

transformers in transformer bay and at intermediate levels for conveyers shall also be provided.

5.14.2 The control station shall include the following equipment as per individual requirement:

- Start/stop push button
- Ammeter (as applicable)
- Auto/Manual or Local/Remote selector switch (if specified)
- Indication lamps etc. (if specified).

5.14.3 Stop push button shall generally have stay put feature except in the case of critical drives such as lube oil pump etc.

#### 5.15 Convenience Receptacles

5.15.1 These shall have the necessary mechanical interlocks and earthing facilities. The enclosure shall have suitable protection for site conditions specified (flame proof, weather proof, dust proof, corrosion resistant, etc.).

5.15.2 Adequate number of welding receptacles shall be provided at suitable locations to ensure accessibility with a 50 m length of trailing cable to any point in the process area and in substations & control rooms. These shall be rated for 63A suitable for 415V, 3 phase system with a scraping earth.

5.15.3 Adequate number of three-pin sockets for lamps and portable tools shall be provided at suitable locations to ensure accessibility with a 15 m length of cable to all manholes of process equipments, other important areas in the process units and in substation, control rooms and other buildings. These shall be rated for 15A, 240 V single phase with earth connection. Hand lamps and portable tools shall be earthed through flexible cords. In hazardous areas, flameproof hand lamps shall be rated for 24V.

#### 5.16 Actuators for Motor Operated Valve

MOVs shall be provided with integral starters. The necessary local/remote selector switch, start/stop control switches or push buttons, torque limit switches etc. shall be provided on actuator for local/remote control depending on the mode of selection. In case of failure of torque limit switches, the mechanical design shall be adequate to stall and trip the motor without damage. The control circuit may be A.C. operated for short distance and D.C. operated for extended distances, where required. The type of MOV control i.e. conventional type or 2 wire control or compatible with instrumentation field bus, etc. shall be as per instrumentation design basis.

#### 5.17 EHV System

The EHV power supply arrangement shall be provided with either conventional switchyard having CT, PT, Disconnecter, circuit breaker, lighting arrestor, etc. located in outdoor fenced area or Gas Insulated Switchgear (GIS). The GIS panels shall be located indoor inside the substation building.

### 6.0 SUBSTATION / MCC ROOM DESIGN PHILOSOPHY

6.1 The sub-stations shall be located in a safe area close to the load center. Proper access shall be provided/ ensured for operation/ maintenance of indoor and outdoor equipment.

- 6.2 EHV and HV sub-station switchgear floor shall be raised above grade level and the space below the switchgear room shall be utilized as cable cellar. The cable cellar floor shall be at least 300 mm above the approach road level and shall be paved and cemented. The cable cellar shall have a minimum clear height of 2.5 m and shall house all cable trays and their supports.
- 6.3 The substation switchgear floor shall have a minimum clear height of 4.0 m. For switchgear floor provided with air-conditioning, the minimum clear height shall be 4.0 m in case of false ceiling and 4.5 m without false ceiling.
- 6.4 MV sub-stations and MCC rooms shall be elevated by compacting the soil so that
- The finished floor level shall be above the approach road level to the building.
  - The finished floor level shall be minimum 1000 mm above the surrounding grade level.
  - The bottom of the cable trench within sub-station is minimum 150 mm above the surrounding grade level.
- 6.5 In addition to the entry to substation for operating personnel, a separate entry of minimum 3m (W) x 3.5m (H) with rolling shutter shall be provided for drawing in all equipment for installation. The main entry for operating personnel for pressurized and air conditioning substations shall be provided with double door system with an airlock lobby. The Sub-station shall also have an emergency door opening outwards.
- 6.6 Sub-station wall adjacent to the transformer bays and walls separating transformers shall be 355 mm thick (inclusive of plastering) in case of brick construction or 230 mm thick in case of RCC construction.
- 6.7 Sub-station building shall be without any columns within the switchgear room to ensure optimum space utilization, unless otherwise specified.
- 6.8 Battery banks shall be located in a separate adequately ventilated room in the sub-station buildings, alongwith the necessary exhaust system and water connection with sink. Floor of the battery room and walls up to 1.5 m height shall have acid/alkaline resistant protective epoxy coating. Separate battery room is not required in case of VRLA batteries, as the VRLA batteries shall be located in the room housing chargers and UPS systems. The battery rooms shall be provided with minimum two exhaust fans and louvered opening in opposite wall/door.
- 6.9 UPS system and other electronics equipment e.g. data concentrator, HMI, RTCC, variable frequency drive panels, battery chargers, thyristorised heater control panels, etc. shall be located in air-conditioned room, unless otherwise specified in project design data sheet.
- 6.10 Sub-station shall have fire extinguishers, first aid boxes and other safety equipment as per statutory requirements. Insulating mats of required voltage rating shall be provided in front and rear of switchboards and GIS panels.
- 6.11 Separation walls between transformers in all substations and safe inter transformer distances for switchyard transformers shall be as per OISD-STD-173.
- 6.12 Equipment like transformers, neutral grounding resistors, reactors and HV capacitor banks shall be located in bays adjacent to the sub-station building. The requirement of roof for bays shall be as defined in project design datasheet. All bays shall have well drained floor, surfaced with gravel or other suitable material.

6.13 In order to prevent oil, whether from a small leakage or outflow from transformer tank, from reaching and polluting the water bearing stratum, transformers shall have the following provisions, depending on the oil capacity of the transformer

6.13.1 Oil Capacity upto 2,000 litres:

Transformers installed adjacent to sub-station/buildings or in Switchyards shall be provided with a layer of 100 mm deep stones of about 40 mm granulation, all around the transformer, for a width of 20% of the transformer height subject to minimum width of 800 mm. However complete transformer bay/ fenced area shall be provided with stone gravels.

6.13.2 Oil Capacity exceeding 2,000 litres:

Transformers installed adjacent to sub-station/building or in Switchyards shall be provided with oil containing pits.

The oil containing pit may be shaped as per OISD STD-173. The pit shall extend all around the transformer for a width of 20% of the transformer height, with a minimum width of about 800 mm around the transformer tank/radiator. In case oil capacity exceeds 9,000 litres, in any chamber, provision shall be made for draining away of any oil, which may escape or leak from the tanks, to a waste oil tank.

6.14 The substation building shall be sized to maintain adequate clearances between equipment for ease of maintenance. The following minimum clearances around various equipment shall be maintained:

Sl. No.	Location	Clearance
a)	Front clearance for HV switchboard including HV GIS	2500 mm
b)	Front clearance for all other switch boards/panels	2000 mm
c)	Rear clearance for panels having maintenance access from front only	Less than 200 mm or more than 750 mm
d)	Rear clearance for panels requiring maintenance from rear	1500 mm (HV swbd) & 1000 mm (MV swbd)
e)	Side clearance between two switch boards or from nearest obstruction	1000 mm after considering space for future panels as per cl. 6.15
f)	All around clearance for transformers	1000 mm
g)	All around clearance for NGR	1000 mm on two sides, 200 mm on other two sides
h)	All around clearance for capacitor bank/ series reactor	1000 mm
i)	Battery rack to wall clearance for - Single row, single/double tier - Double row, single tier - Double row, double tier - Multistep racks	100 mm 100 mm 750 mm 750 mm
j)	Battery rack to rack clearance	750 mm
k)	Head room clearance below bus ducts or any other overhead equipment	2000 mm
l)	Front clearance for wall mounted equipment	1000 mm

Sl. No.	Location	Clearance
m)	Front clearance for operation station/ annunciation/ control panel	2500 mm

For EHV GIS, minimum all around clearance and vertical clearance shall be as per manufacturer recommendation.

Vertical clearance above the top of the highest equipment shall be minimum 1000 mm measured from the bottom of the lowest roof beam. However for the areas with false ceiling, minimum clearance of 750 mm shall be provided between false ceiling and top of any equipment.

- 6.15 In all Substations/ MCC rooms, space for future extension of switchboards shall be provided. One panel extension space on each side (for each Bus section) or two panel extension space on one side (in exceptional cases) shall be provided for all GIS, HV Switchboards, PCCs, MCCs and ASBs. In addition, space for future extension of the substation/ MCC room building shall be considered, as specified in project design data sheet.
- 6.16 The DG sets shall be preferably located in a separate building other than the substation, in a safe area to reduce noise level in substation. However in case the same is located in the substation building, the DG set foundation shall be structurally delinked from the slab/floor of the rest of the substation building. Exhaust of diesel engine shall be kept away from the process/hydrocarbon handling areas and diesel day tanks shall be located outside the DG room. Suitable ventilation system shall be provided to avoid heat accumulation in the DG room.
- 6.17 Fire protection for transformers and switchgear room shall be provided to comply to requirements of OISD-STD-173.
- 6.18 Overhead EOT crane of required capacity shall be provided in substation building/ area housing EHV GIS panels.

## 7.0 INSTALLATION DESIGN PHILOSOPHY

### 7.1 General

The installation work for equipments, cabling system, earthing system and lighting system shall generally conform to EIL standard specifications and installation standards.

### 7.2 Cabling System

- 7.2.1 Cabling system for various areas shall be as specified in Project design data sheet. Preferably, total cable route connected to Fire Water pump/motors starting from receiving substation to Fire Water pump house shall be directly buried underground.
- 7.2.2 The cable trenches shall be sized depending upon the number and voltage grade of cables. The cable trenches in hazardous areas and in transformer bays/ substation cellar shall be filled up with sand. Where underground cables cross road ways, pipe sleepers at grade etc. they shall be protected by being drawn through sleeves/ducts to provide a permanent crossing.
- 7.2.3 RCC cable trenches shall be sealed against ingress of liquid and gases wherever the trenches leave or enter a control room or substation. Pipes laid for mechanical protection shall be sealed at both ends. In case of direct burial, cable route markers shall be installed at 30 m

interval all along the cable routes and where the direction of cable trench changes. Additionally, markers shall be provided at cable straight through joint locations.

- 7.2.4 Above ground cables shall be well supported on cable trays and suitably protected against mechanical damage. Routing shall be decided to avoid interference with hot surfaces or places subject to undue fire risk. Requirement of walkway for cable trays on overhead piperack shall be as specified in project design data sheet.
- 7.2.5 Cable trays, racks and trenches shall be sized to allow for 10 % space for future cables. Cable installations shall provide minimum cable bending radii as recommended by cable manufacturer. Separate trays shall be provided for EHV cables, HV Cables, MV power cables, MV control cables and plant communication cables to the possible extent. However, where specifically agreed upon in exceptional cases, HV and MV power, control cables may be laid together, with a barrier plate separating HV and MV cables.
- 7.2.6 Separate cables shall be provided for AC and DC signal/control circuits, except for cables to Local control stations/ local control panels/ MOVs.
- 7.2.7 Cables connected in parallel shall run together so that their length remains the same.
- 7.2.8 Type of cable tray and accessories shall be as specified in project design data sheet. For tray system design, in addition to self load and wind forces, following guidelines for design shall be considered.
- a) Maximum Support span : 3000 mm
- b) Cable load for
- |                             |   |                     |
|-----------------------------|---|---------------------|
| i. 150 mm wide cable tray   | : | 30 kg/linear meter  |
| ii. 300 mm wide cable tray  | : | 60 kg/linear meter  |
| iii. 600 mm wide cable tray | : | 75 kg/linear meter  |
| iv. 750 mm wide cable tray  | : | 75 kg/linear meter. |
- c) In addition to this, 70 kg concentrated load at center span shall be considered. All structural steel design shall be as per Indian Standards.
- 7.2.9 Bends, tees, reducers, crosses, droppers etc. shall have the required bending radii as required for various cable sizes with a minimum radius of 300 mm.
- 7.2.10 All cables shall carry the cable tag numbers for easy identification.
- 7.2.11 Signal cables i.e. Instrument, communication, fire alarm, LAN and data highway, etc. shall preferably not be laid in the same trench/ tray along with electrical cables. In case these are laid in the same trench/ tray, a clearance of minimum 300 mm from electrical cables shall be provided. The overall cable layouts shall be designed for minimum interference between signal and power cables.
- 7.2.12 For single core EHV and HV cables, the armour & metallic screen shall have either single point bonding or cross bonding scheme. Both side bonding shall not be considered due to reduction in cable current carrying capacity. The bonding scheme for complete cable route shall be finalized considering link boxes with/ without SVL as per screen/ sheath voltage calculation.
- 7.2.13 GI or FRP cover shall be considered for top most cable tray and bottom of the lowest cable trays shall also be covered with GI or FRP sheet. GI or FRP type sheet shall be selected based

on the type of cable trays. Tray cover shall be provided for the outermost trays of vertical droppers.

### 7.3 Earthing System

7.3.1 It is recommended that all electrical equipment 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 Instrumentation, DCS, ECS etc. as per specified requirements.

7.3.2 Plant earthing design shall generally be carried out in accordance with the requirements of CEA regulations and IS: 3043. The earthing system shall have an earthing network with required number of earth electrodes connected to it. The following shall be earthed:

- System neutral
- 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, feeder pillars, NGT/ NGR Panels, 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, yard 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

7.3.3 Unless adequately connected to earth elsewhere, all utility and process pipelines should be bonded to a common conductor by means of earth bars or pipe clamps and connected to the earthing system at a point where the pipelines enter or leave the hazardous area except where conflicting with the requirements of cathodic protection.

7.3.4 Where installed, lightning protection shall be provided as per the requirements of IS: 2309. Self-conducting structures having metal thickness of more than 4.8 mm may not require lightning protection with aerial rod and down conductors. They shall, however, be connected to the earthing system, at least, at two points at the base. OISD-STD-180 may be referred for details on lightning protection.

7.3.5 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 sub stations, 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. 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.
- Earthing of Tanks shall comply to OISD-STD-173.

- 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.
- 7.3.6 Earth rods and conductors shall be designed to cope with the conditions imposed. The earth conductor shall be adequately sized to carry the applicable maximum earth fault current without undue temperature rise. All joints shall be protected against corrosion.
- 7.3.7 All the electrical equipment operating above 250 volts shall have two separate and distinct connections to earth grid. Transformers, including lighting transformers shall be provided with two dedicated earth electrodes for earthing of neutral and transformer tank earthing.
- 7.3.8 All earth connections should be visible for inspection to the extent possible. In all cases, connection to earth should be made in accordance with IS: 3043.
- 7.3.9 The main earthing network shall be used for earthing of equipment to protect it against static electricity. The lightning protection system shall be bonded with the main earthing network below ground, minimum at two points.
- 7.3.10 An approach for removing fire or explosion danger is to provide means for adequate dissipation and prevention of accumulation of static electricity, thereby ensuring that static discharges do not occur. One of the methods to eliminate risk of static electricity build up is grounding and bonding.  
The subject of static accumulation caused by flow of petroleum products and the mitigation methods are dealt in detail in OISD-STD-110 and same should be followed.
- 7.3.11 Normally earthing system shall comprise of main earth grid alongwith suitably located disconnecting plates to provide multiple earth connections between earth grid and equipment and for connections between main earth grid and electrodes.

All connections shall be adequately secured against loosening.

Connections between earth electrode and the disconnecting plates shall be done by GI strip. Connection between the disconnecting plate and various equipments shall be done by GI strip, GI wire or GI wire rope.

#### 7.4 Lighting System

7.4.1 Plant lighting system shall comprise:

- a) Normal lighting
- b) Emergency lighting
- c) Critical lighting.

Normal and emergency lighting shall be fed by AC supply (415/240V, three phase four wire except in case of Mines and Oil fields where it shall be in line with Chapter IX of CEA regulations and statutory requirements) while critical lighting shall be fed by DC supply. Additional precautions as per Chapter IX of CEA regulations to be adopted in mines and oil fields shall not apply to apparatus above the ground level except where such apparatus may directly affect the safety of the persons employed in underground mines, open cast mines and oil fields.

7.4.2 All emergency and DC critical lighting (if specified) fixtures and associated Junction Boxes in Hazardous areas shall be Flameproof type.

7.4.3 Normal lighting system shall provide enough illumination so as to enable plant operators to move safely within the accessible areas of plant to perform routine operation including reading of field instruments, operation of all valves etc. and to carry out all the necessary maintenance and adjustment to equipment.

7.4.4 Areas requiring AC emergency lighting shall include, but not be limited to, the following:

- All Areas requiring DC critical lighting.
- Strategic locations in process, utility areas where specific safety/shutdown operation are to be carried out.

Generally 20-25 % of the total lighting fixtures shall be fed from AC emergency supply.

7.4.5 Areas requiring DC critical lighting shall include, but not be limited to, the following:

- Control rooms
- Substations
- DG shed
- Central fire station
- Fire water pump house
- Compressor houses
- Non plant buildings as specified in project design data sheet.

DC critical lighting shall be provided in the pipe rack, exit/entry point only in case considered for process units

Adequate number of self contained portable hand lamps and battery operated emergency lighting units shall be provided for immediate use for buildings where no DC supply is available.

7.4.6 During normal operation, both emergency and normal lighting shall be fed by normal power source. On failure of normal supply, emergency lighting load shall be transferred to emergency power supply source. Critical (DC) lighting shall be normally kept 'OFF' and during failure of AC power; battery bank shall feed the critical lighting system.

7.4.7 HPMV lamps shall generally be used for outdoor plant lighting. Keeping in view the restrike time lag and to avoid complete darkness in case of a voltage dip/black out condition necessary incandescent lamps may be judiciously distributed throughout the plant area. Fluorescent lamps shall be used for indoor lighting for non-process buildings and control room. Safe area street lighting and area lighting may employ sodium vapour lamps. All chemical handling facilities shall be provided with chemical resistant fixtures. Sodium vapour lamps shall not be installed in hazardous areas. DC critical lighting shall employ incandescent lamps or CFL lamps as specified in project design basis. Tall structures shall have aviation obstruction lighting as per statutory requirements. Energy efficient lighting with CFL/ LED lamps may also be employed for indoor/ outdoor lighting, as specified in project design datasheet.

7.4.8 Telescopic tubular high masts shall be provided for illumination of tank farm/general area. Where feasible, street lighting poles may be avoided where lighting high masts provide adequate illumination. The high masts shall be of continuously tapered polygonal cross section and fabricated out of steel plates. The masts shall be provided with motorized racking mechanism for lowering and hoisting lantern carriage.

7.4.9 Lighting system shall consist of lighting transformers, lighting distribution boards (LDBs), lighting and power panels, fixtures, junction boxes etc. as specified. All outdoor lighting shall be automatically controlled by means of photoelectric cell/synchronous timers with



manual overriding control as specified. Lighting and power panels shall be fed from LDB through 415/415V, Dyn-II, dry type lighting transformer having taps up to  $\pm 5\%$  (Refer clause 7.4.1 above for mine and Oil fields installations). The lighting and power panels shall be provided with MCB and ELCB as incomer and Miniature Circuits Breakers (MCBs) for outgoing feeders control and protection of lighting circuits. ELCBs shall not be provided at the incomers of lighting and power panels, in case ELCBs are provided in the outgoing feeders of LDBs/ASBs feeding to these lighting and power panels. 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. In areas having less lighting load, lighting transformer can be avoided.

#### 7.4.10 Lighting Lux Levels

Lighting system design shall be based on average illumination levels as specified below:

S NO.	AREA	LUX
a)	Main roads (along process units, power houses, workshops, etc.)	10
b)	Secondary roads (along storage tanks, settling basins, etc.)	5
c)	Tank farm	10
d)	Pump houses, Sheds	100
e)	Main operation platforms & access stairs	60
f)	Ordinary platforms	20
g)	Process areas, pipe racks, heat exchanger, heater, separators, cooling tower, columns, pig launching/ receiving loading area, flare etc.	60
h)	Switchgear room, Rack room	200
i)	Cable cellar	70
j)	Transformer bay	100
k)	Battery room	150
l)	Control room (Console Area), Laboratory	400
m)	Boiler house	150
n)	Charger/ UPS rooms	200
o)	Switchyard	
	Operating area	100
	Other areas	50
p)	Warehouse	100
q)	Office, Operator Room	300
r)	Compressor operating area	200
s)	Watch room	100
t)	Stairs	50
u)	Corridors/ lifts	70
v)	Tube well, Gate & watchman booth	100
w)	Fire house, Garage	150

However, lighting levels in all areas shall take into consideration the requirements from point of view of safety, ease of operation and maintenance.

7.4.11 Lighting design shall conform to relevant Indian and International Codes and Standards, IES Hand Book and shall take into consideration the requirements from point of view of safety and ease in operation and maintenance. A maintenance factor of 0.8 shall be assumed for lighting illumination level calculations for normal areas. However for dusty areas, maintenance factor as per relevant codes and standards shall be considered.

- 7.4.12 Wiring for lighting and convenience outlets in outdoor areas shall be carried out with PVC insulated armoured FRLS cables run along the column/platforms and structures. Double compression cable glands required for terminating armoured cables in lighting fixtures, control gear boxes and junction boxes in hazardous areas shall meet the requirements of IS/IEC 60079-0. For outdoor/ indoor safe area equipment, double/single compression cable glands shall be used respectively.
- 7.4.13 Adequate number of ceiling fan points shall be provided in Administration Building, Offices, rooms allocated for operating and maintenance personnel etc.
- 7.4.14 Two pole isolation devices shall be used for controlling lighting fixtures and sockets in hazardous areas to isolate phase as well as neutral. (For all Mine and Oil field installations refer clause 7.4.1 above).
- 7.4.15 For buildings with false ceiling, concealed conduit wiring shall be employed below the false ceiling and surface conduit wiring above the false ceiling.
- 7.4.16 Adequate number of pull boxes shall be used to aid wire pulling and inspection. No joints shall be allowed inside these pull boxes.
- 7.4.17 Battery room shall have fixtures mounted on wall in order to facilitate easy replacement of fused lamps. Switches controlling the lighting fixtures and exhaust fan shall be installed outside the battery room. Lighting fixtures and exhaust fans in battery room shall be flameproof type suitable for gas group IIC.
- 7.4.18 Locally mounted lighting fixtures on platforms, walkways, stairs shall be installed in such a way that relamping can be done without the use of ladders.
- 7.4.19 Telephone wiring/ sockets and LAN wiring/ sockets (as required) shall be provided in plant and non plant buildings/ rooms which are normally manned during operation and maintenance of the plant.

**DRAWINGS AND DOCUMENTS REQUIRED FOR OWNER / PMC'S REVIEW / APPROVAL**

**DISCIPLINE: ELECTRICAL**

S.NO.	DESCRIPTION	CATEGORISATION			REMARKS
		Approval	Review	Records	
1.0	Drawing & document Schedule for Contractor generated Documents		X		
2.0	<b>Basic Design</b>				
2.1	Area Classification (if required)		X		
2.2	Single Line Diagram (Overall)		X		
2.3	System Architecture drawing for Numerical Relays		X		
2.4	Block Diagram for Fire alarm and Public Address system		X		
3.0	<b>Design Calculations</b>				
3.1	Design Calculations - Load Analysis - Transformer Sizing - Battery & charger Sizing - HV Cable Sizing - MV Cable sizing for motors, large Power feeders, Incomers of UPS & DC systems - UPS Sizing		X		
3.3	Design Calculations - Lighting system - Earthing system - Lightning protection System - Cable tray/trench sizing - Fire alarm system			X	
4.0	<b>Purchase Requisition</b>				
4.1	Purchase Requisitions for Critical custom built equipment (E.g. HV switchboard & MV Switchboards, distribution transformer, UPS System, DC System, VFDs, HV cables)		X		
4.2	Purchase Requisitions for other electrical Equipment			X	
5.0	<b>Layouts</b>				
5.1	Substation equipment layout, overall cable and lighting layout		X		
5.2	Lighting, cable, earthing and fire alarm, Public Address, and lightning protection Layouts for buildings / Individual areas			X	
6.0	<b>MTO</b>				
6.1	Material take-off for electrical items such as lighting fixtures, cables, earthing material etc.			X	
7.0	<b>Vendor Drawings</b>				

S.NO.	DESCRIPTION	CATEGORISATION			REMARKS
		Approval	Review	Records	
7.1	Critical Vendor Drawings for custom built equipments (E.g.) GA, SLD		X		
7.2	All Other Vendor drawings including control schematics for custom built equipment/system architecture			X	
8.0	<b>Miscellaneous</b>				
8.1	Cable schedule-Power, control, FA, PA			X	
8.2	Interconnection Drawings- Power, control, FA, PA			X	
8.3	Relay Setting & Coordination Documents			X	
8.4	Catalogues and brochures for all equipments			X	
8.5	Operational and maintenance manual			X	
8.6	Type test certificates			X	
8.7	Motor list			X	
8.8	LCS schedule			X	
8.9	Site Acceptance procedure			X	

**NOTE:**

1. Review of electrical documents for package equipments/units shall be governed by the above electrical vendor data requirement.

SCOPE:

Sl. No.	Description	Bidder	Purchaser
<b>1.0</b>	<b>Scope of Design &amp; Engineering</b>		
1.1	Design and detailed engineering including residual engineering (Note-2), procurement etc. for instrumentation items, detailed engineering for hardware and software for all system oriented items, including preparation of engineering drawings and documents, review of vendor drawings.		
1.1.1	All Instruments	Yes	
1.1.2	Local Panels (if applicable)	Yes	
1.1.3	Weighing system		
1.1.4	Loading/unloading system		
1.1.5	Temperature monitoring system	Yes	
1.1.6	Dust extraction system		
1.1.7	Fumigation system		
1.1.8	Fire water system		
1.1.9	Programmable Logic Controller based control system with MMI for Food Grain Storage Silo Project at NABHA Plant Control Room.	Yes	
1.1.5	Dedicated CCTV System	Yes	
<b>2.0</b>	<b>Scope of procurement / supply</b>		
2.1	All field-mounted instruments as shown in P&IDs of for food grain storage silo plant, and indicated elsewhere in this BID.	Yes	
2.2	Local panels with all instruments and accessories duly mounted on them for local and manual operation.	Yes	
2.3	Local gauge board/s with all instruments and accessories, duly mounted on them if applicable.	Yes	
2.4	Control Room/ Weighing Room mounted special instruments.	Yes	
2.5	Instruments for Fumigation system, Instruments for fire water system	Yes	
2.6	Weighing system – This will include the Weighbridges and its associated items, local display system, Data transfer in main control room.	Yes	
<b>2.6</b>	<b>PLC based control system</b>		
2.6.1	Marshalling Racks, Relay Cabinets, Data acquisition & Control.	Yes	
2.6.2	Programmable Logic Controller	Yes	
2.6.3	MMI (Man Machine Interface) with printer	Yes	
2.6.4	Control Panel/ Hardwired Panel (as required) for hard wired alarms, lamps, push buttons, selector switches etc.	Yes	
2.65	All the diagnostic facilities, software checking, calibration etc. are to be menu driven only. Provision should be available for in the system software for the user to add/delete/modify the input/output points and other facilities.	Yes	

Sl. No.	Description	Bidder	Purchaser
2.6.5	Power supply distribution board	Yes	
2.7	Temperature Monitoring System		
2.7.1	Bidder shall provide the temperature monitoring system for all silos . This shall include the all temperature sensors, installation materials etc. as defined in process package/general civil specifications /P&IDs, Ins. Job Specification etc..	Yes	
2.7.3	Bidder shall be fully responsible for satisfactory performance of the temperature monitoring system.	Yes	
2.7.6	All the diagnostic facilities, software checking, calibration etc. are to be menu driven only.	Yes	
2.8	CCTV System		
2.8.1	CCTV system as per Job Specification	Yes	
2.9	Junction boxes		
2.9.1	For interconnection between field and local panels.	Yes	
2.9.2	Three way junction boxes in field for connection to loop powered indicators in local panels, wherever required	Yes	
2.9.3	For interconnection between field/ local panels and Plant Control Room.	Yes	
2.10	Cables (signal, alarm, thermocouple extension, RTD, power supply etc.)		
2.10.1	Between field instruments and junction boxes	Yes	
2.10.2	Between field instruments and local panels	Yes	
2.10.3	Between junction boxes and local panels.	Yes	
2.10.4	Multipair cables between junction boxes and Control Room.	Yes	
2.10.5	Multipair cables between local panels and Control Room.	Yes	
2.10.6	Multipair cables between weighing system/Temp. monitoring local panels and Control Room.	Yes	
2.10.7	Multipair cables between local panels and Control Room.	Yes	
2.10.8	Power cable between Control Room and Field Weighing system, loadin/unloading etc.	Yes	
2.10.9	All other special cables from field to Control Room.	Yes (Note-3)	
2.10.10	Cables between local panel of Plant and Control Room for interface signals (both for serial interface and hard-wired interface)---As applicable	Yes	
2.11	Universal type hand held configurator for Smart Transmitters in quantities as per Job Specification (Instrumentation).	Yes	
2.12	All installation materials such as impulse lines (pipes), pipes, valves and fittings for all field instruments.	Yes	
2.13	Cable glands and PVC sleeves (cable shrouds) for different types of cables.	Yes	
2.14	Canopies for field mounted electronic/ electrical instruments located outside shed.	Yes	
2.15	Sunshield/ weather hood for local panels located outside shed.	Yes	

Sl. No.	Description	Bidder	Purchaser
2.16	FRP cable duct/trays, angle trays for cable laying.	Yes	
2.17	Burried/Concrete Cable Trench (wherever required) for cable laying.	Yes	
2.18	All erection materials such as instrument supports, stanchions all types of consumables for mounting of instruments, local panels, gauge boards, structural supports and consumables for cable laying.	Yes	
2.19	All piping and pipe fittings, tubes and tube fittings for instrument air supply distribution.	Yes	
2.20	Earthing		
2.20.1	Construction of standard earth pits for system and signal earth separated from electrical grounding. Bidder to construct redundant separate sets of pits for PLC system .	Yes	
2.20.2	Complete field earthing including GI/ copper earthing strip, earth pit & earthing cables for earthing of all instrumentation items including junction boxes, field instruments etc (including for free issue package).	Yes	
2.20.3	Complete Control Room and weighing system/Temperature monitoring system etc. earthing including GI/ copper earthing strip, earthing lugs in panels/ cabinets, earth pits and earthing cables.	Yes	
2.21	Pipe sleeves (Multi Cable Transit) for cable entry to Control Room including filling materials, packing etc.	Yes	
2.22	Furniture for control system (PLC and CCTV) in Plant Control Room.	Yes	
2.23	Insulation and painting of instruments and impulse lines (as applicable) in line with insulation and painting specifications attached elsewhere in bid documents.	Yes	
2.24	Any other installation material required.	Yes	
2.25	Supply of drawings and documents as listed in Vendor Data Requirement	Yes	
2.26	Any special tools or tackles for instrumentation	Yes	
2.27	Any additional instruments required in the opinion of bidder for meeting functional requirements, safe and efficient operation, which are not listed specifically in this document.	Yes	
2,28	Procurement and supply of Hand Held Configurator	Yes	
3.0	<b>Factory Testing &amp; Calibration</b>		
3.1	Carrying out/ witnessing shop testing, calibration for system oriented items e.g. PLC, weighing system, loading, unloading, temperature monitoring system etc. supplied by bidder and inspection & testing of all other instruments.	Yes	
4.0	<b>Installation, Field Calibration/ Testing, Loop Checking, pre-commissioning and commissioning</b>		

Sl. No.	Description	Bidder	Purchaser
4.1	All package instruments & accessories including local panels, local gauge boards.	Yes	
4.2	Instrument cable trays	Yes	
4.3	Laying and termination of all cables supplied by bidder.	Yes	
4.4	Instrument air distribution within package.	Yes	
4.5	Instrument Cable trench, sand filling and slab cover.	Yes	
4.6	Control System items / equipments (PLC Cabinets, MMI, CCTV Camera, furniture etc.) in Plant Control Room in coordination with owner.	Yes	
4.7	Site Acceptance Test	Yes	
<b>5.0</b>	<b>Coordination</b>		
5.1	Coordination with <ul style="list-style-type: none"> <li>• Owner/ purchaser,</li> <li>• PLC Vendor,</li> <li>• Weighing system vendor,</li> <li>• Temperature Monitoring system vendor</li> <li>• Loading/unloading system,</li> <li>• Bagging system,</li> <li>• Dust extraction system ,</li> <li>• Fire water system,</li> <li>• CCTV Vendor</li> </ul> for successful commissioning of the Plant.	Yes	
<b>6.0</b>	<b>Training</b>		
6.1	Training for PLC based control system	Yes	
6.2	Training for temperature monitoring system	Yes	
<b>7.0</b>	<b>Spares</b>		
7.1	Commissioning Spares (included in base price)	Yes	
7.2	Consumables for six months (included in base price)	Yes	
7.3	Mandatory Spares (included in base price)	Yes	
7.4	10% Pressure gauge temperature gauge, transmitter etc.	Yes	
8.0	AMC for PLC system and Temperature monitoring system for 3 years	Yes	

**Notes:**

1. The descriptions and requirements contained in the specifications are concise by necessity and cannot include all details. However it is the responsibility of the bidder to execute the job on in accordance with the specifications and internationally recognized good engineering practices for smooth and successful operation of Plant of NABHA. This scope of work shall be in conjunction with Job specifications, various standard specifications and standards attached with the bid documents.
2. Residual engineering includes instrument sizing, utility consumption, specifying derived data in process data sheets, deriving process data for instruments where specific data sheet for these are not included in BID, type and material selection of



instruments wherever required. Residual engineering shall also include actual transfer/ implementation of the information provided in the form of notes in P&ID and equipment data sheets and other documents provided in BID.

3. All these cables shall be armoured.
4. All instruments shall be supplied as per area classifications indicated in Bid document. For hazardous area the instrument shall be either explosion proof or intrinsically.

## 1.0 GENERAL

1.1 This specification outlines the minimum requirements under which contractor's scope shall include design, engineering, procurement of raw material and bought out components, manufacturing, painting (Complete primer and finish paint), assembly, inspection & testing, packing, delivery, erection, pre-commissioning, commissioning, calibration & site acceptance testing of Instrument items as applicable for following systems which shall be installed for Food Grain Storage Silo Project of M/s CWC, Nabha:

- Vehicle weighing by means of two number weigh bridge of capacity 60 MT
- ~~In motion weigh Bridge for Rail~~
- Suitable instrumentation (Assumed digital display). A computer will be provided which will be linked to Plant Control System
- Vehicle unloading facility
- Dust Extraction system
- Tunnels (Sensing and monitoring instruments)
- Pre-storage/receiving silo
- Storage facility which includes aeration system
- Silo Temperature Monitor and pest detection system
- Sampling arrangement
- Food Grain Handling (Receiving and Stacking)
- Food grain dispatch system
- Dispatch of Food Grains
- Disposal of rejected Food Grain
- Plant Control System
- Bulk Handling Facility
- Building works
- Suitable diversion of Telephone cables
- ~~Fire hydrant system~~
- Smoke detectors, fire alarm and sprinklers
- Security equipment including CCTV
- Breather valve, flame arrester and vent for Diesel Day Tank
- Moisture Analyser

1.2 The equipment and materials supplied and installed as per these specification, data sheet, standard specification, other attachments and drawings shall be complete in all respect, ready for installation and operation. Any item not specifically mentioned in this specification but required for proper operation, maintenance and safety of the equipment/ personnel shall deem to have been specified and vendor shall include the same in their scope of work/supply. All materials supplied under this requisition shall be adequate for the proposed service. Proper consideration shall be given to their function with regard to corrosion, chemical and other process hazards and erosion due to the material being handled.

## 2.0 CODES AND STANDARDS

- 2.1 Contractor shall refer various codes and standards indicated in clause 1.3 of 'standard specifications for instrumentation package units' 6-52-0052 in addition to EIL standards attached along with this package.
- 2.2 In general, Contractor shall carryout engineering as per IS-9178 Part-I, II & III, IS-9215, SS EN 1993-4-1:2011, IS 5503 Part-I & II, EN-1992 and EN-1997 standards. Any other standard, if necessary, can also be referred by contractor during the execution of the job, without diluting the basic requirements, however with prior information to Owner/ PMC. In

any case contractor must furnish a list of codes and standards including those specified in this document which shall be followed by them during engineering.

### 3.0 ORDER OF PRECEDENCE OF VARIOUS DOCUMENTS

3.1 In the event of any conflict between this specification, related standards and codes, any other attachment to this package, the contractor shall follow the following documents in the order of their priority:

- a) Statutory requirements
- b) Instrumentation Job Specification
- c) Drawings
- d) Standard specifications and Installation Standards
- e) Codes and standards

3.2 In case of contradiction between different specifications, CONTRACTOR shall refer the matter to Owner/ PMC for clarification. Owner/ PMC's decision in this regard shall be final and binding.

### 4.0 DESIGN REQUIREMENTS

The design requirement specified in this section, in bid documents, standard specifications for instrumentation package units (6-52-0052) and other specifications provides the requirements for design, selection and detailed engineering of Instrumentation.

#### 4.1 OVERALL CONTROL SYSTEM STUDY

4.1.1 This project has been conceptualized as one of the most automated with Evolutionary state of the art technology. The technology selection and system design has incorporated all features which would be necessary to achieve this goal.

4.1.2 Apart from technology, the design shall also truly translate strategically, tactical and operational requirements of the Food Grain Storage Silo so as to operate the plants most effectively and efficiently.

4.1.3 The prime objective of providing this specification is to specify a system and its implementation approach, which would be necessary to:

- a) Implement the necessary operational and control requirements within the specified project schedule
- b) Select an evolutionary state of the art technology which would form a solid backbone to implement higher level functionalities

4.1.4 In order to evolve a systematic methodology for the implementation of this concept, the complete job has been conceptualized as a combination of certain logical levels arranged in a hierarchical fashion. Each of this level, bottom up, can be implemented independently and can be interfaced with upper level as an independent activity.

#### 4.2 INSTRUMENT DESIGN CRITERIA

4.2.1 All basic design and detailed engineering shall be carried out by contractor considering requirements specified in STD. SPEC and P&IDs. In case of any conflict between 'STD. SPEC. and job specifications/ data sheets/ standards enclosed in the package, the requirements must be clarified with Owner/ PMC before proceeding.

- 4.2.2 Area Classification: All Instrumentation shall be supplied as per area classification indicated in the tender document. For hazardous area, instruments shall be explosion proof or Intrinsic safe.
- 4.2.3 Power supply distribution scheme for instrumentation shall be fully coordinated with overall power distribution scheme. Proper fuse coordination, number of feeders, Isolation levels etc. must be evaluated during design.
- 4.2.4 Contractor shall select instruments in classified area as per clause 'Standard Specifications for Instrumentation Package units 6-52-0052.
- 4.2.5 In general, intrinsically safe philosophy shall be followed for all inputs/ outputs. All Field Instruments shall be intrinsically safe with a minimum of IP-65 rated ingress protection. Contractor must select external barriers, wherever applicable, on entity concept. All barriers shall be isolating type.
- 4.2.6 Instruments, which are not available as per their standard design from any reputed manufacturer as intrinsic safe, can be supplied in flameproof design. All such instruments shall be certified for the applicable area classification. Specification for all type of instruments is described in this job specification and data sheets enclosed.
- 4.2.7 For instrument whose specification is not covered in this package shall be prepared by contractor as per standard design and state of art with proveness requirements as explained below.
- 4.2.8 The type of instruments shall be as per the requirements of process schemes, P&IDs, Engineering Design Basis, Design selection criteria for instruments and the process requirements and various specifications, standards enclosed with this specification.
- 4.2.9 Contractor shall provide 110 VAC 50 Hz UPS for instrumentation & control system in all the respective control buildings. Further distribution and conversion shall also be done the by the contractor.
- 4.2.10 Other power supplies such as 230VAC Non UPS, etc. shall be arranged by the contractor as per the requirement as detailed in electrical part of this bid document.
- 4.3 JUNCTION BOXES AND CABLING PHILOSOPHY:
- 4.3.1 Cable Routing
- 4.3.1.1 Contractor to note that ladder trays/ buried trenches shall be used for routing multi-cables as much as possible.
- 4.3.1.2 From field junction box to main cable ladder trays, the cables shall be routed through angle / perforated trays. Single pair cables from instrument to junction box shall be through perforated trays. Cable glands shall be provided at instrument end and at junction box end and at local panel end/marshalling cabinet end as per requirements. Slip-in type PVC sleeves shall be used over cable glands for all cable entries at instrument end, junction box end, local panel end etc. (as applicable).
- 4.3.1.3 Wherever trenches are required, Contractor to provide buried trench as required for routing of cables. All cable trenches shall be back filled with sand after cabling is completed.
- 4.3.1.4 Inside the control room building, the cables shall be segregated in cable trays as per type of signal carried and are routed in separate cable trays.

- 4.3.1.5 All cables inside the control rooms shall be properly dressed and routed in perforated trays under false flooring which will be supplied & installed by the Contractor. Separate cable route and trays shall be used for signal and alarms in control room.
- 4.3.2 Cable Trays (ladder, perforated and angle)
- 4.3.2.1 Cable ladder trays shall be used for cable routing between junction boxes & control room and shall be routed beside the pipe rack. Perforated and angle trays shall be considered only for branch cable routing. Ladder trays shall be sized considering 65% occupancy of the tray by cables. For all cable trays Contractor shall provide support at a minimum interval of 1.5 meter.
- 4.3.3 Trenches
- 4.3.3.1 Where ever cables are to be routed underground, these shall be laid in RCC trench/buried trenches. Buried trenches shall have a minimum width of 600 mm and depth of 1000 mm. One layer of sand is to be laid at the bottom, over which cables shall be laid with approximate segregation between signal and other cables. Trenches shall have sufficient depth and width to accommodate all cables correctly spaced. RCC trench shall be provided in control room.
- 4.3.3.2 Trench space equivalent to 40 % additional cables of largest size shall be considered while sizing these trenches.
- 4.3.3.3 Before cables are placed the trench bottom shall be filled with 100 mm layer of sand and leveled. Each layer of cables shall be covered with 150mm of sand on top and sand shall be lightly pressed. A protective covering of 75mm thick second class red bricks shall be placed flat on the final layer of sand and cable. The remaining portion of the trench shall be then back filled with soil compacted and leveled.
- 4.3.3.4 Cable routes markers indicating number of cables, depth and direction will be placed en-route, on crossovers/ turnings etc. to mark the cable route.
- 4.3.3.5 For any crossing of cable trench (underground) with electrical trench, it must be made at 90 degree only and the cross-section area of the trench must be same at the point of crossing.
- 4.3.4 Multi-cables
- 4.3.4.1 All multi-cables between field /control rooms shall be as per 6-52-0052.
- 4.3.5 Junction Box
- 4.3.5.1 In general separate junction boxes shall be used for the following:
- Contact signals (NON IS Field switches etc.)
  - IS signals
  - RTD/Thermocouple
  - Contact signals (push buttons etc.)
  - Power supply to various instruments
- 4.4 INSTRUMENT PAINTING REQUIREMENTS
- 4.4.1 All instrument impulse lines and instrument structural items shall be painted by the contractor as per the 'Technical specifications of Shop and Field Painting/Coating' enclosed elsewhere in the document.

4.4.2 The painting/coating specifications shall be followed in totality for all instrument items such as:

- a) All line mounting and equipment mounted instruments.
- b) All instrument impulse piping.
- c) All instrument structural items like, instrument supports and tray supports, instrument stanchion, impulse line supports etc.
- d) All surfaces of GI items wherever repair has been carried out shall also undergo painting as per this requirements
- e) All cabinets/panels, base frames which have undergone repair at site shall also be painted.

4.4.3 The final coating on external surfaces shall be applied just before handing over the plant or commissioning of the plant.

4.4.4 Name of the manufacturer, color and quality of all types of primers and paints shall be subject to approval of the Owner/ PMC.

#### 4.5 ELECTRICAL / INSTRUMENTATION INTERFACE

4.5.1 In order to have smooth and trouble free engineering, a proper well defined methodology must be adopted to define the interface between Electrical and Instrumentation.

4.5.2 In general, contractor shall follow the philosophy defined in appendix - I attached along with this document, for the interface between these two areas. Any change from this philosophy must, in principle, be brought to the notice of Owner / PMC.

4.5.3 Substation interconnections with PLC based system are to be made through unit wise multi-pair cable only. It should have dedicated laying route inside control room.

#### 4.6 UPS POWER REQUIREMENT

4.6.1 Contractor shall provide UPS power considering following requirements in addition to those indicated in electrical portion of the package:

- a) The instrumentation load which is required to be considered must include:
  - i) 20% installed spares
  - ii) 20% additional load on the overall value

4.6.2 The UPS load requirement for instrumentation shall be calculated for each unit considering UPS requirement for the systems and instruments connected to systems. (Systems mean PLC based system), etc. which is in contractors scope

#### 4.7 CONTROL AND CABLE REQUIREMENTS

4.7.1 PLC based control system shall be implemented for plant running, monitoring, controlling and tripping. Suitable terminal blocks for termination of signal cables from field instruments in the field to the marshalling cabinet shall be considered.

- 4.7.2 Terminal blocks shall be anti-vibration type, suitable for terminating a minimum of 2.5 mm<sup>2</sup> size cable conductors. Flying leads are not acceptable.
- 4.7.3 Single pair cables shall be 1.5 mm<sup>2</sup> twisted in pair individually shielded with aluminum Mylar tape with drain wire and armoured. Cables shall be flame retardant as per IEC 60332 Cat. A. Power cable (for local panel etc.) size shall be minimum 2.5 mm<sup>2</sup>. Cable glands shall be Nickel-plated brass, double compression type suitable for armoured cables. Slipper type PVC sleeves (cable shrouds) shall be provided for all cable entries in junction boxes and instruments. Cable entries shall generally be ½" NPTF for signal & ¾" NPTF for power. Control cables, Signal and alarm cable shall be blue for IS and black for Non-IS.
- 4.7.4 Multi pair cables shall be 6 pair/ 12 pair with individual and overall shielded with aluminum mylar tape with drain wire and armoured. Conductors shall be 1.0 mm<sup>2</sup> twisted for signal, control & shutdown cables.
- 4.7.5 Contractor shall supply the junction boxes (if required) suitable for 6 pair/ 12 pair cables for signal / alarm / Control. Material of the junction box shall be LM6 alloy as a minimum. All junction boxes shall be sized to keep at least 20% spare terminals in each. All junction boxes shall have terminals for termination of cable shield/ drain wires. Ferrules shall be heat shrinkable printed sleeve type. Cable entries shall be from side for all single pair/triad cables and bottom of the junction box for multi-pair. All spare entries shall be plugged.
- 4.7.6 This technical specification document shall be read in conjunction with its attachments listed elsewhere in the tender document.
- 4.8 CRITERIA OF SELECTION OF VENDOR:
- 4.8.1 Proveness Requirements
- 4.8.1.1 The system/sub-system/bought out items and services as offered should have been supplied and working satisfactorily for a period of minimum 4000 hours on a similar application.
- 4.8.1.2 The instrumentation selected shall be rugged in design and must be field proven. Prototype design or equipment of experimental nature or design undergoing testing etc. shall not be selected and supplied. Following criteria must be applied before selecting a particular instrument item:
- a) For Instrument Items (Other than Systems)  
The instruments as being offered / supplied should have been operating satisfactorily in similar process conditions for at least 4000 hrs in last seven years.
  - b) For PLC based System Item:-
    - i) The system (with all its sub-systems) as being offered / supplied should have been installed and operating satisfactorily in similar application for at least 4000 hrs (as collaborated by user certificate).
    - ii) The system should be supplied engineered & tested from a factory from where the system / sub-systems as offered / supplied, engineered & tested/ have already been supplied and meet the criteria b (i) above.

- iii) All the activities including engineering should be carried out by the agency which has carried out the similar activity in the past and meets the criteria b (i) above.
- iv) The system should be supplied by the manufacturer in the fully engineered condition or should be supplied by the manufacturer's representative / subsidiary (except basic engineering- refer responsibility chart and explanation given above) who have proper infrastructural facilities and meets the criteria b (i) above.
- v) In any case, the manufacturer whose system is being offered / supplied should have a local representation / subsidiary which has the proper infrastructural facilities like engineering, installation, maintenance, testing, spare part support, system fault diagnosis and other related logistic support. Systems which don't have the local base should be avoided

#### 4.8.2 Vendor List

4.8.2.1 Vendor List for Instrumentation items is provided elsewhere in the Bid package. Contractor shall consider the instrument supplier as identified in the Vendor List.

Vendor list provided in the package is for the Make only, and not for any specific Model. For any instrumentation item, the offered model for the same must meet the specification and proven track record (PTR) requirement, as explained above.

For Instruments / items not covered in the vendor list, contractor shall get approval for the vendors proposed, prior to the placement of order.

CONTRACTOR may procure material from any of Owner/PMC approved / recommended vendors. However, current validity and range of approval as per EIL enlistment letter, work load, stability and solvency need to be verified by the CONTRACTOR before placement of order.

**Vendors on Owner/PMC holiday list shall not be considered for ordering. Names of such vendors who are put on Owner/PMC "Holiday List" subsequent to vendor approval at bidding stage shall be informed to the CONTRACTOR at any stage of the project. CONTRACTOR shall comply with this requirement without any time or cost implication to the OWNER.**

At any stage of the project, if it comes to the notice of Owner/PMC that CONTRACTOR has procured material/equipment, intentionally or unintentionally whatsoever, from an unapproved vendor and/or items not falling in approved range of vendor(s) such items shall be summarily rejected and contractor shall arrange to replace the same to the full satisfaction of Owner/PMC, with no time and cost effect to Owner.

#### 4.8.3 CONTROL SYSTEM FURNITURE

Furniture shall be provided for all equipments being supplied by Contractor at control room for Control room as per respective system specifications which shall include tables, cabinets, desks etc. executive chairs of any reputed make shall be provided for operators.

#### 4.8.4 SPECIAL INSTRUCTIONS

4.8.4.1 Contractor is responsible to comply with the total scope of work indicated in the package regarding the Plant Control, Monitoring and Interlock system and meeting all the functional



- x) Any instruments which is not indicated in the tender document but required for efficient operation shall be supplied by contractor as per 6-52-0052. Make and model no. of the supplied instruments shall be approved by Owner/PMC.

## 5.0 TECHNICAL SPECIFICATIONS

### 5.1 INSTRUMENTS- GENERAL

- 5.1.1 The selection of type of instruments is Contractor's responsibility. For the instruments where type is already identified in the P & IDs / data sheets, the Contractor shall follow the same. However during the engineering / procurement stage if it is found that a different type of instrument is most suited for a particular application then the same shall be referred to Owner / PMC for review, and if suitable, the changed instrument shall be supplied by the contractor. Contractor shall also be responsible for selecting and reviewing the type of instrument where specifically indicated in P& ID's.
- 5.1.2 Instrument selection and specifications shall be carried out as per this package, standard specifications for instrumentation package units 6-52-0052 in general.
- 5.1.3 Pump discharge pressure gauges are to be mounted at a distance from the discharge pipe through longer impulse line and proper support to minimize vibration.
- 5.1.4 Fittings shall be tested as per BS 4368 or equivalent standards.
- 5.1.5 The material selection for the instruments shall be carried out as per Piping material specifications and guidelines provided in standard specifications for instrumentation package units 6-52-0052.
- 5.1.6 The material selection chart attached in 6-52-0052 provides the guidelines for selecting the minimum material, which have to be supplemented by contractor based upon actual process requirements.
- 5.1.7 For any specific requirements, contractor shall refer Piping Material Specifications for guidelines and include the same accordingly.
- 5.1.8 All the systems to be interfaced with plant control system.
- 5.1.9 Specification of Instrumentation and control
- Process instrument type for shutdown shall be by switches only with switch action generated in PLC based control system.
  - Junction boxes if required shall be as per area classification.
  - Start / Stop, Auto / Manual, Local / Remote commands for all electrical drives from Local Control Station in field (A/M switch shall be in the control room) shall be directly wired to MCC.

### 5.2 FIELD INSTRUMENTATION

#### 5.2.1 Pressure Gauges

- Case material shall be SS304 with dial size of 150mm. Accuracy of the gauge shall be  $\pm 1.0$  % URV. Differential pressures gauges may have an accuracy of 2% of URV Over range protection shall be provided (at least 130% of maximum operating pressure) with blow out discs. Process connection shall be  $\frac{1}{2}$ " NPTM (bottom entry). Pointers shall have micrometer adjustment.
- Sensing element shall be bourdon tube/ diaphragm (for low pressures).

Material shall be SS316.

- c. Glass shall be shatter proof. Solid front case shall be provided for gauge range of 60 kg/cm<sup>2</sup>g and above.
- d. Over range protector and pulsation dampener, whenever used, shall be of SS 304, as a minimum. Pulsation dampener shall be used for all pulsating services. It shall be floating pin type, externally mounted and externally adjustable.
- e. Ranges shall be so specified that the gauge normally operates in the middle third of the scale and shall conform to IS-3624 standard dials.
- f. Pressure Gauge shall be supplied with snubber/ pulsation dampner whenever subjected to vibration. The pressure gauges on pump discharge lines shall be equipped with pulsation dampner. Further it shall be mounted on 2" NB pipe. Suitable accessories like mounting bracket etc. for the mounting the gauge on 2" NB pipe shall be supplied along with the gauge.

## 5.2.2 SILO Level Instrument

5.2.2.1 For solid level measurement, type of instrument shall be ultrasonic/electromechanical/capacitance/nucleonic/non-contact type radar as per the process condition. The actual type selection shall be carried out based on the provenness of the selected type for similar type of application.

5.2.2.2 Radar type transmitter shall be provided with  $\pm 3$  mm accuracy for storage silo and  $\pm 1$  mm for custody transfer. Whenever  $\pm 3.0$  mm accuracy is required, process connection on vessel/ silo/ equipment for non-contact radar gauge can be 4" with 4" Carbon Steel/ Stainless Steel (depending on the pipe schedule requirement) still well. However wherever  $\pm 1.0$  mm accuracy is required (e.g. in custody application), process connection on vessel/ tank/ equipment for non-contact radar gauge shall be 8" with 8" Carbon Steel / Stainless Steel (depending on the pipe schedule requirement) still well.

5.2.2.3 Radar type instruments shall be capable of providing serial output as per vendor standard protocol in addition to analog 4-20 mA DC current output. These instruments shall also be capable of accepting input from multi element SILO temperature sensors (thermocouple/ RTD) and transmit the same as a part of serial signal from the transmitter.

## 5.3 SILO TEMPERATURE MONITOR AND PEST DETECTION SYSTEM

5.3.1 A temperature monitoring and pest detection system shall be provided for each Silo. Each system shall consist of temperature sensing cables suspended vertically, scanners, all cables, computers in all respects. Same shall be accessible from outside for maintenance.

5.3.2 Each Silo shall be equipped with a controllable scanner capable of interfacing with the Plant Control System.

## 5.4 WEIGH-BRIDGES

5.4.1 Bidder's Scope of Instrumentation includes implementation of complete instrumentation and controls for 2 nos. Pitless Type Electronic Type Weigh Bridge (Road) and 1 In Motion weigh bridge (Rail). This shall include the following as a minimum.

- a) Design & Engineering
- b) Supply of all applicable Instrumentation items
- c) Manufacture & Testing

- d) Factory Acceptance Test  
e) Supervision of erection, testing, commissioning & performance guarantee testing at project site
- 5.4.2 The Bidder's scope shall include the supply of One No PC & One No Printer for each weigh bridge.
- 5.4.3 One no. Weigh Bridge Console with Digital display unit for each Weigh bridge at local.
- 5.4.4 Minimum six (6) nos. load cells (Compression Type) or more as per bidder's recommendation, with integral cables, accessories and mountings for Load cells.
- 5.4.5 One feeder of 110VAC UPS shall be provided by purchaser at single point in each weigh bridge cabin. Bidder shall provide necessary distribution and derive the voltage levels required for weighing system in each weigh cabin. Further distribution including all interconnecting cabling to connect weigh console, PC, Printer etc shall be by bidder. Bidder to furnish the estimated load required along with the offer. Cable between field to JB and weigh cabin (approximately 4mX4m-by others) with necessary conduits are in bidders scope. cable laying, routing etc with necessary protection and conduiting from weigh bridge to weigh cabin shall be by bidder. The weigh cabin shall be located approximately 10 m from the nearest edge of Weigh Bridge. Actual distance may vary as per site conditions.
- 5.4.6 Also refer 6-27-0001 for other instrumentation requirement such as Junction Box, installation material etc.
- 5.4.7 Each Weigh console shall also have RS 422/485 serial link with MODBUS RTU protocol for connecting/ interfacing with the owner's control system communication network such as Ethernet or other industrially recognized open networks available. Bidder shall provide all required hardware and software for the same. Necessary converters and serial link cable shall also be in bidder's scope of supply. Serial cable distance from each weigh console to serial port of PLC in control room shall be approximately 150m. Actual distance may vary as per site conditions.
- 5.4.8 All necessary software for generating reports desired by operating personal.
- 5.4.9 Necessary furniture (table, chairs of reputed make) for weigh cabin.
- 5.4.10 Load Cells:-Load cells shall be of low mass and shall have small deflection. Bidder shall select the proper type for the service indicated.
- 5.4.11 The load cell shall be hermetically weld-sealed for protection against moisture and vibration. The system shall be immune from RF interferences in that area.
- 5.4.12 The connections for load cells shall be available on the terminal strip of with special connectors. Flying leads are not acceptable. Separate entry shall be available for power and signal.
- 5.4.13 Personal Computer:-Minimum quad Core Technology, 4 GB DDR3 RAM with at least 60% spare memory capacity at full loading, HDD 320GB, DVD Read/Write Drive & 21" TFT monitor shall be supplied for each weigh cabin.
- 5.4.14 Licensed version of latest antivirus shall be provided in PC. Bidder should supply licensed software of programs preloaded in the PC and in CD with all password to access the software.

- 5.4.15 The use of any unauthorized CDs, DVDs, USB devices or similar removable media on any node that is part of or connected to the PLC system should not be permitted in order to prevent the introduction of malware or the inadvertent loss or theft of data.
- 5.4.16 Printers: - One no Laser Printer with TCP/IP Ethernet connectivity shall be supplied for each weigh cabin.
- 5.4.17 Resolution shall be 640 dpi or better with paper size and type of "A4" & "Cut Sheet" respectively.
- 5.4.18 Printers shall be suitable for operation from 110 V AC UPS supply.
- 5.4.19 Mounting shall be self-contained with Integral stand.
- 5.4.20 Services:- Bidder shall provide services for technical assistance for integration and testing of weigh bridge console with owners control system

## 5.5 FOOD GRAIN HANDLING SYSTEM

- 5.5.1 Bidder's scope of instrumentation supply and work shall cover instruments as per Conveyor datasheet and P&ID attached with this tender including the following as a minimum
- Supply of Zero Speed switch (one no. on non-drive end) to indicate if conveyor stops running as per requirements indicated in this specification and standards & code (as applicable).
  - Current transmitter
  - Switch to detect if the cover is closed.
  - Any other instrumentation required for flushing of the shaft seals and necessary operation of screw conveyor.
  - Design, engineering, procurement, testing and installation of instruments.
  - Erection material including all fittings, mounting accessories, instruments supports (2" yoke type) as required for installation/ erection of instruments, under bidder's scope of supply.
  - Cable glands/plugs shall be duly installed with the instruments. The size of cables shall be informed to the successful bidder during detailed engineering.
  - Submission of filled in data sheets for instruments. Bidder shall also indicate make and model numbers of the offered instruments. Data sheets shall be submitted for Review/ Approval with one set of technical catalogues of offered instruments with model decoding details.
  - Mandatory spares as required, price for the same shall be included in the base price.
  - Pre-commissioning and commissioning spares as required, price for the same shall be included in the base price.

- k) Special tools & tackles if any for maintenance of the instruments being supplied shall be included in the base price of the respective item in Bidders offer.
- 5.5.2 Instrumentation cabling required for interconnection between Bidder's supplied field instruments and owner's Control System shall be done by others and it is excluded from Bidder's scope of work.
- 5.6 PLANT CONTROL SYSTEM
- 5.6.1 The Plant Control system and equipment to be installed and operated as part of the Storage Facility shall include:-
- (a) Plant operation
  - (b) Food grain inventory
  - (c) Quality and preservation
  - (d) Truck identification and internal truck movement
  - (e) Environment and safety
  - (f) Disaster/Hazard management
- 5.6.2 The Plant Control System shall be installed for operating the equipment in sequence, in accordance with the operational requirements of the Storage Facility.
- 5.6.3 Equipment shall be interlocked through the Plant Control System so that the failure of one piece of equipment shall stop all other equipment upstream and also close all feed gates.
- 5.6.4 It shall comprise, *inter alia*, the operation and control system, Food grain inventory control system, quality and preservation control system, Vehicle identification and movement control system and disaster/hazard management system.
- 5.7 VEHICLE UNLOADING FACILITY
- 5.7.1 Vehicle unloading facility will consist of 6 unloading stations (1 Tripper + 5 Normal bays), each with an unloading hopper located underground to handle 20 T/ Hr.
- 5.7.2 If wheat is received through wagons, the same could be unloaded on the track used for wagon loading.
- 5.7.3 For unloading, additionally 2 No. unloading pits will be provided below the rail track at loading point and shall be connected to shipping silo only.
- 5.7.4 Suitable Instruments to be provided for vehicle unloading facility.
- 5.8 DUST EXTRACTION SYSTEM
- 5.8.1 Dust extraction system shall be provided for entire unloading area. A common dust extraction system is envisaged for all 6 unloading hoppers.
- 5.8.2 Suitable Instruments to be provided for dust extraction system and monitoring.
- 5.9 TUNNELS

- 5.9.1 The unloading hopper tunnels will consist of receiving conveyor located below grade level running beneath the unloading area.
- 5.9.2 Tunnels will be equipped with suitable sensing and monitoring instrumentation.
- 5.10 STORAGE FACILITY
- 5.10.1 Storage facility will have drying area for 10 MT of food grains.
- 5.10.2 Storage silo will be provided for Silo aeration system, which will include:-
- a) Internal perforated ducts on concrete channels
  - b) External ducting
  - c) Fans
  - d) Dampers
  - e) Roof vent
  - f) Instrumentation (Temperature monitoring system)
  - g) Air volume
- 5.10.3 A portable air circulation power unit will be provided to all silos. Each silo will be provided with a closed loop fumigation system, which will include
- a) Fixed plastic pipes to inject fumigants into the silo aeration
  - b) Ducting at the bottom of silo
  - c) Fixed plastic pipes for collecting exhausted fumigant from the top of silo for recirculation
- 5.11 SILO TEMPERATURE AND PEST DETECTION SYSTEM
- 5.11.1 Silo Temperature Monitor and pest detection system will be provided for each silo.
- 5.11.2 Each system will consist of temperature sensing cables suspended vertically from the silo roof and accessible from outside for maintenance.
- 5.11.3 Each silo will be equipped with controllable scanner capable of interfacing with Plant Control System.
- 5.12 SAMPLING ARRANGEMENT
- 5.12.1 The number of sample stations will have at least 20 samples per hour for a storage capacity of 25,000 MT or part thereof.
- 5.12.2 The system will be provided for data entry table linked to the individual batch displayed on the inspector's screen.
- 5.12.3 Suitable Instruments shall be provided for sampling arrangement system.
- 5.13 FOOD GRAIN DISPATCH SYSTEM
- 5.13.1 Food grain system will have the capacity to dispatch 60 MT/ Hr.
- 5.13.2 Food grain will be dispatch through shipping silo (1 No.) of capacity 4000 MT.

- 5.13.3 Dispatch facility will include Bulk Truck dispatch Silo (1 No.) of capacity 100 MT. (4 silos / hoppers will be required for 4 unloading bays, one for each bay.)
- 5.13.4 Dispatch facility will also include Bagging Silo (1 No.) of capacity 60 MT.
- 5.13.5 The bagging warehouse will have covered capacity of at least 200 MT and a CAP storage capacity of at least 500 MT of food grains.

5.13.6 Bagging lines will have minimum capacity of 60 MT/Hr for automatic bagging.

5.13.7 Food grain will be stored in bags in warehouse. Floor area of at least 100 Sqm will be provided in warehouse for storage of bags prior to dispatch.

5.13.8 Suitable Instrumentation shall be provided for Food Grain Dispatch terminal.

#### 5.14 BULK HANDLING SYSTEM

5.14.1 Food grains received in bulk will be first stored in pre storage silo comprising of 2 hopper bottom silos of 250 MT.

5.14.2 The intake and discharge capacity of each silo will be minimum 125 T/Hr.

5.14.3 The rack loading system will consist of 1 flat bottom sheet metal pre shipping silo having aeration floor, aeration fans, temperature monitoring system and provision for fumigation connected through material handling system in a combination comprising chain conveyors and bucket elevators, online weigher of matching capacity and loading system.

5.14.4 Suitable Instrumentation shall be provided for bulk handling system.

#### ~~5.15 FIRE HYDRANT SYSTEM~~

~~5.15.1 Fire Hydrant system with adequate exclusive storage connected with 2 or more source of supply and with sufficient electric and diesel driven working and standby pumps.~~

5.15.2 Suitable Instrument to be provided for fire hydrant system.

5.15.3 Smoke detectors and fire alarm shall be provided.

#### 5.16 INSTRUMENTS FOR DIESEL DAY TANKS

5.16.1 Breather valve, flame arrester and vent, level transmitter and level gauge etc, shall be provided for diesel day tank.

#### 5.17 MOISTURE ANALYSER

Moisture analyser probes and transmitter for entire silos for each silo shall be provided and same shall be communicated PLC system.

#### 5.18 CCTV

5.18.1 CCTV shall be provided considering following location:-

- Loading/Unloading area- 8 nos.
- Main Entry Gate- 1 no.
- On boundry wall- 4 nos.



5.18.2 Procurement, Supply and installation of CCTV system comprising of 13 nos. Cameras (IP Based PTZ camera, IP65 to weatherproof), Network Video Recorder Server Hardware with Storage capacity for recording of 60 days (minimum 20 TBs) & licensed software-Qty-1 No., Viewing Monitor Wall mounted (55" LED) with workstation & licensed software - Qty- 1 No., Ethernet Switch (24 Ports, Layer-2) – Qty- 1 No., Ethernet Switch (8 Ports, Layer-2) – Qty- 4 Nos., Ethernet CAT-6 cable- Qty.- 250 m, Optical Fibre Cable (6 Fibre, SM, ITU-T G.652)- Qty.- 2 Km, LIU (Line Interface Unit)- Qty- 8 Nos., Self-Supported Pole with shades & associated accessories for mounting Cameras- Qty- 13 Nos., Power Converter with Cables (if required, 110 VAC UPS Power is available at Site ) – Qty- 13 Nos. For footage requirement, local administrative requirement to be fulfilled. However, footage storage for minimum 60 days to be considered.

Number of CCTVs are tentative only. Number of CCTVs may be vary according to site conditions.

5.18.3 Refer typical CCTV system architecture drawing A951-000-16-51-3303.

5.18.4 Refer specification 6-52-0090 for CCTV system.

#### 5.19 PIPE SLEEVES

For instrument cable entry to Control Room for Food Grain storage plant/weigh bridge cabin, pipe sleeve shall be provided. 25 % spare pipe sleeves shall be considered.

#### 6.0 PLC BASED CONTROL SYSTEM

Procurement, supply and installation of PLC based control system which shall consist of redundant Processor, dual PSU, redundant communication and dual IO card, Marshilig panel, Control panel, 21" LCD TFT monitor,, with all types of hardware , licensed software, Processor-i7,6 GB RAM, 500GB Hard disc, , laptop(processor i7,6GB RAM, 500GB Hard disc, minimum 15"LED display, serial communication port for PLC configurator, A4 laser jet colour printer, furniture etc. PLC system hardware shall be of latest version.

#### 7.0 FACTORY ACCEPTANCE TEST OF PLC BASED CONTROL SYSTEM

- 7.1 On the basis of guidelines specified in this specification, vendor shall submit their own FACTORY ACCEPTANCE TEST (FAT) procedure. For hardware, the procedures shall include purpose of test, test definition of input, procedure, results expected and acceptance criteria. For software it shall include details of the method, lists of tests, sequence of execution, results expected and acceptance criteria.
- 7.2 The testing and acceptance of the system shall be carried out on the mutually agreed procedures and criteria based on these guidelines and vendor standard procedures.
- 7.3 Factory Acceptance Test (FAT) & Acceptance of Complete System including Field Units.
- 7.4 Vendor shall demonstrate functional integrity of the system hardware and software. No material or equipment shall be transported until all required tests are successfully completed and certified "Ready for shipment" by owner/ consultant.
- 7.5 Owner/ consultant reserves the right to involve and satisfy himself at each and every stage of testing. They shall be free to request any specific test on equipment considered necessary by him, although not listed in this specification. The cost of performing all tests shall be borne by the vendor.

- 7.6 Vendor to note that acceptance of any equipment or the exemption of inspection/ testing in no way absolve the vendor of delivering the equipment meeting all the requirements specified.
- 7.7 It shall be vendor's responsibility to modify and/or replace any hardware or software if the specified functions are not completely achieved satisfactorily during FAT.
- 7.8 Schedule of FAT shall be indicated by vendor.
- 7.9 Vendor shall not replace any component/module/subsystem unless it has failed and a log of such failures shall be maintained during FAT. If a subsystem fails during FAT and is not repaired and made successfully operational within 4 Hours of active repair time after the failure, the test shall be suspended and restarted all over again only after vendor has replaced the device and brought the system into acceptable operational condition.
- 7.10 Testing and FAT shall be carried out in two phases. The minimum requirements for testing during these two phases shall be as follows:

Under first phase, Vendor shall perform test at his works to ensure that all components function in accordance with the specifications for each type of test. A test report shall be submitted for owner/consultant review within two weeks of completion of this test. All subsystem shall undergo a minimum of 30 days burn out period.

Following tests shall be performed by the vendor and reports shall be forwarded to owner/consultant.

- a) Quality control test, which shall be carried out to ensure quality of all components and modules.
- b) System pre-heat, which shall be of physical check of all modules, racks, cabinets etc.
- c) System power up test, which test functionality of all hardware and software.

Second phase of testing shall systematically, fully and functionally test all hardware and software in the presence of owner/consultant. All subsystem shall be interconnected to simulate, as close as possible, the total integrated system.

Following minimum test shall be carried out:

- d) Visual and mechanical testing.
- e) Functional testing.

- 7.11 Vendor shall notify the owner/consultant at least three weeks prior to factory acceptance test. In the event that representatives arrive and the system is not ready for testing, the vendor shall be liable for back charges for any extra time and expenses incurred.
- 7.12 Contractor shall be responsible for the correct sizing of all the control systems and their accessories, which are being supplied by them including items, which are required for the integration of control systems.
- 7.13 Contractor must keep the guidelines provided herein and requirements provided elsewhere in this document for sizing the system and accessories in their scope.
- 7.14 Contractor shall be responsible to size PLC based control system and other system and nodes as indicated in system architecture diagrams attached along with this package.

## 8.0 INSPECTION AND TESTING

- 8.1 All instruments and PLC based system shall undergo factory testing and inspection by contractors authorized representatives, Owner/EIL, unless specified otherwise. Owner/PMC participation shall be as per inspection categorization of various items defined elsewhere in the tender document.
- 8.2 Wherever inspection at manufacturer's shop is waived because of any reason, the sub vendor's own testing reports shall be verified before dispatch. In no case, items shall be released without proper inspection/ verification.
- 8.3 The inspection and testing shall be carried out as per related specifications, international codes and practices/standards, approved documents and/or any other document attached along with specifically suggesting testing to be carried out at manufacturer's works.
- 8.4 Items for which 'Witness Inspection' is specifically exempted, manufacturer shall forward the test certificates as desired for review. The material shall be dispatched only after obtaining written dispatch clearance.
- 8.5 No system or system oriented item shall be dispatched without integrated factory testing witnessed by representatives of contractor/ purchaser/ Owner / EIL. The testing procedures shall be detailed out by contractor based on testing requirements indicated in individual system specifications and shall be approved by owner/ EIL. Contractor must certify that the system is actually ready before calling the Owner / EIL for FAT. Also all the necessary documents & literature are to be submitted before calling for FAT.
- 8.6 Testing and inspection for all items shall be carried out as per approved factory testing procedures. For items where no testing is witnessed by the purchaser, following test certificates shall be forwarded for review before dispatch of such equipment:
- Verification of certificates as applicable for the material certificates, NDT reports like radiography/ X-ray/ die-penetration/ MP etc., statutory certificates for Intrinsic safety and explosion proof, certificates of conformity etc.
  - Visual verification for quantity, quality and workmanship.
  - Hydro testing and pneumatic testing as applicable.
  - Functional and performance testing including calibration, accuracy, repeatability testing.
- 8.7 Contractor must detail out performance specifications of each time, which shall be verified, by contractor or contractor appointed agency/Owner/ EIL during factory testing.
- 8.8 Inspection and testing requirements as per 6-52-0052 shall be referred.
- 8.9 Contractor shall submit all test records / test results for records to purchaser as bound volume along with the test procedure for each test carried out.
- 8.10 Testing procedures shall be developed by contractor based on relevant codes, international standards and practices followed for various items unless otherwise indicated separately.

## 9.0 INSTALLATION, LOOP CHECKING AND COMMISSIONING REQUIREMENTS

### 9.1 INSTALLATION REQUIREMENTS

- 9.1.1 All instruments shall be accessible from grade or a platform for operation and maintenance.
- 9.1.2 Contractor shall consider the, "EIL installation standards" as attached or equivalent for installation of each instrument. In case, any instrument require a special installation or any instrument not provided with installation standard the contractor shall prepare the standard and get it approved by Owner/EIL along with other documents.
- 9.1.3 The Impulse pipe for instrument installation shall be as per the piping material specifications of respective process line. Tubing when used between manifold and the instrument, it shall be 12 mm O.D SS 316 tube and be suitable for the process fluid/conditions.
- 9.1.4 Insulation of impulse lines shall be as per piping class.
- 9.1.5 Based on the installation standards for each type of instrument, contractor shall prepare Bill of materials (BOM), which indicate the requirements of different materials for installation of each instrument.
- 9.1.6 The instrument connections on vessels & piping shall be in accordance with EIL standards 7-52-0001 and 7-52-0002 respectively.
- 9.1.7 Mounting of instrument (if remote mounted)/JB on the stanchion or instrument support shall be at the height of 1.3M from the grade level / finished floor level.
- 9.1.8 Perforated tray shall be MS and hot dipped galvanized and thickness shall be 2.5 mm.
- 9.1.9 The installation and erection materials like, cables (signal, control, thermocouple extension and power), cable glands, junction boxes, instrument valves and manifolds, impulse pipe and pipe fittings, pneumatic signal tubes, instrument airline fittings and valves and cable trays/ducts required for installation of complete instrumentation shall be as per specifications in 'standard specifications for instrumentation package units' 6-52-0052 enclosed in this package along with additional standards in this package.
- 9.1.10 As far as possible, the instrument tapping shall be located such that the instruments are approachable from the platform. If not, then the instrument nozzles should be provided such that common platform could be provided to service the number of instruments. Platforms shall also be provided on the pipe racks for approach to instruments.
- 9.1.11 All sections of the Storage Facility shall be equipped with a Closed-Circuit Television system capable of retaining recorded footage for a period of two month. The Concessionaire shall install and operate such other security equipment as may be required in accordance with Applicable Laws, Applicable Permits and Good Industry Practice for assurance of the security of personnel and Food grains at the Storage Facility.
- 9.1.12 Smoke detectors and fire alarms shall also be provided in critical areas.
- 9.1.13 The unloading hopper tunnels and the receiving conveyor and reject conveyor tunnels shall be located below grade level running beneath the unloading area.  
The tunnels shall be equipped with sensing and monitoring instrumentation.
- 9.2 LOOP CHECKING AND COMMISSIONING

- 9.2.1 Contractor is totally responsible for all work related to loop checking including cable laying, dressing, identification, ferruling, calibrations and loop testing in coordination with his control system vendor.
- 9.2.2 Before proceeding for loop checking the calibration results of individual elements shall be recorded on the Contractor supplied proforma which shall be approved by Owner / EIL for correctness of installation/ measurements and calibration results.
- 9.2.3 For calibration of special instruments, loop checking and for loop checking of sub-vendor packages Contractor shall do necessary coordination with sub-suppliers. The Contractor shall carryout the necessary loop checking to the satisfaction of Owner / EIL which shall be part of Contractor's scope of work.
- 9.2.4 The procedure and scope of loop checking shall be as detailed below for the loops connected to PLC based panel.
- 9.2.5 Contractor's scope is to lay all single/multi-pair cables up to the control rooms, laying of all cables till the cabinets, tagging of all field cables, performing continuity /insulation test of cable, identification of all cables and cores and dressing the cable inside the control room , along with
- i) Calibration of all field instruments independently.
  - ii) Providing all assistance to control system sub-vendor during loop checking. This shall include providing signals from the field instruments and checking valve operation with respect to the output from control system to enable control system vendor to verify loop performance.
  - iii) Co-ordination with control system sub-vendor to meet loop checking schedule. It shall be contractor's responsibility to demonstrate /prove measuring signal levels of field instrument output in control room in the respective identified pair of cable, in case of any problem.
  - iv) Rectification/ re-calibration of field instruments, if found defective during loop checking.
- 9.2.6 The Silos shall be calibrated and appropriately marked with at least 2 (two) scaled rulers to identify the aggregate volume of each Silo in fractions of 1/500th (one upon five hundredth) of such aggregate volume. The scaled ruler shall be indelibly imprinted and shall be in the form of concentric circles running on the inside wall of the Silo such that the volume of the Food grain stored in the Silos can be readily ascertained by reference to such scaled rulers. The Silo shall be designed with appropriate mechanisms to enable easy access to and reading of the scaled ruler for verification of the volume of Food grain stored in a Silo at any point of time.
- 9.2.7 However, the termination of field cables, checking of interconnection between instrument/equipments inside control room, ferruling/ tagging (follow cross-direct ferruling concept) of interconnecting cables inside control room and performing loop checking with the co-ordination of contractor shall be in the scope of control system sub-vendor/other Contractor.
- 9.2.8 Loop testing shall be conducted to check the functional performance of all elements comprising the loop, thereby ensuring proper inter-connections and operations.
- 9.2.9 After the loop test is complete, contractor shall connect back any terminations and connections removed for loop checking

- 9.2.10 The contractor shall complete all entries in the 'Loop Sheet' related to field instrumentation including calibration, installation checks, interconnection of tubing and cabling, hydro test etc. and get it signed by PMC/Owner. All loop sheets duly filled and signed shall be handed over to control system vendor for overall loop checking records.
- 9.2.11 The control system sub-vendor shall complete the loop check column in loop sheet after acceptance of loops and hand over the sheets to PMC/Owner. All field related assistance shall be provided by the contractor during all these activities.

#### 10.0 SITE ACCEPTANCE TEST OF PLC BASED SYSTEM

The owner will take over the system (PLC based system etc.) from the contractor after the site acceptance test attended by Owner/ EIL, which is defined as successful uninterrupted operation of the integrated system for three weeks for all units of the plant. Contractor & System Vendor's personnel shall be present during the test. Any malfunctioning of the system components shall be replaced/ repaired as required. Once the system failure is detected, the acceptance test shall start all over again from the beginning. The warranty period commences from the day owner takes over the system.

#### 11.0 COMMISSIONING SPARES AND CONSUMABLE SPARES

- 11.1 Commissioning spares shall be supplied as required for commissioning the plant. Contractor shall procure these spares as per recommendation of Vendors/ Suppliers and these shall be available at the time of commissioning. These shall include all instrumentation and control items including sub-package items.
- 11.2 Consumable spares for a minimum of six month duration after acceptance, as required
- #### 12.0 LOGISTIC SUPPORT

- 12.1 Vendor shall provide back-up engineering, maintenance support and spare parts for a period of ten (10) years for the system, being supplied. Logistic support certificates shall be furnished by vendor for providing necessary support services as per Appendix - II
- 12.2 Certificate from sub vendors for items such as PLC based system etc. shall be furnished.

#### 13.0 CONTRACTOR DATA REQUIREMENTS

For drawings/ documents to be submitted by contractor, refer Documents/Drawings for Owner's/PMC Review (Instrumentation) A951-000-16-51-VDR-01.

## APPENDIX - I

### INSTRUMENT & ELECTRICAL INTERFACE

Areas of responsibility between Instrument and Electrical should be clearly defined and identified in order to

- execute the job without any gaps and overlaps.
- ensure compatibility of equipments on the either side.
- adopt to any expansion or update on either side without any problem.

APPENDIX - II

**CERTIFICATE FOR LOGISTIC SUPPORT**

(By PLC based control system, etc. vendors)

(TO BE SIGNED BY VENDOR'S PRINCIPAL CORPORATE LEVEL SIGNATORY ON COMPANY LETTERHEAD)

I, ON BEHALF OF M/s \_\_\_\_\_ CONFIRM THAT THE \_\_\_\_\_  
QUOTED BY M/s \_\_\_\_\_ FOR FOOD GRAIN STORAGE PROJECT, NABHA,  
PUNJAB, INDIA AGAINST BASIC ENGINEERING PACKAGE SHALL CONTINUED TO  
BE SUPPORTED BY US AND QUOTED \_\_\_\_\_ SHALL NOT BE  
WITHDRAWN FROM "INDIAN" MARKET AS A MATTER OF CORPORATE POLICY.

I, FURTHER CONFIRM THAT IN CASE OF PLACEMENT OF ORDER OF FOOD GRAIN  
STORAGE PROJECT, NABHA, PUNJAB, INDIA ON M/s \_\_\_\_\_ CWC,  
INDIA SHALL BE SUPPORTED IN PROVIDING BACK-UP ENGINEERING,  
MAINTENANCE SUPPORT, AND SPARE PART SUPPORT FOR A PERIOD OF NOT  
LESS THAN TEN (10) YEARS FROM THE DATE OF PLACEMENT OF ORDER

(SIGNATURE WITH SEAL)