BOQ	Doc No:	PE-PF-485-154-A001
	Rev No:	0
	Date of issue	03-06-2024

SUGGESTED PRICE FORMAT

NAME OF PROJECT: 1X800 MW North Chennai FGD STAGE-III

NAME OF PACKAGE: CHEMICAL DOSING SYSTEM (NaOH DOSING).

TECHNICAL SPECIFICATION: **PE-TS-485-154-A001**

S. No.	DESCRIPTION	HSN NO	UNIT	QTY	AMOUNT (F.O.R.)
1.0	Total lump sum firm price inclusive of all prevailing taxes, duties and other levies for **SUPPLY PART & MANDATORY SPARES**, design (i.e. preparation and submission of drawing /documents including "As Built" drawings and O&M manuals), engineering, manufacture, fabrication, assembly, inspection / testing at vendor's & sub-vendor's works, painting, maintenance tools & tackles (as applicable), fill of lubricants & consumables (excluding chemicals), Mandatory spares, startup and commissioning spares, forwarding, proper packing, shipment and delivery at site for project and package specified above complete with all accessories for the total scope defined as per BHEL NIT & tender technical specification, amendment & agreements till placement of order.		Set	1	
2.0	**MAJOR BREAK-UP OF PRICES GIVEN IN 1.0 ABOVE.**				
2.1	Prices inclusive of all prevailing taxes, duties and other levies for SUPPLY PART comprising of design (i.e.preparation and submission of drawing /documents including "As Built" drawings and O&M manuals), engineering, manufacture, fabrication, assembly, inspection / testing at vendor's & sub-vendor's works, painting, maintenance tools & tackles (as applicable), fill of lubricants & consumables (excluding chemicals), alongwith spares for erection as required, startup and commissioning spares, forwarding, proper packing, shipment and delivery at site for project and package specified above complete with all accessories for following items for the total scope defined as per BHEL NIT & tender technical specification, amendment & agreements till placement of order. (Break-up of prices as per Annexure I)	84041000	Set	1	
2.2	Total lumpsum firm price inclusive of all prevailing taxes, duties and other levies for **Mandatory spares** comprising of manufacture, fabrication, assembly, inspection / testing (as applicable) at vendor's & sub-vendor's works, painting, forwarding, proper packing, shipment, delivery at site & guarantee as per tender technical specification above, amendment & agreements till placement of order. (Price break up of Mandatory spares is to be furnished as per Annexure- II).	84041000	Lot	1	

Particulars of bidder / authorised representative

Name	Designation	Signature		Date	Company Seal

BOQ **ANNEXURE-I**			Doc No:	PE-PF-485-154-A001	
			Rev No:	0	
			Date of issue	03-06-2024	
NAME OF PROJECT: 1X800 MW North Chennai FGD STAGE-III					
NAME OF PACKAGE: CHEMICAL DOSING SYSTEM (NaOH DOSING).					
TECHNICAL SPECIFICATION:		**PE-TS-485-154-A001**			
S. No.	**DESCRIPTION**		**UNIT**	**QTY**	**AMOUNT** (F.O.R.)
	BREAK-UP OF SUPPLY PRICES GIVEN IN 2.1 OF MAIN SHEET.				
2.1	Prices inclusive of all prevailing taxes, duties and other levies for SUPPLY PART comprising of design (i.e.preparation and submission of drawing /documents including "As Built" drawings and O&M manuals), engineering, manufacture, fabrication, assembly, inspection / testing at vendor's & sub-vendor's works, painting, maintenance tools & tackles (as applicable), fill of lubricants & consumables (excluding chemicals), startup and commissioning spares, forwarding, proper packing, shipment and delivery at site for project and package specified above complete with all accessories for following items for the total scope defined as per BHEL NIT & tender technical specification, amendment & agreements till placement of order.		Set	1	
2.1.1	NaOH dosing skid		No.	1	
2.1.2	Supply of **Startup and Commissioning spares** inclusive of all prevailing taxes, duties and other levies etc. (As per BHEL NIT & tender technical specification, amendment & agreements till placement of order.)		Set	1	
Particulars of bidder / authorised representative					
Name	**Designation**	**Signature**	**Date**	**Company Seal**	

BOQ **ANNEXURE-II** **LIST OF MANDATORY SPARES**		**Doc No:**	PE-PF-485-154-A001	
		Rev No:	0	
		Date of issue	03-06-2024	
NAME OF PROJECT:1X800 MW North Chennai FGD STAGE-III				
NAME OF PACKAGE: CHEMICAL DOSING SYSTEM (NaOH DOSING).				
TECHNICAL SPECIFICATION:		**PE-TS-485-154-A001**		
BREAK-UP OF SUPPLY PRICES GIVEN IN 2.2 OF MAIN SHEET.				
S. No	**DESCRIPTION**	**UNIT**	**QTY**	**AMOUNT** (F.O.R.)
1	**Agitators**			
	Impeller assembly	1 No		
	Bearing Assembly	1 No		
	Motor	1 No		
	Belt and Pulley (If applicable)	1 No		
	Gear Box Assembly (If Applicable)	1 No		
	Agitator shaft assembly	1 No		
	Complete Agitator assembly	1 No		
2	**MEASURING INSTRUMENTS**			
	Local Gauges for Pressure, Differential pressure, flow, level, temp	5% or 1 no. of each type, model and range, whichever is more.		
	Transmitters of all types and model no. (for measurement of pressure, differential pressure, flow, level, temp, etc.). This shall include magnetic/ electromagnetic flow meter, mass flow meter also.	10% or 1 no. of each type and model, whichever is more.		
3	**PROCESS CONNECTION PIPING (For Impulse Piping / Tubing and Air Supply Piping as Applicable)**			
	Valves	10% or 1 no. of each type, class, size and model whichever is more.		
	2 way, 3 way, 5 way valve manifolds	10% or 1 no. of each type, class, size and model whichever is more.		
	Fittings	10% or 1 no. of each type, class, size and model whichever is more.		
Particulars of bidder / authorised representative				
Name	**Designation**	**Signature & Company Seal**		**Date**

BHEL-PEM-MAUX
PRE-QUALIFICATION CRITERIA

	PACKAGE: CHEMICAL DOSING SYSTEM	PE-PQ-STD-154-A001	
		DATE	09/06/2021
		REV NO	00

1.0	Supplier should have capabilities for design/ manufacture and having in-house/ out-sourced facility for testing of Chemical Dosing System.
2.0	The supplier has to submit either of following supporting documents meeting above mentioned pre-qualifying requirement a. Copy of minimum one (1) performance certificate in English from end user along with copy of related Purchase Order (PO) or letter of intent (LOI) or letter of award (LOA) or work order (WO) specifying that the product/ equipment is running successfully for one (1) year from date of commissioning meeting the minimum pre-qualifying requirement. OR b. Minimum two PO/ LOI /LOA/ WO placed with a minimum gap of six (6) months from same purchaser meeting the minimum pre-qualifying requirement. OR c. Minimum one PO/ LOI /LOA/ WO after commissioning of first order from same purchaser meeting the minimum pre-qualifying requirement. OR d. In case, vendor has executed contract (s) for BHEL-PEM, internal assessment by BHEL-PEM shall be followed for evaluation for satisfactory performance. For this, vendor to submit the request along-with relevant documents. OR e. Minimum three customer's/ third party's inspection reports/ test certificates/commissioning certificates meeting the minimum pre-qualifying requirement.
3.0	Minimum one (1) no. PO/ LOI/LOA/WO shall be submitted which should not be more than Ten (10) years old, for establishing continuity in business. This is over and above the requirement of PO/ LOI/LOA/WO mentioned at Sl. no. 2.0 above.
4.0	The bidder should be an OEM and will meet PQR based on its own credentials. Bid from joint venture (JV) company /Consortium bid is not acceptable.

PROJECT:
1X800 MW NORTH CHENNAI TPP ST-III
(FGD SYSTEM PACKAGE)

CUSTOMER: TANGEDCO

TECHNICAL SPECIFICATION
FOR
CHEMICAL DOSING SYSTEM (NaOH DOSING)

SPECIFICATION NO: PE-TS-485-154-A001

BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA, INDIA

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SECTION - A
INTENT OF SPECIFICATION

1.0 SCOPE OF INQUIRY/ INTENT OF SPECIFICATION:

This specification is intended to cover design, engineering, manufacturing, fabrication, assembly, painting, packing, inspection & testing at manufacturer's works, **mandatory spares, start up and commissioning spares,** special tools & tackles, supply and dispatch to power station site of skid mounted **CHEMICAL DOSING SYSTEM (NaOH DOSING SYSTEM)** as specified in different sections / volumes of this specification hereinafter for the **1X800 MW NORTH CHENNAI (FGD SYSTEM PACAKGE)** for following systems:-

- **NaOH Dosing system (1 number for entire unit).**

1.1 The contractor shall be responsible for providing all material, equipment & services, which are required to fulfil the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. Omission of specific reference to any component / accessory necessary for proper performance of the equipment shall not relieve them of the responsibility of providing such facilities to complete the supply of **CHEMICAL DOSING SYSTEM.**

1.2 It is not the intent to specify herein all the details of design and manufacture. However, the equipment shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to purchaser who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material which in his judgment is not in full accordance herewith.

1.3 The extent of supply under the contract includes all items shown in the drawings, notwithstanding the fact that such items may have been omitted from the specification or schedules. Similarly, the extent of supply also includes all items mentioned in the specification and /or schedules, notwithstanding the fact that such items may have been omitted in the drawing.

1.4 Items though not specifically mentioned but needed to make the system complete as stipulated under these specifications are also to be furnished unless otherwise specifically excluded.

1.5 The general terms and conditions, instructions to tenderer and other attachment referred to elsewhere are made part of the tender specification. The equipment materials and works covered by this specification are subject to compliance to all attachments referred to in the specification. The bidder shall be responsible for and governed by all requirements stipulated herein.

1.6 While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under Vol-III of the specification. In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of BHEL/Customer shall prevail and shall be complied by the bidder without any commercial and delivery implication on account of the same. Further in case of any missing information in the specification not brought out by the prospective bidders as part of pre-bid clarification, the same shall be furnished by BHEL/ Customer as and when brought to their notice either by the bidder or by BHEL/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication.

1.7 Deviations, if any, should be very clearly brought out clause by clause along with cost of withdrawal in the enclosed schedule (in Vol – III); otherwise, it will be presumed that the vendor's offer is strictly in line with NIT specification. If no cost of withdrawal is given against the deviation, it will be presumed that deviation can be withdrawn without any cost to BHEL/its customer.

1.8 In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.

1.9 Unless specified otherwise, all through the specification, the word contractor shall have same meaning as successful bidder/vendor and Customer/Purchaser/Employer will mean BHEL and/or Customer (TANGEDCO: Tamil Nadu Generation and Distribution Corporation Ltd.) as interpreted by BHEL in the relevant context. Please refer GCC/SCC for better clarity.

1.10 The equipment covered under this specification shall not be dispatched unless the same have been finally inspected, accepted and dispatch release issued by BHEL/Customer.

1.11 BHEL's/Customer's representative shall be given full access to the shop in which the equipment are being manufactured or tested and all test records shall be made available to him.

1.12 Pre-bid meeting shall be held before bid submission. Bidder to ask all their queries in Prebid clarifications format only.

SECTION – B

PROJECT INFORMATION

ANNEX - 1.1

PROJECT INFORMATION

1.0	**General**		
1.1	Project Title	:	1 x 800 MW North Chennai Coal Based Super Critical Thermal Power Project Stage III.
1.2	Plant capacity	:	800 MW
1.3	Type of project	:	Brown field
1.4	Owner	:	Tamil Nadu Generation and Distribution Corporation Limited (TANGEDCO)
1.5	Plant site location	:	In the premises of North Chennai Thermal Power Station (NCTPS)
1.6	Location co-ordinates	:	80° 19' E to 80° 20' E Longitude 13° 13' N to 13° 18' N Latitude
1.7	Nearest Village	:	Ennore & Puzhudhivakkam Village
1.8	Nearest Town & City	:	Chennai (35 Km)
1.9	State Capital	:	Chennai (35 Km)
1.1	Nearest Railway Station	:	Athipattu Pudunagar (~ 5 Km) on Chennai – Vijayawada Line
1.11	Nearest Airport	:	Chennai (~ 60 Km)
1.12	Nearest Seaport	:	Ennore (~ 3 Km)
1.13	Nearest Road access	:	All weather road from Pattamandri on the Thiruvottiyur – Ponneri highway
2.0	**Meteorological Condition**		
2.1	Climate	:	Tropical, very dry and hot summer, dry and cold winter and good rain-fall in monsoon accompied with strong wind
2.2	Site Elevation	:	(+) 10.0 Meter above Mean Sea Level
2.3	Ambient Temperature		
a.	Annual Maximum Mean Temperature	:	45 ºC
b.	Annual Minimum Mean Temperature	:	15 ºC
c.	Design ambient temperature	:	30 ºC
2.4	Relative Humidity		
a.	Maximum	:	90%
b.	Minimum	:	36%
c.	Design	:	75%
2.5	Annual Rainfall		

	Maximum	:	2540 mm
	Average	:	1600 mm
	Minimum	:	1175 mm
2.6	Basic Design Wind Pressure	:	As per IS: 875 (Latest Edition)
2.7	Wind Speed	:	11.8 kmph (Avg), 50 m/s (max)
2.7	Seismic zone	:	Zone: III as defined in IS:1893-2002
2.8	Design ambient temperature for Electrical equipment	:	50 ℃

SECTION – C1
SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)

1.0 BRIEF DESCRIPTION OF THE SYSTEMS:

The Chemical Dosing System shall consist of NaOH dosing system to dose dilute NaOH in ECW tank and suction header of DMCW pumps.

2.0 *NaOH DOSING SYSTEM for ECW SYSTEM*

Sodium Hydroxide (NaOH) dosing system is provided to dose NaOH solution in Equipment cooling water lines to increase pH up to 9.5. The sodium hydroxide dosing is done in the ECW cycle during the initial fill and for the compensation of cooling water for any leakage during normal run. The 5% solution of NaOH is prepared manually by opening the inlet valve of DM water and adding NaOH lye in basket. The NaOH is being dissolved by locally starting the motorized stirrer. The dosing is done manually as per requirements of desired pH in ECW line judged by trial basis. Normally the leakage is occasionally and of small quantity. At the low level of solution in tank the solution is to be prepared again.
The dosing system consists of following (Refer Data Sheet-A and P&ID).

3.0 *SCOPE OF SYPPLY:*

The bidder's scope of supply includes the following under this specification:

a) One number NaOH Dosing tank.
b) Two (2X100%) NaOH Dosing Pumps.
c) Associated Piping, valves, fitting as indicated in the P&ID of NaOH dosing system and data sheet-A enclosed and as required to make the system complete.
d) Foundation nuts & bolts to fix each skid on the floor, as required.
e) Control & instrumentation as per P&ID of NaOH dosing system, Data sheet-A and as indicated in different section in this specification.
f) Commissioning spares as indicated in specification.
g) Mandatory spares as indicated in specification.

4.0 *SCOPE OF SERVICE:*

The bidder's scope service includes the following under this specification:

a) Design and engineering.
b) Fabrication of the skid mounted chemical dosing system.
c) Inspection and testing of the skid as per the approved quality assurance plan.
d) Supply of the skid mounted chemical dosing system up to the power plant site along with all accessories as defined in the technical specification.
e) Painting as per technical specification.
f) Packing of skid (**Refer Packing, Shipping, Handling and Preservation Procedure**)

Note: To prevent damage to the equipment of the skid during loading/unloading, transit and in view of the site storage suitable wooden packing with steel angel/frame shall be provided. Auto Stroke controller shall be packed separately in weather proof packing box.

Document Title	**:- Packing, Shipping, Handling and Preservation Procedure**

Item Name	Pump	Tank	Skid	Instruments	Motors	Panel/Auto Stroke Controller	Spares
Storage Location (Warehouse/Sunshade/outside)	Sunshade	Sunshade	Sunshade	Sunshade	Sunshade	Sunshade	Ware House
Protection Cover / Packing (Required / Not required)	Required	Required	Required	Required	Required	Required	Required
Connection Cap (Required / Not required)	Not Required	Not Required	Not Required	Not Required	Not Required	Not Required	Required
Drain Check (Required / Not required)	Required	Required	Not Required	Not Required	Not Required	Not Required	Not Required
Lube Oil Filling (Required / Not required)	Required	Not Required	Not Required	Not Required	Not Required	Not Required	Not Required
Shipping (Assembled / Loose)	Assembled	Assembled	Assembled	Assembled/Loose	Assembled	Assembled	Loose (Box Tie on Skid)

PACKING PROCEDURE:

1. Packing shall withstand the hazards normally encountered with the means of transport including loading and unloading operation both by crane and by pushing off.
2. The packing shall be strong and efficient enough to ensure safe preservance upto the final point of destination.
3. Fragile articles should be packed with special packing materials depending on the type of Materials, and the packing shall bear the words "HANDLE WITH CARE GLASS FRAGILE, DON'T ROLL THIS END UP. THIS END DOWN," to be indicated by arrow.
4. Spare parts of equipment and all small pieces shall be packed separately in cases with adequate protection inside the case.
5. Each item shall be suitably tagged with identification of main equipment, item denomination and reference number of respective assembly drawing.
6. All nozzles, holes and openings and also all delicate surfaces shall be carefully protected against damage and bad weather.
7. Wherever required, equipment/ materials instruments shall be enveloped in polythene bags.
8. Entire package shall be packed in wooden Crates.
9. Detailed packing list in waterproof envelope shall be inserted in the package together with equipment/materials.
10. One copy of the detailed packing list shall be fastened outside of the package in waterproof envelope.

Notes:

a) Width of all planks including the tongue shall be more than 125mm and after plaining it shall be minimum 100mm.
b) Horizontal, vertical, diagonal planks shall be given for binding (number of such planks depend on the dimension of Panel.)

General Notes:

1. Above table indicates preservation, packing, shipping & procedure during site storage, pre commissioning and commissioning.
2. Handle all above with Equipement with care to avoide damages. To handle the equipement Fork lift or overhead crane required.

SUB VENDOR LIST (TABLE-1)

SL NO.	ITEM	APPROVED SUPPLIERS	PLACE	REMARKS
	MECHANICAL:			
1	**TANK/DISSOLVING BASKET/WATER SEAL POT/ CO_2 ABSORBER/BREATHER**	SELF-MAKE OF MAIN VENDOR	AS APPLICABLE	
2	**AGITATOR/STIRRER**	REMI (REFER NOTE 1)	MUMBAI	
		CEECON	CHENNAI	
		FIBRE & FIBRE		
3	**GATE/GLOBE/NON-RETURN (CHECK) VALVES**	PRECISION ENGG.	MUMBAI	
		CRESENT VALVE	MUMBAI	
		BDK	HUBLI	
		LEADER	JALANDHAR	
		CHEMTECH	MUMBAI	
		TECHNO VALVE	MUMBAI	
		FOURESS	MUMBAI	
		FLUIDLINE	MUMBAI	
		STEELSTRONG	MUMBAI	
		L&T AUDCO		
		GM ENGINEEIRNG		
		A.V. VALVES		
		ATAM VALVES	JALANDHAR	
4	**2/3 WAY VALVE MANIFOLDS**	TECHNO VALVE	MUMBAI	
		HI TECH	AHMEDABAD	
		CHEMTROL		
		BLISS ANAND	GURGAON	
		APPROVED ORIGINAL SUPPLIER FOR THE RESPECTIVE INSTRUMENT	AS APPLICABLE	
5	**METERING PUMP WITH PRV**			
		MILTON ROY		
		VK PUMP		
		SWELORE		
		METACHEM		
		DENCIL		
		POSITIVE METERING		
		EXCEL HYDRO		
6	**PIPES**	CHOKSHI TUBES	AHMEDABAD	
		REMI	MUMBAI	
		RATNAMANI	AHMEDABAD	
		PRAKASH STEELAGE	SILVASA	
		KALYANI		
		PRAKASH		
		SAW		
7	**FITTINGS**	BHARAT FORGE	PUNE	
		RELIANCE FORGE	MUMBAI	
		EBY	MUMBAI	
		SIDDARTH & GAUTAM	FARIDABAD	
		MS FITTINGS	KOLKATA	
		PRADEEP METALS LTD	MUMBAI	

		TUBE PRODUCT INCOROPORATION	BARODA	
		CSA FITTINGS		
8	**FLANGES**	PRADEEP METALS LTD	MUMBAI	
		TUBE PRODUCT INCOROPORATION	BARODA	
		RELIANCE FORGE	MUMBAI	
		CD INDUSTRIES		
9	**PAINT**	BERGER PAINTS	KOLKATA	
		ASIAN PAINTS	MUMBAI	
		SHALIMAR PAINTS	KOLKATA	
		JENSON & NICOLSON	KOLKATA	
		GUNJAN PAINT	MUMBAI	
	ELECTRICAL:			
10	**LT MOTORS**	KEC	BANGALORE	
		SIEMENS	MUMBAI	
		ABB	FARIDABAD	
		CROMPTON GREAVES LTD	MUMBAI	
		BHARAT BIJLEE	MUMBAI	
		NGEF	BANGALORE	
		MARATHON	KOLKATA	
		JYOTI	VADODARA	
		LHP	SOLAPUR	
	C&I:			
11	**LOCAL CONTROL PANEL**	INDSUSTRIAL SWITCHGEAR & APPS	MUMBAI	BOM OF THE LCP SHALL BE SUBJECT TO BHEL/ CUSTOMER APPROVAL DURING DETAILED ENGINEERING.
		PROCON	CHENNAI	
		CONTROL & SWITCHGEAR		
		PYROTECH	UDAIPUR	
		DELTA CONTROL	MUMBAI	
		RITTAL		
		SUCHITRA		
		INDUSTRIAL CONTROLS & APPLIANCES LTD.		
12	**INST CABLES (SCREENED)**	RELIANCE	BANGLORE	
		DELTON	FARIDABAD / NEW DELHI	
		NICCO	KOLKATA	
		CHORDS CABLE	BHIWADI	
		UNIVERSAL	SATNA	
		INCAB	PUNE	
		POLYCAB	DAMAN	
13	**LT CONTORL CABLES**	DELTON	FARIDABAD/NEW DELHI	
		FINOLEX	PUNE	
		NICCO	KOLKATA	
		PARAMOUNT CABLES	ALWAR	
		FGI	KOLKATA	
		POLYCAB WIRES	DAMAN	
		TORRENT CABLES	NADIAD	
		FINOLEX	PUNE	
		INDUSTRIAL CABLE	RAJPURA	
		THERMOCABLES	HYDERABAD	

		ADVANCE CABLE TECHNOLOGIES	BANGALORE	
		APAR INDUSTRIES	MUMBAI	
		CMI LTD.	FARIDABAD	
		CRYSTAL CABLE INDUSTRIES	KOLKATA	
		DIAMOND POWER	VADODARA	
		ELKEY TELELINKS	NEW DELHI	
		GOVIND CABLES	KOLKATA	
		HAVELLS INDIA	NOIDA	
		KEI INDUSTRIES	DELHI	

14	LEVEL GAUGE	BLISS ANAND PVT. LTD.	
		TOSHNIWAL BROTHERS PVT.LTD.	MAKE:NIVO CONTROLS
		SIGMA INSTRUMENTS CO.	
15	TRANSMITTERS	ABB LIMITED	PRESSURE TRANSMITTER, DP TRANSMITTER and TEMP TRANSMITTER
		Pune Techtrol Pvt. Ltd.	Only for capacitance Type Level Transmitter
		V. AUTOMAT & INTRUMENTS (P) LTD.	a) DISPLACEMENT TYPE TRANSMITTERS. b)PRESSURE AND DP TRANSMITTERS
		Moore Industries International Inc.	
		PANAM ENGINEERS	For Pressure and Diff. Pressure transmitter
		TOSHNIWAL INDUSTRIES PVT. LTD.,	
		Endress + Hauser (India) Pvt. Ltd.,	
		YOKOGAWA INDIA LIMITED,	
		SBEM PVT. LTD.	FOR CAPACITANCE TYPE.
		SIEMENS LIMITED	
		EMERSON PROCESS MANAGEMENT (INDIA) PVT.LTD.	
		SMART INSTRUMENTS LTD, BRAZIL	LD-301 & T-301 TRANSMITTER FROM M/S SMART EQUIPMENTS BRAZIL.
		NIVO CONTROLS PVT. LTD.	For Capacitance type only
		Honeywell Automation India Limited	
16	JUNCTION BOX	Shrenik & Company,	
	JUNCTION BOX	SUCHITRA INDUSTRIES	
	JUNCTION BOX	FLEXPRO ELECTRICALS PVT. LTD.	Metal type junction box only
	JUNCTION BOX	K.S. INSTRUMENTS PVT.LTD.	
	JUNCTION BOX	AJMERA INDUSTRIAL & ENGINEERING WORKS	
17	INSTRUMENTS TUBE FITTINGS	VIKAS INDUSTRIAL	

		PRODUCTS	
	INSTRUMENTS TUBE FITTINGS	Fluid Controls Pvt. Ltd.	
	INSTRUMENTS TUBE FITTINGS	AURA INCORPORATED	
	INSTRUMENTS TUBE FITTINGS	PRECISION ENGINEERING INDUSTRIES	
17	INSTRUMENTS PIPE FITTINGS	VIKAS INDUSTRIAL PRODUCTS	
	INSTRUMENTS PIPE FITTINGS	Fluid Controls Pvt. Ltd.	
	INSTRUMENTS PIPE FITTINGS	PRECISION ENGINEERING INDUSTRIES	
	INSTRUMENTS PIPE FITTINGS	AURA INCORPORATED	
	INSTRUMENT FITTINGS	Perfect Instrumentation Control (India) Pvt. Ltd.	
	INSTRUMENT FITTINGS	Arya Crafts & Engineering Pvt. Ltd.	
	INSTRUMENT FITTINGS	Comfit & Valve Pvt. Ltd.	
	INSTRUMENT FITTINGS	HP VALVES & FITTINGS INDIA PVT. LTD.	
	INSTRUMENT FITTINGS	AURA INCORPORATED	
	INSTRUMENT FITTINGS	PRECISION ENGINEERING INDUSTRIES	
	INSTRUMENT FITTINGS	FLUIDFIT ENGINEERS PVT. LTD.	
	INSTRUMENT FITTINGS	VIKAS INDUSTRIAL PRODUCTS	
	INSTRUMENT FITTINGS	Fluid Controls Pvt. Ltd.	
	INSTRUMENT FITTINGS	PANAM ENGINEERS	
19	Pressure gauge and differential Pressure gauge	SWITZER, CHENNAI. AN INSTRUMENTS, KOLKATA, H GURU, NEW DELHI. MANOMETER INDIA, MUMBAI. GIC, MUMBAI/GOA. GLUCK INDIA, MUMBAI. BUDENBERG GAUGE. DRESSER IND. FORBES MARSHALL, WAREE	

Notes:-

1. Bidder to note that geared motor of REMI makes for stirrers (for stirrers of REMI make ONLY) is acceptable to BHEL.
2. All the finally selected sub vendors shall be subject to customer approval during detailed engineering without any delivery/ commercial implications to BHEL/ Customer.
3. Calibration column may be purchased from sources as per pump manufacturer's recommendation.
4. The sub vendor list enclosed is indicative only and is subject to approval / acceptance by customer.

Bidder to propose his sub vendor list with back up documents (experience list, end user certificate as applicable) etc. The same shall subject to BHEL and Customer approval during detailed engineering stage without any technical, commercial & delivery implication to BHEL or customer.

DRAWING DOCUMENTS DISTRIBUTION SCHEDULE

TABLE-2

SL NO	DESCRIPTION	NTPC ENGG	NTPC SITE	BHEL SITE	BHEL PEM
1	Drawing/Document for approval				
	Vendor to BHEL/ TANGEDCO	--	--	--	SC
2	Inspection/Test report				
	Vendor to BHEL/ TANGEDCO	--	--	--	2+SC
3	O&M Manual for approval				
	Vendor to BHEL/ TANGEDCO	--	--	--	SC
4	Final approved drawing/document (as built/O&M Manual)	--	2+2CD	2+2CD	--

Note-1: SC: Soft copy, CD-Compact Disc.
Note-2: All soft copy (Autocad/EXCEL/Microsoft Word/Stad/etc) document shall be submitted by bidder whenever required by BHEL/Customer/Consultant.

TABLE -3

LIST OF COMMISSIONING SPARES

Sl.No.	Description	Quantity
1.1	Oil Seals for drive end for motor	4 Nos.
1.2	Gaskets for drive end for motor	4 Nos.
1.3	Guide ring for plunger.	4 Nos.
1.4	Teflon rings for valve/s.	4 Nos.
1.5	Level gauge glass	4 Nos.
1.6	Back up fuse	4 Nos.
1.7	Pilot lamp	4 Nos.
1.8	Push Button	4 Nos.
1.9	Control fuse	4 Nos.
1.10	Bulb for Annunciation	4 Nos.

TABLE -4

LIST OF MANDATORY SPARES

Sl.No.	Description	Quantity
A		
1.1	Local Gauges for Pressure, Differential pressure, flow, level, temp	5% or 1 no. of each type, model and range, whichever is more.
1.2	Transmitters of all types and model no. (for measurement of pressure, differential pressure, flow, level, temp, etc.). This shall include magnetic/ electromagnetic flow meter, mass flow meter also.	10% or 1 no. of each type and model, whichever is more (to be divided to various ranges in proportion to main of all make, model, type population)
1.3	Any other instrument (as applicable)	10% or 1 no. of each type and model whichever is more
B		
1.1	Valves of all types and models	10% or 1 no. of each type, class, size and model whichever is more.
1.2	2 way, 3way, 5way valve manifolds	10% or 1 no. of each type, class, size and model whichever is more.
1.3	Fittings	10% or 1 no. of each type, class, size and model whichever is more.
C	Agitator	
1.1	Impeller assembly	1 No
1.2	Bearing assembly	1 No
1.3	Motor	1 No
1.4	Belt and pully	1 No
1.5	Gear box assembly	1 No
1.6	Agitator shaft assembly	1 No
1.7	Complete agitator assembly	1 No

PAINTING SPECIFICATION (ANNEXURE-I)

1.0 General

This specification covers the general requirements related to the cleaning protective coating and painting of equipment, components and systems that are covered under main equipment / system specifications. The components and/or equipment shall be mechanically and /or chemically cleaned during the following stages of the Contract.

- Cleaning in workshop
- Cleaning before painting and/or corrosion protection (application of prime coat)
- Cleaning before erection and during installation.

Cleaning of fabricated component items shall be carried out after fabrication and final heat treatment or welding at manufacturer's works or at site, as appropriate. No paint shall be applied surfaces within 75 mm of field welded connections. These surfaces shall be coated with a consumable preservative and marked.

For cleaning in workshop and before painting, mechanical cleaning by power tool and scrapping with steel wire brushes shall be adopted to clear the surfaces. However, in certain locations where power tool cleaning cannot be carried out, hand scrapping may be permitted with steel wire brushes and/or abrasive paper. Cleaning with solvents shall be resorted to only in such areas where other methods specified above have not achieved the desired results. Cleaning with solvents shall be adopted only after written approval of the Owner / Engineer.

Machined surfaces shall be protected during the cleaning operations.

In the event of the surfaces not being cleaned to the Owner's satisfaction, such parts of the cleaning procedures or agreed alternatives as are deemed necessary to overcome the deficiencies shall be carried out at the supplier's sole expense.

For reclining small areas, hand cleaning by wire brushing may be permitted.

1.1 Codes and Standards

Painting of equipment shall be carried out as per the Codes indicated below and shall conform to the relevant IS Code for the material and workmanship.

The following codes and standards shall be followed for the surface preparation, surface protection and painting works.

IS: 5	Colors for ready mixed paints and enamels.
IS: 101	Methods of test for ready mixed paints and enamels.
IS: 104	Ready mixed paint, brushing, Zinc Chrome, priming.
IS: 158	Ready mixed paint, brushing, bituminous, black, lead free, acid, alkali, water and heat resisting.
IS: 161	Heat resistant paints
IS: 1303	Glossary of terms relating to paints.
IS: 1477	Code of practice for painting of ferrous metals in buildings (Parts I & II).
IS: 2074	Specifications for ready mixed paint, Air drying, red oxide zinc chrome priming.
IS: 2338	Code of practice for finishing of wood and wood based materials: Parts 2 schedules.
IS: 2339	Aluminum paint for general purposes, in dual container.
IS: 2395	Code of practice for painting of concrete, masonry and plaster

	surfaces: Part 2 schedules.
IS: 2524	Code of practice for painting of non-ferrous metals in buildings (Parts I & II).
IS: 2932	Specification for enamel, synthetic, exterior (a) undercoating, (b) Finishing
IS: 3140	Code of practice for painting asbestos cement building products.
IS: 6158	Recommended practice for design safeguarding against Embrittlement of hot dip Galvanized Iron & steel products.
IS: 6159	Recommended practice for design & fabrication of Iron &steel products prior to Galvanizing & metal spraying.
IS: 6278	Code of practice for white washing and Color - Washing.
IS: 10221	Code of practice for coating & wrapping of underground mild steel pipelines.
IS: 33	Inorganic pigments and extenders for paints –Methods of sampling & test.
IS: 13183	Aluminum paint, Heat resistant - specifications.
IS: 144	Specification for ready mixed paint brushing, petrol resisting, Air drying for Interior paints of tanks and containers, Red oxide.
IS: 9954	Pictorial surface preparation standards for painting of steel surfaces.
IS: 11883	Specification for Ready Mixed Paint, Air Drying, Red Oxide Priming for metals.
IS: 9404	Color code for identification of pipelines used in the Thermal Power Plants.
IS: 12744	Specification for Ready Mixed Paint, Air Drying, Red Oxide-Zinc Phosphate Priming.
BS: 2015	Glossary of paint selected terms.
BS: 5252	Final coat color.
BS: 7079A1/S1	Specification for rust grades and preparation grades of uncoated substrates after overall removal of previous coating.
BS: 7079A2	Preparations grades of previously coated steel substrates.
BS: 7079GrC	Surface roughness characteristics of blast cleaned steel substrates.
BS: 7079GrD	Methods for surface preparation.
BS-4232	Surface Finish of Blast cleaned steel for painting.
ASTM	American Standard for Testing Material.
ASTM A 780	Standard practice for repair of damaged galvanized coatings.
AWWA	American Water Works Association.
ASA-A-13.1-1981	Scheme for identification of piping system (American National Standard Institution).
DIN	Deutsehes Institute for Normung
S1S-055900-1967	Surface preparation standards for painting steel surfaces. (Swedish standard Institution)
SSPC-SP	Preparation Specifications (Steel structures painting council, U.S.A.).
	National Association of Corrosion Engineers, U.S.A. (NACE).

1.2 Scope of Work and General Requirements

This specification covers the surface preparation, method of application and material to be used for all coating of equipment, steel structures and piping. Steel material subjected to surface preparation on shop/site shall have minimum requirements in accordance with Rust Grade B (SSPC/SSPM Volume-2).

Coating materials according to SSPC, EN ISO, ASTM, BIS or DIN standards, shall be used. The paint shall comply with applicable laws, regulations, ordinances etc., of the local authority,

state or the nation pertains to the work. The materials shall be matched with each other so that they are compatible. Coatings deviating this specification shall be subject to approval.

Standards of surface preparation and painting shall give a time to first maintenance of minimum 10 years.

The paint to be applied shall be approved by Owner.

All paints & paint material used shall be procured from approved manufacturers. Paint shall be supplied in manufacturers original containers with the description of content, specification No., colour, ref no, date of manufacture, shelf life expiry date & pot life.

The paint manufacturers shall provide coating system data sheet for each coating system to be used containing the following information

a. Surface preparations
b. Film thickness (min and max)
c. Min and max recoating intervals at relevant temperatures
d. Mixing ratio, thinner details and coating repair systems

The sample for testing the paint being used may be taken by the Owner at any time.

In general Shop fabricated equipment will be delivered to the site coated with a shop applied system or the manufacturer's standard finish in accordance with the requirements of this specification.

For equipment that has received shop prime coat, all touch-up prime coat and additional coats shall be applied in accordance with the coating schedule. It is responsibility of the vendor to ensure compatibility between shop and field applied paint systems.

Necessary precautions shall be provided to all equipment, structures to protect other surfaces from abrasive blasting, coating over spray and spatter. Damage to other surfaces or equipment shall be repaired by the vendor.

The Contractor shall submit the following for review and approval by the Owner:

a. Manufacturer's recommended paint scheme for the project
b. Latest published product & instructions for application data,
c. Procedures for surface preparation and application.
d. Pre qualification for equipments and blasting materials, product, procedure and personnel qualifications for the paint and painting systems.
e. Painting repair procedures

Painting records shall contain:

- Equipment/components/location painted
- Date of painting
- Paint details such as specification No, colour, date of manufacture, shelf life, expiry date
- Application equipments
- Ambient conditions at the time of painting
- Surface temperature
- Drying time between coating, DFT and number of coatings
- Appropriate work plan for painting.

The supply of all necessary equipments, weather protection, and scaffolding for painting to ensure work is carried out in accordance with the specification and agreed programme.

Maintenance of the paint work until completion of the contract, this shall include repair of any damaged areas caused by third party.

Disposal of painting waste resulting from painting, shall comply with applicable laws, regulations, ordinances etc., of the local authority, state or the nation pertains to the work and coating materials.

It is a mandatory requirement that all operatives working to this procedure take full cognizance and implement necessary safety precautions.

2.0 Cleaning at manufacturer's works

Mechanical cleaning shall preferably be carried out by abrasive blasting. The Owner is prepared to consider alternative methods such as chemical cleaning provided they achieve the necessary surface condition.

In case of chemical cleaning, the detailed procedure for chemical cleaning as well as the system for which chemical cleaning is required shall be submitted by the contractor for Owner's approval. The procedure shall comprise of pre-treatment and acid treatment to achieve cleanliness equivalent to that specified for mechanical cleaning.

Surface condition:
The Metal surfaces shall be clean and free of mil scale, rust, dirt, grease and any other deleterious matter.

Where metal surfaces are to be painted the surface profiles shall conform to the painting specification requirements.

Where this does not apply, surfaces shall have a surface texture not coarser than Grade 80 abrasive paper.

Abrasives:
Abrasives containing silica, silicates or slag residues shall not be used for water/steam side surfaces of plant except for cleaning sand castings, where hydro blasting may be employed.

For austenitic materials only, abrasives containing 98% or more of alumina, $Al_2 O_3$, shall be used.

Removal of abrasive and debris:

After cleaning, abrasive and debris shall be thoroughly removed for components.

3.0 Protection at manufacturer's works

As soon as all items have been cleaned and within four hours of the subsequent drying, they shall be given suitable anti-corrosion protection.

All water, air and steam side surfaces shall be protected by the application of approved water soluble corrosion inhibitors, or vapor phase inhibitors that can be subsequently removed by site water washing or steam blowing.

The gas side of steam generating plant items shall be protected by the application of temporary protective that do not require to be removed before commissioning, but which are removed during initial firing.

The rate of application of volatile corrosion inhibitors shall be at least 10 grams per square meter or 35 grams per cubic metre, whichever is the greater, except for pipes up to 300 mm diameter for which the minimum application rates shall be 5 grams per square metre.

Immediately after the protective treatment has been applied all vessels and pipes shall be suitably sealed off by discs or caps or approved alternatives to prevent ingress from the surroundings. Cylindrical plugs shall not be driven into the ends of pipes. These protective covers shall not be removed until immediately before final connection is made to the associated equipment.

4.0 Weather conditions

Painting shall be done only when the surface temperature is above 5℃. Surface temperature must be at least 3℃ above dew point to ensure that condensation does not occur on the surface.

Reasonable protection against precipitation and seawater spray shall be exercised for the painting of outdoor parts.

Precautions shall also be taken against solar radiation to ensure that the specified dry film thickness of priming or finish coats is obtained.

Any prime coat exposed to excess humidity, rain, dust etc., before drying, shall be permitted to dry and the damaged area of primer shall be removed and the surface prepared and primed again.

Sheltered or unventilated horizontal surfaces on which dew may collect require more protection, and to achieve this additional top coat of paint shall be applied.

The temperature quoted as “normal” in the “Paint System Tables” refers to the average local climatic conditions.

5.0 Surface preparation

In preparing any surface to be coated, all loose paint, dirt, grease, rust, scale, weld slag or spatter or any other extraneous material shall be removed and defects repaired, so as to obtain a clean, dry, even surface to receive the priming or finishing coat (s) as called for in the painting schedules. Sharp edges should be rounded, especially when tank linings have to be applied.

All machined surfaces, including flange faces, shall be suitably covered to prevent damage during surface preparation.

All surfaces should be blast cleaned whenever possible.

Surface preparation methods:

Bare steel surfaces should be prepared by one of the methods described below in order of preference and in accordance with Swedish Standard SIS 05 59 00 or Steel Structures Painting Council, SSPC, Vis 1, or DIN 55928, section 4.

The relative humidity level should not be more than 60% & the steel surface temperature at least 3º C above the dew point during dry blast cleaning operations.

a. White metal blast cleaning Sa 3 or SSPC - SP 5

Sa 3 Blast cleaning to bare metal. Mill scale, rust and foreign matter must be removed completely. Subsequently, the surface is cleaned with vacuum cleaner, clean dry compressed air or a clean brush. It must then have a uniform metallic color and correspond in appearance to the prints designated Sa 3.

b. Near white metal blast cleaning Sa 2 1/2 or SSPC - SP 10

Sa 2 1/2. very thorough blast cleaning. Mill scale, rust and foreign matter shall be removed to the extent that the only traces remaining are slight imperfections in the form of spots or stripes. Subsequently, the surface is cleaned with a vacuum cleaner, clean dry compressed air or a clean brush. It must then correspond in appearance to the prints designated Sa 2 1/2.

Mechanical cleaning should only be used when procedures (a) and (b) are not practicable.

c. Near white metal blast cleaning P Sa 2 1/2 DIN 55928

Very thorough blast cleaning. Very adhesive coatings remain. From all other surface mill scale and rust are to be removed to such an extent that the only traces remaining are slight imperfections in the form of spots or stripes. Further treatments see Sub b).

The adhesivity of residual coatings in the transition zone has to be tested even after the application of the primer.

d. Very thorough mechanical scraping and wire brushing St 3

St 3 very thorough scraping and wire-brushing - machine brushing - grinding - etc. are to be preferred. Surface preparation as for St 2. But much more thoroughly. After the removal of dust, the surface must have a pronounced metallic sheen and correspond to the prints designated St. 3.

e. Thorough scraping and wire brushing St 2

St 2 Thorough scraping and wire-brushing - machine brushing - grinding - etc. The treatment shall remove loose mill scale, rust and foreign matter. Subsequently, the surface is cleaned with a vacuum cleaner, clean dry compressed air or a clean brush. It should then have a faint metallic sheen. The appearance must correspond to the prints designated St 2.

f. Air Blasting with Non-Metallic Abrasives Powder

Whenever the "Duplex"-process is to be applied (hot dip galvanising followed by painting), prepare the hot dip galvanised surface by water washing to remove flux residues and careful air blasting with non-metallic abrasive powder. Use an abrasive with grain size from 0.1 to 0.5 mm, at a greatly reduced air pressure, max. 2 bar (g) (28 psig).

This procedure also applies to stainless steel and aluminium surfaces to be coated.

Surface preparation methods	SIS 055900	DIN 55928 Part-4	BS 4232 only for blasting	SSPC-Vis
Blasting acc to item (a),(b),(c),	Sa 3		First quality	White metal SP 5
Blasting acc to item (b)	Sa 2 1/2		Second quality	near White SP 10
Blasting acc to item (c)	Sa 2		Third quality	Commercial blast SP 6
Hand/or power tool derusting acc to item (e)	St 2		--	Hand tool cleaning SP 2
acc to items (d) and (e)	St 3		--	Power tool cleaning SP 3

Surface preparation methods	SIS 055900	DIN 55928 Part-4	BS 4232 only for blasting	SSPC-Vis
Flame jet cleaning		F1	--	Flame cleaning SP 4
Pickling		Be	--	Pickling

Steel structures to be blast cleaned have to be free of pitting and other severely corroded places in accordance with B.S. 4232 and SIS 055900.

The abrasives used for blast-cleaning shall be graded flint, grit, shot or silica sand and shall be such that they will produce an average keying profile on the blast-cleaned surface of not more than 40 microns.

An air pressure of 7 bar g at the nozzle shall be used.

After blast-cleaning, all accumulated grit, dust, etc., must be removed leaving the surface clean, dry and free of mill scale, rust grease and other foreign matter.

In the event of rusting after completion of the surface preparation, the surface must be cleaned again in the manner specified.

Oil, grease, soil, cement, salts, acids or other corrosive chemicals shall be cleaned from steel surfaces, by the use of solvents, emulsions or cleaning compounds. The final wiping shall be with clean solvent and clean rags or brushes. There shall be no detrimental residue left on the surface.

Primed areas which suffer damage must be spot blasted on site to a degree of cleanliness Sa 2 1/2 before, touching up.

Protective coating must be applied as quickly as possible after the completion of surface preparation no matter what cleaning method has been used.

No blast-cleaned surface shall be allowed to remain uncoated overnight.

Steel work protected by shop primer after arrival on site must be cleaned of salt, sand, oil etc. Before the first coat of paint is applied on site. Shop primer damaged during transport must be rectified by blast-cleaning and coating before application of the site coats.

Wood surfaces shall be sanded clean. All nail holes shall be puttied and sanded before priming.

Concrete: If a protective coating is required, concrete shall be allowed to cure before painting.

6.0 Preparation of coating materials

All containers shall remain un-opened until required for use.

Primers and paints which have livered, gelled or otherwise deteriorated shall not be used.

The oldest primer or paint of each kind shall be used first.

All ingredients in any container shall be thoroughly mixed before use, and shall be agitated frequently during application to keep the primer in suspension.

Primer or paint mixed in the original container shall not be transferred until all settled pigment is incorporated into the body of liquid.

Mixing in open containers shall be done in a well ventilated area.

Primer or paint shall be mixed in a manner ensuring the breakdown of all lumps, complete dispersion of pigment and uniform composition.

Two-component primers shall be mixed in accordance with the manufacturer's instructions.

Thinners shall not be added to primers or paints unless necessary for proper application according to the manufacturer's instructions.

When use of thinners is permitted, it must be added to the primer or paint during mixing.

6.1 Primer Paint

After the surface is prepared, one coat of suitable primer shall be applied. After this first coat is dried up completely, second coat of primer shall be applied.

Primer shall be applied by brushing to ensure a continuous film without 'holidays'. The dry film thickness of each coat shall be as specified in Paint System of this specification.

The primer should be worked by brush application to cover the crevices, corners, sharp edges etc. in the presence of inspector.

The shades of successive coats should be slightly different in color in order to ensure application of individual coats, the thickness of each coat and complete coverage should be checked as per specification approved by Engineer before application of successive coats.

The contractor shall provide standard thickness measurement instrument with appropriate range(s) for measuring.

Elko meter for measuring the Dry film thickness of each coat, surface profile gauge for checking of surface profile in case of sand blasting. Holiday detectors and pinhole detectors for checking the painted surface discontinuities should be provided by the contractor.

The contractor shall make arrangements for paint manufacturer to provide expert technical service at site as and when required free of cost and without any obligation to the Owner, as it would be in the interest of the manufacturer to ensure that both surface preparation and application are carried out as per their recommendations.

Final inspection shall include measurement of paint dry film thickness, check of finish and workmanship.

6.2 Rub down and Touch Up of Primer

The shop coated surfaces shall be rubbed down thoroughly with emery paper to remove all dust, rust and other foreign matters, washed, degreased, then cleaned with warm fresh water and air dried.

The portions, from where the shop coat has peeled off, shall be touched up and allowed to dry before applying a coat of primer.

The compatibility between shop coat and field primer shall be ascertained from the paint manufacturer. In case degreasing with white spirit is not effective, the surface shall be finally wiped clean with aromatic solvent like xylol or light naphtha.

6.3 Non Compatible Shop Coat Primer

a) The compatibility of finishing coat shall be confirmed from the paint manufacturer. In the event of use of primer such as zinc rich epoxy, inorganic zinc silicate etc., the paint system shall depend on condition of shop coat. If the shop coat is in satisfactory condition showing no major defect, the shop coat shall not be removed. The touch up primer and finishing coat(s) shall be identified for application by Engineer. Shop coated (coated with primer & finishing coat) equipment shall not be repainted unless paint is damaged.

b) Shop primed equipment and surfaces shall only be 'spot cleaned' in damaged areas by means of power tool brush cleaning or hand tool cleaning and then spot primed before applying one coat of field primer unless otherwise specified. If shop primer is not compatible with field primer then shop coated primer shall be completely removed before application of selected paint system for particular environment. For package units/equipment, shop primer shall be as per the paint system given for particular environment.

c) In case of existing paint, compatibility between finishing coat and new selected finish coat shall be ascertained before application of finish coat. In case, the coat is selected for upgrading existing alkyd coating to high performance coating then, surface preparation shall be by manual/mechanical means to remove loose rust, peeled off/damaged paint, but sound old coating need not be removed. It shall be touched with suitable primer wherever it has peeled of before application of tie coat. The tie coat shall be applied after 7 days of curing of the primer. If, new paint system is not suitable to upgrade existing coating then complete paint shall be removed by mechanical or blast cleaning before application of new coating system.

6.4 Finish Paint

Suitable Finish paints as per the schedule shall be applied for the jobs. The color/shade shall be as approved by the Owner. After cleaning the dust on the dried up primer, first coat of finished paint shall be applied. After this first coat dries up hard, the surface is wet scrubbed cutting down to a smooth finish and ensuring that at no place the first coat is completely removed. After applying second coat, allowing the water to get evaporated completely, third finish coat of finish paint may be applied(if applicable).

7.0 Steel Structures Painting

Generally, all steel structures shall receive two primer coats and two finish coats of painting. First coat of primer shall be given in shop after fabrication before dispatch to erection site after surface preparation as described below. The second coat of primer shall be applied (if required) after erection and final alignment of the erected structures. Two finish coats shall also be applied after erection.

Steel surface which is to painted shall be cleaned off dust and grease and the heavier layers of rust shall be removed by chipping to grade ST-2 as per SIS05-5900 or as per IS: 1477 (part -I) prior to actual surface preparation. Suitable primer of required DFT shall be applied as specified in the Paint system of this document- Annex-1.

Suitable finish paint of required DFT shall be applied as specified in the Paint system of this document- Annex-1. The undercoat and finish coat shall be of different tint to distinguish the same from finish paint. All paints shall be of approved brand and shade as per the Owner's requirement.

Joints to be site welded shall have no paint applied within 100 mm of welding zone. Similarly where Friction grip fasteners are to be used no painting shall be provided. On completion of the joint the surfaces shall receive the paint as specified.

Surfaces inaccessible after assembly shall receive two coats of primer prior to assembly. Surfaces inaccessible after erection including top surfaces of floor beams supporting gratings or chequered plate shall receive one additional coat of finish paint over and above number of coats specified before erection. Portion of steel member embedded / to be encased in concrete shall not be painted.

8.0 Paint Materials

The paints shall conform to the specifications given in this Annex and class - 1 quality in the products range of any of the following manufacturers:

a. Asian Paints (India) Ltd.
b. Bombay Paints
c. Berger Paints India Ltd.,
d. Good lass Nerolac Paints Ltd.,
e. Garware Paints
f. Jenson & Nicholson
g. Shalimar Paints
h. Equivalent other country manufacturer after prior approval of Owner.

9.0 Storage

All paints and painting material shall be stored only in rooms to Engineer's approval. All necessary precautions shall be taken to prevent fire. The storage building shall preferably be separated from adjacent buildings. A signboard bearing the words "PAINT STORAGE - NO NAKED LIGHT - HIGHLY INFLAMMABLE - DANGER - NO SMOKING" shall be clearly displayed outside. All paints shall be stored in the safest manner so that no container rolls down and causes accidents. The shelf life of the paints shall be ensured so that the paint materials are not in storage and use after the date of expiry.

10.0 Application

Health and safety of work

The supplier has to check all painting work to be carried out according to the specification of the paint supplier further to all relevant prescriptions and regulations concerning the health and safety of work.

The paint supplier has to present a written specification including at least the flash point of the paints, ventilation requirements, handling precautions such as inhalation, eye and skin protection, and first aid procedure, storage requirements, spill or leak procedure, fire precaution, waste disposal.

Methods

Quality of the surface to be painted or coated has to be tested acc. to DIN 55928 and DIN 8202.

Temporary corrosion protections are to be completely removed prior to applying the definite one, in acc. with DIN 55928.

All prime coatings shall be applied by brush or airless spray or a combination of these methods, as approved by the coating manufacturer.

All doors, windows, stairways, handrails (if painted), bolts, flanges and equipment supports shall be finish painted by brush.

Spray guns should not be used outside in windy weather or near surfaces of a contrasting colour unless the latter is properly protected.

All cold-spray painting shall be done using standard equipment in accordance with accepted standards and methods.

Care has to be taken not to connect spraying devices for nitro and backelite paints simultaneously to oil based paints.

Paint applied to items that are not being painted shall be removed at the supplier's expense, leaving the surface clean, unstained and undamaged.

Dry film thickness (DFT)

To the maximum extent practicable the coats shall be applied as a continuous film of uniform thickness and free of pores. Overspray, skips, runs, sags and drips should be avoided. The different coats shall not be of the same colour.

For a composite paint or coating system consisting of several coats, the total DFT must be at least equal to the sum of the minimal DFT's for the individual coats. If, the paint system does not have the required minimum DFT those areas should be marked & repainted. If the occurrence of those areas is high, the complete surface must be repainted. It is also critically important to check the DFT of primers and intermediate coats and to correct them where necessary.

For paintings based on Zinc silicate the DFT is limited as well on minimum DFT as on maximum (150µm) because of the risk of mud cracking.

Consumption of paints

Has to be evaluated according to DIN 53220. The paints shall be tested as per IS - 101.

Each coat of paint shall be allowed to harden before the next is applied. For epoxy paint the hardening time normally is 12-14 hours. Suppliers' recommendations regarding hardening time of epoxy paints must be followed.

Particular attention must be paid to full film thickness at edges.

The minimum total dry film thickness of the paint systems shall be as recommended in the following tables below. The DFT is given in microns (millionths of a metre).

11.0 Protective coatings and paint systems

The colour coding for identification of pipelines should comply with IS-2379 & IS -9404.

The type and number of protective coats for any item requiring painting are to be in accordance with DIN 55928 and are to be at least of a quality as shown in the attached Annex-1- Paint System.

Alternative to the Annex-1- Paint System specified, are to be presented on the schedule Departure from Specification, as indicated elsewhere.

Generally, all parts shall receive the specified prime coat (s) at the supplier's works to ensure that no corrosion occurs during transport to the site and storage at the site.

Parts which cannot be damaged during transport shall receive the full number of coats.

Types of Substrate, Base metal:

- Ferrous (Surface Temperature during operation < 120º C, EN ISO 12944:1998)

  To this group belongs carbon steel, low alloyed steel & high alloyed steel. All paint systems are inevitable for corrosion protection.

- Hot dip galvanized surfaces.

  Hot dip galvanized surfaces do require painting in a wet, industrial, chemicals and/or marine environment

- SS (EN ISO 12944:1998 conditionally applicable)

  In general, SS surfaces do not require painting unless in a chemical and/or marine environment. In case of chemical and/or marine environments determination of whether or not the surface requires painting depends on the chemical content of the base metal.

  The following formula applies
  W = Cr + 3.3 x Mo + 22.45 N2

  If W < 23, then the surface has to be painted.

  If W < 28 & W > 23, then the surface to be painted if splash contact with the media (i.e. sea) is possible. This may also occur if there is a strong wind carrying drops to the surface.
  If W > 28, then the surface need not be painted.

- Aluminium

  By default such surfaces/components will not be painted. Exceptions are architectural/ aesthetic reasons and high corrosive conditions, which shall be evaluated separately depending on aluminum alloys.

12.0 Galvanizing

Galvanizing works shall conform in all respect to B.S. 729, B.S. 3083 and B.S.C.P. 2008 and to DIN 50976 whatever requires the higher quality and shall be performed by the hot dip process, unless otherwise specified.

It is essential that details of steel members and assemblies which are to be hot-dip galvanized should be designed in accordance with B.S 4479.

Vent-holes and drain-holes should be provided to avoid high internal pressures and air-locks during immersion, which may cause explosions, and to ensure that molten zinc is not retained in pockets during withdrawal.

Careful cleaning of welds is necessary before welded assemblies are dipped. The welds and the surrounding metal should be cleaned separately, preferably be blast-cleaning, because the usual preliminary pickling cannot be relied on to remove the welding slag.

All defects of the steel surface including cracks, surface laminations, laps and folds shall be removed in accordance with B.S. 4360. All drilling, cutting, welding, forming and final fabrication of unit members and assemblies shall be completed, where feasible, before the structures are galvanized. The surface of the steelwork to be galvanized shall be free from paint, oil, grease and similar contaminants in accordance with DIN 55928, part 4 and DIN 50976. The weight of zinc coating per unit area has to be noted in the manufacturing documents in accordance with DIN 50976.

The minimum average coating weight shall be as specified in Table 1 of B.S. 729 or Table 2, DIN 50976, whatever requires higher quality.

Structural steel items shall be initially grit-blasted to B.S. 4232, second quality, (Sa 21/2) or by pickling in a bath and the minimum average coating weight on steel sections 5 mm thick and over shall be 900 g/m^2.

On removal from the galvanizing bath, the resultant coating shall be smooth, continuous, free from gross surface imperfections such as bare spots, lumps, blisters and inclusions of flux, ash or dross.

Galvanized contact surfaces to be joined by high-tensile friction-grip bolts shall be roughened before assembly so that the required slip factor (defined in B.S. 3294, part 1 and B.S. 4604, part 1) is achieved. Care shall be taken to ensure that the roughening is confined to the area of the mating faces.

Bolts, nuts and washers, including general grade high-tensile friction grip bolts (referred to in B.S. 3139, and B.S.4395 part 1) shall be hot dip galvanized and subsequently centrifuged (according to B.S. 729). Nuts shall be tapped up to 0.4 mm oversize after galvanizing and the threads oiled to permit the nuts to be finger-turned on the bolt for the full depth of the nut. No lubricant, applied to the projecting threads of galvanized high-tensile friction-grip bolt after the bolt has been inserted through the steelwork, must be allowed to come into contact with the mating faces of the steelwork,. A local remelting of the galvanized parts to achieve the nuts to be finger turned on the bolt is possible in accordance with DIN 50976.

Protected slings must be used for offloading and erection. Galvanized work which is to be stored at the works or on site shall be stacked so as to provide adequate ventilation to all surfaces to avoid wet storage staining (white rust).

Small areas of the galvanized coating damaged in any way shall be restored in accordance with DIN 55928, part A and DIN 50976 by:

- Cleaning the area of any weld slag rust and other impurities and by thorough wire brushing to give a metallic clean surface.

- Application of suitable number of coats of zinc-rich paint containing more than 90 % w/w of zinc in dried film. The dry film thickness shall exceed at least 50 % the thickness of the desired galvanization. In case of application of a low melting point zinc alloy repair rod, the rods shall be in accordance with DIN1707, the thickness of the alloy shall be at least as of the desired galvanization.

The restored area is not to exceed 1 % of the galvanized surface.

Surface restoration of parts in contact with drinking water is not allowed and the quality of the galvanization is to be in accordance with DIN 2444.

After fixing, bolt heads, washers and nuts shall receive two coats of zinc-rich paint. Connections between galvanized surfaces and copper, copper alloy or aluminum surfaces shall be protected by suitable preferably hydrophobe tape wrappings to the owner's approval.

13.0 Sprayed Metal Coatings

Corrosion protection may be also achieved by spraying of suitable metals as zinc and/or aluminum on the surfaces of structures. For special cases tin, copper, lead can be used as well. Methods of surface preparation have to conform to B.S. 2569 or to DIN 8567. A proper treatment of the surface followed by an immediate spraying is to apply to ensure adhesion of the sprayed metal. The surface has to be clean, free of impurities, rust, mill scale and rough enough to have binding properties to ensure good enticulation with the sprayed layer. Suitable

roughness can be achieved by blast cleaning acc. to BS 4232 or DIN 8567. Welds are to be cleaned and prepared with special care. All surfaces to be treated have to be dry and accessible.

Application of coatings, requirements for thickness, adhesion, composition of coating metals, and subsequent treatment have to conform to BS 2569, DIN 8565 and 8567.

Testing of the spray coated layers are to be carried out in accordance with DIN 8565.

The contractor has to specify the type, composition and thickness of the sprayed metal and of the sealing coating according to DIN 8565 including the corresponding warranties and tests if, sprayed metal coating will be applied.

Safety of work:

All precautions connected with this type of application of corrosion protection have to be in accordance with German regulation DVS 2307, page 1. 2.

Sprayed, unfused coating of metals and metallic compounds applied by combustion gas flame, plasma arc, detonation and similar processes, and the preparation of components, spraying techniques, sealing, finishing and inspection shall be according to B.S. 4761.

The hot galvanized surface has to be cleaned before the application of the coats to remove corrosion products, dirt, dust, grease.

The cleaning can be achieved by

- brush off
- washing with 1 - 1.5 % ammonia water with up to 0.1 % detergent added and followed by wet grinding to turn the foam to grey color,
- steam blasting.

14.0 Warning Notes / Signals

This Instruction serves the identification of the coated surfaces that are received from shop in assembled condition / module wise.

The warning note shall prevent any possible damage to the coated surfaces during transportation / assembly at site.

Eg.: Welding work OR Heat treatment work on the outside of coated or lined surfaces is prohibited.

15.0 Colour Code for Piping

a. The colour code scheme is intended for identification of the individual group of the pipeline. The system of colour coding consists of a ground colour and colour bands superimposed on it. The colour coding for the identification of pipelines shall comply with **Annex – 1** of this specification.

   Ground Colour shall be applied throughout the entire length for un insulated pipes. For insulated pipes, on the metal cladding or on the pipes of material such as non-ferrous metals, austenitic stainless steel etc., ground colour coating of minimum 2m length or of adequate length not to be mistaken as colour band shall be applied at places requiring colour bands. Colour band(s) shall be applied at the following location.

   i. At battery limit points

   ii. Intersection points & change of direction points in piping ways.

iii. Other points, such as midway of each piping way, near valves, junction joints of service appliances, walls, on either side of pipe culverts.

iv. For long stretch/yard piping at 50 M interval.

v. At start and terminating points.

b. Flow direction shall be indicated by an arrow in the location stated above and as directed by Engineer. Colors of arrows shall be black or white and in contrast to the color on which they are superimposed. The size of the arrows shall confirm to IS:2379. Product names shall be marked at pump inlet, outlet and battery limit in a suitable size as approved by Engineer. As a rule minimum width of color band shall conform to 75 mm up to 300 NB and to 100 mm over 350 NB. Whenever it is required by the Engineer to indicate that a pipeline carries a hazardous material, a hazard marking of diagonal stripes of red and golden yellow as per IS:2379 shall be painted on the ground color.

c. All uninsulated piping systems, hangers and supports shall have two coats of suitable primer coats and with suitable finish paints as per Annexure-3 Painting system. Shades shall be as per IS 5 or as indicated by Owner /Engineer. Service of the pipe/line designations shall be painted on all pipes at visible locations.

16.0 Identification of Vessels, Piping etc.

Equipment number shall be stenciled in black or white on each vessel, column, equipment and machinery after painting.

Line number in black or white shall be stenciled on all the pipelines of more than one location as directed by Engineer; size of letters printed shall be 150 mm (high) for column & vessels. 50 mm (high) for pump compressor and other machinery and shall be as per IS: 9404 for piping. The storage tanks shall be marked as detailed in the respective drawing.

17.0 Inspection and Testing

a) All painting materials including primers and thinners brought to site for application shall be procured directly from manufacturer as per specifications and shall be accompanied by manufacturer's test certificates. Paint formulations without certificates are not acceptable. Engineer at his discretion, may call for tests for paint formulations. Contractor shall arrange to have such tests performed including batch wise test of wet paints for physical & chemical analysis. All costs thereof shall be borne by the contractor. The paints shall be tested as per IS: 101 / equivalent international standard and approved by the Owner.

b) The painting work shall be subject to inspection by Engineer at all times. In particular, following stage wise inspection shall be performed and contractor shall offer the work for inspection and approval of every stage before proceeding with the next stage. The record of inspection shall be maintained in the registers. Stages of inspection shall be surface preparation, primer application and each coat of paint. In addition to above, record shall include type of shop primer already applied on equipment e.g. red oxide zinc chromate or zinc phosphate or Silicate primer etc.

c) Any defect noticed during the various stages of inspection shall be rectified by the contractor to the entire satisfaction of Engineer before proceeding further. Irrespective of the inspection, repair and approval at intermediate stages of work, contractor shall be responsible for making good of any defects found during final inspection/guarantee period/defect liability period as defined in general condition of contract. Dry film thickness (DFT) shall be checked and recorded after application of each coat and extra coat of paint shall be applied to make-up the DFT specified without any extra coat to the Owner.

18.0 Guarantee

The contractor shall guarantee that the chemical and physical properties of paint materials used are in accordance with the specifications contained herein/to be provided during execution of work. The contractor shall produce test reports from the manufacturer regarding the quality of the particular batch of paint supplied. The Engineer shall have the right to test wet samples of paint at random for quality of the same. Batch test reports of the manufacturer's for each batch of paints supplied shall be made available by the contractor.

19.0 Standard Final Colour of Equipment and Piping

19.1 Standard Colour Code for Mechanical Equipment

Sl. No.	Description	Ground Colour
A	**Service Water System**	Sea Green
B	**Crane & Hoist**	
1	EOT crane	Canary Yellow
C	**Compressed Air Plant**	
1	Air compressor	Sky Blue
2	Compressed air dryer	Sky Blue
3	Air receiver	Sky Blue
D	**Chemical Dosing**	Dark Admiralty Grey
E	**Fire Protection System**	Fire red
F	**Air Conditioning and Ventilation System**	
1	Refrigerant compressor	Sky Blue
2	Chilled / condenser pumps	Sea Green
3	Condenser water pipe	Sea Green
4	Fans	Grey

Notes:

This color code basically refers to IS:2379 for piping with necessary modifications
For any item left out, color coding will be decided after Owner's approval.

19.2 Standard Colour Code for Electrical Equipment

1	Transformers	Olive grey for power transformers and pebble grey for service transformer	RAL 7002 for power transformers and RAL 7032 for service transformers
2	Bus ducts	pastel turquoise for indoor and olive grey for outdoor	indoor 6034 and outdoor 7002
3	Junction boxes.	Pebble grey	RAL 7032
4	HT/LT Switchboards, Distribution boards, Control & Relay panels		
	a) Indoor	Pebble grey	RAL 7032
	b) Outdoor	Pebble grey	RAL 7032
5	UPS Panel, charger panels	Light grey	Exterior RAL 7032 Interior Brilliant white

7	LT Motor	Pebble grey	RAL 7032
8	HT Motor	Pebble grey	RAL 7032
9	Lighting fittings	As per manufacturer's standard	As per manufacturer's standard
10	Cable trays	Galvanized	

1. For interior coating, manufacturer's standard can be adopted subject to Owner's approval.

2. All panels that are to be erected at control room shall be painted using RAL 7032 (exterior colour). All Electrical, C&I, Fire alarm or any other panel shall have this colour.

19.3 Colour Coding for Identification of Pipelines used in Thermal Power Plants/FGD plants

		Ground Shade		Band Shade		
Sl.No	**Medium**	**Color**	**Color No. as per IS:5**	**Color**	**Color No. as per IS:5**	**Remarks**
1	Water system					
a)	Untreated or raw / service	Sea green	217	White	-	White is not included in IS - 5-2007
b)	Treated/dematerialized	Sea green	217	Light orange	557	
c)	Potable water	Sea green	217	French blue	166	
d)	Service & clarified water	Sea green	217	French blue	166	
2	Steam system					
a)	Auxiliary steam	Aluminum	-	Signal red	537	with aluminum
3	Air system					
a)	Instrument	Sky Blue	101	White	-	
b)	Service/Plant	Sky Blue	101	White	-	White not included in IS-5 - 2007
c)	Vacuum pipes	Sky Blue	101	Black	-	Black not included in
4	Transformer oil	Light brown	410	Light orange	557	
5	Fire services	Fire red	536	-	-	-
6	Effluent pipes	Black	-	-	-	-

19.4 Colour Code for Structural Steel

SL. NO	ITEM/SERVICE	COLOR	COLOR No. as per IS:5
1	Gantry girder & monorail	Brilliant green	221
2	Gantry girder & monorail stopper	Signal red	537
3	Building structural steel columns brackets, beams bracings, roof truss, purloin, side grit, louvers, stringers	Dark admiralty grey	632
4	Pipe rack structure & trestle	Dark admiralty grey	632
5	Chequered plate (Plain Face)	Black	-
6	Grating	Black	-
7	Ladder	Dark admiralty grey	632
8	Hand railing Hand rail	Signal red	537
9	Middle rail	Signal red	537
10	Toe Plate	Signal red	537
11	Vertical post	Black	-
12	Structural steel for Silo	Smoke grey	692

Notes

1. Covering capacity and DFT depends on method of application. Covering capacity specified above is theoretical. Allowing the losses during application, min specified DFT shall be maintained.

2. All primers and finish coats shall be cold cured and air dried unless otherwise specified.

3. All paints shall conform to relevant Indian Standard and shall be applied in accordance with manufacturer's instructions for surface preparation, intervals, curing and application. The surface preparation, quality and workmanship shall be ensured.

4. Technical data sheets for all paints shall be supplied at the time of submission of quotations.

5. In case of use of epoxy tie coat, manufacturer shall demonstrate satisfactory test for inter coat adhesion. In case of limited availability of epoxy tie coat, alternate system may be used taking into consideration the service requirement of the system.

6. Contractor will submit the final colour shade for all equipments & piping under his scope for final approval by client / consultant.

Painting Systems						
Cleaning, Protective Coating and Painting. - Systems designed as per ISO 12944 with service life of 10 yrs.						
Surface/ Location	**Temp**	**Surface prep**	**Coat**	**No. of coats**	**Generic Type**	**Dft/Coat**
Structural Steel work, piping (Oil + Water), tanks outside surface, transmission towers cranes, steel floors, galleries, stairways, Outdoor.	< 130 Deg	SA 3	Primer	1	Solvent based IZS - VS of 60%. Zn Dust - 1.77 kg/ltr minimum. Zn dust by weight - minimum 85%. Pot life 12 hrs / 21 Deg.- Paint to meet compositional & performance specifications for SSPC Paint 20 , Level 1	75
			Touch up	1	Two component Zinc rich Primer meeting performance and compositional specifications of SSPC Paint 20 Level2	(75)
			Mid coat	1	2 pack High build High Solid Lamellar MIO based Epoxy Mid coat.	200
			Finish	1	2 pack Acrylic Aliphatic Polyurethane top coat - with Gloss retention of at least 90% on QUVB exposure of minimum 1000 hrs.	75
					Total	**350**
Surface/ Location	**Temp**					
Structural Steelwork, piping, indoor and outdoor	130 to 200 Deg	SA 3	Primer	1	Solvent based IZS - VS of 60%. Zn Dust - 1.77 kg/ltr minimum. Zn dust by weight - minimum 85%. Pot life 12 hrs / 21 Deg.- Paint to meet compositional & performance specifications for SSPC Paint 20 , Level 1.	75
			Touch up	1	Two component Zinc rich Primer meeting performance and compositional specifications of SSPC Paint 20 Level2	(75)
			Sealer	1	Single pack Heat Resistant Silicon Acrylic Finish paint.	25
			Finish	2	Single pack Heat Resistant Silicon Acrylic Finish paint.	25
					Total	**150**
Alternative -2		SA 3	Primer	1	Solvent based IZS - VS of 60%. Zn Dust - 1.77 kg/ltr minimum. Zn dust by weight - minimum 85%. Pot life 12 hrs / 21 Deg.- Paint to meet compositional & performance specifications for SSPC Paint 20 , Level 1.	75
				1	Single pack Moisture Cured, Inorganic Silicate based heat resisting finish up to 400 Deg - Grey shade./ white/ Aluminium.	50
			Finish	1		50
					Total	**175**

Surface/ Location	Temp	Surface prep	Coat	No. of coats	Generic Type	Dft/Coat
Alternative-3			Finish	1	Single pack Heat Resistant Silicon Acrylic Finish paint. - either Aviation White/ Aviation Orange.	80
					Total	**155**
Surface/ Location	**Temp**					
		Surface prep	Coat	No. of coats	Generic Type	Dft/Coat
Structural Steel work Piping, Un-insulated Carbon Steel Indoor and Outdoor	200 to 400 mmmm mDeg C.	SA 3	Primer	1	Solvent based IZS - VS of 60%. Zn Dust - 1.77 kg/ltr minimum. Zn dust by weight - minimum 85%. Pot life 12 hrs / 21 Deg.- Paint to meet compositional & performance specifications for SSPC Paint 20 , Level 1.	75
			Touch up	1	Two component Zinc rich Primer meeting performance and compositional specifications of SSPC Paint 20 Level 2.	(75)
			Finish	2	Heat Resisting Silicon Aluminium Paint. VS to be min 28%.	20
					Total	**115**
Structural Steel work, Piping (Oil + water) , Tanks Indoor.	<130 Deg.C	SA 3	Primer	1	Solvent based IZS - VS of 60%. Zn Dust - 1.77 kg/ltr minimum. Zn dust by weight - minimum 85%. Pot life 12 hrs / 21 Deg.- Paint to meet compositional & performance specifications for SSPC Paint 20 , Level 1.	75
			Touch up	1	Two component Zinc rich Primer meeting performance and compositional specifications of SSPC Paint 20 Level2	(75)
			Mid coat	2	2 pack High build High Solid Lamellar MIO based Epoxy Mid coat.	100
			Finish	2	Two component Polyamide Cured Epoxy Coating.	25
					Total	**325**
Surface/ Location	**Temp**					
Structural Steel work in the battery rooms, chlorination plant and water treatment plant, (extremely aggressive atmosphere)	Ambient	SA 3	Primer	1	Solvent based IZS - VS of 60%. Zn Dust - 1.77 kg/ltr minimum. Zn dust by weight - minimum 85%. Pot life 12 hrs / 21 Deg.- Paint to meet compositional & performance specifications for SSPC Paint 20 , Level 1	75
			Touch up		Two component Zinc rich Primer meeting performance and compositional specifications of SSPC Paint 20 Level2	(75)

Surface/ Location	Temp	Surface prep	Coat	No. of coats	Generic Type	Dft/Coat
			Mid coat	1	Two component, high build rust encapsulating, aluminium pigmented modified epoxy coating.	125
			Finish	1	Two component High Build high Solid Aliphatic Amine Cured Epoxy coating. - Min VS 85%	150
					Total	**350**
Steel Tanks inside Surface (Total) for Oil Storage	Normal	SA 2.5	Primer	1	Two component high build amine cured epoxy Primer with zinc phosphate pigment.	75
			Finish	2	Two component Self priming High Build Polyamine adduct cured epoxy coating.	125
					Total	**325**
Alternative-1			Finish	3	Two component Self priming High Build Polyamine adduct cured epoxy coating. **(No primer required. Self priming coating post blasting)**	125
					Total	**375**
Alternative-2			Finish	2	Two component High build high solid Solvent free epoxy coating - certified by CFTRI for Potable water usage.**(Primer same as above)**	150
					Total	**300**
Surface/ Location	**Temp**					
Steel Tanks inside Surface (Total) for Water Storage (Potable and Distilled Water)	Ambient	SA 3	Primer	1	Two component high build polyamide cured zinc phosphate Primer	75
			Finish	2	Two component Self priming High Build Polyamine adduct cured epoxy coating - certified by CFTRI for Potable water usage.	125
						325
Alternative 1			Finish	2	Two component High build high solid Solvent free epoxy coating - certified by CFTRI for Potable water usage. **(No primer required. Self priming coating post blasting)**	200
						400
Steelwork immersed in water such as inlet/	< 60 Deg C	SA 3	Primer	1	Two component High Build High Solid Rapid Curing Epoxy Zinc Phosphate Primer.	75

Surface/ Location	Temp	Surface prep	Coat	No. of coats	Generic Type	Dft/Coat
outlet structures, dolphins, sheet piling			Finish	1	Two component High build High Solid Modified Epoxy coating.	500
					Total	**575**
			Wherever TAR based product is not to be recommended.			
			Finish	1	Two component High build High Solid Modified Epoxy coating	500
					Total	**500**
			Finish	1	Two component High build High Solid Modified Epoxy coating with Glass Flake.	500
					Total	**500**
Alternative 1						
Cast Iron Water pipelines - Outside surface, buried in Soil	< 60 Deg C	SA 3	Primer	1	Solvent based IZS - VS of 60%. Zn Dust - 1.77 kg/ltr minimum. Zn dust by weight - minimum 85%. Pot life 12 hrs / 21 Deg.- Paint to meet compositional & performance specifications for SSPC Paint 20 , Level 1	75
			Finish	2	Polyamide Cured Coal Tar Epoxy, Vs min 65% black.	200
					Total	**475**
Alternate-1			Finish	1	Two component High build High Solid Modified Epoxy coating	500
Alternate -2			Finish	1	Two component High build High Solid Modified Epoxy coating with Glass Flake	500
Surface/ Location	**Temp**					
Steel Pipes - Inside surfaces such as cooling water lines.	< 60 Deg C	SA 3	Primer	1	Solvent based IZS - VS of 60%. Zn Dust - 1.77 kg/ltr minimum. Zn dust by weight - minimum 85%. Pot life 12 hrs / 21 Deg.- Paint to meet compositional & performance specifications for SSPC Paint 20 , Level 1.	75
			Finish	2	Coal Tar Epoxy, Vs min 65% black.	225
					Total	**525**
Water Pipelines - Outside Surface, Indoor	< 60 Deg C	SA 3	Primer	1	Solvent based IZS - VS of 60%. Zn Dust - 1.77 kg/ltr minimum. Zn dust by weight - minimum 85%. Pot life 12 hrs / 21 Deg.- Paint to meet compositional & performance specifications for SSPC Paint 20 , Level 1.	75

Surface/ Location	Temp	Surface prep	Coat	No. of coats	Generic Type	Dft/Coat
			Touch up	1	Two component Zinc rich Primer meeting performance and compositional specifications of SSPC Paint 20 Level2	(75)
			Finish	2	Two component High Build high Solid Aliphatic Amine Cured Epoxy coating. - Min VS 85%	100
					Total	**275**
Oil pipelines - Outside surface, above ground	< 100 Deg C	SA 3	Primer	1	Solvent based IZS - VS of 60%. Zn Dust - 1.77 kg/ltr minimum. Zn dust by weight - minimum 85%. Pot life 12 hrs / 21 Deg.- Paint to meet compositional & performance specifications for SSPC Paint 20 , Level 1.	75
			Touch up		Two component Zinc rich Primer meeting performance and compositional specifications of SSPC Paint 20 Level2	(75)
			Mid coat	2	Two component High Build high Solid Aliphatic Amine Cured Epoxy coating. - Min VS 85%	100
			Finish	1	2 pack Acrylic Aliphatic Polyurethane top coat - with Gloss retention of at least 90% on QUVB exposure of minimum 1000 hrs.	75
					Total	**350**
Surface/ Location	**Temp**					
Pumps, Motors, Turbine, Claddings, Steam Turbine Condenser, Indoor	Up to 90 Deg	SA 2.5	Primer	1	Catalysed Zn rich Primer with a VS of 60% min, complying to SSPC Paint 20 level 2.	75
			Finish	2	Two component High Build high Solid Aliphatic Amine Cured Epoxy coating. - Min VS 85%.	100
					Total	**275**
Alternative 1		SA 2.5	Primer	1	Catalysed Zn rich Primer with a VS of 60% min, complying to SSPC Paint 20 level 2.	75
			Mid coat	1	Two component High Build high Solid Aliphatic Amine Cured Epoxy coating. - Min VS 85%.	100
			Finish	2	2 pack Acrylic Aliphatic Polyurethane top coat - with Gloss retention of at least 90% on QUVB exposure of minimum 1000 hrs.	75

Surface/ Location	Temp	Surface prep	Coat	No. of coats	Generic Type	Dft/Coat
					Total	**250**
Heat Exchangers - Inside Surface.	Up to 60 Deg	SA 2.5	Primer	1	Solvent based IZS - VS of 60%. Zn Dust - 1.77 kg/ltr minimum. Zn dust by weight - minimum 85%. Pot life 12 hrs / 21 Deg.- Paint to meet compositional & performance specifications for SSPC Paint 20 , Level 1.	75
			Finish	2	Coal Tar Epoxy, Vs min 65% black.	200
					Total	**475**
Instrument panels, Electrical cubicles and similar steel sheet – indoor **(Can be used on Aluminium, steel, stainless steel and galvanized substrates.)**	Ambient	Oil grease and contamin atnts must be removed	Primer	1	Two pack , high build siloxane modified epoxy primer with zinc phosphate pigment.	75
			Mid coat	1	Two component High Build Surface Tolerant Epoxy coating pigmented with Aluminium and Lamellar Micaceous iron oxide	100
			Top coat	1	Two component High Build high Solid Aliphatic Amine Cured Epoxy coating. - Min VS 85%	100
					Total	**275**
Surface/ Location	**Temp**					
Instrument panels, Electrical cubicles and similar steel sheet – outdoor **(Can be used on Aluminium, steel, stainless steel and galvanized substrates.)**	Ambient	Oil grease and contamin atnts must be removed	Primer	1	Two pack , high build siloxane modified epoxy primer with zinc phosphate pigment.	100
			Mid coat	1	Two component High Build Surface Tolerant Epoxy coating pigmented with Aluminium and Lamellar Micaceous iron oxide.	150
			Top coat	1	2 pack Acrylic Aliphatic Polyurethane top coat - with Gloss retention of atleast 90% on QUVB exposure of minimum 1000 hrs.	75
					Total	**325**
Substrate, base metal: Carbon steel, HDG acc ISO 1461 Or. Equiv. Non Insulated. - Outdoor	<120 Deg	Air blasting with Nonmetallic	Touch up	1	Two component Zinc rich Primer meeting performance and compositional specifications of SSPC Paint 20 Level2	(75)
			Primer	1	Two pack , high build siloxane modified epoxy primer with zinc phosphate pigment.	50

Surface/ Location	Temp	Surface prep	Coat	No. of coats	Generic Type	Dft/Coat
		abrasive Powder	Mid coat	1	Two component High Build Surface Tolerant Epoxy coating pigmented with Aluminium and Lamellar Micaceous iron oxide	150
			Finish	1	2 pack Acrylic Aliphatic Polyurethane top coat - with Gloss retention of atleast 90% on QUVB exposure of minimum 1000 hrs.	75
					Total	**275**
Substrate, base metal: Carbon steel, HDG acc ISO 1461 Or. Equiv. Non Insulated.- Indoor	<120 Deg	Air blasting with Nonmetallic abrasive Powder	Touch up	1	Two component Zinc rich Primer meeting performance and compositional specifications of SSPC Paint 20 Level 2.	75
			Primer	1	Two pack, high build siloxane modified epoxy primer with zinc phosphate pigment.	125
			Finish	1	Two component High Build high Solid Aliphatic Amine Cured Epoxy coating. - Min VS 85%.	100
					Total	**225**
			For Outdoor Application			
			Touch up	1	Two component Zinc rich Primer meeting performance and compositional specifications of SSPC Paint 20 Level2	(75)
			Primer	1	Two pack , high build siloxane modified epoxy primer with zinc phosphate pigment.	125
			Finish	1	2 pack Acrylic Aliphatic Polyurethane top coat - with Gloss retention of at least 90% on QUVB exposure of minimum 1000 hrs.	75
					Total	**200**
			For Indoor Application			
Substrate, Stainless Steel - Non insulated.	< 120 Deg	Air blasting with Nonmetallic abrasive Powder	Primer	1	Two pack , high build siloxane modified epoxy primer with zinc phosphate pigment.	125
			Finish	1	Two component High Build high Solid Aliphatic Amine Cured Epoxy coating. - Min VS 85%	100
					Total	**225**
			For Outdoor Application			
			Primer	1	Two pack , high build siloxane modified epoxy primer with zinc phosphate pigment.	125

Surface/ Location	Temp	Surface prep	Coat	No. of coats	Generic Type	Dft/Coat
			Finish	1	2 pack Acrylic Aliphatic Polyurethane top coat - with Gloss retention of atleast 90% on QUVB exposure of minimum 1000 hrs.	75
					Total	**200**
Applicable for Water - Water Cooled heat Exchangers like Condensers, Flash box, Water - Water coolers etc. For Outdoor installations in corrosive atmosphere - like Chemical/ Marine.				**For Indoor Application**		
	< 120 Deg	Air blasting with Nonmetallic abrasive Powder	Primer	1	Two pack , high build siloxane modified epoxy primer with zinc phosphate pigment.	75
			Top coat	2	Two component High Build high Solid Aliphatic Amine Cured Epoxy coating. - Min VS 85%.	100
					Total	**275**
				For Outdoor Application		
			Primer	1	Two pack , high build siloxane modified epoxy primer with zinc phosphate pigment.	125
			Mid coat	1	Two component High Build high Solid Aliphatic Amine Cured Epoxy coating. - Min VS 85%.	100
			Top coat	1	2 pack Acrylic Aliphatic Polyurethane top coat - with Gloss retention of at least 90% on QUVB exposure of minimum 1000 hrs.	75
					Total	**300**

QUALITY PLAN

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO: PE-TS-485-154-A001	DATE:
		CUSTOMER: TANGEDCO		QP NO.: PE-QP-485-154-A001 REV-0	DATE:
		PROJECT: 1X800 MW NORTH CHENNAI FGD		PO NO.:	DATE:
		ITEM: CHEMICAL(NaOH) DOSING SYSTEM	SYSTEM: NaOH DOSING	SHEET 1 of 12	

SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY **			REMARKS
									M	B	C	
1	2	3	4	5	6	7	8	9				
1.0	**WELDER'S QUALIFICATION**											
1.1	WELDING PROCEDURE SPECIFICATION (WPS)	CORRECTNESS	MA	SCRUTINY	100%	ASME IX	ASME IX	QW 482	P	V	V	
1.2	WELDER PERFORMANCE & PROCEDURE QUALIFICATION RECORD	WELD SOUNDNESS & WELDING PERFORMANCE	MA	PHYSICAL TEST	ASME IX	ASME IX	ASME IX	QW 483 & QW 484	P	V	V	
2.0	**TANKS**											
2.1	**RAW MATERIAL:**											
2.1.1	PLATE	CHEMICAL. & PHY. PROPERTIES	MA	CHEM &.PHY TEST	1/PLATE/HT BATCH	ASTM A 240 GR.TP 304	ASTM A 240 GR.TP 304	MFG.TC/LAB REPORT	P	V	-	IDENTIFICATION BY BHEL

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		VARUN GOEL	Checked by:		ASHISH PANIGRAHI
Reviewed by:		JITENDRA PAL	Reviewed by:		HARISH KUMAR

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO: PE-TS-485-154-A001	DATE:
	CUSTOMER: TANGEDCO		QP NO.: PE-QP-485-154-A001 REV-0	DATE:
	PROJECT: 1X800 MW NORTH CHENNAI FGD		PO NO.:	DATE:
	ITEM: CHEMICAL(NaOH) DOSING SYSTEM	SYSTEM: NaOH DOSING	SHEET 2 of 12	

SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	**			
									M	B	C	
		IGC TEST	MI	IGC TEST	1/PLATE/HT BATCH	ASTM A 262 PR.'E'	ASTM A 262 PR.'E'	MFG.TC/LAB REPORT	P	V	-	
2.1.2	PIPE FOR NOZZLE	CHEMICAL. & PHY. PROPERTIES	MA	CHEM.& PHY.TEST	1/HT BATCH/SIZE	ASTM A 312 GR.TP 304	ASTM A 312 GR.TP 304	MFG.TC/LAB REPORT	P	V	-	
		MICRO STRUCTURE	MI	GRAIN STRUCTURE	1/HT BATCH/SIZE	FOR HEAT TREATMENT	FOR HEAT TREATMENT	MFG.TC/LAB REPORT	P	V	-	
		IGC TEST	MI	IGC TEST	1/HT BATCH/SIZE	ASTM A 262 PR.'E'	ASTM A 262 PR.'E'	MFG.TC/LAB REPORT	P	V	-	
		HYDRO TEST	MA	LEAKAGE	100%	NO LEAKAGE	NO LEAKAGE	MFG. TC/IR	P	V/ W	-	REFER NOTE 4

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		VARUN GOEL	Checked by:		ASHISH PANIGRAHI
Reviewed by:		JITENDRA PAL	Reviewed by:		HARISH KUMAR

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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Approved by:			

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO: PE-TS-485-154-A001	DATE:
		CUSTOMER: TANGEDCO		QP NO.: PE-QP-485-154-A001 REV-0	DATE:
		PROJECT: 1X800 MW NORTH CHENNAI FGD		PO NO.:	DATE:
		ITEM: CHEMICAL(NaOH) DOSING SYSTEM	SYSTEM: NaOH DOSING	SHEET 3 of 12	

SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	**			
									M	B	C	
2.1.3	FLANGES FOR TANKS	CHEMICAL & PHY PROPERTIES	MA	CHEM & PHY TEST	1/HT BATCH	ASTM A 182 GR. F 304	ASTM A 182 GR. F 304	MGF.TC/LAB REPORT	P	V	-	
2.2	**IN PROCESS**											
2.2.1	DISHED ENDS	DIMENSIONS	MI	MEASUREMENT WITH TEMPLATE	100%	APPD.DWG. (BY BHEL)	APPD.DWG. (BY BHEL)	IR	P	V	-	
		SURFACE DEFECTS ON WELDMENTS	MA	DP TEST	100%	ASTM E 165	NO SURFACE DEFECTS	IR	P	V	-	
2.3	**FINAL ASSEMBLY FOR TANKS:**	DIMENSIONS & ORIENTATION	MA	MEASUREMENT	100%	APPD.DWG. (BY BHEL)	APPD.DWG. (BY BHEL)	IR	P	W	V	TO BE OFFERED ALONG WITH FINAL SKID ASSEMBLY INSPECTION.
		LEAKAGE	MA	WATER FILL FOR 2 HR	100%	N.A.	NO LEAKAGE	IR	P	W	W	
3.0	**STIRRER:**											

BHEL					
ENGINEERING			QUALITY		
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Reviewed by:		JITENDRA PAL	Reviewed by:		HARISH KUMAR

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
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Reviewed by:			
Approved by:			

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO: PE-TS-485-154-A001	DATE:
	CUSTOMER: TANGEDCO		QP NO.: PE-QP-485-154-A001 REV-0	DATE:
	PROJECT: 1X800 MW NORTH CHENNAI FGD		PO NO.:	DATE:
	ITEM: CHEMICAL(NaOH) DOSING SYSTEM	SYSTEM: NaOH DOSING	SHEET 4 of 12	

SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	**			
									M	B	C	
3.1	RAW MATERIAL FOR SHAFT	CHEM.& PHY. PROPERTIES	MA	CHEM &.PHY TEST	1/BAR	ASTM A 479 GR.TP 304	ASTM A 479 GR.TP 304	MFG.TC/LAB REPORT	P	V	-	
		IGC TEST	MA	IGC TEST	1/HT BATCH	ASTM A 262 PR.'E'	ASTM A 262 PR.'E'	MFG.TC/LAB REPORT	P	V	-	
3.2	IMPELLER	CHEMICAL PROP.	MA	CHEMICAL TEST	1/PLATE	ASTM A 240 GR.TP 316	ASTM A 240 GR.TP 316	MFG.TC/LAB REPORT	P	V	-	
3.3	COMPLETE STIRRER UNIT WITH MOTOR	PERFORMANCE IN WATER FILLED TANK										
		- VIBRATION	MA	MEASUREMENT	100%	IS:10816	IS:10816	MFG.TC	P	V	-	
		- WOBBLING	MA	VISUAL	100%	NO WOBBLING	NO WOBBLING	MFG.TC	P	V	-	
		- POWER CONSUMPTION/ CURRENT DRAWN	MA	MEASUREMENT	100%	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC	P	V	-	
4.0	**MOTORS:**	ROUTINE TEST, TYPE TEST, DEGREE OF PROTECTION	MA	MFG. TC	100%	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MANUFACTURER'S COC	P	V	-	

BHEL					
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Reviewed by:		JITENDRA PAL	Reviewed by:		HARISH KUMAR

BIDDER/ SUPPLIER	
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MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO: PE-TS-485-154-A001	DATE:
	CUSTOMER: TANGEDCO		QP NO.: PE-QP-485-154-A001 REV-0	DATE:
	PROJECT: 1X800 MW NORTH CHENNAI FGD		PO NO.:	DATE:
	ITEM: CHEMICAL(NaOH) DOSING SYSTEM	SYSTEM: NaOH DOSING	SHEET 5 of 12	

SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY **			REMARKS
									M	B	C	
1	2	3	4	5	6	7	8	9				
5.0	**METERING PUMP:**											
5.1	**RAW MATERIAL :**											
5.1.1	WETTED PARTS	CHEM & PHY. PROPERTIES	MA	CHEM. & PHY. TEST	1/BAR	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MFG.TC/LAB REPORT	P	V	-	
		SURFACE TEST	MI	UT ON BAR>25 MM DIA	100%	ASTM A 388	REF. NOTE # 1	MFG.TC/LAB REPORT	P	V	-	
				DP ON M/C SURFACE	100%	ASME - E - 165	NO SURFACE DEFECTS	MFG.TC/LAB REPORT	P	V	-	
5.2	**FINAL INSPECTION**											
5.2.1	PUMP WITH MOTOR	LINEARITY	MA	PERFORMANCE	100%	API 675	API 675	INSPECTION REPORT	P	W	V	
		STEADY STATE ACCURACY	MA	SHOP TEST	100%	API 675	API 675	INSPECTION REPORT	P	W	V	SHALL BE TESTED WITH EITHER JOB MOTOR OR SHOP

BHEL					
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Sign & Date	
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MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO: PE-TS-485-154-A001	DATE:
	CUSTOMER: TANGEDCO		QP NO.: PE-QP-485-154-A001 REV-0	DATE:
	PROJECT: 1X800 MW NORTH CHENNAI FGD		PO NO.:	DATE:
	ITEM: CHEMICAL(NaOH) DOSING SYSTEM	SYSTEM: NaOH DOSING	SHEET 6 of 12	

SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY **			REMARKS
									M	B	C	
1	2	3	4	5	6	7	8	9				
		REPEATABILITY	MA	SHOP TEST	100%	API 675	API 675	INSPECTION REPORT	P	W	V	MOTOR OF SIMILAR FRAME SIZE
		POWER DRAWN @ 100% STROKE	MA	MEASURED AT WORK	100%	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	INSPECTION REPORT	P	W	V	
		LEAKAGE	MA	HYDRO TEST	100%	@1.5X MAXIMUM ALLOWABLE WORKING PRESSURE	NO LEAKAGE	INSPECTION REPORT	P	W	V	
		DIMENSIONS	MA	MEASUREMENT	100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P	W	V	
		NOISE	MA	MEASUREMENT	100%	--	< 85 dbA AT 1 M RADIUS	INSPECTION REPORT	P	W	V	
		VIBRATION	MA	MEASUREMENT	100%	--	≤45 MICRONS (PEAK TO PEAK)	INSPECTION REPORT	P	W	V	
7.0	**PRESSURE RELIEF VALVE**	MTC, DIM, SET PRESSURE, LEAKAGE TEST	MA	MFG. TC	100%	BHEL APPD.DATA SHEET & API	BHEL APPD.DATA SHEET & API RP-520	MANUFACTURER'S COC	P	V	-	

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No:			
	Sign & Date	Name		Sign & Date	Name	Seal			Sign & Date	Name	Seal
Prepared by:		VARUN GOEL	Checked by:		ASHISH PANIGRAHI			Reviewed by:			
Reviewed by:		JITENDRA PAL	Reviewed by:		HARISH KUMAR			Approved by:			

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO: PE-TS-485-154-A001	DATE:
	CUSTOMER: TANGEDCO		QP NO.: PE-QP-485-154-A001 REV-0	DATE:
	PROJECT: 1X800 MW NORTH CHENNAI FGD		PO NO.:	DATE:
	ITEM: CHEMICAL(NaOH) DOSING SYSTEM	SYSTEM: NaOH DOSING	SHEET 7 of 12	

SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	**			
									M	B	C	
						RP-520						
8	**VALVES (GATE, GLOBE & NRV)**	MTC, DIM, LEAKAGE TEST	MA	MFG. TC	100%	BHEL APPD.DATA SHEET & API RP-520	BHEL APPD.DATA SHEET & API RP-520	MANUFACTURER'S COC	P	V	-	
9.0	**FITTING/FLANGES FOR PIPING:**											
9.1	RAW MATERIAL	CHEM.& PHY PRPERTIES	MA	CHEM.& PHY TEST	1/HT BATCH	ASTM A 182 GR.TP 304	ASTM A 182 GR.TP 304	MFG.TC/LAB REPORT	P	V	-	
		HEAT TREATMENT	MA	HEAT TREATMENT	100%	ASTM A 182 GR.TP 304	ASTM A 182 GR.TP 304	MFG.TC/LAB REPORT	P	V	-	
		IGC TEST	MI	IGC TEST	1/HT BATCH	ASTM A 262 PR. 'E'	ASTM A 262 PR. 'E'	MFG.TC/LAB REPORT	P	V	-	
9.2	FINAL INSPECTION	DIMENSIONS	MI	MEASUREMENT	100%	BHEL APPD.DATA SHEET/DWG/ ANSI B 16.11/16.5	BHEL APPD.DATA SHEET/DWG/ ANSI B 16.11/16.5	MFG.TC	P	V	V	

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		VARUN GOEL	Checked by:		ASHISH PANIGRAHI
Reviewed by:		JITENDRA PAL	Reviewed by:		HARISH KUMAR

BIDDER/ SUPPLIER	
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MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO: PE-TS-485-154-A001	DATE:
	CUSTOMER: TANGEDCO		QP NO.: PE-QP-485-154-A001 REV-0	DATE:
	PROJECT: 1X800 MW NORTH CHENNAI FGD		PO NO.:	DATE:
	ITEM: CHEMICAL(NaOH) DOSING SYSTEM	SYSTEM: NaOH DOSING	SHEET 8 of 12	

SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY **			REMARKS
									M	B	C	
1	2	3	4	5	6	7	8	9				
10.0	**STRAINERS :**	MTC, DIMENSION, LEAKAGE, MESH SIZE	MA	MFG. TC	1/BAR/SIZE	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MANUFACTURER'S COC	P	V	-	
11.0	**PIPE (SEAMLESS)**											
11.1	MATERIAL	CHEMICAL	MA	CHEMICAL	1/HT BATCH/SIZE	ASTM A 312 GR.TP 304	ASTM A 312 GR.TP 304	MFG.TC/LAB REPORT	P	V	-	
		MECHANICAL TEST	MA	MECHANICAL TEST	1/HT BATCH/SIZE	ASTM A 312 GR.TP 304	ASTM A 312 GR.TP 304	MFG.TC/LAB REPORT	P	V	-	
		MICRO STRUCTURE	MI	GRAINS STRUCTURE	1/HT BATCH/SIZE	FOR HEAT TREATMENT	FOR HEAT TREATMENT	MFG.TC/LAB REPORT	P	V	-	IDENTIFICATION BY BHEL. REFER NOTE 4.
		IGC TEST	MI	IGC TEST	1/HT BATCH/SIZE	ASTM A 262 PR 'E'	ASTM A 262 PR 'E'	MFG.TC/LAB REPORT	P	V	-	
		HYDRO TEST	MA	LEAKAGE	100%	NO LEAKAGE	NO LEAKAGE	MFG.TC/IR	P	V/ W	-	
12.0	**LEVEL GAUGE :**	MTC, DIMENSION, LEAKAGE	MA	MFG. TC	100%	BHEL APPD.DATA SHEET & API	BHEL APPD.DATA SHEET & API RP-520	MANUFACTURER'S COC	P	V	-	

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No:			
	Sign & Date	Name		Sign & Date	Name	Seal			Sign & Date	Name	Seal
Prepared by:		VARUN GOEL	Checked by:		ASHISH PANIGRAHI			Reviewed by:			
Reviewed by:		JITENDRA PAL	Reviewed by:		HARISH KUMAR			Approved by:			

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO: PE-TS-485-154-A001	DATE:
		CUSTOMER: TANGEDCO		QP NO.: PE-QP-485-154-A001 REV-0	DATE:
		PROJECT: 1X800 MW NORTH CHENNAI FGD		PO NO.:	DATE:
		ITEM: CHEMICAL(NaOH) DOSING SYSTEM	SYSTEM: NaOH DOSING	SHEET 9 of 12	

SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	**			
									M	B	C	
						RP-520						
13.0	**PRESSURE & DP GAUGE**	MTC, DIM.,ACCURACY & OVERLOAD PROTECTION	MA	MFG. TC	1/BAR/SIZE	BHEL APPD.DATA SHEET	BHEL APPD.DATA SHEET	MANUFACTURER'S COC	P	V	-	INSTRUMENTS AS APPLICABLE FOR THE MODULE ORDERED SHALL BE CONSIDERED.
14.0	**SWITCHES (LEVEL, PRESURE & DP) & TRANSMITTERS (LEVEL, PRESSURE & DP):**	MTC, FUNCTIONAL, IR-HV-IR, DIM., DEGREE OF PROTECTION	MA	MFG. TC	100%	BHEL APPD.DATA SHEET & API RP-520	BHEL APPD.DATA SHEET & API RP-520	MANUFACTURER'S COC	P	V	-	
15.0	**CONTROL PANEL:**	DIMENSIONS	MA	MEASUREMENT	100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P	W	W	CONTOL PANEL TEST TO BE OFFERED ALONG WITH FINAL SKID ASSEMBLY.
		CONTINUITY, IR-HV-IR	MA	ELECTRICAL	100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P	W	W	
		VERIFICATION OF MAKE	MA		100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P	W	W	

BHEL					
ENGINEERING			QUALITY		
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Prepared by:		VARUN GOEL	Checked by:		ASHISH PANIGRAHI
Reviewed by:		JITENDRA PAL	Reviewed by:		HARISH KUMAR

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO: PE-TS-485-154-A001	DATE:
	CUSTOMER: TANGEDCO		QP NO.: PE-QP-485-154-A001 REV-0	DATE:
	PROJECT: 1X800 MW NORTH CHENNAI FGD		PO NO.:	DATE:
	ITEM: CHEMICAL(NaOH) DOSING SYSTEM	SYSTEM: NaOH DOSING	SHEET 10 of 12	

SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY **			REMARKS
									M	B	C	
1	2	3	4	5	6	7	8	9				
		RATING OF COMPONENTS	MA		100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P	W	W	
		PAINT SHADES, THICKNESS	MA		100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P	W	W	
		ADHESION	MA		100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P	W	W	
		DEGREE OF PROTECTION	MI	VERIFICATION OF TYPE TEST CERTIFICATE	TYPE TEST	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	MFG.TC/LAB REPORT	P	V	V	
16.0	**COMPLETE SKID ASSEMBLY:**	DIMENSIONS & ORIENTATION	CR	MEASUREMENT	100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P	W	W	
		LEAKAGE, CHECK ON WELDMENTS	CR	VISUAL & HYDRO TEST	100%	DISCH.PIPING - 1.5 x DISCH PR. OF PUMP, SUCTION PIPING -10 KG/CM2	NO LEAKAGE	INSPECTION REPORT	P	W	W	REFER NOTE 7

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		VARUN GOEL	Checked by:		ASHISH PANIGRAHI
Reviewed by:		JITENDRA PAL	Reviewed by:		HARISH KUMAR

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
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Approved by:			

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO: PE-TS-485-154-A001	DATE:
	CUSTOMER: TANGEDCO		QP NO.: PE-QP-485-154-A001 REV-0	DATE:
	PROJECT: 1X800 MW NORTH CHENNAI FGD		PO NO.:	DATE:
	ITEM: CHEMICAL(NaOH) DOSING SYSTEM	SYSTEM: NaOH DOSING	SHEET 11 of 12	

SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY **			REMARKS
									M	B	C	
1	2	3	4	5	6	7	8	9				
		FUNCTIONAL TEST FOR INTERLOCKS	MA	VISUAL	100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P	W	W	REFER NOTE 8
	PMI Test for SS	GRADE CONFIRMATION	MA	CHEM.TEST	100%	BHEL APPD.DATA SHEET/DWG	BHEL APPD.DATA SHEET/DWG	INSPECTION REPORT	P	W	W	
		PAINTING	MA	VISUAL & MEASUREMENT	100%	BHEL APPD PAINTING SCHEME	APPD DWG/PAINTING	INSPECTION REPORT	P	W	W	
17.0	**PACKING**	TRACEABILITY OF MATERIAL	MI	VISUAL	100%	TECH SPEC.	TECH SPEC.	INSPECTION REPORT	P	V/ W	-	V – FOR DOMESTIC JOBS. W – FOR EXPORT JOBS

NOTE-1) WHEN BACK WALL ECHO IS SET TO 100% OF FSH IN SOUND AREA, DEFECT ECHO SHALL NOT EXCEED 20% OF FSH. MAX BACH WALL ECHO IS 20% OF FSH. TOTAL NO OF DEFECTS SHALL BE MAX. 5 NO IN ONE METER LENGTH. MIN DISTANCE BETWEEN TWO DEFECTS SHALL BE 3 TIMES THE DIA OF BAR.

NOTE-2) FOR PIPES PURCHASED DIRECTLY FROM MANUFACTURER'S OR AUTHORIZED DEALERS, APART FROM TC REVIEW, CHECK WILL BE AS PER CLAUSE 2.1.2 AND 10.0; HOWEVER, FOR HYDRAULIC TEST, MANUFACTURER TC SHALL BE REVIEWED. IN CASE ON IMPORTED PIPES PURCHASED FROM OPEN MARKET, TEST SHALL BE PERFORMED AS PER CLAUSE 2.1.2 AND 10.0 (INCLUDING HYDRAULIC TEST).

NOTE-3) FOR RAW MATERIAL (BARS/PIPES/CASTINGS/FORGINGS) WHERE HEAT TREATMENT ARE CARRIED OUT BY MATERIAL PRODUCERS ON BULK QUANTITIES, THEIR TEST CERTIFICATE SHALL BE REVIEWED (EXCEPT TIME TEMPERATURE CHART)

NOTE-4) NDT REQUIREMENT ON WELDING (TANK, PIPE, BREATHER/WATER SEAL/CO2 ABSORBER) SHALL BE AS -- A) ON BUTT WELD-- 25% DP & 25% RT FOR PUMP SUCTION SIDE & 100% DP & 100% RT FOR PUMP DISCHARGE SIDE. B) ON FILLET WELD--100% DP TEST. NDT TESTS MENTIONED IN NOTE 6) SHALL BE PERFORMED BY VENDOR AND REVIEWED BY BHEL/CUSTOMER.

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		VARUN GOEL	Checked by:		ASHISH PANIGRAHI
Reviewed by:		JITENDRA PAL	Reviewed by:		HARISH KUMAR

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO: PE-TS-485-154-A001	DATE:
		CUSTOMER: TANGEDCO		QP NO.: PE-QP-485-154-A001 REV-0	DATE:
		PROJECT: 1X800 MW NORTH CHENNAI FGD		PO NO.:	DATE:
		ITEM: CHEMICAL(NaOH) DOSING SYSTEM	SYSTEM: NaOH DOSING	SHEET 12 of 12	

SL NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	**			
									M	B	C	

NOTE-5) LEAKGE, CHECK ON WELDMENTS CAN BE CONDUCTED EITHER WITH COMPLETE SKID ASSEMBLY OR SUCTION & DISCHARGE PIPE ASSEMBLY SEPARATELY.

NOTE-6) DUE TO THE UNAVAILABILITY OF DCS SYSTEM VENDOR TO OFFER SAMPLING FUNCTIONAL INTERLOCK FOR THE PUMP ACTUATOR AS PER THE FOLLOWING METHOD-
A. WORKING OF ACTUATOR TO BE INTIATED BY THE DCS 4-20 mA SIGNALS HENCE 4-20 mA SOURCE TO BE USED AS A DCS SYSTEM.
B. FOR THE SOURCE EXTERNAL 230V AC SUPPLY TO BE PROVIDED, TWO WIRED FEEDBACK SIGNAL CONNECTION SHOULD BE TERMINATED IN THE CONTROL PANEL.
C. CONTROLLER TO BE INSTALLED IN THE CONTROL PANEL AND THE FEEDBACK SIGNALING TERMINATION TO BE DONE AS PER THE DRAWING, EXTERNAL 230 V AC SUPPLY FOR THE CONTROLLER TO BE PROVIDED TO INTIATE THE DISPLAY.
D. AFTER ABOVE ACTIVITY, SIGNAL OF 4-20 mA FROM SOURCE SHALL BE PROVIDED TO CONTROLLER. STROKE WILL BE DISPLAYED ON THE CONTROLLER AS PER THE LINEAR ACTUATION OF PUMP STROKE.

LEGENDS:

*RECORDS, INDENTIFIED WITH "TICK"(√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION,

** M: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, B: MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, C: CUSTOMER,

P: PERFORM, W: WITNESS, V: VERIFICATION, AS APPROPRIATE,

MA: MAJOR, MI: MINOR, CR: CRITICAL

IR: INTERNAL REPORT D: DOCUMENTATION MTC: MANUFACTURER'S TEST CERTIFICATE

RT: RADIOGRAPHY TEST UT: ULTRASONIC TEST DPT: DIE PENETRANT TEST MPI: MAGNETIC PARTICLE INSPECTION

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		VARUN GOEL	Checked by:		ASHISH PANIGRAHI
Reviewed by:		JITENDRA PAL	Reviewed by:		HARISH KUMAR

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

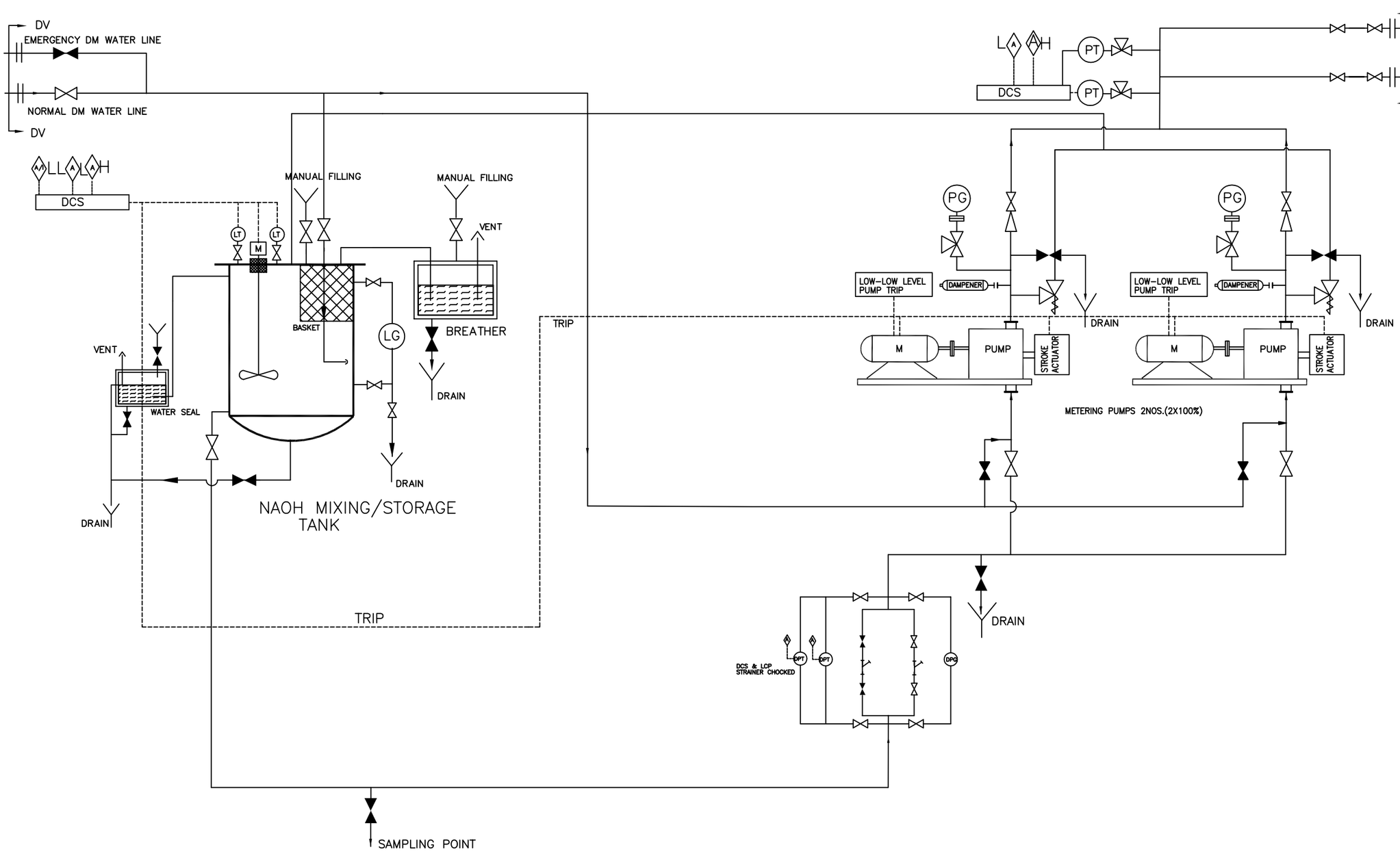
FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

DATA SHEET-A

SL.No.	Description	NaOH
1.0	No. of skid	One (1) for entire Plant.
2.0	**Mixing cum storage tank**	
2.1	No. of tanks per Skid	One
2.2	Capacity in litres	500
2.3	Type	Vertical cylindrical, Bottom Dished end
2.4	Material of the tank	SS-316
2.5	Thickness	6 mm
2.6	Motorised Stirrer	Provided with reduction gear for 200 RPM.
2.7	Dissolving basket	Provided (30 mesh B.S.) of SS 316.
2.8	Type of agitator	Motor operated
2.9	Instrument	Refer P&ID.
3.0	**METERING PUMP**	
3.1	Quantity	2 Nos (1W+1S)
3.2	Type	Positive displacement (Plunger type) metering pump.
3.3	Capacity and Head	10 LPH and 10 kg/cm2
3.4	MOC	All wetted part SS 316.
3.5	NRV and PRV	1 No per pump shall be provided.
4.0	**Piping:**	
4.1	Material & rating	SS-316 (Sch 40 min)
3.2	Diameter	25 NB
5.0	**Valves:**	
5.1	Body Material	SS-316
5.2	Weld ends	Socket weld ends
6.0	**Fittings & Flanges**	**SS 316, CL 300**
7.0	**Structural steel**	**MOC: IS 2062**
8.0	**Ladder and platform (with Chequered Plate)**	**Shall be provided to reach top of tank and chemical filling**
9.0	**Nuts/Bolts/Fasteners**	**MOC: Stainless Steel.**

DRAWING

(P&ID FOR NaOH DOSING SYSTEM)



	LEGEND
	METERING PUMP
	PUMP MOTOR
	GATE VALVE NORMALLY OPEN
	GATE VALVE NORMALLY CLOSED
	NON RETURN VALVE
	MULTI VALVE MANIFOLD
	PRESSURE RELIEF VALVE
	STUFFING BOX
	VENT TO ATMOSPHERE
	FUNNEL
PG	PRESSURE GAUGE
LG	LEVEL GAUGE
M	STIRRER MOTOR
	CHEMICAL SEAL DIAPHRAGM
LT	LEVEL TRANSMITTER
	Y-TYPE STRAINER
DPT	DIFFERENTIAL PRESSURE TRANSMITTER
DPG	DIFFERENTIAL PRESSURE GAUGE
PT	PRESSURE TRANSMITTER
	STIRRER
	INTERLOCK
	ALARM
DV	DOSING VENDOR

NOTES: –

1 THE DOSING SYSTEM INCLUDING ITS LOCAL CONTROL PANEL SHALL BE SKID MOUNTED.
2 ALL DRAINS SHALL BE CONNECTED VIA FUNNELS TO MAIN DRAIN HEADER AND TERMINATED AT ONE POINT ON SKID.
3. COUNTER FLANGES SHALL BE PROVIDED AT SKID INLET & OUTLET TERMINAL POINTS.
4. THIS SCHEME IS FOR ONE UNIT (01 NO. SKID PER UNIT).
5. EFFECTIVE CAPACITY IS THE CAPACITY BETWEEN OVERFLOW LEVEL & LOW LEVEL SET POINT.
6. LEVEL TRANSMITTERS SHALL BE OF ULTRASONIC TYPE LT.

REV.	DATE	ALTD -SD-	CHD -SD-	APPD -SD-	REV.	DATE	ALTD -SD-	CHD -SD-	APPD -SD-	REV.	DATE	ALTD -SD-	CHD -SD-	APPD -SD-
					02					01	29.10.13			

PROJECT: 1 x 800 MW NCTPP Stage-III FGD System & Auxiliaries Chennai, TAMILNADU

OWNER: TAMILNADU GENERATION AND DISTRIBUTION CORPORATION LTD.(TANGEDCO)

OWNER'S CONSULTANT: FICHTNER INDIA

JOB NO. 485
STATUS CONTRACT
DISTRIBUTION

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA

DEPT CODE		NAME	SIGN	DATE
M	DRN	AR		
	DESN	AR		
	CHD	RN		
	APPD	SB		

TITLE: P & ID FOR NAOH DOSING SYSTEM

DEPT. SCALE NONE
DRAWING NO. PE-DG-485-154-A001
SIGN
SHEET REV. 00
SIZE-A0

SECTION – C2
SPECIFIC TECHNICAL REQUIREMENTS (ELECTRICAL)

SPECIFIC TECHNICAL REQUIREMENTS: ELECTRICAL

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER/ PURCHASER

a) Services and equipment as per "Electrical Scope between BHEL and Vendor".

b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.

c) Supply of mandatory spares as specified in the specifications of mechanical equipments.

d) Electrical load requirement for **NAOH DOSING SYSTEM** (all AC & DC load at different voltage levels like 415V AC, 240 V AC, 220 V DC etc).

e) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.

f) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer/BHEL approval without any commercial and delivery implications to BHEL.

g) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.

h) Motor shall meet minimum requirement of motor specification.

i) Vendor to clearly indicate equipment locations and local routing lengths in their cable listing furnished to BHEL.

j) Cable BOQ worked out based on routing of cable listing provided by the vendor for "both end equipment in vendor's scope" shall be binding to the vendor with +10 % margin to take care of slight variation in routing length & wastages.

2.0 EQUIPMENT & SERVICES TO BE PROVIDED BY PURCHASER FOR ELECTRICAL & TERMINAL POINTS:

Refer "Electrical Scope between BHEL and Vendor".

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

3.1 The electrical specification without any deviation from the technical/ quality assurance requirements stipulated shall be deemed to be complied by the bidder in case bidder furnishes the overall compliance of package technical specification in the form of compliance certificate/ No deviation certificate.

3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer.

4.0 LIST OF ENCLOSURES

4.1 Electrical Scope Between BHEL & Vendor (Annexure-I).

4.2 Electrical Load Data Format (Annexure-II).

4.3 Cable Schedule Format (Annexure-III).

4.4 Technical Requirements-Motors.

4.5 Data Sheet-A & C

4.6 Standard Quality Plan.

4.7 Technical Requirements –Earthing & Lightning Protection System

4.8 Technical Requirements- Cabling Accessories

4.9 Motor Sub Vendor List

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR FOR SKID MOUNTED SYSTEM (FOR EPC PROJECTS)

PACKAGE : NAOH DOSING SYSTEM
SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT
PROJECT: 1X800MW TANGEDCO NORTH CHENNAI TPP STAGE-III (FGD SYSTEM & AUXALIRIES)

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	415V MCC	BHEL	BHEL	240 V AC (supply feeder)/415 V, 3 phase, 4 wire AC supply shall be provided by BHEL. based on the load data provided by the vendor at contract stage for all equipment supplied by the vendor as part of contract. Any other voltage level (AC/DC) required will be derived by the vendor.
2	Local control panel	Vendor	Vendor*	Refer C & I specification for details
3	Local push buttons	Vendor	Vendor*	
4	Power cables, ordinary control cables and screened control cables	Vendor	Vendor*	Within the skid. If starters are in MCC, then outside skid, cables scope shall be as per note no. 1.
5	Junction box for control & instrumentation cable (if applicable)	Vendor	Vendor*	
6	Any special type of cable like compensating, co-axial, prefab, MICC & fibre optical	Vendor	Vendor*	Within the skid
7	Equipment grounding	Vendor	Vendor*	Within the skid. All equipment metallic enclosures / frames, metal structure etc. shall be grounded at two points each to the nearest grounding points / risers provided by BHEL.
8	Motors with base frame and fixing hardware for motors.	Vendor	Vendor*	Makes shall be subject to customer/ BHEL approval at contract stage.

STANDARD ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR FOR SKID MOUNTED SYSTEM (FOR EPC PROJECTS)

PACKAGE : NAOH DOSING SYSTEM
SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT
PROJECT: 1X800MW TANGEDCO NORTH CHENNAI TPP STAGE-III (FGD SYSTEM & AUXALIRIES)

9	Cable glands ,lugs and bimetallic strip for equipment supplied by Vendor	Vendor	Vendor*	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tinned copper lugs for power and control cables.
10	Below grade grounding	BHEL	BHEL	
11	a) Input cable schedules (C & I) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for Control and Instrumentation Cable in enclosed excel format shall be submitted by vendor during detailed engineering stage.
12	Electrical Equipment GA drawing & skid GA drawing	Vendor	-	For necessary interface review.

NOTES **:** - 1. If motor starters are provided in main MCC then BHEL will provide power & control cable including supply, laying & termination.
2. All QPs shall be subject to approval of BHEL/customer after award of contract without any commercial implication.

*E &C by vendor during factory assembling of the skid.

LOAD TITLE	RATING (KW / A)		UNIT (U)/STN (S)	Nos.		VOLTAGE CODE*	FEEDER CODE**	EMER. LOAD (Y)	CONT.(C)/ INTT.(I)	STARTING TIME >5 SEC (Y)	LOCATION	BOARD NO.	CABLE		BLOCK CABLE DRG. No.	CONTROL CODE	REMARKS	LOAD No.	VERIFICATION FROM MOTOR DATASHEET (Y/N)	KKS NO
	NAME PLATE	MAX. CONT. DEMAND (MCR)		RUNNING	STANDBY								SIZE CODE	NOs						
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
ANNEXURE-II																				

NOTES: 1. COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)/ CUSTOMER

2. ABBREVIATIONS : * VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=415 V, E=240 V (1 PH), F=110 V (cc): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V

: ** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTER CONTROLLED)

LOAD DATA (ELECTRICAL)	JOB NO.	485	ORIGINATING AGENCY		PEM (ELECTRICAL)
	PROJECT TITLE	1X800MW TANGEDCO NORTH CHENNAI TPP STAGE-III (FGD SYSTEM & AUXALIRIES)	NAME		DATA FILLED UP ON
	SYSTEM	NaOH DOSING SYSTEM	SIGN.		DATA ENTERED ON
	DEPTT. / SECTION	MAUX	SHEET 1 OF 1	REV. 00	DE'S SIGN. & DATE

CABLE SCHEDULE FORMAT

UNITCABLENO	FROM	TO	PURPOSE	CABLE SCOPE (BHEL PEM/ VENDOR)	REMARKS	CABLESIZE	PATHCABLENO	TENTATIVE CABLE LENGTH

Explanatory notes for filling up cable list for routing through WinPath, the cable routing program (developed by Corporate R&D) being used in PEM.

1. For the purpose of clarity, it may please be noted that the information given in regard to the cables to be routed through WinPath as per the system elaborated below is called "Cable List", while the term "Cable Schedule" applies to the cable list with routing information added after routing has been carried out.
2. The cable list shall be entered as an MS Excel file in the format as per enclosed template EXT_CAB_SCH_FORMAT.XLS. No blank lines, special characters, header, footer, lines, etc. shall be introduced in the file. No changes shall be made in the title line (first line) of the template.
3. The field properties shall be as under:
    a. UNITCABLENO: A/N, up to sixteen (16) characters; each cable shall have its own unique, unduplicated cable number. In case this rule is violated, the cable cannot be taken up for routing.
    b. FROM: A/N, up to sixty (60) characters; the "From" end equipment/ device description and location to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
    c. TO: A/N, up to sixty (60) characters; the "To" end equipment/ device description and location to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
    d. PURPOSE: A/N, up to sixty (60) characters; the purpose (i.e. power cable/ indication/ measurement, etc.) to be specified here. Information in excess of 60 characters will be truncated after 60 characters.
    e. REMARKS: A/N, up to forty (40) characters; Any information pertinent to routing to be specified here (e.g., cable number of the cable redundant to the cable number being entered). Information in excess of 40 characters will be truncated after 40 characters.
    f. CABLESIZE: A/N, 7 characters exactly as per the codes indicated below shall be specified here. The program cannot route cables described in any other way/ format.
    g. PATHCABLENO: Field reserved for utilization by the program. User shall not enter any information here.
4. One list shall be prepared for each system/ equipment (i.e., separate and unique cable lists shall be prepared for each system).
5. The cables shall be described as per the scheme listed below:

A	NN	A	NNN
|	|	|	|
Cable Voltage Code (see B below)	No. of cores (e.g. 01,03,3H, 07)	Cable code (See C below)	Cable size (e.g. 035,185,2.5, 0.5)

(A) SYSTEM VOLTAGE CODES:
(ac) A = 11KV, B = 6.6KV, C = 3.3KV, D = 415V, E = 240V, F = 110V
(dc) G = 220V, H = 110V, J = 48V, K = +24V, L = -24V

(B) CABLE VOLTAGE CODES:
A = 11KV (Power cables)

Explanatory notes for filling up cable list for routing through WinPath, the cable routing program (developed by Corporate R&D) being used in PEM.

B = 6.6KV (Power cables)
C = 3.3KV (Power cables)
D = 1.1KV (LV & DC system power & control cables)
E = 0.6KV (0.5 sq. mm. Control cables)

(C) CABLE CODES

PVC Copper

A = Armoured FRLS	B = Armoured Non-FRLS
C = unarmoured FRLS	D = Unarmoured Non-FRLS

PVC Aluminium

E = Armoured FRLS	F = Armoured Non-FRLS
G = unarmoured FRLS	H = Unarmoured Non-FRLS

XLPE Copper

J = Armoured FRLS	K = Armoured Non-FRLS
L = unarmoured FRLS	M = Unarmoured Non-FRLS

XLPE Aluminium

N = Armoured FRLS	P = Armoured Non-FRLS
Q = unarmoured FRLS	R = Unarmoured Non-FRLS

S = FIRE SURVIVAL CABLES
T = TOUGH RUBBER SHEATH
U = OVERALL SCREENED
V = PAIRED OVERALL SCREENED
W = PAIRED INDIVIDUAL SCREENED
Y = COMPENSATING CABLES
I = PRE-FABRICATED CABLES
Z = JELLY FILLED CABLES

SECTION – C3
SPECIFIC TECHNICAL REQUIREMENTS
(CONTROL AND INSTRUMENTATION)

OPERATION AND CONTROL PHILOSOPHY:

The normal mode of operation of NaOH dosing system shall be from **DDCMIS** including **ON/OFF** command to individual pumps.
A local panel comprising of **'ON' & 'OFF'** push button and an emergency **'OFF'** push button along with '**ON/OFF'** indication shall be provided. The emergency '**OFF'** Push Button shall be wired directly to MCC whereas **ON & OFF** push button shall be routed to **DDCMIS.** The respected Auto stroke controllers shall also be provided in the local panel.
The local /remote selection along with remote control shall be provided in **DDCMIS** only.
The stroke position & adjustment will be done from DDCMIS and the stroke actuator shall be suitable for accepting 4-20 mA DC signal. The pumps shall be provided with 24 V DC, 2- wire LVDT Type Position feed back transmitter to generate 4-20 mA DC signal to indicate stroke position.
The starter of all the motors shall be clubbed with main plant MCC.
All controls, fault indicators/alarms, interlocks, logics shall be implemented in DDCMIS only.
The ON/OFF operation of all motorized stirrers/pumps shall also be provided in DDCMIS with local ON/OFF and emergency OFF facility along with ON/OFF check backs.

The following signals/status shall be shown on local panel.
• Pump 1/2-ON, Stirrer 1-ON.
• Pump 1/2-OFF, Stirrer 1- OFF.
• Pump 1/2-Tripped, Stirrer 1- Tripped.

Following interlocks shall be provided at low-low Level in the mixing cum storage tank.
i) Running Dosing pump shall be tripped.
ii) Stirrer motor of the respective tank shall be tripped.

Following fault indications shall be provided in DDCMIS:
i. Low level in the mixing cum storage tank.
ii. Running Dosing pump motor & stirrer motor tripped due to low-low level.
iii. Dosing Pump-1/2 trip due to over load.

Following conditions to be ensured before starting a pump/stirrer
ii Level in the tank adequate.
iii MCC not disturbed.
All the field instruments shall be terminated at local panel.

SECTION – D1
GENERAL TECHNICAL REQUIREMENTS (MECHANICAL)

VOID

SECTION – D2
GENERAL TECHNICAL REQUIREMENTS (ELECTRICAL)

SECTION : 3.1- MOTORS

1.0.0 INTENT OF SPECIFICATION

This section covers the technical requirements of HT and LT Motors.

2.0.0 CODES AND STANDARDS

The equipment to be furnished under this specification shall be in accordance with the applicable section of the latest edition (including amendments) of the following Indian Standards (IS), IEC publications and other codes, especially the Indian Statutory Regulation, except where modified and /or supplemented by this specification.

-

a)	IS: 325	Three phase induction motors
b)	IS: 12615	Energy efficient induction motors
c)	IS: 900	Code of practice for installation and maintenance of induction motors
d)	IS: 996	Single-phase AC induction motor for general purpose
e)	IS: 1231	Dimensions of three-phase foot-mounted induction motors
f)	IS: 2223	Dimensions of flange mounted AC induction motors
g)	IS: 4029	Guide for testing three-phase induction motors
h)	IS: 8789	Values of performance characteristics for three-phase induction motors
i)	IS: 13555	Guide for selection and application of 3-phase AC induction motors for different types of driven equipment
j)	IS: 5571	Guide for selection of electrical equipment for hazardous areas
k)	IS: 12065	Permissible limits of noise level for rotating electrical machines
l)	IS: 12075	Mechanical vibration of rotating electrical machines
m)	IS: 9334	Electrical motor operated actuators
n)	IS 60034-5	Degree of protection provided by Integral design of rotating electrical machines
o)	IS 60034-8	Terminal marking and direction of rotation
p)	IS 60079-1	Equipment protection by flame proof enclosure
q)	IS 60034-1	Rotating electrical machines.
r)	IS 60079	Explosive atmospheres
s)	IS/IEC 60529	Degrees of protection provided by enclosures (IP code)
t)	IEC 60034	Rotating electrical machines.

3.0.0 TECHNICAL REQUIREMENTS

3.1.0 Design ambient temperature

Motors shall be suitable for an ambient temperature of 50 degree C and relative humidity of 95% and shall deliver the rated output without exceeding its guaranteed temperature limits. The equipment shall operate in highly polluted environment.

3.2.0 Supply voltage

Motors rated up to and including 415V are termed as LT motors and the motors rated higher than 415V are termed as HT motors.

Motors shall be capable of delivering the rated output under following voltage and frequency variations without exceeding its guaranteed temperature limits.

- Frequency variation : (+) 3% and (-) 5%
- Voltage variation for LT motors : (±) 10%
- Voltage variation for HT motors : (±) 10%
- Combined variation of voltage and frequency : 10% (absolute sum)

All the motors shall be so designed that maximum inrush currents, locked rotor torque and pullout torque developed at extreme voltage and frequency variations do not endanger the motor and the driven equipment.

3.3.0 System Parameters

Sl. No.	Description	HT System	LT System
1.	Voltage level	11 KV Above 2000 KW 6.6KV above 200KW & upto 2000KW	240 V : up to 0.2 KW 415 V : >0.2 KW and up to 200KW .
2.	System earthing	Earthed through resistance. Earth fault current : 300 Amps	415V: Solidly grounded.
3.	System fault level	50 KA for 3 sec for 11KV 40KA for 1sec for 6.6KV	50 KA for 1 second
4.	Fault withstand rating of motor terminal box (Breaker operated)	50 KA for 0.25 sec for 11KV 40KA for 0.25 sec for 6.6KV	50 KA for 0.25 second

3.4.0 Type

- AC Motors shall be squirrel cage induction type unless otherwise it is specified. All the motor shall be bi-directional.

3.5.0 Duty

- All AC motors shall be squirrel cage three phase/single phase induction motors. All the motor shall be designed for bi-directional rotation.
- Motors shall be suitable for installation in hot, humid and tropical atmosphere and polluted at places with coal ash and fly ash or any dusty chemical handling area.
- All LV motors above 10KW shall be with S1 duty.

3.6.0 Design margin

- Motor rating shall be selected higher than the maximum load demand of the driven equipment, as per the criteria stated in mechanical section of this specification, under entire operating range, including voltage and frequency variation.
- The motor name plate rating shall have 15% margin over duty point input (or) 10% margin over the maximum demand of driven equipment whichever is higher considering highest system frequency.
- The motor characteristics shall match the requirements of the driven equipment so that adequate starting, accelerating; pull up, breakdown and full load torques are available for the intended service.
- Service shall be considered as 1.0 only.

3.7.0 Method of Starting

- All the motors shall be suitable for direct on-line starting on full load.
- HT Motors will be controlled through vacuum circuit breaker.
- LT motors rated less than 90KW will be controlled through MPCB/MCCB and contactor. LT motors rated 90 KW and above will be controlled through air circuit breaker (ACB).

3.8.0 Efficiency

All the continuous duty motors shall be energy efficient type. For LT motors, it shall be IE3 class as per IS 12615. For HT motors, efficiency shall be more than 95%.

3.9.0 Temperature rise

- Winding Insulation shall be Class F.
- Temperature rise of motors shall not exceed 70°C over air temperature of 50°C by resistance method, while delivering its maximum rated output.

3.10.0 Starting voltage

a) Motors shall be capable of starting and accelerating the load at following starting voltage, with direct on line starting, without exceeding specified winding temperatures.

- HT Motors : 85% of rated voltage
- LT motors : 80% of rated voltage

b) During fast changeover of power supply source, vector difference between the motor residual voltage and the incoming supply voltage will be about 150% of the rated voltage and the motors shall withstand voltage stress and torque stress developed during that time, which may last for a period of one (1) second.

c) The motor shall be capable of operating at full load at a supply voltage of 80% of the rated voltage for 5 minutes.

d) The motor shall be capable of withstanding the stresses imposed if started at 110% rated voltage.

e) Motor shall not stall if the supply voltage drops to 70% of the rated voltage two (2) second duration

3.11.0 No. of Starts

Continuous duty motors shall be suitable for the following starting requirements under the specified conditions of load, torque and inertia.

- No. of consecutive hot starts shall be 2 (with initial temperature of the motor at full load operating level).
- No. of consecutive cold starts shall be 3 (with initial temperature of the motor at ambient temperature).
- For conveyor motors, no. of consecutive hot starts shall be 3 (with initial temperature of the motor at full load operating level).

3.12.0 Starting current

- Motor shall be designed for direct online starting at full voltage. Starting current shall not exceed 6 times full load current for all auxiliaries. No further tolerances are applicable on starting current specified above for HT motors.
- For LT motors, the applicable starting current shall be limited to 7.2 times of full load current including all tolerance.

3.13.0 Locked rotor withstand time

- The locked rotor withstand time for HT motors under hot conditions at 110% rated voltage shall be more than the starting time at minimum permissible voltage specified above by atleast three seconds or 15% of the accelerating time whichever is greater.
- For the LT motors having starting time upto 20 seconds at minimum permissible voltage, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 seconds more than the starting time.
- For the motors having starting time more than 20 seconds and up to 45 seconds at minimum permissible voltage, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 seconds more than the starting time.
- For motors having starting time more than 45 seconds at minimum permissible voltage, the locked rotor withstand time under hot condition at highest voltage limit shall be more than starting time by at least 10% of the starting time.
- The motors shall be designed to withstand 120% of rated speed for 2 minutes without any mechanical damage
- All motors shall be so designed that maximum in rush currents and locked rotor and pull out torque developed by them at extreme voltage and frequency variation do not endanger the motor & driven equipment.

3.14.0 Torque Requirements

- Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.
- Pull out torque at rated voltage shall not be less than 205% of full load torque.
- Motors subjected to reverse rotation shall be designed to withstand the stresses encountered when starting with non-energized shaft rotating at 125% of rated speed in reverse direction.
- The motor shall be designed to withstand momentary overload of 60% of full load torque for 15 second without any damage.

3.15.0 Enclosure

a) All motor enclosures shall conform to the degree of protection IP 55 unless otherwise specified. Motor for outdoor or semi outdoor service shall be of weather proof construction.

b) For hazardous location, the enclosure of motors shall have flame proof construction conforming to applicable standard.

3.16.0 Cooling

- LT motors shall be totally enclosed fan cooled (TEFC), type IC411. The cooling shall be effected by self-driven bi-directional centrifugal fan protected by fan cover.
- HT motors can be totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or closed air circuit air cooled (CACA) type.
- Motors rated >3000KW can be closed air circuit water cooled (CACW).
- Motors with CACA/CACW heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate the following:
  - Hot and cold air temperatures of the closed air circuit for CACA motors.
  - Hot and cold, air and water temperatures for CACW motors.
- The Alarm switch contact rating shall be minimum 0.5 A at 220 V DC and 5A at 240 V AC.

3.17.0 Winding

- Winding shall be class F insulation with temperature limited to class B. Insulation shall be Non-hygroscopic, oil resistant, and flame resistant. Winding, fittings and hardware shall be corrosion resistant. Winding shall be tropicalized and suitably varnished, baked and treated for operating satisfactorily in humid and corrosive atmosphere.
- For the VFD operated drives, insulation shall be designed to take care of stresses due to high Dv/dt. Motors shall be wound with dual coated winding wires and impregnated with VPI process. Further for such application, insulated bearings shall be provided to avoid circulating current caused by shaft induced voltages.
- Space heaters rated for 240V AC, 50 Hz supply shall be provided for motors rated 30KW and above to maintain windings in dry condition when motor is standstill.
- For HT motors, insulation shall be Vacuum Impregnated (VPI).
- HT motors shall withstand 1.2/50 microsec impulse Voltage wave of 4U+5 KV (U=Line voltage in KV). The coil inter-turn insulation shall be suitable for 0.3/3msec surge of 32KVp and 12KVp for 11KV & 6.6KV system respectively, followed by 1 min power frequency high voltage test of appropriate voltage on inter turn insulation.

Temperature Detectors

- All 11KV motors shall be provided with six (6) nos. duplex, or twelve (12) nos. simplex type winding temperature detectors, i.e. two (2) nos. duplex or four (4) nos. Simplex per phase.
- 11KV motor bearing shall be provided with duplex type temperature detectors.
- The temperature detector mentioned above shall be resistance type, 3 wire, platinum wound, 100 Ohms at 0℃.
- Leads of all simplex type motor winding RTDS and motor bearing RTDS shall be wired up to respective switchgear metering & protection compartment. From which one set of RTDS will be connected to numerical protection relay and another set shall be kept free for DCS/PLC connectivity.
- Five number of Temperature detectors / thermisters shall be provided for L.T. motors above 90 KW (3 numbers winding temperatures & 2 numbers bearing temperatures)

3.18.0 Bearings

- Motor shall be provided with antifriction bearings, unless sleeve bearings are required by the motor application. Bearings shall be provided with seals to prevent leakage of lubricant or entrance of foreign matters like dirt, water etc. into the bearing area.
- Sleeve bearings shall be split type, ring oiled with permanently aligned, close running shaft sleeves. Grease lubricated bearings shall be pre-lubricated and shall have provisions for in-service positive lubrication with grease nipple and relief holes.
- Vertical shaft motors shall be provided with thrust and guide bearings. Thrust bearing of tilting pad type is preferred. However, if anti-friction bearings can take vertical thrust, thrust and guide bearings are not required.
- Lubricant shall not deteriorate under all service conditions. The lubricants shall be limited to normally available types. For motors rated 30KW and above re-lubrication facility shall be provided.
- For motor with forced lubrication, a shaft driven oil pump shall be provided along with an electrical auxiliary pump. Alternatively, two motor driven pumps may be provided, one working and one standby. All necessary auxiliaries and accessories shall be provided to complete the system. A pressure gauge and pressure switch for low oil pressure warning and to start the standby oil pump automatically shall also be provided. A motor driven jacking oil pump may be provided, for heavy shaft loads.
- Flow switches shall be provided for monitoring oil flow of forced lubrication bearings, if used. Alarm switch contact rating shall be minimum 0.5 A at 220 V DC and 10A at 230 V AC.
- For bearing temperature measurement, duplex RTDs shall be provided for each bearing and shall be wired upto the terminal box.
- Each bearing shall be provided with dial type thermometer.
- For all VFD operated motors and motors rated above 1000KW shall have insulated bearings to prevent flow of shaft currents.

3.19.0 Terminal Boxes

- For single core cables, gland plate shall be non-magnetic material. Terminal box shall be capable of being turned 360° in steps of 90°, unless otherwise approved. The terminal boxes shall be split type with removable cover with access to connections.
- Terminals for motors shall be stud type, thoroughly insulated from the frame. The terminals shall be clearly identified by phase markings, with corresponding direction of rotation marked on the non-driving end of the motor.
- The terminal box shall be capable of withstanding maximum system fault current for 0.25 sec for all breaker operated motors and shall be provided with explosion vent.
- For contactor operated LT motors, the terminal box shall be capable of withstanding the fault current for 0.2 sec minimum and operating time of MPCB/MCCB.
- Removable gland plates of thickness not less than 2.5 mm sheet steel or 3 mm aluminium (for single core cables) shall be provided for cable boxes.
- Cable spreader box shall be provided for larger cable sizes.

- Cable boxes of HT motors shall be phase segregated type. The terminals of three phases shall be segregated by barriers of metal or fibre glass. For HT motors, cable box design shall be suitable for accommodating cable termination kits.
- Separate terminal box for space heaters shall be provided.
- A separate terminal box of IP 55 degree of protection shall be provided for temperature detectors.
- Motor 1000 KW and above shall be provided with three differential current transformers mounted over the neutral leads within the enclosure. Loose 3 numbers CT for mounting on switchgear side shall be in bidder's scope. The arrangement shall be such as to permit easy access for C.T. testing and replacement. Current transformer characteristics shall match Owner's requirements to be intimated later to the successful bidder. The CT details shall be finalized during detail engineering. Neutral terminal box shall have IP 55 degree of protection.
- The secondary leads of CT shall be wired to separate auxiliary terminal box of IP 55 degree of protection
- All the accessory terminal boxes shall be located on the same side of the main (power) terminal box.
- For LT motors, terminal box shall be located on top, unless otherwise specified.

3.20.0 Earthing Terminals

The frame of each motor shall be provided with two separate and distinct grounding pads complete with tapped hole, GI bolts and washer. The terminal box shall have a separate grounding terminal.

The grounding connection shall be suitable for accommodation of ground conductors as follows :

Above 100 to 200 KW	: 75x10 mm GS flat
Above 55 KW to 100 KW	: 50x6 mm GS flat
Above 22 KW to 55 KW	: 50x6 mm GS flat
Above 5.5 KW to 22 KW	: 25x6 mm GS flat
Fractional HP LV Motors	: 8 SWG GS Wire

3.21.0 Noise and Vibration

- Motors shall be selected with low noise levels in accordance with IS 12065. Noise level for all motors shall be limited to 85db (A).
- The peak amplitude of the vibration shall also be within the specified limits of IS: 12075.
- All HT motors shall be provided with vibration pads for mounting vibration detectors. Motors shall withstand vibration produced by driven equipment.

3.22.0 Name Plates

Motor shall have stainless steel nameplate(s) showing diagram of connections, all particulars as per IS: 325 / IS: 12615 and shall also have 'BEE' marking.

In addition to the minimum information required by IEC/IS, the following information shall be shown on motor rating plate:

- Temperature rise in ºC under rated condition and method of measurement.

- Degree of protection.
- Bearing identification no. and recommended lubricant.
- Location of insulated bearings.

3.23.0 Drain plug

Motor shall have drain plugs so located that they will drain the water, resulting from the condensation or other causes from all pockets of the motor casing.

3.24.0 Lifting provision

Motor weighing 25 Kg. or more shall be provided with eyebolt or other adequate provision of lifting.

3.25.0 Dowel pins

The motor shall be designed to permit easy access for drilling holes through motor feet or mounting flange for installation of dowel pins after assembling the motor and driven equipment

4.0.0 INSTALLATION

Installation shall be carried out as per IS: 900.

5.0.0 PAINTING

Painting shall be carried out by an approved process. Pretreatment shall conform to applicable standard. The equipment shall be subject to a coat of red oxide primer paint. All inside and outside surface shall be painted with epoxy based paint. The final thickness of paint film on steel shall not be less than 100 microns. Paint Shade for the Motor shall be RAL 7032 (Siemens Grey). Sufficient quantity of touch-up paint shall be furnished for application at site.

6.0.0 TESTING AND INSPECTION

6.1.0 Tests shall be performed in presence of Owner's representatives. Successful Bidder shall give atleast fifteen (15) days advance notice for witnessing the tests. Copies of certified reports of all tests carried out at the works shall be furnished. The equipment shall be dispatched from works, only after receipt of Owner's written approval of the test reports.

6.2.0 Routine and Type Tests are to be conducted for all HT motors and for LT motors above 60 KW rating in presence of customer's representative as per IS:325, IS:4722, IS:9283 and required copies of test certificates are to be furnished for approval.

6.3.0 Test certificates for Routine tests conducted as per IS:325, IS:4722, IS:9283 for motors of rating 60 KW and below shall be submitted for TANGEDCO review, approval and dispatch clearance.

6.4.0 The following minimum tests/ checks shall be conducted at site. Any other tests/ checks as per the manufacturer's recommendation shall also be carried out

i) Measurement of vibration.
ii) Measurement of insulation resistance and polarization index
iii) Measurement of full load current.
iv) Test running of the motors, checking the temperature rise and identifying the hot spot etc.

7.0.0 OTHERS

7.1.0 The responsibility of co-ordination with electrical agencies and obtaining all necessary clearances shall be the contractor.

7.2.0 Canopy shall be provided for outdoor motors.

7.3.0 Contractor shall provide fully compatible electrical system, equipment, accessories and services.

8.0.0 SPECIFIC REQUIREMENTS

8.1.0 The following shall be considered for control & protection of motors.

a) Motors below 18.5 KW: MPCB incomers

b) Above 18.5 KW but below 90 KW: contactor controlled with MCCB

c) 90 KW and above but 160 KW & below: ACB controlled with numerical relays

d) HT Motors shall have vacuum breakers

e) HV motors 1000KW above shall have differential protection

f) For motors 1000KW & above, neutral CT of Cl. PS shall be provided as each box on separate terminal box

g) Key phasor arrangement shall be provided for all motors

h) All motors shall be provided with an emergency stop PB near motor as per Indian Statutory regularity.

i) Spacious platform shall be provided around motor area with min. of 300mm below the level of motor base plate.

j) Capillary type temp. Gauge cum shall be provided for DE/NDE of HV motors

k) After erection of electrical equipment at site, corrosion proof paint touch up to be done before test & commissioning of equipment.

2.3.0 MOTORS

Item/ Components/ Sub-system	Tests/ Checks																	
	Visual	Dimensional	Make,Type,Rating,TC,General physical	Mechanical, Chemical properties	NDT, DP or MPI, UT	Metallography	Electrical characteristics	Welding/ Brazing (WPS/ PQR)	Heat treatment	Magnetic characteristics	Hydraulic, Leak, Pressure test	Thermal characteristics	Run out	Dynamic balancing	All tests as per IS:325/ IS:4722/ IS:9283	Vibration	Over speed	Tan delta, shaft voltage and polarisation
Plates for stator frame, end shield, spider etc.	Y	Y	Y	Y					Y									
Shaft	Y	Y	Y	Y	Y	Y			Y									
Magnetic material	Y	Y	Y	Y	Y		Y			Y		Y						
Rotor copper/ Aluminium	Y	Y	Y	Y		Y	Y		Y									
Stator copper	Y	Y	Y	Y			Y		Y			Y						
SC ring	Y	Y	Y	Y	Y	Y	Y	Y	Y									
Insulating material	Y		Y	Y			Y					Y						
Tubes for cooler	Y	Y	Y	Y	Y				Y		Y							
Sleeve bearing	Y	Y	Y	Y	Y				Y		Y							
Stator, Rotor coils	Y	Y	Y				Y	Y										
Castings, stator frame, terminal box and bearing housing etc.	Y	Y	Y	Y	Y			Y										
Fabrication and machining of stator, rotor, terminal box	Y	Y			Y				Y									
Wound stator	Y	Y					Y	Y										
Rotor complete	Y	Y					Y						Y	Y				

Item/ Components/ Sub-system	Tests/ Checks																	
	Visual	Dimensional	Make,Type,Rating,TC,General physical	Mechanical, Chemical properties	NDT, DP or MPI, UT	Metallography	Electrical characteristics	Welding/ Brazing (WPS/ PQR)	Heat treatment	Magnetic characteristics	Hydraulic, Leak, Pressure test	Thermal characteristics	Run out	Dynamic balancing	All tests as per IS:325/ IS:4722/ IS:9283	Vibration	Over speed	Tan delta, shaft voltage and polarisation
Stator, Rotor, Terminal Box assembly	Y	Y					Y											
Accessories, RTD, BTD,CT, Brushes, Diodes, space heater, antifriction bearing, cable glands, lugs, gaskets etc.	Y	Y	Y															
Complete motor (IS: 325/ IS:4722/ IS:9283)	Y	Y	Y												Y	Y	Y	Y
Y =Test applicable, Y1 = for 11kV and 3.3kV motors only																		
Note																		
This is an indicative list of tests/ checks. The manufacture is to furnish the detailed Quality Plan indicating the practices and procedure followed along with relevant supporting documents during QP finalization. However QP approval is not envisaged for 415V motors upto 50 KW.																		

Site Tests :

The following minimum tests/ checks shall be conducted at site. Any other tests/ checks as per the manufacturer's recommendation shall also be carried out

i) Measurement of vibration.
ii) Measurement of insulation resistance and polarization index
iii) Measurement of full load current.
iv) Test running of the motors, checking the temperature rise and identifying the hot spot etc.

1.0	Design ambient temperature	:	50 °C
2.0	Maximum acceptable kW rating of LV motor	:	Upto 200KW
3.0	Installation (Indoors/ Outdoors)	:	As required
4.0	Degree Of Protection	:	IP55 (INDOOR), IPW55(OUTDOOR)
5.0	Cooling	:	TEFC
6.0	Details of supply system		
	a) Rated voltage (with variation)	:	415V ± 10%
	b) Rated frequency (with variation)	:	50 Hz (Variation: +3% To –5%)
	c) Combined voltage & freq. variation	:	10% (sum of absolute values)
	d) System fault level at rated voltage	:	50 kA for 1 sec
	e) Short time rating for terminal box	:	50 kA for 0.25 sec
	f) LV System grounding	:	Solidly
7.0	Class of insulation	:	Class 'F', with temp rise limited to class B.
8.0	Minimum voltage for starting (As percentage of rated voltage)	:	80% of rated voltage
9.0	Power cables data	:	Shall be given during Detailed engg.
10.0	Earth Conductor Size & Material	:	Shall be given during Detailed engg.
11.0	Space heater supply **(30KW & ABOVE)**	:	240 V, 1Φ , 50 Hz
12.0	Rating up to which Single phase motor	:	Acceptable upto 0.20 Kw
13.0	TYPE OF STARTER PROVIDED IN MCC	:	DOL
14.0	Locked rotor current		
	a) Limit as percentage of FLC	:	As per IS 12615
	b) Permissible tolerance, if any	:	
15.0	Additional tests	:	As per QP
16.0	Flame-proof motor		
	a) Enclosure suitable (As per IS:2148)	:	As per requirement
	b) Classification of Hazardous area (As per IS: 5572 part-I)	:	As per requirement
	c) Degree of protection	:	IP65
17.0	Makes	:	AS PER ANNUXURE-I
19.0	Paint shade	:	RAL 7032 (Siemens Grey).
20.0	Efficiency class	:	IE3

NOTE :1. Also detailed Customer spec. for Motors is to be referred as enclosed with technical spec.

S. No.	Description	Data to be filled by successful bidder
A.	**General**	
1	Manufacturer & country of origin	
2	Motor type	
3	Type of starting	
4	Name of the equipment driven by motor & Quantity	
5	Maximum Power requirement of driven equipment	
6	Rated speed of Driven Equipment	
7	Design ambient temperature	
B.	**Design and Performance Data**	
1	Frame size & type designation	
2	Type of duty	
3	Rated Voltage	
4	Permissible variation for	
5	a Voltage	
6	b Frequency	
7	c) Combined voltage & frequency	
8	Rated output at design ambient temp (by resistance method)	
9	Synchronous speed & Rated slip	
10	Minimum permissible starting voltage	
11	Starting time in sec with mechanism coupled	
12	a) At rated voltage	
13	b) At min starting voltage	
14	Locked rotor current as percentage of FLC (including IS tolerance)	
15	Torque	
	a) Starting	
	b) Maximum	
16	Permissible temp rise at rated output over ambient temp & method	
17	Noise level at 1.0 m (dB	
18	Amplitude of vibration	
19	Efficiency & P.F. at rated voltage & frequency	
	a) At 100% load	
	c) At 75% load	

S. No.	Description		Data to be filled by successful bidder
	c) At starting		
C.	**Constructional Features**		
1	Method of connection of motor driven equipment		
2	Applicable Standard		
3	DOP of Enclosure		
4	Method of cooling		
5	Class of insulation		
6	Main terminal box		
	a) Type		
	b) Power Cable details (Conductor, size, armour/unarmour)		
	c) Cable Gland & lugs details (Size, type & material)		
	d) Permissible Fault level (kArms & duration in sec)		
7	Space heater details (Voltage & watts)		
8	Flame proof motor details (if applicable)		
	a) Enclosure		
	b) suitability for hazardous area		
	i	Zone	O / I / II
	ii	Group	IIA / IIB / IIC
9	No. of Stator winding		
10	Winding connection		
11	Kind of rotor winding		
12	Kind of bearings		
13	Direction of rotation when viewed from NDE		
14	Paint Shade & type		
15	Net weight of motor		
16	Outline mounting drawing No (To be enclosed as annexure)		
D.	**Characteristic curves/ drawings** (To be enclosed for motors of rating ≥ 55KW)		
	a) Torque speed characteristic		
	b) Thermal withstand characteristic		
	c) Current vs time		
	d) Speed vs time		

GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

SPECIFICATION NO.: PE-SS-999-506-E101 Rev 00

1.0 INTENT OF SPECIFIATION

The specification covers the design, materials, constructional features, manufacture, inspection and testing at manufacturer's work, and packing of Low voltage (LV) squirrel cage induction motors along with all accessories for driving auxiliaries in thermal power station.

Motors having a voltage rating of below 1000V are referred to as low voltage (LV) motors.

2.0 CODES AND STANDARDS

Motors shall fully comply with latest edition, including all amendments and revision, of following codes and standards:

IS:325	Three phase Induction motors
IS : 900	Code of practice for installation and maintenance of induction motors
IS: 996	Single phase small AC and universal motors
IS: 4722	Rotating Electrical machines
IS: 4691	Degree of Protection provided by enclosures for rotating electrical machines
IS: 4728	Terminal marking and direction of rotation rotating electrical machines
IS: 1231	Dimensions of three phase foot mounted induction motors
IS: 8789	Values of performance characteristics for three phase induction motors
IS: 13555	Guide for selection and application of 3-phase A.C. induction motors for different types of driven equipment
IS: 2148	Flame proof enclosures for electrical appliance
IS: 5571	Guide for selection of electrical equipment for hazardous areas
IS: 12824	Type of duty and classes of rating assigned
IS: 12802	Temperature rise measurement for rotating electrical machnines
IS: 12065	Permissible limits of noise level for rotating electrical machines
IS: 12075	Mechanical vibration of rotating electrical machines

In case of imported motors, motors as per IEC-34 shall also be acceptable.

3.0 DESIGN REQUIREMENTS

3.1 Motors and accessories shall be designed to operate satisfactorily under conditions specified in data sheet-A and Project Information, including voltage & frequency variation of supply system as defined in Data sheet-A

3.2 Motors shall be continuously rated at the design ambient temperature specified in Data Sheet-A and other site conditions specified under Project Information
Motor ratings shall have at least a 15% margin over the continuous maximum demand of the driven equipment, under entire operating range including voltage & frequency variation specified above.

3.3 Starting Requirements

3.3.1 Motor characteristics such as speed, starting torque, break away torque and starting time shall be properly co-ordinated with the requirements of driven equipment. The accelerating torque at any speed with the minimum starting voltage shall be at least 10% higher than that of the driven equipment.

3.3.2 Motors shall be capable of starting and accelerating the load with direct on line starting without exceeding acceptable winding temperature.

The limiting value of voltage at rated frequency under which a motor will successfully start and accelerate to rated speed with load shall be taken to be a constant value as per Data Sheet - A during the starting period of motors.

3.3.3 The following frequency of starts shall apply

i) Two starts in succession with the motor being initially at a temperature not exceeding the rated load temperature.

ii) Three equally spread starts in an hour the motor being initially at a temperature not exceeding the rated load operating temperature. (not to be repeated in the second successive hour)

iii) Motors for coal conveyor and coal crusher application shall be suitable for three consecutive hot starts followed by one hour interval with maximum twenty starts per day and shall be suitable for mimimum 20,000 starts during the life time of the motor

3.4 **Running Requirements**

3.4.1 Motors shall run satisfactorily at a supply voltage of 75% of rated voltage for 5 minutes with full load without injurious heating to the motor.

3.4.2 Motor shall not stall due to voltage dip in the system causing momentary drop in voltage upto 70% of the rated voltage for duration of 2 secs.

3.5 **Stress During bus Transfer**

3.5.1 Motors shall withstand the voltage, heavy inrush transient current, mechanical and torque stress developed due to the application of 150% of the rated voltage for at least 1 sec. caused due to vector difference between the motor residual voltage and the incoming supply voltage during occasional auto bus transfer.

3.5.2 Motor and driven equipment shafts shall be adequately sized to satisfactorily withstand transient torque under above condition.

3.6 Maximum noise level measured at distance of 1.0 metres from the outline of motor shall not exceed the values specified in IS 12065.

3.7 The max. vibration velocity or double amplitude of motors vibration as measured at motor bearings shall be within the limits specified in IS: 12075.

4.0 **CONSTRUCTIONAL FEATURES**

4.1 Indoor motors shall conform to degree of protection IP: 54 as per IS: 4691. Outdoor or semi-indoor motors shall conform to degree of protection IP: 55 as per IS: 4691and shall be of weather-proof construction. Outdoor motors shall be installed under a suitable canopy

4.2 Motors upto 160KW shall have Totally Enclosed Fan Cooled (TEFC) enclosures, the method of cooling conforming to IC-0141 or IC-0151 of IS: 6362.

Motors rated above 160 KW shall be Closed Air Circuit Air (CACA) cooled

4.3 Motors shall be designed with cooling fans suitable for both directions of rotation.

4.4. Motors shall not be provided with any electric or pneumatic operated external fan for cooling the motors.

4.5 Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point.

4.6 In case Class 'F' insulation is provided for LV motors, temperature rise shall be limited to the limits applicable to Class 'B' insulation.
In case of continuous operation at extreme voltage limits the temperature limits specified in table-1 of IS:325 shall not exceed by more than 10°C.

4.7 **Terminals and Terminal Boxes**

4.7.1 Terminals, terminal leads, terminal boxes, windings tails and associated equipment shall be suitable for connection to a supply system having a short circuit level, specified in the Data Sheet-A.

Unless otherwise stated in Data Sheet-A, motors of rating 110 kW and above will be controlled by circuit breaker and below 110 kW by switch fuse-contactor. The terminal box of motors shall be designed for the fault current mentioned in data sheet "A".

4.7.2 unless otherwise specified or approved, phase terminal boxes of horizontal motors shall be positioned on the left hand side of the motor when viewed from the non-driving end.

4.7.3 Connections shall be such that when the supply leads R, Y & B are connected to motor terminals A B & C or U, V & W respectively, motor shall rotate in an anticlockwise direction when viewed from the non-driving end. Where such motors require clockwise rotation, the supply leads R, Y, B will be connected to motor terminals A, C, B or U W & V respectively.

4.7.4 Permanently attached diagram and instruction plate made preferably of stainless steel shall be mounted inside terminal box cover giving the connection diagram for the desired direction of rotation and reverse rotation.

4.7.5 Motor terminals and terminal leads shall be fully insulated with no bar live parts. Adequate space shall be available inside the terminal box so that no difficulty is encountered for terminating the cable specified in Data Sheet-A.

4.7.6 Degree of protection for terminal boxes shall be IP 55 as per IS 4691.

4.7.7 Separate terminal boxes shall be provided for space heaters.. If this is not possible in case of LV motors, the space heater terminals shall be adequately segregated from the main terminals in the main terminal box. Detachable gland plates with double compression brass glands shall be provided in terminal boxes.

4.7.8. Phase terminal boxes shall be suitable for 360 degree of rotation in steps of 90 degree for LV motors.

4.7.9 Cable glands and cable lugs as per cable sizes specified in Data Sheet-A shall be included. Cable lugs shall be of tinned Copper, crimping type.

4.8 Two separate earthing terminals suitable for connecting G.I. or MS strip grounding conductor of size given in Data Sheet-A shall be provided on opposite sides of motor frame. Each terminal box shall have a grounding terminal.

4.9 **General**

4.9.1 Motors provided for similar drives shall be interchangeable.

4.9.2 Suitable foundation bolts are to be supplied alongwith the motors.

4.9.3 Motors shall be provided with eye bolts, or other means to facilitate safe lifting if the weight is 20Kgs. and above.

4.9.4 Necessary fitments and accessories shall be provided on motors in accordance with the latest Indian Electricity rules 1956.

4.9.5 All motors rated above 30 kW shall be provided with space heaters to maintain the motor internal air temperature above the dew point. Unless otherwise specified, space heaters shall be suitable for a supply of 240V AC, single phase, 50 Hz.

4.9.6 Name plate with all particulars as per IS: 325 shall be provided

4.9.7 Unless otherwise specified, the colour of finish shall be grey to Shade No. 631 and 632 as per IS:5 for motors installed indoor and outdoor respectively. The paint shall be epoxy based and shall be suitable for withstanding specified site conditions.

5.0 INSPECTION AND TESTING

5.1 All materials, components and equipments covered under this specification shall be procured, manufactured, as per the BHEL standard quality plan No. PED-506-00-Q-006/0 and PED-506-00-Q-007/2 enclosed with this specification and which shall be complied.

5.2 LV motors of type-tested design shall be provided. Valid type test reports not more than 5 year shall be furnished. In the absence of these, type tests shall have to be conducted by manufacturer without any commercial implication to purchaser.

5.3 All motors shall be subjected to routine tests as per IS: 325 and as per BHEL standard quality plan.

5.4 Motors shall also be subjected to additional tests, if any, as mentioned in Data Sheet A.

6.0 DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT

a) OGA drawing showing the position of terminal boxes, earthing connections etc.
b) Arrangement drawing of terminal boxes.
c) Characteristic curves:
(*To be given for motor above 55 kW unless otherwise specified in Data Sheet*).

i) Current vs. time at rated voltage and minimum starting voltage.
ii) Speed vs. time at rated voltage and minimum starting voltage.
iii) Torque vs. speed at rated voltage and minimum voltage.
For the motors with solid coupling the above curves i), ii), iii) to be furnished for the motors coupled with driven equipment. In case motor is coupled with mechanical equipment by fluid coupling, the above curves shall be furnished with and without coupling.
iv) Thermal withstand curve under hot and cold conditions at rated voltage and max. permissible voltage.

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
	CUSTOMER :		QP NO.: PE-QP-999-Q-006, REV-02	DATE: 17.04.2020
	PROJECT:		PO NO.:	DATE:
	ITEM: AC ELECT. MOTORS UPTO 55KW (LV (415V))	SYSTEM:	SECTION: II	SHEET 1 of 2

S. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	*	**		
					M	C/ N				D	M	C	N	
1.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	-	MFG. SPEC.	MFG. SPEC.	LOG BOOK		P	-	-	
		2.DIMENSIONS	MA	VISUAL	100%	-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	LOG BOOK		P	-	-	
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	-	MFG.SPEC./	MFG.SPEC.	LOG BOOK		P	-	-	
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	-	MFG. SPEC/ APPROVED DATASHEET	MFG. SPEC/ APPROVED DATASHEET	LOG BOOK	✓	P	V	-	
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST	MA	VISUAL	100%	-	IS-325 / IS-12615/ APPROVED DATA SHEET	IS-325 / IS-12615/ APPROVED DATA SHEET	TEST/ INSPN. REPORT	✓	P	V *	-	* NOTE -1
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	-	APPROVED DRG/ DATA SHEET	APPROVED DRG/ DATA SHEET	TEST/ INSPN. REPORT	✓	P	V *	-	* NOTE -1 & NOTE-2

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		3.NAMEPLATE DETAILS	MA	VISUAL	100%	-	IS-325 / IS-12615 / APPROVED DATA SHEET	SAME AS COL. 7	TEST/ INSPN. REPORT	✓	P	V	-	
4.0	PACKING	SURFACE FINISH & COMPLETENESS	MA	VISUAL	100%	100%	AS PER MFG. STANDARD / (#)	AS PER MFG. STANDARD / (#).	INSPC. REPORT	✓	P	W	-	(#) REFER NOTE-8

NOTES:
1. Routine tests on 100% motors shall be done by the vendor. However, BHEL/ Customer shall witness routine tests on random samples. The sampling plan shall be mutually agreed upon.
2. For exhaust/ventilation fan motors of rating up to 1.5 KW, only routine test certificates shall be furnished for scrutiny.
3. In case test certificates for these tests on similar type, size and design of motor from independent laboratory are available, the same is valid for 5 years.
4. BHEL reserves the right to perform repeat test, if required.
5. After packing and prior to issue MDCC, photographs of items to be despatched shall be sent to BHEL for review.
6. In case of any changes in QP commented by customer at contract stage, same shall be carried out by bidder without any implication to BHEL/ Customer.
7. Project specific QP to be developed based on customer requirement.
8. For export job, BHEL technical specification for seaworthy packing to be followed.
9. Packing shall be suitable for storage at site in tropical climate conditions.
10. Latest revision/ year of issue of all the standards (IS/ ASME/ IEC etc.) indicated in QP shall be referred.

LEGENDS:

*RECORDS, INDENTIFIED WITH "TICK"(√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION,
** **M**: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, B: MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, **C**: CUSTOMER,
P: PERFORM, **W**: WITNESS, **V:** VERIFICATION, AS APPROPRIATE
MA: MAJOR, **MI**: MINOR**, CR:** CRITICAL
D: DOCUMENTATION

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Sign & Date	
Seal	

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MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:17.04.2020
	CUSTOMER :		QP NO.: PE-QP-999-Q-007, REV-04	
	PROJECT:		PO NO.:	
	ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))	SYSTEM:	SECTION: II	SHEET 1 OF 9

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
1.0	RAW MATERIAL & BOUGHT OUT CONTROL													
1.1	SHEET STEEL, PLATES, SECTION, EYEBOLTS	1.SURFACE CONDITION	MA	VISUAL	100%	-	-	FREE FROM BLINKS, CRACKS, WAVINESS ETC	LOG BOOK		P	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S DRG./SPEC	MANUFACTURER'S DRG./SPEC	LOG BOOK		P	-	-	
		3.PROOF LOAD TEST (EYE BOLT)	MA	MECH. TEST	SAMPLE	-	MANUFACTURER'S DRG./SPEC	MANUFACTURER'S DRG./SPEC	TEST REPORT		P/V	-		
1.2	HARDWARES	1.SURFACE CONDITION	MA	VISUAL	100%	-		FREE FROM CRACKS, UN-EVENNESS ETC.	TEST REPORT		P	-	-	
		2.PROPERTY CLASS	MA	VISUAL	SAMPLES	-	MANUFACTURER'S DRG./SPEC	MANUFACTURER'S DRG./SPEC	TC		P/V	-	-	PROPERTY CLASS MARKING SHALL BE CHECKED BY THE VENDOR
1.3	CASTING	1.SURFACE CONDITION	MA	VISUAL	100%	-	MANUFACTURER'S DRG./SPEC	FREE FROM CRACKS, BLOW HOLES ETC.	LOG BOOK		P/V	-		
		2.CHEM. & PHY. PROP.	MA	CHEM & MECH TEST	1/HEAT NO.	-	MANUFACTURER'S DRG./SPEC	MANUFACTURER'S DRG./SPEC	TC		P/V	-		HEAT NO. SHALL BE VERIFIED
		3.DIMENSIONS	MA	MEASUREMENT	100%	-	MANUFACTURER'S DRG.	MANUFACTURER'S DRG.	LOG BOOK		P/V	-		
1.4	PAINT & VARNISH	1.MAKE, SHADE, SHELF LIFE & TYPE	MA	VISUAL	100% CONTINUOUS	-	MANUFACTURER'S DRG./SPEC	MANUFACTURER'S DRG./SPEC	LOG BOOK		P/V	-		

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Reviewed by:	PRAVEEN DUTTA	PRAVEEN DUTTA	Reviewed by:	RITESH KUMAR JAISWAL	R K JAISWAL

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Seal	

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	CUSTOMER :		QP NO.: PE-QP-999-Q-007, REV-04	DATE:17.04.2020
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	ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))	SYSTEM:	SECTION: II	SHEET 2 OF 9

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND.	MA	VISUAL	100%	-	-	FREE FROM VISUAL DEFECTS	LOG BOOK		P	-	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED
		2. CHEM. & PHYSICAL PROPERTIES	MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO	-	MANUFACTURER'S DRG./ SPEC.	MANUFACTURER'S DRG./ STD.	TC		P/V	-		
		3. DIMENSIONS	MA	MEASUREMENT	100%	-	MANUFACTURER'S DRG./ SPEC.	MANUFACTURER'S DRG.	LOG BOOK		P/V	-		
		4.INTERNAL FLAWS	CR	ULTRASONIC TEST	100%	-	ASTM-A388	MANUFACTURER'S STD.	INSPECTION REPORT	✔	P/W	V	-	FOR DIA OF 55 MM & ABOVE
1.6	SPACE HEATERS, CONNEC-TORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING	MA	VISUAL	100%	-	MANUFACTURER'S DRG./STD.	MANUFACTURER'S DRG./STD.	INSPECTION REPORT		P/V	-	-	
		2. PHYSICAL COND.	MA	VISUAL	100%	-	MANUFACTURER'S DRG./STD.	NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY	INSPECTION REPORT		P/V	-	-	
		3.DIMENSIONS (WHEREVER APPLICABLE)	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S DRG./ STD	MANUFACTURER'S DRG. / STD.	INSPECTION REPORT		P/V	-	-	
		4.PERFORMANCE/ CALIBRATION	MA	TEST	100%	-	MANUFACTURER'S DRG./ STD	MANUFACTURER'S DRG. / STD.	TEST REPORT		P/V	-	-	

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MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:17.04.2020
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	ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))	SYSTEM:	SECTION: II	SHEET 3 OF 9

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND. ETC.	MA	VISUAL	100%	-	-	NO VISUAL DEFECTS	TEST REPORT		P/V	-	-	
		2.DIMENSION(BORE DIA, WALL THICKNESS, BDV AS RECEIVED, BDV AFTER FOLDING AT 180°	MA	TEST	SAMPLE	-	MANUFACTURER'S STD.	MANUFACTURER'S STD.	LOG BOOK AND OR SUPPLIER'S TC		P/V	-	-	
1.8	SHEET STAMPING (PUNCHED)	1. SURFACE COND.	MA	VISUAL	100%	-	-	NO VISUAL DEFECTS (FREE FROM BURS)	LOG BOOK		P	-	-	
		2.DIMENSIONS INCLUDING BURS HEIGHT	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S DRG. .	MANUFACTURER'S DRG.	LOG BOOK		P/V	-	-	
		3. ACCEPTANCE TESTS	MA	ELECT. & MECH TESTS	SAMPLE	-	MANUFACTURER'S DRG./ STD.	MANUFACTURER'S DRG./ STD.	TC		P/V	-	-	
1.9	CONDUCTORS	1. SURFACE FINISH	MA	VISUAL	100%	-	-	FREE FROM VISUAL DEFECTS	LOG BOOK		*P/V	-	-	* MOTOR MANUFACTURER TO CONDUCT VISUAL CHECK FOR SURFACE FINISH ON RANDOM BASIS (10% SAMPLE) AT HIS WORKS AND MAINTAIN RECORD FOR VERIFICATION BY
		2.ELECT. PROP, & MECH. PROP	MA	ELECT. & MECH.TEST	SAMPLES	-	MANUFACTURER'S DRG./ SPEC.	MANUFACTURER'S / SPEC.	TC & VENDOR'S TEST REPORTS		P/V	-	-	

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	ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))	SYSTEM:	SECTION: II	SHEET 4 OF 9

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
		3.DIMENSIONS	MA	MEASUREMENT	SAMPLES	-	MANUFACTURER'S DRG./ SPEC.	MANUFACTURER'S / SPEC.	LOG BOOK		P/V	-	-	
1.10	BEARINGS	1.MAKE & TYPE	MA	VISUAL	100%	-	MANUFACTURER'S DRG./ APPROVED DATASHEET	MANUFACTURER'S DRG./ APPROVED DATASHEET	LOG BOOK		P/V	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	-	APPROVED DATASHEET	APPROVED DATASHEET/ BEARING MANUF'S CATALOGUES	LOG BOOK		P/V	-	-	
		3.SURFACE FINISH	MA	VISUAL	100%	-	-	FREE FROM VISUAL DEFECTS	LOG BOOK		P/V	-	-	
1.11	SLIP RING (WHEREVER APPLICABLE)	1.SURFACE COND.	MA	VISUAL	100%	-	-	FREE FROM VISUAL DEFECTS	LOG BOOK		P	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S DRG	MANUFACTURER'S DRG	LOG BOOK		P	-	-	
		3.TEMP.WITH-STAND CAPACITY	MA	ELECT.TEST	SAMPLE	-	MANUFACTURER'S STD./ APPROVED DATASHEET	MANUFACTURER'S STD./ APPROVED DATASHEET	LOG BOOK		P/V	-	-	
		4.HV/IR	MA	-DO-	100%	-	MANUFACTURER'S STD./ APPROVED DATASHEET	MANUFACTURER'S STD./ APPROVED DATASHEET	LOG BOOK		P/V	-	-	
1.12	OIL SEALS & GASKETS	1.MATERIAL OF GASKET	MA	VISUAL	100%	-	MANUFACTURER'S DRG/SPECS	MANUFACTURER'S DRG./ SPECS.	LOG BOOK		P	-	-	
		2.SURFACE COND.	MA	VISUAL	100%	-	-	FREE FROM VISUAL DEFECTS	LOG BOOK		P	-	-	
		3.DIMENSIONS	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S DRG	MANUFACTURER'S DRG	LOG BOOK		P	-	-	

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	ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))	SYSTEM:	SECTION: II	SHEET 5 OF 9

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
2.0	IN PROCESS													
2.1	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR)	1.WORKMANSHIP & CLEANNESS	MA	VISUAL	100%	-	MANUFACTURER'S DRG	GOOD FINISH	LOG BOOK		P/W	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	100%	-	MANUFACTURER'S DRG	MANUFACTURER'S DRG	LOG BOOK		P	-	-	
2.2	MACHINING	1.FINISH	MA	VISUAL	100%	-	-DO-	GOOD FINISH	LOG BOOK		P	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	100%	-	MANUFACTURER'S DRG	MANUFACTURER'S DRG	LOG BOOK		P	-	-	
		3.SHAFT SURFACE FLOWS	MA	PT	100%	-	MANUFACTURER'S STD./ ASTM-E165	MANUFACTURER'S STD./ APPROVED DATASHEET.	LOG BOOK	✔	P	V	-	
2.3	PAINTING	1.SURFACE PREPARATION	MA	VISUAL	100%	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-	
		2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT)	MA	MEASUREMENT BY ELCOMETER	SAMPLE	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-	
		3.SHADE	MA	VISUAL	SAMPLE	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-	
		4.ADHESION	MA	CROSS CUTTING & TAPE TEST	SAMPLE	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-	

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Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
2.4	SHEET STACKING	1.COMPLETENESS	MA	MEASUREMENT	SAMPLE	-	MANUFACTURER'S STD.	MANUFACTURER'S STD.	LOG BOOK		P	-	-	
		2.COMPRESSION & TIGHTENING	MA	MEASUREMENT	100%	-	MANUFACTURER'S STD.	MANUFACTURER'S STD.	LOG BOOK		P	-	-	
2.5	WINDING	1.COMPLETENESS	CR	VISUAL	100%	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-	
		2.CLEANLINESS	CR	VISUAL	100%	-	MANUFACTURER'S STD./APPROVED DATASHEET	MANUFACTURER'S STD./APPROVED DATASHEET	LOG BOOK		P	-	-	
		3.IR-HV-IR	CR	ELECT. TEST	100%	-	IS-325//IS-12615/IEC-60034 PART-1	IS-325//IS-12615/IEC-60034 PART-1	TEST/INSPC. REPORT	✔	P	V	-	
		4.RESISTANCE	CR	ELECT. TEST	100%	-	IS-325//IS-12615/IEC-60034 PART-1	IS-325//IS-12615/IEC-60034 PART-1	TEST/INSPC. REPORT	✔	P	V	-	
		5.INTERTURN INSULATION	CR	ELECT. TEST	100%	-	IS-325//IS-12615/IEC-60034 PART-1	IS-325//IS-12615/IEC-60034 PART-1	TEST/INSPC. REPORT		P	-	-	
2.6	IMPREGNATION	1.VISCOSCITY	MA	PHY. TEST	AT STARTING	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	LOG BOOK		P	-	-	
		2.TEMP. PRESSURE VACCUM	MA	PROCESS CHECK	CONTINUOUS	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	LOG BOOK		P	-	-	
		3.NO. OF DIPS	MA	PROCESS CHECK	CONTINUOUS	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	LOG BOOK	✔	P	V	-	THREE DIPS TO BE GIVEN

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Reviewed by:			
Approved by:			

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:17.04.2020
	CUSTOMER :		QP NO.: PE-QP-999-Q-007, REV-04	
	PROJECT:		PO NO.:	
	ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))	SYSTEM:	SECTION: II	SHEET 7 OF 9

Sl No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
		4.DURATION	MA	PROCESS CHECK	CONTINUOUS	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	LOG BOOK	✔	P	V	-	
2.7	COMPLETE STATOR ASSEMBLY	1.COMPACTNESS & CLEANLINESS	MA	VISUAL	100%	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	LOG BOOK		P	-	-	
2.8	BRAZING/COMPRESSION JOINT	1.COMPLETENESS	CR	VISUAL	100%	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	LOG BOOK		P	-	-	
		2.SOUNDNESS	CR	MALLET TEST & UT	100%	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	TEST/INSPC. REPORT	✔	P	V	-	
		3.HV	MA	ELECT. TEST	100%	-	MANUFACTURER'S STANDARD	MANUFACTURER'S STANDARD	TEST/INSPC. REPORT	✔	P	V	-	
2.9	COMPLETE ROTOR ASSEMBLY	1.RESIDUAL UNBALANCE	CR	DYN. BALANCE	100%	-	MANUFACTURER'S SPEC./ ISO 1940	MANUFACTURER'S DWG.	LOG BOOK		P	-	-	
		2.SOUNDNESS OF DIE CASTING	CR	ELECT. (GROWLER TEST)	100%	-	MANUFACTURER'S SPEC.	MANUFACTURER'S SPEC.	TEST/INSPC. REPORT	✔	P	V	-	
2.10	ASSEMBLY	1.ALIGNMENT	MA	MEAS.	100%	-	MANUFACTURER'S SPEC.	MANUFACTURER'S SPEC.	LOG BOOK		P	-	-	
		2.WORKMANSHIP	MA	VISUAL	100%	-	MANUFACTURER'S SPEC.	MANUFACTURER'S SPEC.	LOG BOOK		P	-	-	
		3.AXIAL PLAY	MA	MEAS.	100%	-	MANUFACTURER'S SPEC.	MANUFACTURER'S SPEC.	LOG BOOK	✔	P	V	-	
		4.DIMENSIONS	MA	MEAS.	100%	-	MANUFACTURER'S DRG./ MANUFACTURER'S SPEC.	MANUFACTURER'S DRG./ MANUFACTURER'S SPEC.	LOG BOOK		P	-	-	
		5.CORRECTNESS, COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	-	MANUFACTURER'S SPEC.	MANUFACTURER'S SPEC.	LOG BOOK		P	-	-	
		6. RTD, BTD & SPACE HEATER MOUNTING.	MA	VISUAL	100%	-	MANUFACTURER'S SPEC.	MANUFACTURER'S SPEC.	LOG BOOK	✔	P	V	-	

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	HEMA KUSHWAHA	HEMA KHUSHWAHA	Checked by:		KUNAL GANDHI
Reviewed by:	PRAVEEN DUTTA	PRAVEEN DUTTA	Reviewed by:	RITESH KUMAR JAISWAL	R K JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
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					M	C/N				D	M	C	N	
3.0	TESTS	1.TYPE TESTS INCLUDING SPECIAL TESTS	MA	ELECT.TEST	1/TYPE/SIZE	1/TYPE/SIZE	IS-325//IS-12615/APPROVED DATASHEET	IS-325/IS-12615/APPROVED DATASHEET	TEST REPORT	✔	P	W*	-	* NOTE - 1
		2.ROUTINE TESTS INCLUDING SPECIAL TEST	MA	ELECT.TEST	100%	-	IS-325//IS-12615/APPROVED DATASHEET	IS-325/IS-12615/APPROVED DATASHEET	TEST REPORT	✔	P	V$	-	$ NOTE - 2
		3.VIBRATION & NOISE LEVEL	MA	ELECT.TEST	100%	-	IS: 12075 / IEC 60034-14 & IS-12065	IS: 12075 / IEC 60034-14 & IS-12065	TEST REPORT	✔	P	V$	-	$ NOTE - 2
		4.OVERALL DIMENSIONS AND ORIENTATION	MA	MEASUREMENT & VISUAL	100%	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET &	TEST/INSPC. REPORT	✔	P	W	-	
		5.DEGREE OF PROTECTION	MA	ELECT. & MECH. TEST	1/TYPE/ SIZE	-	IEC 60034-5/IS-12615	APPROVED DATASHEET	TC	✔	P	V	-	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		6. MEASUREMENT OF RESISTANCE OF RTD & BTD	MA	ELECT. & MECH. TEST	100%	-	IS-325//IS-12615/IEC-60034 PART-1/IS: 12802	IS-325/IS-12615/IEC-60034 PART-1/IS: 12802	TC	✔	P	V$	-	$ NOTE - 2
		7. MEASUREMENT OF RESISTANCE, IR OF SPACE HEATER	MA	ELECT. & MECH. TEST	100%	-	IS-325//IS-12615/IEC-60034 PART-1	IS-325/IS-12615/IEC-60034 PART-1	TC	✔	P	V$	-	$ NOTE - 2
		8. NAME PLATE DETAILS	MA	VISUAL	100%	-	IS-325//IS-12615& DATA SHEET	IS-325//IS-12615 & DATA SHEET	TEST/INSPC. REPORT	✔	P	V$	-	$ NOTE - 2
		9.EXPLOSION FLAME PROOF NESS (IF SPECIFIED)	MA	EXPLOSION FLAME PROOF TEST	1/TYPE	-	IS 2148 / IEC 60079-1	IS 2148 / IEC 60079-1	TC	✔	P	V	-	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		10. PAINT SHADE, THICKNESS & FINISH	MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	SAMPLE	APPROVED DATASHEET	APPROVED DATASHEET	TC	✔	P	W$	-	SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY $ NOTE - 2

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
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BIDDER/ SUPPLIER	
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					M	C/N				D	M	C	N	
4.0	PACKING	SURFACE FINISH & COMPLETENESS	MA	VISUAL	100%	100%	AS PER MANUFACT. STANDARD / (#)	AS PER MANUFACT. STANDARD / (#)	INSPC. REPORT	✔	P	W	-	(#): REFER NOTE-8

NOTES:

1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED.

2 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL/CUSTOMER SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON.

3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE, THE SAME IS VALID FOR 5 YEARS.

4 BHEL RESERVES THE RIGHT TO PERFORM REPEAT TEST, IF REQUIRED.

5 AFTER PACKING AND PRIOR TO ISSUE MDCC, PHOTOGRAPHS OF ITEMS TO BE DESPATCHED SHALL BE SENT TO BHEL PURCHASE GROUP FOR REVIEW.

6 IN CASE , ANY CHANGES IN QP COMMENTED BY CUSTOMER AT CONTRACT STAGE SHALL BE CARRIED OUT BY BIDDER WITHOUT ANY IMPLICATION TO BHEL/ CUSTOMER.

7 PROJECT SPECIFIC QP TO BE DEVELOPED BASED ON CUSTOMER REQUIREMENT.

8 FOR EXPORT JOB, BHEL TECHNICAL SPECIFICATION FOR SEAWORTHY PACKING TO BE FOLLOWED.

9 PACKING SHALL BE SUITABLE FOR STORAGE AT SITE IN TROPICAL CLIMATE CONDITIONS.

10 LATEST REVISION/ YEAR OF ISSUE OF ALL THE STANDARDS (IS/ ASME/ IEC ETC.) INDICATED IN QP SHALL BE REFERRED.

LEGENDS:

*RECORDS, INDENTIFIED WITH "TICK"(√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION,

** **M**: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, B: MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, **C**: CUSTOMER,

P: PERFORM, **W**: WITNESS, **V:** VERIFICATION, AS APPROPRIATE

MA: MAJOR, **MI**: MINOR, **CR:** CRITICAL

D: DOCUMENT

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
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Reviewed by:	PRAVEEN DUTTA	PRAVEEN DUTTA	Reviewed by:	RITESH KUMAR JAISWAL	R K JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

SECTION–3.17: CABLING ACCESSORIES

1.0.0 INTENT OF SPECIFICATION

SECTION-II

This section covers the requirements of cabling accessories. List of major items shall include the following:

- Cable joints & terminations
- Cable glands
- Cable lugs
- Camps
- Tags
- Conduits & Pipes
- Junction boxes

2.0.0 CODES AND STANDARDS

The equipment to be furnished under this specification shall be in accordance with the applicable section of the latest version of the following Standards except where modified and /or supplemented by this specification.

a) VDE 0278 : Joints and Terminations
b) IS: 13573 : Joints and Terminations for polymeric cables for working voltages from 6.6 KV up to and including 33 KV-Performance requirements and type tests.
c) BS:6121 : Mechanical cable glands (Part 1 –Specification for metallic glands)
d) IS: 12943 : Brass Glands for PVC Cables
e) IS:8309 : Specification for compression type tubular terminal ends for aluminium conductors of insulated cables.

3.0.0 TECHNICAL REQUIREMENTS

3.1.0 Joints & terminations

3.1.1 Termination and jointing kits shall be of proven design and make which have already been extensively used and fully type tested. Kits shall be complete with all accessories and consumables required for complete termination or jointing. Copper cable lugs & jointing ferrules for straight through joints shall form part of the kit.

3.1.2 Termination and jointing kits shall be suitable for the following types of cables as per IS.

- 11 KV unearthed grade cable
- 1.1 KV grade power cables

3.1.3 Termination kits shall be ‘elastimold’ or ‘Push on type’ or ‘heat shrinkable type’. Jointing kits shall be ‘ Tapex type’ or ‘heat shrinkable type’.

3.1.4 Straight through joint and termination shall be capable of withstanding the fault level of 44KA for HT Cables.

3.1.5 Straight through joints shall be protected against mechanical damage, rodent and termite attack. It shall be suitable for directly buried cables.

3.2.0 Cable glands

Cables shall be terminated using cable glands suitable for the voltage grade of cables. Cable glands shall be heavy duty brass machine finished and tinned. Cable glands shall be supplied with neoprene seal and earth lugs suitable for the fault capacity of the armour of the installed cables. Cable glands shall be double compression type for armoured cables. For flame proof equipment cable glands shall be of flame proof type.

3.3.0 Cable lugs

3.3.1 Cable lugs shall be of aluminium for aluminium cables and tinned copper for copper cables. Thickness of tinning shall be not less than 10 microns Type of end connection shall be solderless crimping type.

3.3.2 Cable lugs for conductors of power cables shall be “heavy duty” type. The type & size of cable lugs for power cables shall be selected according to the number and sizes of strands of the cable.

3.3.3 Solder less crimping of terminals shall be done by using corrosion inhibiting compound. Cable lugs for control cable termination shall be insulated. These lugs shall be pin type/flat type/ ring type/U Type to suit the terminals provided in the panels.

3.3.4 Type of cable lugs shall be as follows:

- Power cables with aluminium conductor : Aluminium crimping type.
- Power cables with copper conductor : Copper crimping type.
- Control Cables : Copper pin type /Copper screw type
- Special cables : pin type / maxi-termi type

3.4.0 Trefoil Cable Clamps

- Clamps required for single core cables carrying alternating current shall be suitable for holding three cables together in delta formation. Clamps shall be of FRP material.
- Clamps shall be of suitable sizes to firmly hold the cables of various outer diameters including tolerance in OD.
- Clamps should have been type tested for Short Circuit Withstand Test .
- For Trefoil clamps run spacing shall be 2000 mm and Axial spacing shall be Double the diameter of larger adjacent trefoils cable or 150 mm whichever is less. Supports shall also be provided at each bend

3.5.0 Omega Cable clamps

- Omega clamps shall be of galvanized mild steel and shall be used to fasten the individual multi-core cables.
- Clamps shall be of simple construction, made of 2mm thick, 25mm wide strip of omega shape and suitable for clamping on the rungs / perforated sheet of tray with the help of two bolts.
- Clamps shall be of different sizes for different outer diameters of cables. Omega cable clamps shall be used for individual cables above 35mm outer diameter.
- Steel clamps shall be hot dip galvanized. Weight of zinc not less than 610 gms. per sq. metre
- For cables of above 35 mm OD, cables shall be individually clamped at 5000 mm interval for Horizontal runs and shall be individually clamped at 1000 mm interval for Vertical runs. Supports shall also be provided at each bend.

- For cables of up to 35 mm OD, cables shall be collectively clamped at 5000 mm interval for Horizontal runs and shall be collectively clamped at 1000 mm interval for Vertical runs. Supports shall also be provided at each bend.
- For cables supported along structures/ceiling, clamp spacing shall be 750 mm. Supports shall also be provided at each bend.

3.6.0 Strip Cable Clamps

- Strip clamps shall be of galvanized mild steel and shall be used to fasten the group of multi-core cables up to 35mm diameter only on a full or part of the tray width.
- Clamps shall be of simple construction, made of 3mm thick Steel, 25mm wide strip to cover the entire width up to 300mm wide tray and part of the tray for more than 300mm wide trays. Strip shall have two right angle bends at each end for fixing on to the rung/ perforated sheet of tray with the help of two bolts.
- Clamps shall be of different sizes for different sizes of tray width. However, the maximum size of clamp shall be 300mm and for cable trays of greater width, two clamps shall be used.
- Clamps shall be hot dip galvanized. Weight of zinc not less than 610 gms. per sq. metre

3.7.0 Self-locking Clamps

- Clamps shall be of FRP material. Clamps shall have self-locking feature when the cord is looped. Clamps shall be provided with manual lock release.
- Clamp cord shall not move in the backward position once it has been locked, unless the lock release is applied.
- Type test certificates to ascertain the strength of clamps shall be submitted for Owner's approval.
- Not more than four (4) cables shall be clamped together, wherever collective clamping is permitted.
- Clamp length shall be selected such that not more than 80% of lockable length is tilized for clamping.
- Nylon self-locking tie strips for collective clamping (up to 35mm OD max. group of 4 cables) shall be 4 mm having Tensile strength 30 kg.
- Nylon self-locking tie strips for Individual multicore clamping (above 35mm OD up to 55mm OD) shall be 4 mm having Tensile strength 20 kg.
- Nylon self-locking tie strips for Individual multicore clamping (above 55mm OD) shall be 7 mm having Tensile strength 60 kg.

3.8.0 Tags

- Cables shall be provided with cable number tags for identification.
- Cable tags shall be of aluminium.
- Cable numbers shall be engraved type
- Tags shall be of durable quality of size 60mm x 12mm with a tie hole at each end.
- Samples of tags shall be approved by the Owner before delivery.
- Tags shall be provided with non-corrosive wire of sufficient strength for tagging.

3.9.0 Junction Boxes

3.9.1 Junction box with IP 55 degree of protection, shall comprise of a case with hinged door constructed from FRP material. The junction box shall be provided with canopy. The boxes shall include brackets, bolts, nuts, screws, glands, lugs, M8 earthing stud etc.

3.9.2 Terminal blocks shall be of 650V grade, rated for 10A and in one piece moulding. It shall be complete with insulating barriers, clip-on-type terminal numbering on wiring diagrams. Terminal block shall be suitable for terminating 2Cx2.5mm^2 cable on both sides and arranged to facilitate easy termination. Cable entry shall be from bottom.

3.9.3 The boxes shall have provision for wall, column, pole or structure mounting and shall be provided with cable / conduit entry knockouts and terminals.

The list of approved make of the LT Motors are as mentioned below:

S. NO.	LIST OF MOTORS	
1	NON FLAME PROOF	ABB
2		BHARAT BIJLEE LTD.
3		CROMPTON GREAVES
4		GE-POWER
5		KIRLOSKAR ELECTRIC CO LTD.
6		LAXMI HYDRAULICS PVT. LTD
7		MARATHON
8		NGEF
9		RAJINDRA ELECT INDUSTRIES
10		SIEMENS
11	FLAME PROOF	RAJINDRA ELECT INDUSTRIES

However, the final list of makes for the LT Motors is subjected to BHEL/Customer approval, during contract stage, without any commercial implications.

The list of make of CABLE LUGS & CABLE GLANDS are as mentioned below:	
CABLE LUGS	
1	DOWELLS
2	UNIVERSAL MACHINES LTD.
CABLE GLANDS	
1	ALLIED TRADERS & EXPORTERS
2	ARUP ENGG & FOUNDARY WORKS
3	BALIGA LIGHTING EQPT.PVT.LTD.
4	COMMET BRASS PRODUCTS
5	DOWELLS
6	ELECTROMAC INDUSTRIES
7	INCAB

However, the final list of makes for the CABLE LUGS & CABLE GLANDS are subjected to BHEL/Customer approval, during contract stage, without any commercial implications.

SECTION – D3
GENERAL TECHNICAL REQUIREMENTS
(CONTROL AND INSTRUMENTATION)

C&I TECHNICAL REQUIREMENT	
1	Control of Chemical Dosing System shall be from FGD DCS through Operator's work station located in Control Room. FGD DCS is in BHEL Scope of supply.
2	Local Control with start, stop push buttons from Local Control Panel shall be provided by bidder.
3	Complete Field Intrumentation for monitoring and operation of Chemical Dosing System shall be provided by bidder.
4	The quantity of instruments for the system shall be as per tender P &ID wherever provided of the respective system as a minimum, for bidding purpose.
5	Bidder to terminate all instrumentation and control elements in the control panel for further cabling to FGD DCS by BHEL.
6	Root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifold, junction boxes and all other accessories required for erection of local / remote instruments shall be provided by bidder. Double root valve to be provided where the design pressure is or more than 40kg/cm2. For pressure, differential pressure, level and flow measurements root valve shall be Socket Welded globe valve of sizes 1/2", 3/4", 1".
7	The contacts of equipment mounted instruments, sensors, switches etc. for external connection including spare contacts shall be wired out in flexible/rigid conduits, independently to suitably located common junction boxes.
8	415 V, 3 phase AC power supply shall be provided by BHEL at a single point for the local control panel. All necessary hardware for deriving other power supply from given feeder shall be in vendor's scope.
9	Diaphragm seal shall be provided with Instruments having contact with corrosive media.
10	Redundancy of sensors shall be provided by bidder (i) Triple redundancy for all analog and binary inputs required for protection of system/drives. (ii) For Interlock purpose dual redundancy of the sensors shall be provided by the bidders.
11	All the wetted parts of the instruments including the accessories like root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifolds and all the other accessories required for mounting/erection of these local instruments as well as valves shall be of SS-316 material, suitable pressure class and same shall be in bidder's scope. For all instruments envisaged for seawater applications, they shall be provided with wetted parts of Super duplex SS.
12	All instruments shall be terminated on JB in field. Number of Junction Boxes shall be sufficient and positioned in the field to minimize local cabling (max 12-15 mtrs) and trunk cable. All Junction Boxes which are not installed inside building, suitable canopy shall be provided and design of canopy shall be approved by Employer during detailed engineering.
13	All the outdoor field instruments such as switches/transmitters/meters etc. shall be provided with suitable Free standing cabinet(s)/panel/rack so that the equipment are protected against rain/ sunlight etc.
14	Every instrument requiring power supply shall be provided with a pair of easily replaceable glasses cartridge fuse of suitable rating. Every instrument shall be provided with a grounding terminal and shall be suitably connected to the panel grounding bus.
15	All the field instruments shall also be provided with SS tag nameplate and double compression type nickel-plated brass cable gland. Gaskets, fastener, counter and mating flange shall also be included

16	An anti-corrosive paint shall be applied to the field mounted enclosures / instruments. All instruments shall be provided with durable epoxy coating for housings and all exposed surfaces of the instruments
17	Bidder shall include all the measurements necessary for the safe, efficient, reliable and fully automatic operation of the entire plant including all fail-safe requirements and recommendations of each equipment manufacturer.
18	All electronic instruments and junction box shall be suitable for area classification as per IEC/NEC codes.
19	All weather Local Panel fitted with integral Air Conditioner shall be provided for housing analyzers etc if the same are not kept in AC rooms.
20	Number of pairs to be selected for Screen/ Control cable (a) F-Type: 2P/4P/8P/12P/24P(Size : 0.5 mm2) (b) G-Type: 4P/8P/12P(Size : 0.5 mm2) (c) Core Cable: 3CX2.5sqmm2/ 5CX1.5sqmm2/ 12CX1.5sqmm2
21	All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. While packing all the materials, the limitation from the point of view of the sizes of railway wagons available in India should be taken account of. The Bidder shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. BHEL shall have right to insist for completion of works in shops before despatch of materials for transportation.
22	Complete C&I system for Chemical Dosing System is in bidder’s scope of supply. Items not specifically mentioned however required for the completeness of the system shall be supplied by bidder without any commercial implication.
23	The make/model of various instruments/items/systems shall be subject to approval of owner/purchaser during detailed engineering stage. No commercial implication in this regard shall be acceptable. In case of any conflict or repetition of clauses in the specification, the more stringent requirements among them are to be complied with.
24	At least 20% spare unused terminals shall be provided everywhere including local junction boxes, instrument racks/enclosures, termination/marshalling cabinets, etc.
25	**TYPE TEST GENERAL REQUIREMENT**
25.1	Submission of type test results and certificate shall be acceptable provided:
25.2	The same has been carried out by the Bidder on exactly the same model /rating of equipment.
25.3	There has been no change in the components from the offered equipment & tested equipment.
25.4	The test has been carried out as per the latest standards alongwith amendments as on the date of Bid opening.
25.5	In case the approved equipment is different from the one on which the type test had been conducted earlier or any of the above grounds, then the tests have to be repeated and the cost of such tests shall be borne by the Bidder within the quoted price and no extra cost will be payable by the BHEL on this account.
25.6	The schedule of conduction of type tests/ submission of reports shall be submitted and finalized during pre-award discussion.
25.7	For the type tests to be conducted,Bidder shall submit detailed test procedure for approval by BHEL. This shall clearly specify test setup, instruments to be used, procedure, acceptance norms (wherever applicable), recording of different parameters, interval of recording precautions to be taken etc. for the tests to be carried out.

TECHNICAL DATA - PART - A

SL.NO	DESCRIPTION	UOM	DETAIL
1.0	**DESIGN CODES & STANDARDS**		
1.1	Impulse pipes, tubes (material, rating)		ANSI B31.1, ANSI B31.1a, ANSI/ISA 77.70
1.2	Valves (material, pr. Class, size)		ASTM A182/ASTM A105 as per ASME 16.34
1.3	Fittings (size, rating, material)		ANSI B31.1, ANSI B31.1a, ASME B16.11
1.4	Installation schemes		BS 6739-2009, ANSI/ISA 77.70
1.5	Instruments and apparatus for pressure		ASME PTC19.2
1.6	Electonic transmitters		BS-6447, IEC-60770
1.7	Bourdon tube pressure and vacuum gauges		IS-3624
1.8	Recommendations for the design of scales and		IS:3602
1.9	ASME standard for Pressure Gauges		ASME B 40.1
1.10	Code of practice for phosphating of iron and steel.		IS-6005
1.11	Colors for ready mixed paints and enamels.		IS-5
1.12	Circuit breaker for household and similar		IS-8828
1.13	Low Voltage switchgear & control gear : Part-I		IS-13947 (Part-I)
1.14	Annunciator Sequences and Specification		ISA-18.1
1.15	Purged & Pressurised Enclosure for Electrical		NFPA-496
1.16	Type of Enclosures		NEMA ICS Part - 6 - 1978 (with Rev. 1 4/80) through 110.22 (Type 4 to 13)
1.17	Racks, panels and associated equipment		EIA : RS - 310 C- 1983 (ANSI C83.9 - 1972)
1.18	Protection class for enclosures, cabinets, control		IS:2147 -1962
2.0	**DESIGN /SYSTEM PARAMETERS**		
2.1	**DATASHEET - PRESSURE TRANSMITTER, DIFFERENTIAL PRESSURE TRANSMITTER**		
	Type/Construction		Sealed capacitance/ Inductance/ Silicon resonance type
	Body		SS316 T
	Diaphragm		316 SS
	Measurement element material		Teflon seal
	Valves		Carbon steel for non-corrosive Applications SS316 for corrosive applications, SS super duplex for sea water application.
	Output signal		4 to 20 m Amp. DC (Two wires) HART Compatible
	Local Indicator		LCD indicator (5 digit) with scale of Engg. Unit
	Overall Accuracy		± 0.065% or better of FSR
	Turn down ratio		10:1 for vacuum / very low pressure application30:1 for other applications
	Stability		± 0.15% for 10 years.
	Response time		100 msec.
	Power supply		24V DC nominal
	Drive capability		500 Ohms minimum
	Enclosure Class		IP-65 (Explosion proof as per NEC article 500 for hazardous area)
	Span and Zero		Locally adjustable, non-interacting
	Zero suppression / elevation		At least 100% of Span
	Connection		
	Process		Half (1/2) inch NPT (F)
	Electrical		Plug and socket, unused entry with blind plug.
	Span and zero adjustment facility		Required
	Accessories		
	For Absolute Pressure		Two (2) valve SS316 manifold
	For Gauge & Vacuum pressure transmitter		Three (3) valve SS316 manifold
	For DP, level & flow Transmitter		Five (5) valve SS316 manifold
	For oil and corrosive liquids		Separator diaphragm seals
	Diaphragm material		SS super duplex
	Flush ring & drain		Provided for lime stone slurry based & sea water applications
	For all transmitters		Mounting bracket
	Mounting		Local (in LIE/LIR)
2.2	**DATASHEET - PRESSURE GAUGE, DIFFERENTIAL PRESSURE GAUGE**		

	Sensing element		Bourdon for high pressure, diaphragm/bellow for low pressure
	Sensing element material		SS316
	Case		SS 316/ Die-cast aluminum with stoved enamel black finish. Epoxy coating shall be provided for corrosive atmosphere.
	Protective Diaphragm		Teflon
	Dial size	mm	150mm with shatter proof glass
	Scale Details		Graduations in black lines on white dial, 270 Deg pointer defection scale provided with glass cover. Smallest scale division shall be one (1) percent of full scale value or smaller. Pointer stop for all gauges.
	Accuracy		± One (1) percent or better
	Connection – Instrument Process		1/2 inch NPT Male Bottom
	Mounting		Local 1/2 inch NPT Male (Back entry) mounted on local gauge board.
	Accessories		
	3 way needle valve/manifolds		For all gauges
	Self-cleaning type : Pulsation dampener/snubber		Pump and compressor discharge lines
	Syphon		For all steam lines
	Protective separating		For fuel oil and corrosive liquid lines
	Other particulars		Blow out disc, siphon, snubber, pulsation, dampener, chemical seal, gauge isolation valve
	Zero & span adjustment		For all gauges
	Housing		IP 65
	Diaphragm material		SS super duplex
	Flush ring & drain		Provided for lime stone slurry based & sea water applications
	Ranges 5 to 20 Kg/cm²		Rubber blow out disc with open front construction
	Ranges above 20 Kg/cm²		Neoprene safety diaphragm at the back with solid front construction
	Over range protection		Fifty (50) percent of full scale Movement mechanism shall be glycerin filled for oil services & vibration prone area.
			For corrosive liquid lines diaphragm type sensors required. Armored capillary of 10 mtrs for Corrosive liquid service. Contact type pressure gauges are not acceptable for interlock & protection.
	Identification		Identification engraved with service legend or laminated phenolic name plate.
2.3	**DATASHEET - ULTRASONIC LEVEL TRANSMITTER**		
	Transmitter type		Non contact microprocessor based 2 wire type , HART protocol compatible
	Principle of Operation		Detection of reflected ultrasonic pulse
	Measuring Ranges		Up to 30 meters (typical)
	Signal Processing		Microprocessor Controlled Signal Processing
	Operating Freq.		10 KHz to 50 KHz (typical)
	Signal Output	mA	Galvanically isolated 4-20mA DC with HART protocol
	Accuracy & Repeatability	%	±0.25% of span or better
	Power supply	V	24 V DC +/- 10% or 230 VAC 50 Hz
	Temperature compensation		To be provided within transducer
	Status		For power, Hi / Lo / V. Hi / V. Lo-level indication, fault etc.
	Construction		Plug-on board
	Hysteresis		Fully adjustable preferred
	False signal tolerance		Transmitter shall be capable of ignoring false echoes
	Display		Head mounted Large alpha-numeric back lit LCD/LED
	Calibration & Configuration		Accessible from front of panel
	Diagnosis		On-line

	Output contacts		2SPDT Potential free changeover contacts @ 8A 230V AC.
	Resolution		±0.1% of span
	Operating temp.		Transmitter-50 deg C and Sensor –80deg C
	MOC Sensor		Body- PVDF and Face – Polyurethane or Corrosion resistant material to suit Individual application requirement
	Humidity		1% to 95% non-condensing
	Enclosure		IP-65 Epoxy painted die cast Aluminum or SS316L housing.
	Cable Connection		Plug and socket.
	Mounting		2” – 4” NPT or flanged
	Accessories		Cable gland, prefab cable, mounting accessories like EPDM seal, SS316 flanged etc
			Additional separate local display unit with large Alphanumeric back light LCD/LED & to be provided for the applications which will be decided during detailed engineering.
			All weather canopy for protection from direct sunlight and direct rain.
			All mounting hardware and accessories required for erection and commissioning mounting fittings material shall be SS 316.
2.4	**DATASHEET - LEVEL GAUGE**		
	Type/Construction		a) Reflex b) Tubular (For tanks open to atmosphere only)
	Material:		
	a) Glass		Tempered toughened borosilicate resistant to thermal shock
	b) Body material		Forged Carbon steel / SS 304
	c) Integral cocks and		i) Forged carbon steel with drain valves stainless steel internals ii) Rubber lined corrosion resistant stainless steel 316 (for demineralized and Osmosis water service)
	d) Fittings		i) Forged carbon steel ii) Rubber lined 316 steel/PVC for corrosive liquids Demineralized and Osmosis water service) iii) 304 Stainless Steel for non-corrosive liquids
	e) Packing		Teflon
	Dial size/scale		150 mm /1.4 Meters maximum length with shatter Proof glass
	Scale details		Aluminum/SS316 scale Graduated in mmwc
	Connection		25 Nb/40 Nb ANSI Flanged
	Enclosure protection		IP 65
	Accessories		a) Integral cocks b) Drain/vent valves 15 NB c) Bolts, nuts and gaskets for all KEL-F shield for transparent type d) Illuminating lamps as required e) Periscope as required
	Tests		Tested at two hundred (200) percent of the maximum process pressure
	Other details		For larger lengths, additional gauge glasses shall be provided with minimum of 50 mm overlap.
2.5	**LOCAL CONTROL PANEL SPEC ARE ATTACHED SEPARATELY.**		

TECHNICAL DATA - PART - B (SUPPLIER DATA TO BE FURNISHED AFTER AWARD OF CONTRACT)

SL.NO	DESCRIPTION	UOM	DETAIL
	FOLLOWING DATA SHALL BE FILLED UP BY VENDOR FOR EACH INSTRUMENT(PT,DPT,LT,LG, PG, LIMIT SWITCH ETC.)		
1.0	MAKE		
1.1	MODEL		
1.2	TAG NO. / KKS NO.		
1.3	SERVICE		
1.4	QUANTITY		
1.5	OPERATING PRESSURE		
1.6	OPERATING TEMPERATURE		
1.7	DESIGN PRESSURE		
1.8	DESIGN TEMPERATURE		
1.9	RANGE		

STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)

CHECK LIST FOR TRANSMITTER

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECKS FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	W	V	
	VISUAL.						
	MODEL/TAG No						
2	PROCESS CONNECTION			P	W	V	
3	ACCURACY			P	W	V	
4	REPEATABILITY			P	W	V	
5	HYSTERESIS			P	W	V	
6	EFFECT OF TEMP VARIATION ON ACCURACY			P	W	V	
7	SPAN / ZERO ADJUSTMENT	ONE / TYPE		P	W	V	
8	EFFECT OF SUPPLY VOLTAGE VARIATION			P	W	V	
9	EFFECT OF LOADING (500 OHM METERS)			P	W	V	
10	HIGH PRESSURE TEST	SEE NOTE-1 BELOW		P	W	V	
11	BURN-IN TEST	ONE / TYPE		P	W	V	
12	DEGREE OF PROTECTION			P	W	V	
13	ACCESSORIES AS APPLICABLE	SEE NOTE-1 BELOW		V	V	V	

Legend :

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL, P = Perform, W = Witness, V = Verification

Note :

1. Quantum of check shall be as below :
   100 % - By Manufacturer
2. Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
3. When material corelation are not available manufacturer's compliance to be provided.
4. Contractor to provide compliance certificate for tests/checks verifid by contractor and submit the same alongwith test certificates to be verified by BHEL.

STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)

CHECK LIST FOR SOLENOID VALVES

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	W	V	
	TYPE						
	MAKE						
	MODEL No.						
2	MATERIAL (BODY. PLUNGER/TRIM)			P	W	V	
3	PORT SIZE			P	W	V	
4	CABLE CONNECTION SIZE			P	W	V	
5	ENCLOSURE CLASS			P	W	V	TYPE TEST CERTIFICATE TO BE FURNISHED BY VENDOR
6	No. OF COILS & INSULATION CLASS			P	W	V	TEST CERTIFICATE TO BE FURNISHED FOR INSULATION CLASS BY VENDOR
7	POWER SUPPLY CHECK			P	W	V	
8	IR / HV TEST			P	W	V	
9	FUCTIONAL TEST			P	W	V	

Legend :

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Note :

1. Quantum of check shall be as below :
   100 % - By Manufacturer
2. Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
3. Contractor to provide compliance certificate for tests/checks verifid by contractor and submit the same alongwith test certificates to be verified by BHEL.

STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)

CHECK LIST FOR PRESSURE & DP GAUGE

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	W	V	
	SENSOR TYPE						
	DIAL SIZE						
	MODEL NO/TAG NO						
	RANGE/SCALE						
	SWITCH CONTACT RATING & NOS.						
	END CONNECTION						
2	CALIBRATION			P	W	V	
	ACCURACY						
	REPEATABILITY						
	SET POINT ADJUSTMENT						
3	OVER PRESSURE & LEAK TEST			P	W	V	
4	OPERATION OF PRESSURE. RELIEF DEVICE	ONE		P	W	V	
5	REVIEW OF TC FOR	FOR LOT		V	V	V	
	MATERIALS OF SENSOR						
	MOVEMENT						
	PROCESS CONNECTION						
	HOUSING						
6	REVIEW OF TC FOR DEGREE OF PROTECTION	TYPE TEST		V	V	V	
7	ACCESSORIES AS APPLICABLE	SEE NOTE-1 BELOW		V	V	V	

Legend :

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL, P = Perform, W = Witness, V = Verification

Note :

1. Quantum of check shall be as below :
   100 % - By Manufacturer
2. Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
3. Manufacturer to carry out ROUTINE TEST on 100 %.
4. When material corelation is not available, MFR's compliance to be provided
5. Contractor to provide compliance certificate for tests/checks verifid by contractor and submit the same alongwith test certificates to be verified by BHEL.

STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)

CHECK LIST FOR LEVEL GAUGE

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS / DRWGS	P	W	V	
	TYPE						
	MODEL/ TAG NO.						
	DAIL SIZE						
	RANGE/SCALE						
	END CONNECTION						
2	DIMENSIONS, PROCESS CONNECTION			P	W	V	
3	ACCURACY			P	W	V	
4	MATERIAL TC FOR	ONE / LOT		P	V	V	
	BODY ISO.						
	VALVE						
	GAUGE GLASS						
5	HYD. TEST	SEE NOTE-1 BELOW		P	W	V	
6	ACCESSORIES AS APPLICABLE			P	W	V	

Legend :

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL, P = Perform, W = Witness, V = Verification

Note :

1. Quantum of check shall be as below :
   100 % - By Manufacturer
2. Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
3. Manufacturer to carry out ROUTINE TEST on 100 %.
4. Contractor to provide compliance certificate for tests/checks verifid by contractor and submit the same alongwith test certificates to be verified by BHEL.

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
	CUSTOMER :		QP NO.: PE-QP-999-145-I056	DATE: 07.02.2020
	PROJECT:		PO NO.: --	DATE: --
	ITEM: LOCAL CONTROL PANEL	SYSTEM: C&I	SECTION: C	SHEET 1 OF 9

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY **			REMARKS
1	2	3	4	5	6		7	8	9	D	M	C	N	
					M	C/N								
	RAW MATERIAL													
1.0	Sheet Steel (CRCA & HR)	1. Chemical Composition	MA	Chemical analysis	Sample	Sample	IS:1079 IS:513	IS:1079 IS:513	Test Certificate	√	P/W	V		
		2. Bend Test	CR	Mech. test	Sample	Sample	IS:1079 IS:513	IS:1079 IS:513	Test Certificate	√	P/W	V		
		3. Surface finish	MA	Visual	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	---		
		4. Waviness	MA	Visual	100%	10%	Manufacturing Standard	No Waviness	Inspection Report	√	P/W	---		
		5. Thickness	MA	Measurement	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W	V		
		6. Mill marking	MA	Visual	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	V		
2.0	Flats / Angles / Channels	1. Dimensions	MA	Measurement	Sample	Sample	IS:2062	IS:2062	Test Certificate	√	P/W	---		
		2. Surface Defects	MA	Visual	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	---		
		3. Straightness	MA	Measurement	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	---		
		4. Mill marking	MA	Visual	100%	10%	IS:2062	IS:2062	Inspection Report	√	P/W	V		

BHEL						BIDDER/ SUPPLIER	
ENGINEERING			QUALITY			Sign & Date	
	Sign & Date	Name		Sign & Date	Name	Seal	
Prepared by:	14/2/2020	CHETAN MALIK	Checked by:	14/02/2020	KUNDAN PRASAD		
Reviewed by:	14/2/2020	RK RAINA	Reviewed by:	14/2/2020	RK JAISWAL		

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
	CUSTOMER :		QP NO.: PE-QP-999-145-I056	DATE: 07.02.2020
	PROJECT:		PO NO.: --	DATE: --
	ITEM: LOCAL CONTROL PANEL	SYSTEM: C&I	SECTION: C	SHEET 2 OF 9

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	*	**		
					M	C/N				D	M	C	N	
3.0	Cables / Wires	1. Visual / Surface defects	MA	Visual	100%	10%	IS:1554 or IS:694	IS:1554 or IS:694	Inspection Report	√	P/W			
		2. IR and HV	MA	Electrical	100%	10%	IS:1554 or IS:694	IS:1554 or IS:694	Inspection Report	√	P/W			
		3. Conductor a) Resistance b) Size c) Sheet colour	MA MA MA	Electrical Measurement Visual	100% 100% 100%	10% 10% 10%	IS:1554 or IS:694	IS:1554 or IS:694	Inspection Report	√	P/W			
		4. Type / Routine Test Certificates	MA	Verification	100%	10%	IS:1554 or IS:694	IS:1554 or IS:694	Inspection Report	√	P/W			
4.0	Electrical Components like Annunciator Transformers Lamps Switches PBs Contactors Relays	1. Verification at make and Type	CR	Visual	Sample	Sample	Approved Drg/Datasheet	Approved Drg/Datasheet	Test Certificate	√	P/W			
		2. Verification of Test Certificates	CR	Scrutiny of Type / Routine T.Cs.	100%	10%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Inspection Report	√	P/W			
		3. Operation / Functional check	CR	Electrical	Sample+ 100% @	Sample+ 10% @	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Inspection Report	√	P/W			+ for relay & contactors only

BHEL						BIDDER/ SUPPLIER	
ENGINEERING			QUALITY			Sign & Date	
	Sign & Date	Name		Sign & Date	Name	Seal	
Prepared by:	14/2/2020	CHETAN MALIK	Checked by:	14/02/2020	KUNDAN PRASAD		
Reviewed by:	14/2/2020	RK RAINA	Reviewed by:	14/2/2020	RK JAISWAL		

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
	CUSTOMER :		QP NO.: PE-QP-999-145-I056	DATE: 07.02.2020
	PROJECT:		PO NO.: --	DATE: --
	ITEM: LOCAL CONTROL PANEL	SYSTEM: C&I	SECTION: C	SHEET 3 OF 9

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	D	**			
					M	C/N					M	C	N	
	Timers, Space Heaters, Thermostat, Indicating meters etc.	4. I.R.	MA	Electrical	100%	10%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Inspection Report	√	P/W			@ for all components except relays & contactors.
		5. H.V.	MA	Electrical	100%	10%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Inspection Report	√	P/W			
		6. Calibration	MA	Electrical	100%	10%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Inspection Report	√	P/W	V		
		7. Pick up / Drop off Voltage	MA	Electrical	100%	10%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Inspection Report	√	P/W			
5.0	Misc. Components like Gaskets, Terminal Blocks etc.	1. Verification of Type / Make	MA	Visual	Sample	Sample	Manufacturing Standard	Manufacturing Standard	Test Certificate	√	P/W			
		2. Surface defects	MA	Visual	Sample	Sample	Manufacturing Standard	Manufacturing Standard	Test Certificate	√	P/W			
		3. IR / HV on Terminal Blocks	MA	Electrical	Sample	Sample	Manufacturing Standard	Manufacturing Standard	Test Certificate	√	P/W			
	IN PROCESS INSPECTION													

BHEL						BIDDER/ SUPPLIER	
ENGINEERING			QUALITY			Sign & Date	
	Sign & Date	Name		Sign & Date	Name	Seal	
Prepared by:	14/2/2020	CHETAN MALIK	Checked by:	14/02/2020	KUNDAN PRASAD		
Reviewed by:	14/2/2020	RK RAINA	Reviewed by:	14/2/2020	RK JAISWAL		

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
	CUSTOMER :		QP NO.: PE-QP-999-145-I056	DATE: 07.02.2020
	PROJECT:		PO NO.: --	DATE: --
	ITEM: LOCAL CONTROL PANEL	SYSTEM: C&I	SECTION: C	SHEET 4 OF 9

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	D	**			
					M	C/N					M	C	N	
6.0	Blanking / Bending / Forming	1. Dimensions	MI	Measurement	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W			
		2. Surface defects after bending	MA	Visual	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W			
7.0	Nibbling / Punching	1. Cutout Sizes	MI	Measurement	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W			
		2. Deburring	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W			
	ASSEMBLY													
8.0	Frame Assembly & Sheet fixing	1. Dimensions	MA	Measurement	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W			
		2. Alignment	MA	Measurement	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W			
		3. Welding Quality	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W			
		4. Surface defects	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W			

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No:			
	Sign & Date	Name		Sign & Date	Name	Seal			Sign & Date	Name	Seal
Prepared by:	14/2/2020	CHETAN MALIK	Checked by:	14/2/2020	KUNDAN PRASAD			Reviewed by:			
Reviewed by:	14/2/2020	RK RAINA	Reviewed by:	14/2/2020	RK JAISWAL			Approved by:			

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
	CUSTOMER :		QP NO.: PE-QP-999-145-I056	DATE: 07.02.2020
	PROJECT:		PO NO.: --	DATE: --
	ITEM: LOCAL CONTROL PANEL	SYSTEM: C&I	SECTION: C	SHEET 5 OF 9

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
9.0	Pre-treatment and Painting	1. Pretreatment Process	MA	Visual	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	V		
		2. Process parameters like bath temp. concentration etc.	MA	Measurement	Periodic	Periodic	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	V		
		3. Dipping / Removal Time	MA	Measurement	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	V		
		4. Surface quality after every dip	MA	Visual	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	V		
		5. Primer after phosphating	MA	Visual, Thickness	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	V		
		6. Putty Application & Rubbing after primer	MA	Visual	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	V		
		7. Paint first coat	MA	Visual, Thickness	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	V		

BHEL						BIDDER/ SUPPLIER	
ENGINEERING			QUALITY			Sign & Date	
	Sign & Date	Name		Sign & Date	Name	Seal	
Prepared by:	14/4/2020	CHETAN MALIK	Checked by:	14/04/2020	KUNDAN PRASAD		
Reviewed by:	14/4/2020	RK RAINA	Reviewed by:	14/4/2020	RK JAISWAL		

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
	CUSTOMER :		QP NO.: PE-QP-999-145-I056	DATE: 07.02.2020
	PROJECT:		PO NO.: --	DATE: --
	ITEM: LOCAL CONTROL PANEL	SYSTEM: C&I	SECTION: C	SHEET 6 OF 9

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY			REMARKS
1	2	3	4	5	6		7	8	9		**			
					M	C/N				D	M	C	N	
		8. Putty Application and Rubbing after first coat of paint	MA	Visual	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	V		
		9. Paint second coat	MA	Visual, Thickness, Scratch test Colour adhesion	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	V		
10.	Panel Wiring	1. Wiring Layout	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W			
		2. Wiring Termination (Crimped Lugs)	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W			
		3. Ferrule numbers	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W			
		4. Colour of wiring	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W	V		
		5. Size of Conductor	MA	Measurement	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W	V		
11.	Component Mounting	1. Correct components	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W			
		2. Fixing	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W			

BHEL						BIDDER/ SUPPLIER	
ENGINEERING			QUALITY			Sign & Date	
	Sign & Date	Name		Sign & Date	Name	Seal	
Prepared by:	14/2/2020	CHETAN MALIK	Checked by:	14/02/2020	KUNDAN PRASAD		
Reviewed by:	14/2/2020	RK RAINA	Reviewed by:	14/2/2020	RK JAISWAL		

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
	CUSTOMER :		QP NO.: PE-QP-999-145-I056	DATE: 07.02.2020
	PROJECT:		PO NO.: --	DATE: --
	ITEM: LOCAL CONTROL PANEL	SYSTEM: C&I	SECTION: C	SHEET 7 OF 9

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	D	**			
					M	C/N					M	C	N	
	FINAL TESTING													
12.	Final Inspection	1. Workmanship	MA	Visual	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	W		
		2. Component layout (neatness, accessibility & safety) Mounting / Proper fixing of all components	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W	W		At Random by BHEL, based on 100 % internal test reports by Mfr.
		3. Components identification Marking / Name plates	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W	W		
		5. Dimensions	MA	Measurement	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W	W		
		6. Door functioning	MA	Functional	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W	W		At Random by BHEL, based on 100 % internal test reports by Mfr.
		7. Paint Shade	CR	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W	W		

BHEL						BIDDER/ SUPPLIER		FOR CUSTOMER REVIEW & APPROVAL			
ENGINEERING			QUALITY			Sign & Date		Doc No:			
	Sign & Date	Name		Sign & Date	Name	Seal			Sign & Date	Name	Seal
Prepared by:	14/12/2020	CHETAN MALIK	Checked by:	14/12/2020	KUNDAN PRASAD			Reviewed by:			
Reviewed by:	14/12/2020	RK RAINA	Reviewed by:	14/12/2020	RK JAISWAL			Approved by:			

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
	CUSTOMER :		QP NO.: PE-QP-999-145-I056	DATE: 07.02.2020
	PROJECT:		PO NO.: --	DATE: --
	ITEM: LOCAL CONTROL PANEL	SYSTEM: C&I	SECTION: C	SHEET 8 OF 9

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	*	AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	D	**			
					M	C/N					M	C	N	
		8. Paint Thickness	CR	Measurement	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W	W		
		9. Workmanship of Gaskets	MA	Visual	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	√	P/W	W		
		10. Wiring Layout	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W	W		
		11. Wire Termination	MA	Pulling manually	Sample	Sample	-----	Firm termination	Inspection Report	√	P/W	W		
		12. Continuity	MA	Electrical	100%	10%	-----	Continuity OK	Inspection Report	√	P/W	W		
13.	TYPE TEST	Degree of Protection	CR	Mech. Protection	Sample	Sample	Approved Drg/Datasheet Relevant IS-13947 Part-1, IS-2148.	Approved Drg/Datasheet Relevant IS-13947 Part-1, IS-2148.	Type Test Certificate	√	P/W	V		
14	ROUTINE TEST	IR before & after HV Test	CR	Electrical	100%	10%	Approved Drg/Datasheet Relevant IS.	Approved Drg/Datasheet Relevant IS.	Inspection Report	√	P/W	W		

BHEL						BIDDER/ SUPPLIER	
ENGINEERING			QUALITY			Sign & Date	
	Sign & Date	Name		Sign & Date	Name	Seal	
Prepared by:	14/2/2020	CHETAN MALIK	Checked by:	14/2/2020	KUNDAN PRASAD		
Reviewed by:	14/2/2020	RK RAINA	Reviewed by:	14/2/2020	RK JAISWAL		

FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :	DATE:
	CUSTOMER :		QP NO.: PE-QP-999-145-I056	DATE: 07.02.2020
	PROJECT:		PO NO.: --	DATE: --
	ITEM: LOCAL CONTROL PANEL	SYSTEM: C&I	SECTION: C	SHEET 9 OF 9

SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD		AGENCY			REMARKS
1	2	3	4	5	6		7	8	9	*	**			
					M	C/N				D	M	C	N	
15	FUCTIONAL TEST	1. Control Logic Operation	CR	Electrical	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W	W		
		2. Instrument Calibration	CR	Electrical	10%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	√	P/W	W		
		3. Temperature rise	CR	Electrical	100%	10%	Approved Drg/Datasheet Relevant IS.	Approved Drg/Datasheet Relevant IS.	Inspection Report	√	P/W	W		

NOTES:

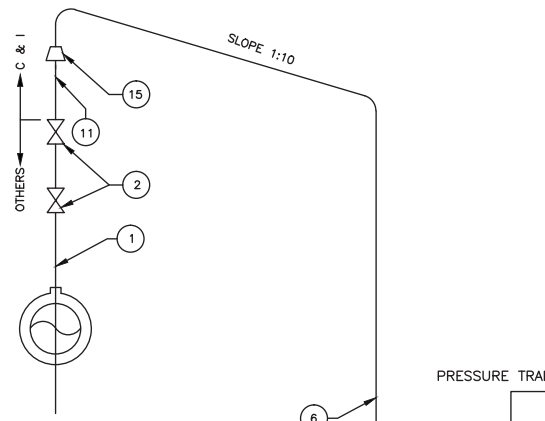
1. Customer's specification for painting shall be included in the technical specification. In the absence of Customer's spec. for painting, vendor to obtain BHEL's approval on their painting specification / procedure.
2. Copies of all TC's (Test Certificates) for components shall be submitted to BHEL for verification and acceptance.
3. BHEL reserves the right to conduct repeat tests, if required.

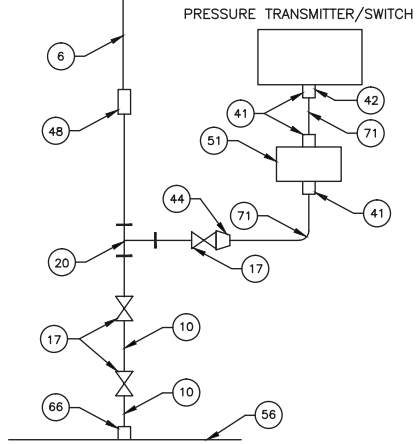
LEGENDS:
*RECORDS, INDENTIFIED WITH "TICK"(√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION, **D**: DOCUMENTATION,
** **M**: SUPPLIER/ MANUFACTURER/ SUB-SUPPLIER, **C**: MAIN SUPPLIER/ BHEL/ THIRD PARTY INSPECTION AGENCY, **N**: CUSTOMER,
P: PERFORM, **W**: WITNESS, **V:** VERIFICATION, AS APPROPRIATE
MA: MAJOR, **MI**: MINOR, **CR:** CRITICAL

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	14/12/2020	CHETAN MALIK	Checked by:	14/12/2020	KUNDAN PRASAD
Reviewed by:	14/12/2020	RK RAINA	Reviewed by:	14/12/2020	RK JAISWAL

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

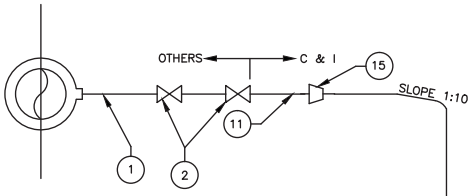
FOR CUSTOMER REVIEW & APPROVAL			
Doc No:			
	Sign & Date	Name	Seal
Reviewed by:			
Approved by:			

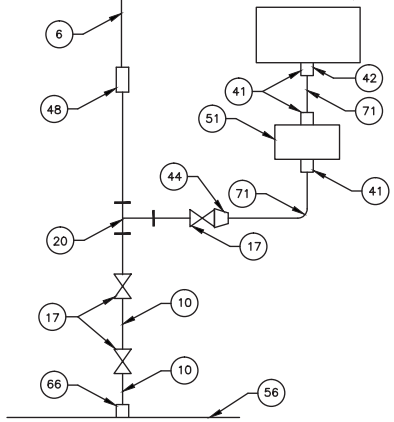




TRANSMITTER MOUNTED BELOW
INSTRUMENT SOURCE POINT

FIG–A





TRANSMITTER MOUNTED BELOW
INSTRUMENT SOURCE POINT

FIG–B

NOTES:–

1. FOR HIGH TEMP. SERVICE (MORE THAN 80°C) A 'U'–TUBE / SYPHON (REF. SHEET NO. 15) SHALL BE PROVIDED BETWEEN THE MANIFOLD AND THE TRANSMITTER/SWITCH.
2. FOR PRESSURE LESS THAN 40KG, ROOT VLV. OF SIZE 1/2"SW, NIPPLE PIECE(11), 1 TO 1/2"SW REDUCER(15) & ISOLATION VALVE(17) ARE NOT REQUIRED.
3. FOR SWITCHES PROCESS CONNECTION SHALL BE NPT(M) & HENCE SL.NO:41 SHALL BE REPLACED BY SL.NO:42.
4. FOR SEA WATER & SLURRY APPLICATION SS SUPER DUPLEX SHALL BE CONSIDERED.
5. FOR LIME STONE SLURRY BASED & SEA WATER APPLICATIONS FLUSH RING & DRAINS SHALL BE PROVIDED.

TAG NO.	DESCRIPTION	A QTY.	B QTY.
71	1/2"OD IMPULSE TUBE, SS–316/SS SUPER DUPLEX	AS REQD.	
66	1/2" GI SOCKET	1	1
56	2"NB GI DRAIN HEADER	AS REQD.	
51	3 VALVE MANIFOLDS, SS–316	1	1
48	1/2"SW,CS/AS BULK HEAD PIPE UNION	1	1
44	1/2"SW X 1/2"OD COMRESSION TUBE FITTING, SS–316/SS SUPER DUPLEX	1	1
42	1/2"NPT(F) X 1/2"OD TUBE COMPRESSION FITTING, SS–316/SS SUPER DUPLEX	1	1
41	1/2"NPT(M) X 1/2"OD TUBE COMPRESSION FITTING, SS–316/SS SUPER DUPLEX	3	3
20	1/2"SW EQUAL TEE,CS	1	1
17	1/2" SW,CS GLOBE VALVE / NEEDLE VALVE	3	3
15	1" TO 1/2" SW REDUCER	1	1
11	1" NPS SCH–80 CS/AS NIPPLE/SS SUPER DUPLEX	1	1
10	1/2" NPS,SCH 80/160, CS/AS NIPPLE/SS SUPER DUPLEX	2	2
6	1/2" NPS. SCH–80/160 CS/ AS PIPE/SS SUPER DUPLEX	AS REQD.	
2	1" ROOT VALVE	2	2
1	1" CARBON/ALLOY STEEL NIPPLE OF MTL. SAME AS THAT OF MAIN PIPE(AS PER PROCESS REQD.)	AS REQD.	

REV.	DATE	DESCRIPTION	DRN.	STR.	MECH.	ELEC.	INST.
				APPROVED BY			
0C	21.01.19	BASED ON COMMENTS	RV				KA
0B	20.12.18	BASED ON COMMENTS	RV				KA
0A	12.05.17	TENDER PURPOSE	KK				KA

PROJECT :

1 x 800MW NORTH CHENNAI TPP STAGE -III
FGD PACKAGE

OWNER :

TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED
CHENNAI-600 002, TAMILNADU, INDIA

OWNER'S ENGINEER

FICHTNER INDIA

FICHTNER Consulting Engineers (India) Private Limited
Chennai

	SIGNATURE	DATE
DRAWN	RV	21.01.19
DESIGNED	KRK	21.01.19
CHECKED	KRK	21.01.19
DEPT.HEAD	KA	21.01.19
PROJ.MGR.	SSR	21.01.19

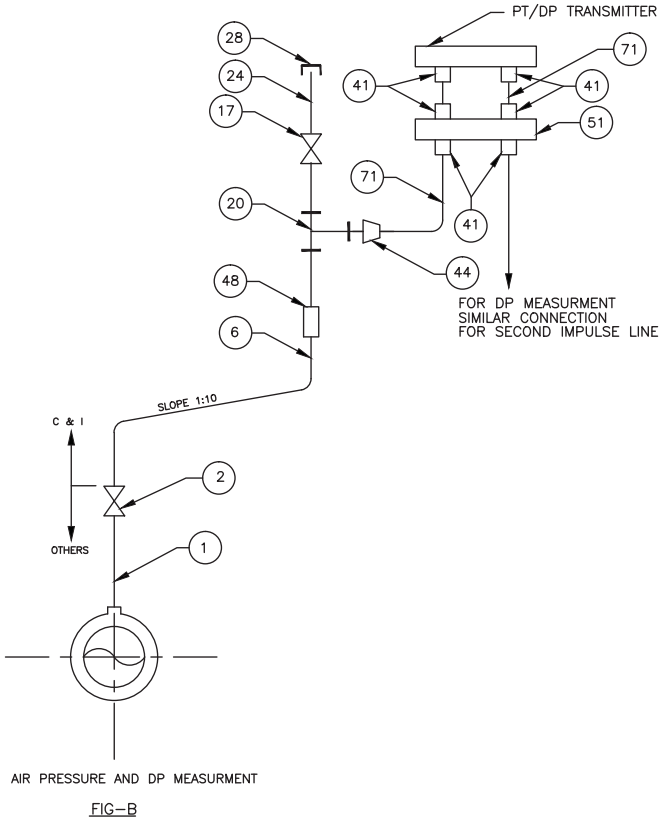
INST. DRAWING FOR PRESSURE & DIFFERENTIAL PRESSURE TRANSMITTER /SWITCH(STEAM & LIQUID SERVICE) – 1

RELEASED FOR		
	PRELIMINARY	
	TENDER	✓
	ENGINEERING	
	CONSTRUCTION	

DEPT. C&I | JOB NO. 111207 | SCALE: NTS | REV.

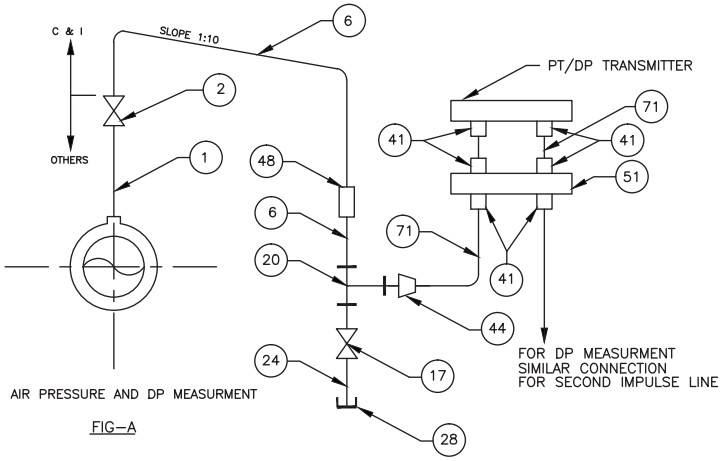
DWG.NO. ANNEXURE–7 | 0C

SHEET: 03 OF 17



AIR PRESSURE AND DP MEASURMENT

FIG–B



AIR PRESSURE AND DP MEASURMENT

FIG–A

NOTES:–

1. QUANTITY IN COLUMN A & B TO BE DOUBLED FOR DP TAPPING EXCEPT ITEM NO. 51
2. FOR INSTRUMENT AIR SERVICE, SL.NO 1 & 2 PIPE, ROOT VALVE SHALL BE SCREWED END AND ADDITIONAL CONNECTOR 1/2" SW X NPT(M) SHALL BE PROVIDED.

TAG NO.	DESCRIPTION	A	B
		QTY.	
71	1/2"OD IMPULSE TUBE,SS–316	AS REQD.	
51	3/5 VALVE MANIFOLDS, SS–316	1	1
48	1/2" SW, CS/AS BULK HEAD PIPE UNION	1	1
44	1/2" SW X 1/2"OD TUBE FITTING, SS–316	1	1
41	1/2" NPT(M) X 1/2"00 TUBE COMPRESSION FITTING ,SS–316	6	6
28	1/2" NPT(F) CS CAP	1	1
24	1/2" NPS, SCH–80 X 1/2"NPS(M)CS NIPPLE	1	1
20	1/2" SW, EQUAL TEE, CS	1	1
17	1/2" SW, CS GLOBE VALVE	1	1
6	1/2" NPS. SCH–80 CARBON STEEL PIPE	AS REQD.	
2	1/2" ROOT VALVE – SW GLOBE VALVE	1	1
1	1/2" CARBON STEEL NIPPLE OF MTL. SAME AS THAT OF MAIN PIPE(AS PER PROCESS REQD.)	AS REQD.	

BILL OF MATERIAL

REV.	DATE	DESCRIPTION	DRN.	STR.	MECH.	ELEC.	INST.
				APPROVED BY			
0C	21.01.19	BASED ON COMMENTS	RV				KA
0B	20.12.18	BASED ON COMMENTS	RV				KA
0A	12.05.17	TENDER PURPOSE	KK				KA

PROJECT :

1 x 800MW NORTH CHENNAI TPP STAGE -III
FGD PACKAGE

OWNER :

TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED
CHENNAI-600 002, TAMILNADU, INDIA

OWNER'S ENGINEER

FICHTNER INDIA

FICHTNER Consulting Engineers (India) Private Limited
Chennai

	SIGNATURE	DATE
DRAWN	RV	21.01.19
DESIGNED	KRK	21.01.19
CHECKED	KRK	21.01.19
DEPT.HEAD	KA	21.01.19
PROJ.MGR.	SSR	21.01.19

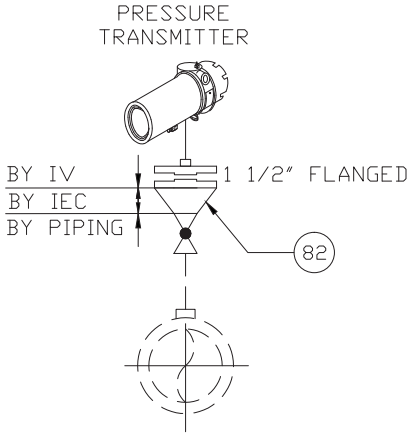
INST. DRAWING FOR PRESSURE & DIFFERENTIAL PRESSURE TRANSMITTER (AIR SERVICE)

RELEASED FOR		
	PRELIMINARY	
	TENDER	✓
	ENGINEERING	
	CONSTRUCTION	

DEPT. C&I | JOB NO. 111607 | SCALE: NTS | REV.

DWG.NO. ANNEXURE–7 | OC

SHEET: 04 OF 17



82	1"x1 1/2" CS EXPANDER, SW, SS316	1
TAG NO.	DESCRIPTION	QTY.
	BILL OF MATERIAL	

REV.	DATE	DESCRIPTION	DRN.	STR.	MECH.	ELEC.	INST.
				APPROVED BY			
0C	21.01.19	BASED ON COMMENTS	RV				KA
0B	20.12.18	BASED ON COMMENTS	RV				KA
0A	12.05.17	TENDER PURPOSE	KK				KA

PROJECT :

1 x 800MW NORTH CHENNAI TPP STAGE -III
FGD PACKAGE

OWNER :

TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED
CHENNAI-600 002, TAMILNADU, INDIA

OWNER'S ENGINEER

FICHTNER INDIA

FICHTNER Consulting Engineers (India) Private Limited
Chennai

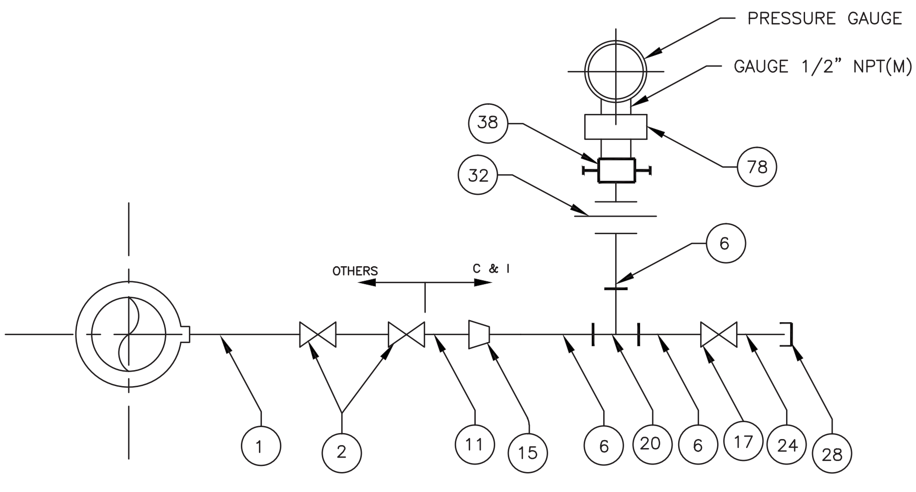
	SIGNATURE	DATE
DRAWN	RV	21.01.19
DESIGNED	KRK	21.01.19
CHECKED	KRK	21.01.19
DEPT.HEAD	KA	21.01.19
PROJ.MGR.	SSR	21.01.19

INST. DRAWING FOR
PRESSURE TRANSMITTERS
DIAPHRAGM SEAL TYPE

RELEASED FOR			DEPT. C&I	JOB NO. 1116127	SCALE: NTS	REV.
	PRELIMINARY					
	TENDER	✓	DWG.NO.	ANNEXURE-7	SHEET: 06 OF 17	0C
	ENGINEERING					
	CONSTRUCTION					

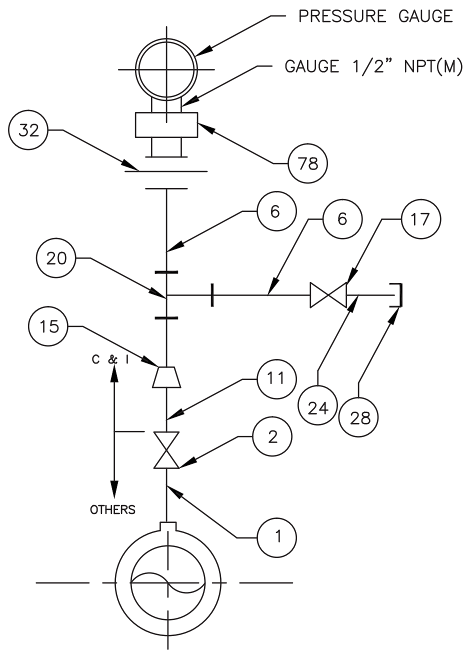
NOTE:-

1. FOR PRESSURE LESS THAN 40KG, ROOT VLV. OF SIZE 1/2"SW, NIPPLE PIECE(11) & 1 TO 1/2"SW REDUCER(15) ARE NOT REQUIRED.
2. BIDDER HAS TO PROVIDE SNUBBER AS REQUIRED.
3. FOR SEA WATER & SLURRY APPLICATION SS SUPER DUPLEX SHALL BE CONSIDERED.
4. FOR LIME STONE SLURRY BASED & SEA WATER APPLICATIONS FLUSH RING & DRAINS SHALL BE PROVIDED.



STEAM/LIQUID SERVICE

FIG-A



AIR SERVICE

FIG-B

TAG NO.	DESCRIPTION	QTY. A	QTY. B	TAG NO.	DESCRIPTION	QTY. A	QTY. B
20	1/2"SW EQUAL TEE, CS/AS	1	1	78	1/2"NPT(F)X1/2"NPT(M) SNUBBER/PULSATION DAMPER AS APPLICABLE	1	1
17	1/2" SW CS/AS GLOBE VALVE	1	1	59	1/2"SW, STRAIGHT PIPE CONNECTOR, CS/AS	AS REQD.	
15	1" TO 1/2" SOCKET WELDED REDUCER	1	1	38	3 WAY GAUGE VALVE 1/2" NB SW	1	–
11	1" NPS SCH-80/160 CS/AS NIPPLE/SS SUPER DUPLEX	1	1	37	6" COILED SYPHON SCH 80/160 1/2"NB CS/SS	AS REQD.	
6	1/2" NPS. SCH-80/160 CS/ AS PIPE/SS SUPER DUPLEX	AS REQD.		32	1/2"NPS,3PIECE PIPE UNION WITH 1/2"NPT(F) SCREWED	1	1
2	1/2"/3/4"/1" ROOT VALVE-SW GLOBE VALVE	2	1	28	1/2"NPT (F) CS CAP	1	1
1	1/2"/3/4"/1" CARBON/ALLOY STEEL NIPPLE OF MTL. SAME AS THAT OF MAIN PIPE(AS PER PROCESS REQD.)	AS REQD.		24	1/2"NPS,SCH-80/160X1/2"NPT(M)CS/AS NIPPLE	1	1

BILL OF MATERIAL

REV.	DATE	DESCRIPTION	DRN.	STR.	MECH.	ELEC.	INST.
0C	21.01.19	BASED ON COMMENTS	RV				KA
0B	20.12.18	BASED ON COMMENTS	RV				KA
0A	12.05.17	TENDER PURPOSE	KK				KA

APPROVED BY

PROJECT :

1 x 800MW NORTH CHENNAI TPP STAGE -III
FGD PACKAGE

OWNER :

TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED
CHENNAI-600 002, TAMILNADU, INDIA

OWNER'S ENGINEER

FICHTNER INDIA

FICHTNER Consulting Engineers (India) Private Limited
Chennai

	SIGNATURE	DATE
DRAWN	RV	21.01.19
DESIGNED	KRK	21.01.19
CHECKED	KRK	21.01.19
DEPT.HEAD	KA	21.01.19
PROJ.MGR.	SSR	21.01.19

INST. DRAWING FOR LOCAL PRESSURE GAUGE

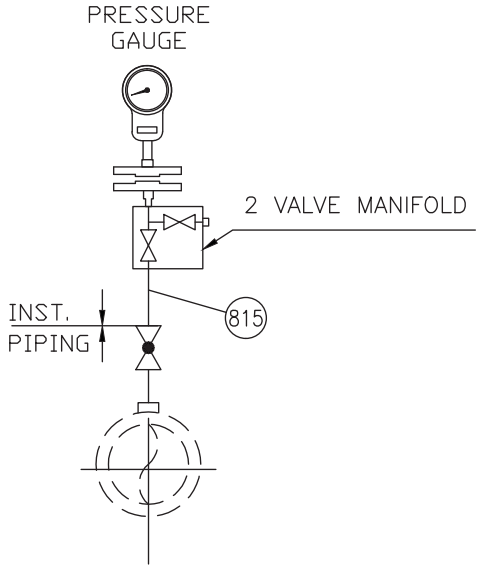
RELEASED FOR	
PRELIMINARY	
TENDER	✓
ENGINEERING	
CONSTRUCTION	

DEPT. C&I | JOB NO. 116127 | SCALE: NTS | REV. 0C

DWG.NO. ANNEXURE-7

SHEET: 07 OF 17

PRESSURE GAUGE WITH DIAPHRAGM SEAL



NOTE:–

1. 2 VALVE INTEGRAL MANIFOLD SHALL BE THE PART OF INSTRUMENT VENDOR SCOPE.
2. SNUBBER SHALL BE PROVIDED FOR PUMP DISCHARGE APPLICATION.
3. DIAPHRAGM SEAL SHALL BE PROVIDED FOR CHEMICAL/OILY WATER APPLICATION.

TAG NO.	DESCRIPTION	QTY.
1	NIPPLE (100mm), 1/2" NPTM X SW, SCH 80, SS316	1

BILL OF MATERIAL

REV.	DATE	DESCRIPTION	DRN.	STR.	MECH.	ELEC.	INST.
				APPROVED BY			
0C	21.01.19	BASED ON COMMENTS	RV				KA
0B	20.12.18	BASED ON COMMENTS	RV				KA
0A	12.05.17	TENDER PURPOSE	KK				KA

PROJECT :

1 x 800MW NORTH CHENNAI TPP STAGE -III
FGD PACKAGE

OWNER :

TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED
CHENNAI-600 002, TAMILNADU, INDIA

OWNER'S ENGINEER

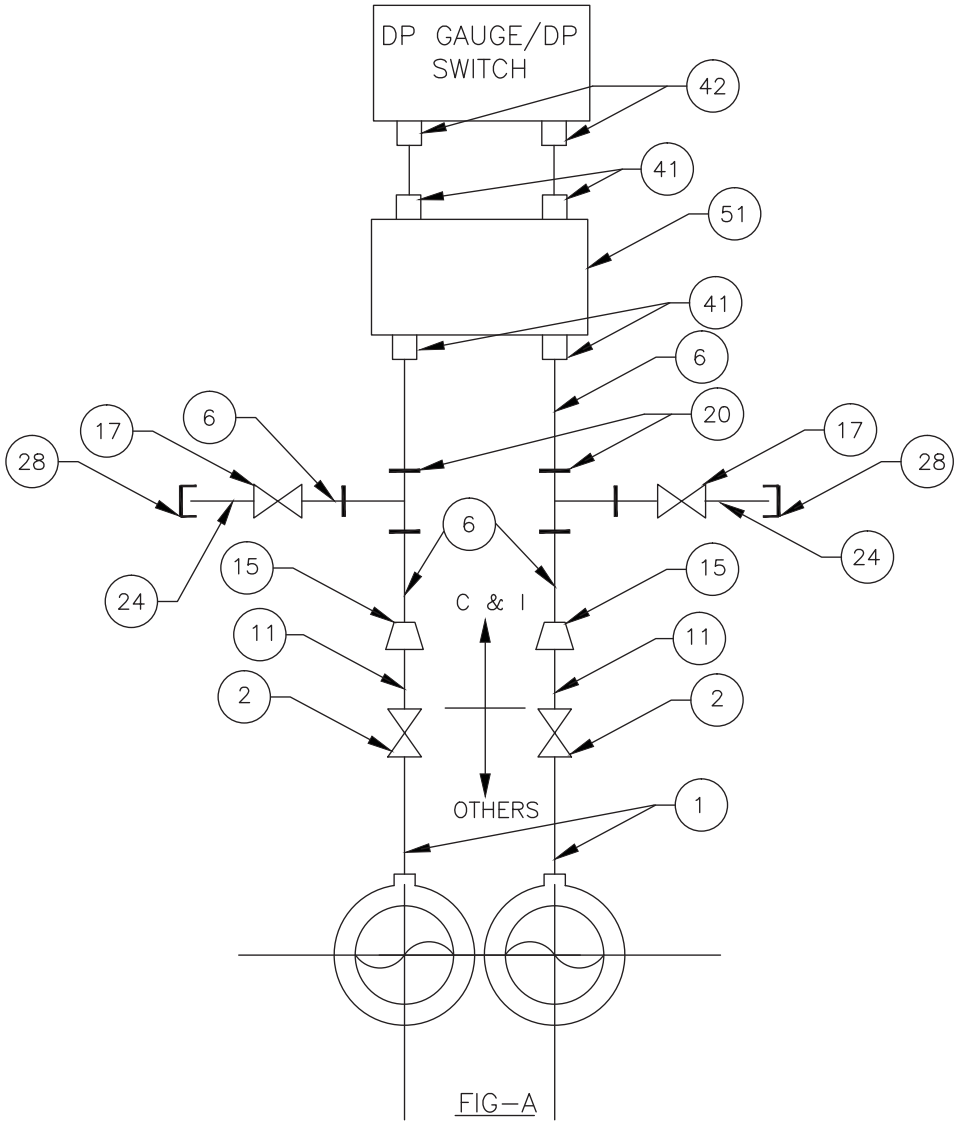
FICHTNER INDIA

FICHTNER Consulting Engineers (India) Private Limited
Chennai

	SIGNATURE	DATE
DRAWN	RV	21.01.19
DESIGNED	KRK	21.01.19
CHECKED	KRK	21.01.19
DEPT.HEAD	KA	21.01.19
PROJ.MGR.	SSR	21.01.19

INST. DRAWING FOR LOCAL PRESSURE GAUGE DIAPHRAGM SEAL TYPE

RELEASED FOR			DEPT. C&I	JOB NO. 114827	SCALE: NTS	REV.
	PRELIMINARY					
	TENDER	✓	DWG.NO. ANNEXURE–7			0C
	ENGINEERING				SHEET: 08 OF 17	
	CONSTRUCTION					



FIG–A

TAG NO.	DESCRIPTION	QTY.
51	3/5 VALVE MANIFOLDS, SS–316	1
42	1/2" NPT(F) X 1/2" OD TUBE COMPRESSION FITTING,SS–316/SS SUPER DUPLEX	2
41	1/2" NPT(M) X 1/2" OD TUBE COMPRESSION FITTING,SS–316/SS SUPER DUPLEX	4
28	1/2" NPT(F) CS. CAP	2
24	1/2" NPS,SCH 80/160 X 1/2" NPT(M) CS/AS NIPPLE/SS SUPER DUPLEX	2
20	1/2"SW EQUAL TEE CS/AS	2
17	1/2" SW,CS/AS, GLOBE VALVE	2
15	1" TO 1/2" SOCKET WELD REDUCER	2
11	1"NPS SCH 80/160 CS/AS NIPPLE/SS SUPER DUPLEX	2
6	1/2"NPS,SCH 80/160 CARBON/ALLOY STEEL PIPE/SS SUPER DUPLEX	AS REQD.
2	1/2"3/4"/1" ROOT VALVE – SW GLOBE VALVE	2
1	1/2"/3/4"/1" CARBON/ALLOY STEEL NIPPLE OF MTL SAME AS THAT OF MAIN PIPE (AS PER PROCESS REQD.)	AS REQD.

NOTE:–

1. FOR PRESSURE LESS THAN 40KG, ROOT VLV. OF SIZE 1/2"SW, NIPPLE PIECE(11) & 1 TO 1/2"SW REDUCER(15) ARE NOT REQUIRED.
2. FOR SEA WATER & SLURRY APPLICATION SS SUPER DUPLEX SHALL BE CONSIDERED.
3. FOR LIME STONE SLURRY BASED & SEA WATER APPLICATIONS FLUSH RING & DRAINS SHALL BE PROVIDED.

REV.	DATE	DESCRIPTION	DRN.	STR.	MECH.	ELEC.	INST.
				APPROVED BY			
0C	21.01.19	BASED ON COMMENTS	RV				KA
0B	20.12.18	BASED ON COMMENTS	RV				KA
0A	12.05.17	TENDER PURPOSE	KK				KA

PROJECT :

1 x 800MW NORTH CHENNAI TPP STAGE -III
FGD PACKAGE

OWNER :

TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED
CHENNAI-600 002, TAMILNADU, INDIA

OWNER'S ENGINEER

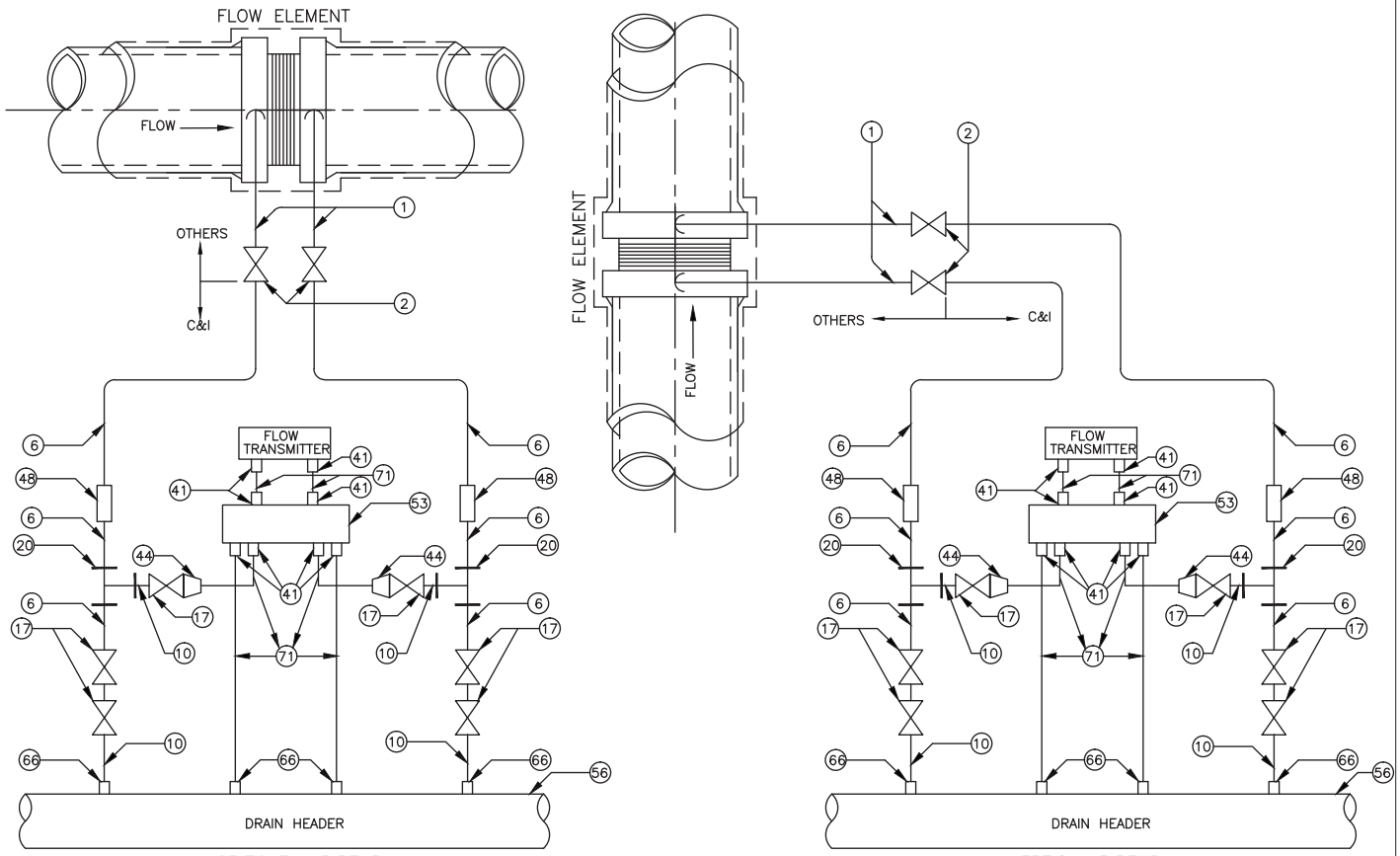
FICHTNER INDIA

FICHTNER Consulting Engineers (India) Private Limited
Chennai

	SIGNATURE	DATE
DRAWN	RV	21.01.19
DESIGNED	KRK	21.01.19
CHECKED	KRK	21.01.19
DEPT.HEAD	KA	21.01.19
PROJ.MGR.	SSR	21.01.19

INST. DRAWING FOR LOCAL PRESSURE & DIFFERENTIAL PRESSURE GAUGE/SWITCH

RELEASED FOR			DEPT. C&I	JOB NO. 114127	SCALE: NTS	REV.
	PRELIMINARY					
	TENDER	✓	DWG.NO. ANNEXURE–7			0C
	ENGINEERING					
	CONSTRUCTION				SHEET: 09 OF 17	



HORIZONTAL PIPE RUN
FIG–A

VERTICAL PIPE RUN
FIG–B

NOTE:–

1. FOR SEA WATER APPLICATION MATERIAL FROM THE FLANGE SHALL BE SS SUPER DUPLEX.

TAG NO.	DESCRIPTION	A	B	TAG NO.	DESCRIPTION	A	B
20	1/2" SOCKET WELDED EQUAL TEE CS/AS	2	2	71	1/2"OD IMPULSE TUBE, SS–316	AS REQD.	
17	1/2" SOCKET WELDED CS GLOBE VALVE	6	6	66	1/2" GI SOCKET / FUNNEL	4	4
10	1/2" NPS SCH 80/160,CS/AS NIPPLE	4	4	56	2"NB GI DRAIN HEADER	AS REQD.	
6	1/2" NPS SCH 80/160 CS/AS PIPE	AS REQD.		53	5–VALVE MANIFOLD, SS–316	1	1
2	1/2" SOCKET WELDED GLOBE VALVE	2	2	48	1/2" SW, CS/AS BULK HEAD PIPE UNION	2	2
1	1/2" NPS SCH 80 NIPPLES OF MATERIAL SAME AS MAIN PIPE WITH NECESSARY ATTACH TO FLANGES	AS REQD.		44	1/2"SWX1/2"OD COMPRESSION TUBE FITTING,SS–316	2	2
				41	1/2"NPT(M)X1/2"OD TUBE COMPRESSION FITTING,SS–316	8	8

REV.	DATE	DESCRIPTION	DRN.	STR.	MECH.	ELEC.	INST.
				APPROVED BY			
0C	21.01.19	BASED ON COMMENTS	RV				KA
0B	20.12.18	BASED ON COMMENTS	RV				KA
0A	12.05.17	TENDER PURPOSE	KK				KA

PROJECT :

1 x 800MW NORTH CHENNAI TPP STAGE -III
FGD PACKAGE

OWNER :

TAMILNADU GENERATION & DISTRIBUTION CORPORATION LIMITED
CHENNAI-600 002, TAMILNADU, INDIA

OWNER'S ENGINEER

FICHTNER INDIA

FICHTNER Consulting Engineers (India) Private Limited
Chennai

	SIGNATURE	DATE
DRAWN	RV	21.01.19
DESIGNED	KRK	21.01.19
CHECKED	KRK	21.01.19
DEPT.HEAD	KA	21.01.19
PROJ.MGR.	SSR	21.01.19

INST. DRAWING FOR FLOW MEASUREMENT

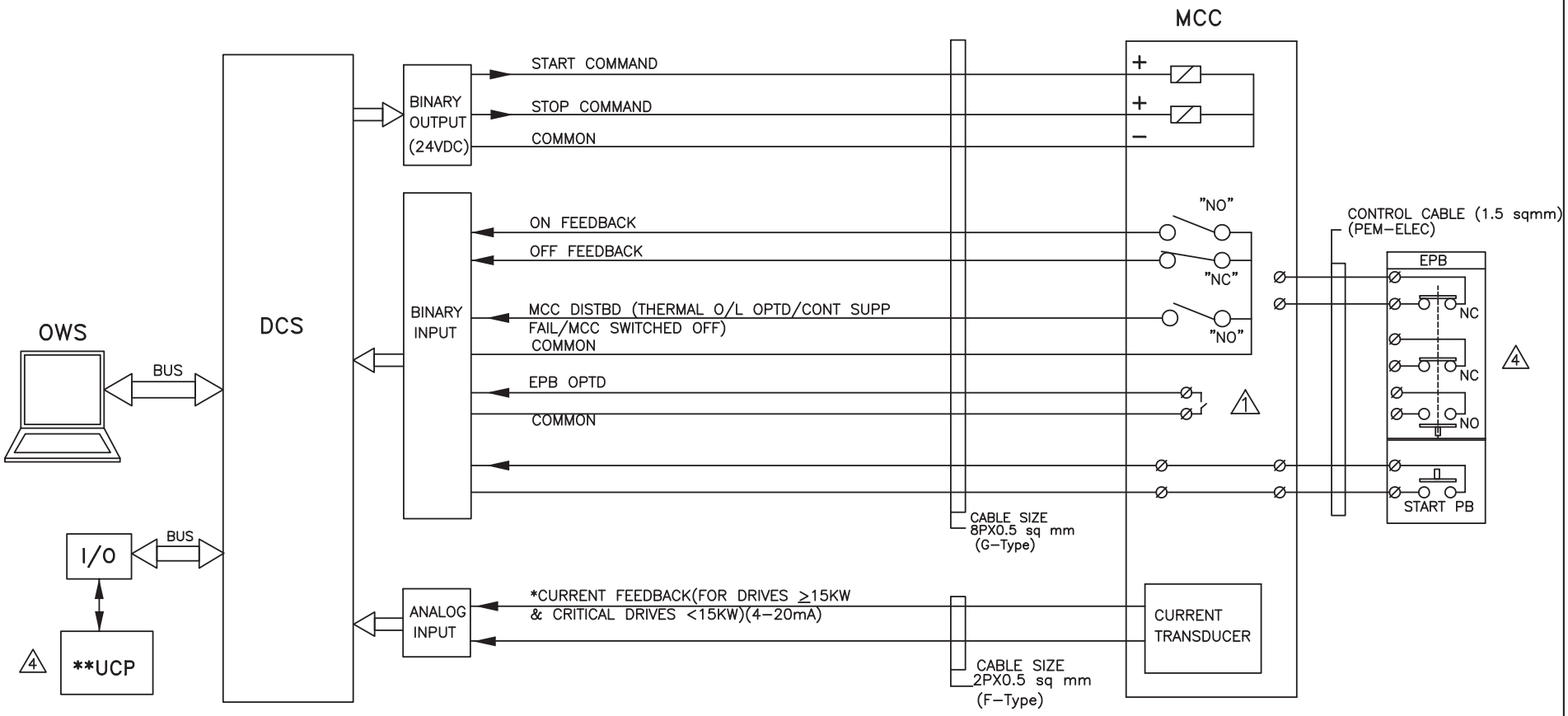
RELEASED FOR		
	PRELIMINARY	
	TENDER	✓
	ENGINEERING	
	CONSTRUCTION	

DEPT. C&I | JOB NO. 116167 | SCALE: NTS | REV.

DWG.NO. ANNEXURE–7 | 0C

SHEET: 15 OF 17

DCS INTERFACE FOR UNIDIRECTIONAL LT DRIVE(CONTACTOR OPERATED)



NOTE:

* FOR LTUD DRIVES, 4–20mA CURRENT TRANSDUCER SHALL BE CONSIDERED FOR BARRING GEARINGMOTOR, JOP, AIR HEATER MOTOR, LUBE OIL PUMPS, SCANNER AIR FANS, SEAL AIR FANS as applicable. ④

** FOR ESSENTIAL DRIVES FOR SAFE SHUT DOWN OF PLANT.

BHEL	PROJECT: 1X800 MW TANGEDCO NORTH CHENNAI TPP STAGE III–BTG	DRG.NO.	:PE–DM–423–145–I002
		DATE	31.10.2017
	TITLE DDCMIS INTERFACE FOR UNIDIRECTIONAL LT DRIVE	REV.NO.	06
		SHT	8 OF 11

1.0 SCOPE

This specification covers the Design, Manufacture, Inspection and Testing at the manufacturer's works, proper packing for transportation and delivery to site, supervision, erection, and commissioning at site of Local Panels required for control and monitoring of the Auxiliary Plant & Equipment.

2.0 CODES AND STANDARDS

2.1 All the equipments specified herein shall comply with the requirements of the latest issue of the relevant National and International standards.

2.2 As a minimum requirement, the following standards shall be complied with:

a) IS-6005 : 1998 : Code of practice for phosphating of iron and steel.
b) IS-5 : 2007 : Colors for ready mixed paints and enamels.
c) IS-1248:2003 : Direct Acting Indicating Analog Elec Measuring Instruments.
d) IS/IEC 60947:Part 1:2004 : Low Voltage switchgear & control gear: Part-I (General Rules)
e) IS-8828:1996 : Circuit breaker for household and similar installations.
f) IS-13947 (Part-I):1993 : Low Voltage switchgear & control gear : Part-I (General Rules)
g) ISA-18.1:1979 : Annunciator Sequences and Specification
h) NFPA-496:2003 : Purged & Pressurised Enclosure for Electrical Equipment in Hazardous Locations.

3.0 TECHNICAL REQUIREMENTS

3.1 Panel Construction

3.1.1 The local panels shall house the secondary instruments, annunciation system, Single loop controller, Control switches / push buttons, indicating lamps/LED cluster, relays, timers and other devices required for operation and monitoring of the equipment locally.

3.1.2 The panels shall be of free standing type either welded construction on angle iron (minimum section of 50 x 50 x 4 mm) structure or folded construction by sheet metal formation depending upon the equipments to be mounted on it. The panels shall be robustly built and stiffeners as necessary shall be provided.

3.1.3 The panel shall be suitably reinforced to ensure adequate support for all instruments mounted thereon. All welds on exposed panel surfaces shall be ground smooth.

3.1.4 The salient features of construction shall be:

Sheet material: Cold rolled sheet steel
Frame thickness: Not less than 3.0mm
Enclosure thickness: Not less than 2.5 mm for load bearing sections (Mounted with instruments)
1.6 mm for doors and Not less than 2.0 mm for others
Panel Height: Not less than 2365 mm (Refer data sheet-A (No. PES-145A-DS1-0)
Gland plate thickness: 3.0mm
Base channel: ISMC 100 with anti-vibration mounting & foundation bolts.

3.1.5 The panel shall be provided with rear doors with integral lockable handle. The door when locked shall be held at minimum three places. The door width shall not be more than 550mm.The doors shall be provided with suitable stiffeners to prevent buckling. The handle shall be on the right side of the door. The door shall be removable type with concealed hinges to facilitate maintenance work. Suitable pocket inside the door shall be provided for keeping the drawings / documents. Double door shall be provided with suitable glass windows, as per the requirement.

3.1.6 Suitable neoprene gasket shall be provided on all doors and removable covers. Suitable ventilation system along with louvers shall be provided at bottom and top of the doors covered with removable wire mesh.

3.1.7 The class of protection shall be in accordance with IP-42 unless otherwise specified in the data sheet – A (No. PES-145-54A-DS1-0).

3.1.8 All steel surfaces shall be cleaned by sand / pellet blasting, treated for pickling, degreasing and phosphating etc. by seven tank method. The panel shall have a high quality finish and appearance. The panel shall be painted with two coats of primer followed by two coats of epoxy / synthetic enamel based final paint of color shade and finish as given in data sheet-A (No. PES-145A-DS1-0). Minimum thickness of the paint shall be 85 microns for external paint and 70 microns for internal paint.

3.1.9 The cable glands of the required size and type as given in data sheet-A (No. PES-145A-DS1-0) shall be supplied alongwith the Panel.

3.1.10 All operable and indicating devices shall be mounted on the front of the panel while aux. Relays / timers MCBs etc. required for realization of control logics shall be mounted on a mounting plate inside the panel. Auxiliary relays and timers etc. shall be grouped according to the control function.
No operable or indicating devices shall be mounted below 750 mm and above 1800 mm (w.r.t. finished ground level). The devices shall be located in such a way so as to ensure easy access for operation / maintenance.

3.1.11 Single / dual control power supply feeders of voltage class as specified in data sheet-A (No. PES-145A-DS1-0) shall be provided by the purchaser. In case redundant power supply feeders are provided then auto changeover unit shall be mounted on the panel are in the panel supplier's scope. Where DC control power supply is specified an additional 240V, 50 Hz AC supply feeder for powering of space heater and lighting shall be provided by the purchaser. Suitable arrangement shall be provided inside the panel to receive and terminate the power supply feeder(s). For this purpose MCBs of suitable current rating shall be provided by the vendor. A supervisory relay along with a pilot lamp to indicate control supply 'ON' shall be provided on the panel. Any other power supply required for the operation of the devices mounted in the panel shall be arranged by the vendor.

3.1.12 The internal wiring shall be carried out with 1100 volt grade PVC insulated copper multi strand wire / flexible of 1.5mm2 size. AC & DC wires shall be kept separate from each other. Separate coloured wires to be used for AC and DC circuits. All wires shall be properly numbered and identified with ferrules as per the Control scheme / wiring diagram. Wires shall be routed and run through PVC troughs.

3.1.13 Terminal blocks shall be clip on type, 1100 volts grade. Separate terminal blocks shall be used for AC & DC circuits. The terminals shall be suitable for terminating 0.5 mm2 to 2.5mm2 external cables. The TB points in terminal block shall be cage clamp type / screw type. The terminal for ammeters shall be provided with removable links for shorting CTs. Each terminal strip shall be provided with identification strip. The terminal shall not be mounted below 250 mm height from finished floor. The panel shall have ten (20) percent spare terminal.

3.1.14 The interior of each panel shall be suitably illuminated through fluorescent lamps / tube lights with shrouded cover of minimum 15W operable on 240V 50 Hz AC power supply through panel door switch. A 15 Amp. 3-pin Power receptacle shall be provided.

3.1.15 Suitable space heaters operable on 240 Volts 50 Hz AC power system shall be provided at the panel bottom. These shall be designed to maintain the panel temperature five (5) deg. C above the ambient temperature during maintenance shutdown. Suitable isolating and control devices comprising of MCB, thermostat etc. shall be provided for the space heater.

3.1.16 The panel shall be provided with a copper earth bus of 25 x 6 mm size running throughout the width of the panel. It shall be terminated internally with 10 mm bolts at extreme ends for connection to; main station earth. The panel mounted equipments / devices shall be connected to earth bus through green coloured PVC insulated stranded copper conductor of 2.5 mm2 size.

3.1.17 Local Panel shall be provided with main name plate of 150 mm x 40 mm size having inscription of 20 mm height. The individual devices on the panels shall be as provided with separate name plate with inscription of 3 mm height. The instrument / devices shall be provided with stick on label plates inside the panel. The material of the main and individual labels shall be three (3) ply 3 mm thick Traffolyte

Sheet / 2 mm Anodised Aluminium Plate. The inscription shall be with white letters on black background on traffolyte sheet. The labels shall be fixed by self tapping non-rusting screws.

3.1.18 Vendor shall furnish electric load and heat load list (in case panel is to be placed in ac environment) of each panel.

3.2 Hazardous Area Panel Requirement

3.2.1 The Local Panel located in hazardous area shall be pressurized as per NFPA-496 requirements to render it non-hazardous. Alarms shall be provided for local and remote annunciation when pressurisation falls below 2.5 mm of water column. Protection shall be of type Z of NFPA-496. It shall not be possible to switch ON the power of purged section unless it is purged as per the recommendation of NFPA-496. Vendor must provide a protective device on the panel to protect the panel from over pressurisation.

3.2.2 Vendor shall supply pressurisation kit consisting of valves, restriction orifices, dual filter regulation, pressure gauges, pressure switches, rotameter etc. Pressurisation kit shall be surface mounting on a metal board and located outside the local panel. Pressurisation kit shall further consist of solenoid valve flow switch, timer blow off safety device etc., so as to make purging fully automatic. However final start shall be manual. Panel protection against over pressure to be provided as per NFPA-496.

3.2.3 Pressurised local control panel pressurization kit assembly design shall provide minimum leakage flow through the Local Control Panel. Panel venting shall be as per NFPA-496.

3.2.4 All components in the local panel like indicating instruments, push buttons switches, lamps etc., which are required to be energized without panel pressurization or before completion of purge cycle shall be explosion proof as per NEMA-7 & suitable for area classification.

3.2.5 All push buttons etc. requiring frequent operation during machine running shall have good positive sealing. Weatherproof housing or cover to be provided wherever necessary. Vendor shall provide pressurisation bypass switch outside explosion proof enclosure of pressurized panel with lamp indication. This shall be used only during maintenance. All hinges, screws, other non-painted metallic parts shall be of stainless steel material.

3.2.6 Provision to switch off manually all types of power shall be provided in the panel. In addition, it shall also be possible to switch off power circuits / components which are powered from motor control centre or control room manually in case of pressurization failure. All such cables from MCC and main control room shall be terminated in explosion proof boxes (NEMA-7).

3.3 Control & Monitoring devices

3.3.1 Instruments like Indicators, recorders, single loop controllers etc. as applicable and specified elsewhere for the plant / equipment shall be supplied and mounted on the panel.

3.3.2 Alarm Annunciator System

It shall be solid state discrete facia type having a sequence of ISA-S18.1A or as specified, opaque facia windows of 70 mm x 50 mm size, having two (2) lamps per window, and hooter of 10W, and provision for repeat group alarm at remote. The annunciator shall be provided with ten (10) percent spare windows or minimum two (2) windows along with electronics.

3.3.3 Relays

The relays shall be electromagnetic type suitable for specified control supply. Its contact configuration and rating shall be suitable for the specified control function. However minimum contact rating shall be 5 Amp AC & 2 Amp DC as applicable. There shall be ten (10) percent spare contacts.

3.3.4 Timers

The timers shall be electronic type suitable for specified control supply. Its contact configuration and rating shall be suitable for the specified control function. However, minimum contact rating shall be 5 Amp AC & 2 Amp DC as applicable.

3.3.5 Control / Selector Switches

Switches shall be Rotary Cam type with minimum of 5 Amps AC & 2 Amp DC continuous current rating. Selector switches shall be stay put type while control switches shall be spring-return-to-neutral type. Contact configuration and rating shall be as per the control function requirement. The switches shall be lockable type wherever specified. Each switch shall be provided with engraved plates indicating the switch position / functions.

3.3.6 Push Buttons / Indicating Lights

The push buttons shall be momentary action self-resetting type, however stop P.B. for unidirectional drives shall be provided with manual reset facility. Its contact configuration & rating shall be as required for the control function but minimum 2 NO + 2 NC of 5 Amp. AC rating. It shall have round coloured projecting tab and engraved escutcheon plate / inscription plate. Colour coding of push buttons shall be as under:

RED	Motor OFF / Valve CLOSE	YELLOW	Alarm acknowledge	Left Hand Side
GREEN	Motor ON / Valve OPEN	BLACK	Lamp test	Right Hand Side

Indicating lights shall be suitable for direct connections across specified power supplies. It shall be fitted with built in resistance to prevent circuit tripping on shorting of lamp filament. It shall be fitted with LED cluster type lamp replaceable from front.

GREEN	Motor OFF / Valve CLOSED condition	AMBER	Motor tripped	Left Hand Side
RED	Motor ON / Valve OPEN condition	WHITE	Normal / healthy	Right Hand Side

3.3.7 Ammeters

Ammeter shall be 96 x 96 mm size, 90 deg. deflection, 1.5% accuracy, 1 Amp. CT operated or with 4-20mA input and Flush mounting type as called for in the data sheet-A (No. PES-145-54A-DS1-0). Ammeters for motors shall have six (6) times folded scale at upper end to enable motor starting current indication

3.3.8 Miniature Circuit Breaker (MCB)

These shall be instantaneous magnetic trip type for short circuit in addition to current time inverse delayed thermal trip feature for over current protection. The housing of MCB shall be made of non-ignitable, high impact material. It shall have minimum short circuit rating of 9 KA for AC Voltages and 4 KA for DC Voltages.

3.3.9 Makes of various instruments / devices shall be as given below

1.	Alarm Annunciators	:	Procon / IIC
2.	Ammeters	:	AEP / IMP
3.	Control / Selector Switches	:	Alsthom / Kaycee / Siemens / L&T
4.	Push Buttons / Indicating Lamps	:	Siemens / L&T / Teknic / Alsthom
5.	Auxiliary Relays	:	Jyoti / Siemens / L&T / OEN
6.	Timers	:	L&T / Alsthom / Bhartiya Cutler Hammer
7.	MCBs	:	S&S Power Engg. / Indo Asian / MDS
8.	Terminal Blocks	:	Jyoti / Elmex

4.0 TESTING AND INSPECTION

4.1 The bidder shall adopt suitable quality assurance program to ensure that the equipments offered will meet the specification requirements in full.

4.2 BHEL's standard Quality Plan for LCP is enclosed with the specification. The bidder shall furnish his acceptance to BHEL's QP and submit the signed and stamped copy of QP along with the offer.

4.3 The vendor shall conduct the following tests as a minimum requirement:

4.3.1 Routine Tests

1. High Voltage (H.V.)
2. Insulation Resistance (I.R.)
3. Functional

4.3.2 Type Tests

1. Enclosure Class Test

5.0 SPARES AND CONSUMABLES

5.1 Commissioning Spares and consumables

The bidder shall supply all commissioning spares and consumables 'as required' during Start-up, as part of the main equipment supply.

5.2. Mandatory Spares

The bidder shall offer alongwith main offer, the Mandatory Spares as specified elsewhere in the specification. The Mandatory Spares offered shall be of the same make and type as the main equipment.

5.3. Recommended Spares

The bidder shall furnish a list of Recommended Spares indicating the normal service expectancy period and frequency of replacement; quantities recommended for 3 years operation alongwith unit rate against each item to enable BHEL/BHEL's Customer to place a separate order later, if required.

6.0 DRAWINGS AND DOCUMENTS

6.1 The bidder shall furnish the following documents in required number of copies along with the bid :

1. Data Sheet no. PES-145A-DS1-0
2. General Arrangement Drawing.
3. Catalogue and technical information for instruments and devices.
4. Quality Plan.

6.2 The vendor shall furnish the following documents in required number as agreed after the award of contract:

1. Data Shee No. PES-145A-DS2-0
2. GA Drawing indicating layout of instruments, construction details, foundation details, cable gland plate alongwith cable glands and all details mentioned in this specification.
3. Control Schematic Diagram along with grouping of different terminals for various functions.
4. Catalogue and technical information for instruments and devices with selected options clearly marked.
5. O&M Manuals.
6. "As Built" Drawing.
7. CDs.

7.0 MARKING AND PACKING

7.1 Panel with all instruments / devices mounted on it shall be suitably packed & protected for the entire period of despatch, storage and erection against impact, abrasion, corrossion, incidental damage due to vermin, sunlight, high temperature, rain moisture, humidity, dust, sea-water spray (where applicable) as well as rough handling and delays in Transit and storage in open.

8.0 APPLICABLE DATA SHEET FORMS

This document shall be read with one or more of the following data sheet forms :

- Data sheet A&B for Local Panels : Data sheet no. PES-145A-DS1-0
- Data sheet C for Local Panels : Data sheet no. PES-145A-DS2-0

DOCUMENTATION REQUIREMENT

DRAWINGS & DOCUMENTS TO BE SUBMITTED BY ALL THE BIDDERS ALONG WITH THE BID	
Sl. No.	**DOCUMENT TITLE**
1	PQR CREDENTIALS
2	COMPLIANCE SHEET

DRAWINGS & DOCUMENTS TO BE SUBMITTED BY SUCCESSFUL BIDDER AFTER AWARD OF CONTRACT ALONG WITH SUBMISSION SCHEDULE		
Sl. No.	**DOCUMENT TITLE**	**SUBMISSION SCHEDULE**
1	TECHNICAL DATASHEETS OF TRANSMITTERS,LOCAL INSTRUMENTS ETC.	
2	DRIVE LIST WITH LOCATION DATA	
3	IO LIST	
4	INSTRUMENT SCHEDULE	
5	CONTROL & OPERATIONAL WRITE-UP FOR THE SYSTEM WITH SET POINTS	
6	CABLE SCHEDULE (IN EXCEL FORMAT)	
7	CABLE INTERCONNECTION	
8	WIRING DIAGRAM	
9	HMI PICTURES/PLANT SCHEMATICS	
10	ANNUNCIATION & SOE LIST	
11	INSTRUMENTS INSTALLATION DIAGRAM	
12	QUALITY PLAN DULY SIGNED & STAMPED FOR APPLICABLE ITEMS	
13	CALIBRATION CERTIFICATES	

DRAWINGS & DOCUMENTS TO BE SUBMITTED AS FINAL/AS-BUILT DOCUMENT	
Sl. No.	**DOCUMENT TITLE**
1	APPROVED DOCUMENTS
2	CALIBRATION CERTIFICATES
3	O&M MANUAL
4	ALL TEST CERTIFICATES

VOLUME-III

SCHEDULE OF PRE-BID CLARIFICATION

All clarification from the Technical Specification shall be filled in by the BIDDER clause by clause in this format only.

VOLUME	SECTION	CLAUSE NO.	PAGE NO.	SPECIFICATION REQUIREMENT	CLARIFICATION	REASONS FOR CLARIFICATION

PARTICULARS OF BIDDER / AUTHORISED REPRESENTATIVE				
NAME	DESIGNATION	SIGNATURE	DATE	COMPANY SEAL

DEVIATION SHEET (COST OF WITHDRAWL)

TECHNICAL SPECIFICATION FOR CHEMICAL DOSING SYSTEM (NaOH DOSING).
PROJECT: 1X800 MW NORTH CHENNAI TPP ST-III (FGD SYSTEM PACKAGE).

TECH SPC NO: PE-TS-485-154-A001

TENDER ENQUIRY REFERENCE:-

NAME OF BIDDER:-

SL NO	VOULME/ SECTION	PAGE NO.	CLAUSE NO.	TECHNICAL SPECIFICATION/ TENDER DOCUMENT	COMPLETE DESCRIPTION OF DEVIATION	COST OF WITHDRAWL OF DEVIATION	REFERENCE OF PRICE SCHEDULE ON WHICH COST OF WITHDRAWL OF DEVIATION IS APPLICABLE	NATURE OF COST OF WITHDRAWL OF DEVIATION (POSITIVE/ NEGATIVE)	REASON FOR QUOTING DEVIATION
TECHNICAL DEVIATIONS									
COMMERCIAL DEVIATIONS									

PARTICULARS OF BIDDERS/ AUTHORISED REPRESENTATIVE

NAME	**DESIGNATIONS**	**SIGN & DATE**	

NOTES:

1. For self manufactured items of bidder, cost of withdrawl of deviation will be applicable on the basic price (i.e. excluding taxes, duties & freight) only.
2. For directly dispatchable items, cost of withdrawl of deviation will be applicable on the basic price including taxes, duties & freight.
3. All the bidders have to list out all their Technical & Commercial Deviations (if any) in detail in the above format.
4. Any deviation not mentioned above and shown separately or found hidden in offer, will not be taken cognizance of.
5. Bidder shall submit duly filled unpriced copy of above format indicating "quoted" in "cost of withdrawl of deviation" column of the schedule above along with their Techno-commercial offer, wherever applicable.
6. Bidder shall furnish price copy of above format along with price bid.
7. The final decision of acceptance/ rejection of the deviations quoted by the bidder shall be at discretion of the Purchaser.
8. Bidders to note that any deviation (technical/commercial) not listed in above and asked after Part-I opening shall not be considered.
9. For deviations w.r.t. Payment terms, Liquidated damages, Firm prices and submission of E1/ E2 forms before claiming 10% payment, if a bidder chooses not to give any cost of withdrawl of deviation loading as per Annexure-VIII of GCC, Rev-06 will apply. For any other deviation mentioned in un-priced copy of this format submitted with Part-I bid but not mentioned in priced copy of this format submitted with Priced bid, the cost of withdrawl of deviation shall be taken as NIL.
10. Any deviation mentioned in priced copy of this format, but not mentioned in the un-priced copy, shall not be accepted.
11. All techno-commercial terms and conditions of NIT shall be deemed to have been accepted by the bidder, other than those listed in unpriced copy of this format.
12. Cost of withdrawl is to be given seperately for each deviation. In no event bidder should club cost of withdrawl of more than one deviation else cost of withdrawl of such deviations which have been clubbed together shall be considered as NIL.
13. In case nature of cost of withdrawl (positive/negative) is not specified it shall be assumed as positive.
14. In case of descrepancy in the nature of impact (positive/ negative), positive will be considered for evaluation and negative for ordering.

COMPLIANCE CUM CONFIRMATION CERTIFICATE

The bidder shall confirm compliance with following by signing/ stamping this compliance certificate and furnishing same with the offer:

1. The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions/ deviations with regard to same.

2. QP/ test procedures shall be submitted in the event of order based on the guidelines given in the specification & QP enclosed therein.

3. QP will be subject to BHEL/Customer approval in the event of order & customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc.
   The charges for 3rd party inspection (Lloyds, TUV or equivalent) for imported components shall be included in the base price of the equipment by the bidder.

4. All drawings/data – sheets etc. to be submitted during contract shall be subject to BHEL/Customer review/ approval. GA drawings, as submitted with offer at tender stage are for reference purpose only and shall be subject to approval during contract stage.

5. There are no other deviations with respect to specification other than those furnished in the 'Schedule of Deviations'.

6. The offered materials shall be either equivalent or superior to those specified. Also for components where material is not specified it shall be suitable for intended duty, materials shall be subject to approval in the event of order.

7. The commissioning spares (if any) are supplied on 'As Required Basis' & prices for same included in the base price (If bidders reply to this is "No commissioning spares are required" and if some spares are actually required during commissioning same shall be supplied by bidder without any cost to BHEL).

8. All sub vendors shall be subject to BHEL/CUSTOMER approval.

9. Any special tools & tackles, if required, shall be in bidder's scope.

10. Performance guarantee test parameters shall stand valid till the satisfactory completion of Performance guarantee test and its acceptance by BHEL/Customer.

11. Prices for recommended spares (if any) for three-year operation shall be furnished separately and not to be included in the base price.

DRAWING/DOCUMENTS SUBMISSION SCHEDULE FOR CHEMICAL DOSING SYSTEM

After award of LOI, following minimum drawing/documents shall be submitted by the bidder for BHEL and Customer approval. However, any additional drawing/document if found necessary for completion of the engineering, the same shall be submitted by bidder without any commercial & delivery implication to BHEL.

For the Drawings/Documents Submission Procedure, please refer **Sec-C1**. The submission of soft copy or hard copy of the drawing/document whichever is later will be considered as final date of submission of the drawing/document. The bidder has to submit the revised drawing/document along with the compliance sheet indicating enumerate reply to all BHEL and customer comments or observations. Without compliance sheet the submission of the drawings/documents will not be considered and the delay on this account will be solely on bidder's side only.

Bidder to note that the drawings to be submitted by bidder in the event of award of contract shall be as per the below given drawing/document list. Bidder to note that any additional drawings/documents requirement during detailed engineering shall be provided by bidder without any technical, commercial and delivery implications to BHEL. Bidder confirmed that every revised submission incorporating comments – within 7 days.

Bidder further confirmed that drawings submitted shall be complete in all respects with revised drawing submitted incorporating all comments. Any incomplete drawing submitted shall be treated as non-submission with delays attributable to bidder's account. For any clarification/ discussion required to complete the drawings, the bidder shall himself depute his personal to BHEL for across the table discussions/ finalizations/ submissions of drawings.

(a) List and schedule of drawings/documents to be submitted after award of contract: -

Sl. No.	BHEL Drg. No.	Title	CATEGORY	No. of weeks for document submission after placing LOI/LOA	SIZE OF DRAWING/ DOCUMENT
1	PE-V1-485-154-A001	P&I DIAGRAM	A	4	A1
2	PE-V1-485-154-A002	GA DRAWING	A	4	A1
3	PE-V1-485-154-A003	DATA SHEET FOR SYSTEM	A	6	A4
4	PE-V1-485-154-A004	LCP DRAWING	A	6	A4
5	PE-V1-485-154-A005	QAP	A	4	A1
6	PE-V1-485-154-A006	O& M MANUAL	A	8	A4

(b) Bidder to note that drawings/documents submission shall be through web based Document Management System. Bidder would be provided access to the DMS for drawings/documents approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end.

- Internet explorer version – Minimum Internet Explorer 7
- Internet speed – 2 mbps (Minimum preferred)
- Pop ups from our external DMS IP (124.124.36.198) should not be blocked
- Vendor's internal proxy setting should not block DMS application's link
    - (http://124.124.36.198/wrenchwebaccess/login.aspx)

- DMS user manuals to be used by BHEL PEM vendors for uploading, viewing, revising, commenting and tracking documents on PEM's DMS have been uploaded on PEM internet website (www.bhelpem.com) under the Vendor session.
- For quick access bidder may refer the link http://bhelpem.com/DMSManuals/DMSManuals.html

NOTES:

1. A= APPROVAL. I = INFORMATION.
2. ANY ADDITIONAL DRAWINGS-DOCUMENTS REQUIRED DURING DETAILED ENGINEERING STAGE SHALL BE PROVIDED BY BIDDER WITHOUT ANY COMMERCIAL, TECHNICAL AND DELIVERY IMPLICATION TO BHEL AND CUSTOMER.
3. BIDDER TO SUBMIT REUSABLE DATABASE FORMATS IN BHEL/NTPC APPROVED FORMATS LIKE MS EXCEL, MS WORD OF DOCUMENTS LIKE INSTRUMENT SCHEDULE, I/O LIST, DRIVE LIST, FIELD JB TERMINATIONS, CABLE SCHEDULE & INTERCONNECTION, ETC. SOFT COPY OF FORMATS SHALL BE PROVIDED TO SUCCESSFUL BIDDERS.
4. DOCUMENTS PERTAINING TO PROVENNESS TO BE SUBMITTED BY THE BIDDER.
5. DWG. / DOCUMENT SHALL BE UPLOADED BY THE SUCCESSFUL BIDDER ON WRENCH /DMS. PROCEDURE FOR THE SAME WILL BE INFORMED AFTER AWARD OF CONTRACT.

DECLARATIONS

I ……..……certify that all the technical data and information pertaining to this specification are correct and are true representation of the equipment/system covered by our format proposal number Dated …….. and there is no deviation to the specification.

I hereby certify that I am duly authorized representative of the Bidder's company whose name appears above my signature.

Bidders Company Name …….

Authorized representative's Signature ……...

Name …….

Bidder's Name

The bidder hereby agrees to fully comply with the requirements and intent of this specification for the price indicated