entries shall only be made on the base of the boxes.

All junction boxes shall be provided with an engraved label giving JB number and duty.

5.6 WIRING

- 5.6.1 All electrical devices requiring external Contractor connections (except motor leads), furnished and installed by Vendor on a purchased equipment package, shall be Vendor wired to terminal or junction boxes located at the edge of the unit.
- 5.6.2 LV motor feeders and LV power distribution wirings shall be single or three core cables, annealed copper conductors, 1000V insulated, heat and moisture and hydrocarbons resistant(when the cable is not lay in cable tray or protection conduit). Minimum wire size shall be 2.5mm², except for control wire which can be 1.5 mm².
- 5.6.3 Control panel wiring (internal) for controls shall be single conductor, stranded copper conductor. Minimum wire size shall be 1.5mm².The insulation voltage will be 0.6/1kV.
- 5.6.4 Control panel wiring shall be done in a neat and professional manner and be tied and secured in wire ways. Wiring shall be collected and gathered wherever possible; however, control and power wiring shall not be intermixed. Interconnection between devices within enclosure may be wired directly from device to device independently of terminal blocks.
- 5.6.5 Different colors shall be used for different operating voltages. Earth will always be yellow/green.

Unless specifically requested, the color of the outer sheath shall be:

 6kV cables	Red (flame retardant)
400V cables	Black or gray (flame retardant)
Control cables	Black or gray (flame retardant)

- 5.6.6 All wiring external to enclosures shall be terminated within the enclosure and wired to one side of the terminal blocks with tubular screw and pressure plate terminals, sized to the current carrying requirements of the conductor. Splicing of power or control circuits is not permitted. Terminal blocks shall be rated for 1000 volts circuitry.
- 5.6.7 All wiring shall be suitable sized for the service intended and each end of each conductor shall be permanently tagged in accordance with the elementary and wiring diagrams. Heat shrinkable type wire marker shall be provided on all wires at both ends.
- 5.6.8 A maximum of two (2) conductors per terminal shall be permitted. This includes all internal panel wiring plus terminal allowance for all external wiring normally required. Thermocouple leads may be wrapped on terminal screws.
- 5.6.9 For thermocouples requiring Contractor connection, Vendor shall furnish a separate raceway system connecting all thermocouples to a single junction box, with thermocouples extension wires installed and labeled. Cables shall be solid conductor, insulated twisted pair, aluminum Mylar wrap, copper drain wire, overall jacket.
- 5.6.10 Wiring for intrinsically safe equipment must be kept isolated from non-intrinsically safe equipment wiring. For Explosive hazardous environment, Wiring should also execute according to GOST 30852.10-2002.
- 5.6.11 For outdoor installation, cables shall be terminated into enclosures using mechanical compression type cable glands, either Nickel plate Brass or stainless steel (metallic enclosures or armored cables), or polyamide (Polyester enclosures and non-armored cables). Cable glands shall be IP65. For Explosive hazardous environment, metal cable glands shall be dual certified Exd-Exe and non-metal cable glands shall be of the same mode of protection as the device being cabled

(i.e. Ex"e" glands for Ex"e" equipment) and execute according to GOST 30852.10-2002.

5.7 Conduit

- 5.7.1 Conduit for power and control circuit or instrument cables shall be intermediate metal conduit galvanized, of standard trade sizes and lengths. Galvanized RGS conduit is acceptable in lieu of IMC. Minimum size shall be DN20 diameter. Conduit shall be installed either parallel with or perpendicular to structural members and grouped wherever possible. Conduit shall be supported at spacing not be exceed 3 m.
- 5.7.2 All joints for conduit shall be made with standard conduit couplings, with the ends of the conduit cut square, reamed and joined-butt-tight in the couplings. Running threads shall not be permitted. Double locknuts and bushing shall be installed at all indoor conduit terminations. Watertight conduit hub connectors shall be employed for conduit terminations located outdoors and in poor environment areas.
- 5.7.3 Conduit fittings shall be with cast cover and neoprene gaskets. Conduit sealing fitting shall be installed as required by the IEC based on area classification. When conduits are used, open conduit system with armored cables shall be used for connections to the equipment.
- 5.7.4 Liquid-tight, flexible metallic conduit shall be employed at all apparatus or devices subject to vibration, movement for belt adjustments, operational inspection and maintenance facility.
- 5.7.5 Conduits for packaged equipment to be located in a Hazardous (Classified) Area shall comply with requirements of the IEC. All seal shall be provided with sealing material for filling in the field by others.

5.8 Equipment Grounding Requirements

Grounding of equipment should be performed in accordance with the requirements of PUE RK Chapter 7. Grounding and protective measures of electrical safety

5.8.1 The following items shall be connected to the grounding system.

- a). Motor, transformer and generator frame and skid (with two grounding bosses in diagonally opposite location).
- b). Non-current carrying metallic parts of electrical equipment and installation, such as enclosures for panel boards, motor control center, and local control stations.
- c). Metal framework of structures.
- d). Tanks and vessels containing flammable liquid or gas.
- e). Exposed conductive materials enclosing electrical conductors, such as metallic armor and sheaths of cable, metallic shields of cable, cable trays and racks and bus duct enclosures.

5.8.2 Grounding connection for overhead equipment bolted directly to grounded metallic structures or vessels such as drum, heat exchanger is not required.

5.8.3 Except for situations where static electricity can occur, bonding for process piping and across flange coupling is not required.

5.8.4 Large steel structures shall be grounded at two or more points which are widely separated.

5.8.5 Additional grounding shall not be required for the following electrical equipment and instruments:

- a). Electrical equipment connected to the grounded metal armor of cables when metal armor is the full or half conductor size as per IEC such as lighting fixtures except for power equipment.
- b). Instruments on grounded steel structures, metal frames, process

equipment or piping.

- 5.8.6 All metallic conduits, armor and sheaths shall be grounded at their supply and load ends except in the case of metallic shield grounded at one point only.
- 5.8.7 With regard to grounding of lighting fixtures, outlets, cable armor or conduit is considered as grounding path when metal armor is the full or half conductor size as per IEC. Otherwise an additional wire is required.
- 5.8.8 Equipment fixing or anchor bolts shall not be used for grounding purposes.
- 5.8.9 When equipment of a package is installed on a common steel structure, the Vendor shall comply with following matters.
- a). A stud or copper bar to be connected to the main ground wire shall be provided.
 - b). Equipment to be grounded shall be connected to this stud or bar by using PVC insulated stranded copper conductor.
 - c). For a large steel structure, two or more points of studs or bars shall be provided.
 - d). With regard to above, studs or bars shall be connected to each other for loop connections by using PVC insulated copper wire. Equipment to be grounded will be clamped to this wire using compression type branch connectors, or directly connected to of studs or bars.
 - e). For complex and large metallic exposed structures, a lightning study about lightning protection requirements according to IEC 62305 shall be performed.

5.9 PAINTING

Painting Work

- a). Paint shall be prepared and applied in accordance with the paint Vendor's instructions, taking into account site conditions, and with Owner approval.

- b). Painting shall be done in dry weather condition on surfaces free from dirt, oil and moisture.
- c). Notices, nameplates, lettering, gauges, sight glasses and similar such items shall not be painted over and shall be protected during painting by the application of masking tape etc.
- d). Major electrical equipment is anticipated to have the following color scheme, which shall be extended across all sites and all facilities:

Transformers	Light Grey, RAL 7035
Switchgear	Light Grey, RAL 7035
Control gear	Light Grey, RAL 7035
Utility Panels	Light Grey, RAL 7035

5.10 Nameplates

5.10.1 All electrical equipment and control devices shall be permanently identified with nameplates. Identification shall correspond with the designation shown on the equipment data sheets, Supplier's wiring diagrams, or fabrication drawings.

5.10.2 Nameplates shall identify the service indication and ratings and Contractor's equipment number. In addition, nameplates shall identify other devices such as instrument transformers, secondary fuses, etc. inside panels with Supplier's numbers. Door- mounted components shall be identified both on the inside and outside of the panel door.

5.10.3 All nameplates shall be of stainless steel material 304L and be machine-engraved, displaying black letters on a white background. Minimum letter height shall be 3 mm. Nameplate shall be bilingual(Russian and English)

5.10.4 Nameplates shall be attached by two (2) stainless steel screws, and stainless steel screw material shall be same as the nameplates. Adhesive backing shall NOT be permitted unless approved by the Contractor. The manufacturer shall

insulate the screws or provide suitable protection against mechanical damage to the control wiring insulation when screws penetrate into panels.

5.11 Heat Tracing

If necessary, vendor shall provide electric heat tracing. Temperature limiting electric heat tracing should be used, and the temperature should not exceed the explosion-proof grade requirements of the place. Electric heat tracing shall comply with the relevant technical requirements, as specified in the specifications of electric heat tracing.

The device protection level must meet the requirements of the installation environment

6 Inspection and Testing

Routine testing shall be performed according to IEC recommendations and relevant Kazakhstan Codes. Special tests, if required, shall be listed on the data sheet. Certification shall be provided and be made available for inspection before the completion of the Packaged Plant. These tests shall include as a minimum:

- Electrical components used within a packaged unit shall be selected from fully tested and certified items.
- Major items of equipment or non-standard items of equipment shall be fully type tested. All wiring shall be checked for insulation resistance.
- All circuits shall be checked for continuity and correctness against the schematic and wiring diagrams.
- Full functional tests shall be performed at the vendor's works; these shall prove the performance of the complete package over the full operating range. Control panels, starters, controllers and components as required shall be included in this test.

- Packaged units, shall be tested, proved and delivered, such that the minimum amount of work is required to install and commission the unit.
- Test Reports shall be furnished to contractor.
- Data sheets, equipment specification, or purchase order will indicate if works tests are to be witnessed by contractor, or his appointed representative.
- Contractor reserve the right to witness tests and shall be notified at least two weeks prior to the tests. Test certificates shall be provided. Authorized representatives of contractor shall be allowed access to suppliers shop and offices for the purpose of inspection and obtaining.

7 Vendor Documentation

7.1 INFORMATION TO BE PROVIDED WITH QUOTATION:

At the bidding stage, documentation shall be provided, as specified by the Engineering Procurement Contractor, to allow evaluation of proposals as to compliance with project specifications. In the case of high criticality items, Contractor may review and approve the selected documentation as part of the technical evaluation. This documentation shall include as a minimum:

- Completed motor data sheets (at bidding stage, motor data sheets may not be completed, but at least with main operational and dimensional data)
- Electrical consumer list
- Skid dimensions, weights and equipment locations, including tagged motor locations, panels, etc.
- Identification of enclosures and material specifications e). Scope of supply for electrical devices and materials

7.2 DRAWINGS AND DATA:

The final documentation to be provided to contractor, shall be as listed in requisition, but shall include as a minimum:

- Complete Electrical Single Line Diagrams, showing power distribution from the incoming source to the ultimate motor loads and control power, etc.
- Electrical consumer list, giving voltage levels, consumption, (maximum and normal), power factor and details of any harmonic distortion likely to be generated.
- Erection details for all controls and major electrical equipment, junction boxes, distribution boards, etc. One typical drawing may be used for similar installations. Outline drawings, showing metric dimensions and including weights shall also be provided.
- Schematic Diagrams for all load and control circuits. Sub supplier drawings will be used whenever practical. The de-energized position of switch and relay contacts shall be clearly designated with respect to the actuating conditions. All devices shall be fully identified as to the manufacturer, complete with model numbers, settings and the ratings of switches and contacts.
- Hazardous area certification package, which need conform to Customs Union Technical Regulation “TP TC 012/2011 On Safety of equipment intended for use in explosive atmosphere”.
- All fuse and MCB sizes shall be shown and all devices properly tagged.
- Wiring diagrams for control and alarm circuits, including all junction boxes. (Drawings must designate contractor connection points including applicable terminal numbers).
- Drawings shall be as per IEC Standards
- Completed equipment data sheets
- Completed Motor Data Sheets, certified correct by motor manufacturer.

- Bill of Materials
- Operating and Maintenance Instructions
- Detailed spares recommendations, based on the first five years of service.

This list shall be split into installation/commissioning and operational spares.

The list shall identify in detail, the original manufacturers name and relevant part numbers.

- Interconnection Diagrams, for all wiring between items of the packaged equipment and contractor equipment. These drawings shall include all wiring by vendor and sub suppliers. Drawings shall designate all contractor connection points.

7.3 EXCEPTIONS

Package supplier shall include with the bid a statement that he meets all aspects of this standard and that he takes no exception, or he shall list specifically any exceptions. Failure to do so shall be regarded as assurance that the Supplier shall fulfill this standard in detail.