







HAI PHONG 2 PROJECT



GENERAL ELECTRICAL SPECIFICATION HP2-00-EL-SPC-0001

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1. GENERAL

1.1. Document Purpose

The purpose of this document is to define the minimum requirements for the design of electrical equipment and installation of Hai Phong 2 Project.

It outlines the electrical design basis and establishes the types of equipment to be used and their functional requirements.

The design of the electrical power supply and distribution systems shall be based on good engineering practice, Technical Requirements of existing Hai Phong 2 Project and international standards with the following objectives:

- ✓ Safety to personnel during operation and maintenance.
- ✓ Reliability and continuity of service of electrical systems to ensure maximum availability of equipment.
- ✓ Use of energy-efficient power generation, distribution, and utilization equipment.
- ✓ Ease of operation, minimum maintenance of equipment and long service life of equipment.
- ✓ Standardization of components for maximum interchangeability with existing assets and minimize inventory.
- ✓ Ease of future additions to the project and extension to existing facilities.

1.2. Definition and Abbreviation

1.2.1. Definition

Definitions used in this document are described below:

PROJECT	Hai Phong 2 Project
OWNER	The Branch of Top Solvent (Vietnam) Limited Liability Company – Hai Phong Terminal
EPC CONTRACTOR	PTSC Thanh Hoa Technical Services Company

1.2.2. Abbreviation



AC	Alternating Current
API	American Petroleum Institute
BS	British Standard
DB	Distribution Board
DOL	Direct On Line
EPC	Engineering Procurement Construction
IEC	International Electrotechnical Commission

VFD

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GRP

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IP	Ingress Protection
KVA	kilovolt Ampere
kW	kilowatt
LCS	Local Control Station
LV	Low Voltage
MCB	Miniature Circuit Breaker
MCC	Motor Control Centre
MCCB	Moulded Case Circuit Breaker
SWA	Steel Wire Armoured
XLPE	Cross-linked Polyethylene



2. CODES AND STANDARDS

Except where indicated otherwise in this standard the design and installation of materials shall conform to the requirements of the latest edition of the following standards and codes where applicable:

- Mandatory Vietnamese Codes and Standards
- The priority of international standards is:
 - ✓ IEC
 - ✓ CENELEC
 - ✓ BS
 - ✓ Other recognized international standards

The design installation, testing & commissioning shall be as per International codes, standards, sound engineering practices, and shall conform to the statutory regulations applicable in the Socialist of Vietnam. The latest editions of the following codes and standards shall be followed:



- QCVN-QTĐ07-2009/BCT- National Technical Codes for Installation Power Network.
- Electrical Equipment Normative:
 - ✓ 11 TCN 18-2006 – Part 1: Common rules.
 - ✓ 11 TCN 19-2006 – Part 2: Power transmission line system.
 - ✓ 11 TCN 20-2006 - Part 3: Distribution equipments and substation.
 - ✓ 11 TCN 21-2006 - Part 4: Automatic and protection.
- TCVN 5334 - Electrical apparatus for petroleum and petroleum products terminal- Requirements on safety in design, installation and operation.

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- TCVN – 2622 – Fire prevention and protection for buildings and structures – design requirements.
- TCVN 7447-5-53:2005 - Electrical installations of buildings - Part 5-53: Selection and erection of electrical equipment - Isolation, switching and control.
- TCVN 7447-5-54: 2015 - Low-voltage electrical installations - Part 5-54: Selection and erection of electrical equipment - Earthing arrangements and protective conductors.
- TCVN 7447-4-42:2015 - Low-voltage electrical installations - Part 4-42: Protection for safety – Protection against thermal effects.
- TCVN 7447-4-41:2010 - Low-voltage electrical installations - Part 4-41: Protection for safety – Protection against electric shock.
- TCVN 7447-4-43:2010 - Low-voltage electrical installations - Part 4-43: Protection for safety - Protection against overcurrent.
- TCVN 7447-4-44:2010 - Low-voltage electrical installations - Part 4-44: Protection for safety – Protection against voltage disturbances and electromagnetic disturbances.
- TCVN 7447-5-51:2010 - Electrical installations of buildings - Part 51: Selection and erection of electrical equipment - Common rules.
- TCVN 7447-5-52:2010 - Low-voltage of electrical installations - Part 5-52: Selection and erection of electrical equipment – Wiring systems.
- TCVN 7447-5-55:2015 - Electrical installations of buildings - Part 5-55: Selection and erection of electrical equipment - Other equipment.
- TCVN 9358:2012 - Installation of equipment earthing system for industrial projects - General requirements.
- TCVN 9888:2013 Protection against lightning.
- TCVN 5738-2021: Fire alarm system – technical requirements.
- TCVN 7568-5:2013 Fire detection and alarm system - part 5: Point-type Heat detector.
- TCVN 7568-6:2013 Fire alarm system - Part 6: Carbon monoxide fire detectors using electro-chemical cells.

IEC (International Electro-Technical Commission)

- ✓ IEC 60034 Rotating electrical machines (all parts)
 - ✓ IEC 60038 IEC standard voltages
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- ✓ IEC 60079 Explosive Atmospheres (Parts 0,1,2,5,6,7,10-15,17 and 18)
- ✓ IEC 60228 Conductors of insulated cables
- ✓ IEC 60287 Electrical cable – Calculation of Current Rating
- ✓ IEC 60364 Low-voltage electrical installations
- ✓ IEC 60502 Power cables with extruded insulation and their Accessories for rated Voltages from 1KV (Um=1,2KV) up to 30KV (Um=36KV)
- ✓ IEC 60529 Degrees of protection provided by enclosures
- ✓ IEC 60614 Specifications for conduits for electrical installation
- ✓ IEC 62305 Protection against lightning – All Parts

3. PROTECTION AGAINST EXPLOSION AND FIRE HAZARDS

The design of electrical facilities and equipment shall be such as to minimize the risk of explosion or fire due to the use of electricity in areas where flammable liquid, vapor or gases may be present.

Hazardous Area Classification Zones are defined based on international standards, American Petroleum Institute - API RP500 & API RP505.

The following type of protection shall be used for Zone 1 and Zone 2, Gas group IIA, Temperature Class T3 areas, as a minimum:

Zone 1: All inherently non-sparking equipment, e.g., junction boxes and luminaires, shall have type of protection 'e' (Ex'e'). All electric motors shall have type of protection 'd' (Ex'd') or 'eb' (Ex'eb'). All inherently sparking equipment e.g. switchgear and control gear, shall have type of protection 'd' (Ex'd') or 'de' (Ex'de')



Zone 2: All electric motors and inherently non-sparking equipment shall have type of protection 'ec' (Ex'ec'). Inherently sparking equipment shall have type of protection 'd' (Ex'd') as stated for Zone 1.

For electrical apparatus in Zone 1 and Zone 2 areas, a certificate of conformity shall be obtained from the Manufacturer.

Area classification drawing(s) shall be prepared based on latest API RP505 issue.

The design of electrical facilities and equipment shall be such as to practically limit the risk of explosion or fire due to the use of electricity in areas where flammable liquid, vapour and gases may be present.

Electrical equipment should, as far as is reasonably practicable and economical, be located in a non-hazardous area. Where electrical equipment has to be installed in hazardous areas, equipment with a type of protection suitable for the relevant zones shall be selected and specified in accordance with IEC 60079-14.

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4. ELECTRICAL SYSTEM DESIGN

3.1 General

- The design of the electrical installation shall be based on the above fundamental principles. Fit for purpose and package design shall be aimed for. It shall be commensurate with the design criteria, philosophy, and/or objective that is stated in the



EpCI CONTRACT Scope of Work.

- The project is designed comply hazardous standard, classification area must be IEC 60079-10 and TCVN 5334:2007.
- All equipment installed in hazardous areas must be referred to drawings 'hazardous area' and the installation work must comply with IEC 60079-14 (Electrical installation in hazardous areas)
- The minimum equipment enclosure degree of ingress protection to be used shall be in accordance with IEC 60529 as follows:

Equipment	Location	IP Ratings
Low Voltage Motor	Outdoor	Min. IP56
Lighting Fixtures	Outdoor	IP65
Junction Boxes	Outdoor	IP65/ IP66
Local Control Station	Outdoor	IP65
Safety/Isolator/Motor Switch	Outdoor	IP65



3.2 Power supply system

LV systems (400V) shall have the neutral point solidly earthed to limit earth fault current to rated phase current. System earthing shall be TN-S.

Distribution voltages for Various equipment are as shown below:

Service	Voltage (V)	Phase	Hz
Motor	400	3	50
Instruments	230 AC UPS	1	50
Lighting distribution	230	1	50
Motor and panel space heater	230	1	50

- The cable routing of the power supply to electrical equipment shall be installed in the existing cable tray/ cable ladder (overhead installation).

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- The feeder must be installed with overload and short circuit protection: Power supply, lighting, socket, motor.

3.3 Electric Motors

- All electric motors shall be high efficiency type and, as a minimum, be provided with short circuit and overload protection. Motors rated 30 kW and above shall be protected against earth fault. Motor shall be totally enclosed, fan cooled type (TEFC) and suitable for continuous outdoor using
- Direct Online Starter shall be used for all induction motors. However, if the voltage drops during starting at the motor terminal is more than 20% from the nominal voltage, soft starter or VFD shall be considered.
- Motors for use in explosive gas atmospheres shall employ the following types of explosion protection depending on the classification of the hazardous area:
 - a) Where the motors are used in Zone 1 areas, Ex(d) or Ex(eb) construction shall be employed.
 - b) Where the motors are used in Zone 2 areas, Ex(ec) construction shall be employed.
 - c) Accessories or parts of the motors, which have make or break contacts (e.g. temperature switches, pressure switches, etc) or sliding contacts, and which are used in Zone 1 or Zone 2 hazardous areas, shall be of Ex(d) Construction.
 - d) Where motors are used in Zone 1 or Zone 2 areas, non-sparking materials of construction shall be used for the cooling fans.
 - e) Certification.

3.4 Junction Box

- Junction boxes for outdoor installation shall have minimum explosion category Ex 'e' IIB T6 and ingress protection of IP66.
- Junction boxes shall be non-metallic enclosures of either high impact resistant GRP, Aluminium Alloy or SS316 enclosures. ???
- Where metal junction boxes are provided, internal and external earth stud(s) shall be provided.
- Entrances to junction boxes shall be from the bottom. The manufacturer's penetrations or hubs in the top of the junction boxes shall not be used without written CLIENT approval and shall be adequately plugged and sealed. No holes shall be provided or field-drilled

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onto the top of any junction box. Where **GRP** junction boxes are provided, earth continuity shall be ensured with an internal metal earth continuity plate.

3.5 Power, Control And Lighting Cables

- Low voltage and lighting cables shall be of Cu/XLPE/SWA/PVC. The voltage designations of the LV cables shall be 0.6/1 kV (1.2 kV).
- Control cables (instrument) shall be of Cu/PVC/PVC include extruded inner and outer sheaths. The voltage designations of the LV cables shall be 300/ 500V.
- Earthing cables shall be of Cu/PVC (0.6/1 kV). Core color code identification is Green with a yellow stripe.
- Multi-core LV cables shall be of “effectively-filled” construction to avoid the use of barrier glands.
- The XLPE conductor insulation shall have a temperature rating of 90 °C for continuous operation. Conductor sizes shall be 2.5 mm² minimum for power and lighting cables, and 1.5 mm² minimum for control cables.
- Colour requirement for cable core is as follows:



CABLE TYPE			COLOUR CODE
3-core	3-Phase	LV	BLACK, BROWN & GREY
	1-Phase		BROWN, BLUE (neutral) & GREEN/YELLOW (earth)
4-core	AC		BLACK, BROWN, GREY & BLUE
4-core + earth	AC		BLACK, BROWN, GREY, BLUE + GREEN/YELLOW (earth)
7-core & above			WHITE with BLACK NUMBERED

3.6 Lighting system

All lighting systems equipments herein specified shall be new and unused, recently manufactured, and free from all defects and imperfections that would affect their performance.

The lighting circuits shall be 230VAC, 50Hz, 1-phase and neutral. All the new lighting fixtures shall be connected to the existing lighting system.

All type of lighting fixtures shall be fully weatherproof, dustproof, corrosion resistant, Ex ‘de’ and increased safety suitable to Zone 2 area, Gas group IIA, Temperature class T4 and ingress protection minimum of IP 65.

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For all Hazardous type fixtures, IECEx certification tested at approved IECEx certification bodies or equivalent are required.

All lighting fixtures shall have 2 x M20 cable entries. Cable entries shall be plugged with dummy plugs during dispatch along with one number spare Ex 'd' stopper plug per fixture.

All fixtures shall have loop in - loop out (through wiring) facility, Internal terminals including electrical earthing for through wiring connection with two entries. Earth terminal shall be in Yellow/green colour.



- ✓ To utilize Explosion-proof, LED lighting fixtures on poles for tank farm area.
- ✓ To utilize Explosion-proof, LED lighting fixtures for pump station area.
- ✓ To relocation of emergency luminaire at the pump station area.

3.7 Cable Glands

- Cable glands shall be compression type with inner diaphragm seal on cable inner sheath that will not damage a cable with "cold-flow" characteristics and outer deluge seal to prevent moisture ingress to the cable armour, corrosionresistant nickel-plated brass components, ISO-metric threads with 1.5 mm pitch, minimum IP66 ingress protection category and ATEX-certified for both Zone 1 (flameproof) and Zone 2 (increased safety), Gas Group IIA and Temperature Class T3 use.

3.8 Grounding system

- The system earthing arrangement is TN-S in accordance with IEC 60364-3 where the neutral and the protective conductors (PE) are separated. All exposed metal of the electrical installation is required to be bonded to earth.
- Grounding system of tank farm, steel structure, earthing clamp and all new system shall be connected to main existing earthing system. If the earthing bar is not enough, the contractor must install or replace the new earthing bar.
- Cable trays/ ladders and metallic boxes and enclosures for electrical wiring and components shall also be earthed. Earthing conductors shall be sized in accordance with IEC60364.
- Each individual the grounding system shall be connected with general grounding system by 2 conductors:
 - ✓ Chemical tank is grounded by 2 points.

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- ✓ Chemical pump is grounded by 2 points (1 point at motor frame and 1 point at motor base plate).
- ✓ Earthing conductor shall be at least 70sqmm for the chemical tank and 25sqmm for chemical pumps.
- Lightning system: The project doesn't require the installation of an additional lightning air terminal for chemical tanks according to TCVN 9888:2013. However, It must be grounded in accordance with this standard.