CLAUSE NO.	TECHNICAL REQUIREMENTS
1.00.00	CONTROL DESK & PANELS
1.01.00	GENERAL
1.01.01	All control desk, panels, LVS panel etc. shall be furnished fully wired with necessary provision for convenience outlets, internal lighting, grounding, ventilation, space heating, anti-vibration pads, internal piping & accessories as required for completeness of the system.
1.01.02	All panels, desks, cabinets shall be free standing type & have bottom / top entry for cables to be finalised application wise during detailed engineering stage. The bottom of desk & cabinets shall be sealed with bottom plate, compression cable glands (double for field and single for inside rooms) and fire proof sealing material to prevent ingress of dust and propagation of fire. Sufficient number of power receptacles with disconnect switches shall be installed within all panels/desk.
1.01.03	Exterior steel surface shall be sand blasted, ground smooth, filled, primed, sanded and smooth enamel painted to give a good finish subject to minimum paint thickness of 65-75 microns for sheet thickness of 3 mm and 50 microns for sheet thickness of 2mm. The exact color shall be finalised during detailed engineering.
1.01.04	The design shall conform to the EN ISO 11064 (Ergonomical design of control room), Part-1,2 and 3.
2.00.00	CONTROL DESK & PANEL
2.01.00	GENERAL
2.01.01	The exact dimensions, material, construction details, grounding, general arrangement etc. of Control Desk etc. shall be as per the actual requirement and shall be finalised during detailed engineering and subjected to Employer's Approval.
2.01.02	For control desk mounted instruments/ devices etc., which are to be powered from UPS, all required conversion of interface equipments / accessories to make such devices compatible with UPS supply shall be provided. All necessary hardware like Input switches/ fuse unit for each feeder as well as switch fuse unit for each instrument/ device on the power supply line shall be provided. From UPS, redundant feeders shall be provided with suitably rated MCB and provision of fast auto changeover of UPS feeders.
2.02.00	Control Desk (CD)
2.02.01	Control desk shall be Modular, non-welded construction free standing table top type with front & back cover constructed of 1.6 mm thick CRCA steel plates. The tabletop of the control desk shall be arc-shaped for mounting TFT monitors & mice. The work surface of control desk shall be 30mm thick with the top 12mm of Acrylic Solid Surface (ASS) and the remaining 18mm of laminated medium density fiber board. Work surface shall be made of two different colors at same level and seamlessly joined in each section. The structure frame shall consist of extruded aluminum top and bottom horizontal beams and vertical support tensioned together to form an integrated, finished curvilinear shaped frame. Vertical & Horizontal supports, minimum 2.5mm and 2mm thick respectively, have to be provided for the structure frame. Extreme side legs shall be illuminated type and should complete the
FLUE GAS DES	A PROJECTS, SULPHURISATION (FGD) EM PACKAGE  TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS-0011-109(1A)-2  SUB-SECTION-IIIC-9 CONTROL DESK & PANELS 1 OF 3

CLAUSE NO.		TECHNICAL REQUIREMENT	rs	एनहीपीसी NTPC
	management system. trays shall be provided	sthetics of the desk. It shall Telephone sets shall be mounted I on the CD. The exact profile of lised during detailed engineering	on the control desk. Slidir	ng keyboard
2.02.02	All operator monitors	& mice shall be mounted on this	CD.	
2.02.03	The cabling / wiring be routed and concealed	etween OWS & CPU's, power su from view.	pply cables etc. shall be a	aesthetically
2.03.00	Internal Panel/Desk I	tems		
		es mounted within the panels/ all be arranged for convenient ac		
FLUE GAS DES	A PROJECTS, SULPHURISATION (FGD) EM PACKAGE	TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS-0011-109(1A)-2	SUB-SECTION-IIIC-9 CONTROL DESK & PANELS	PAGE 2 OF 3



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### 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.

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## SPECIFICATION FOR LOCAL PANELS

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- 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



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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.



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### 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

Alarm Annunciators
 Ammeters
 Procon / IIC
 AEP / IMP

Control / Selector Switches
 Push Buttons / Indicating Lamps
 Siemens / L&T / Teknic / Alsthom
 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.



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- 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



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### 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

REV. NO.

D

### 38045/2020/PS-PEM-MAX REMOVABLE BOLT FIXING SLOT WITH (TYP) D (SEE NOTE-7) 75 mm 25 mm SEE NOTE-4 100 mm KNOB - 150 mm **-**B В NOTES:-1. JUNCTION BOXES SHALL HAVE GLAND PLATES AT THE BOTTOM OF THE BOX ONLY. TUBULAR TYPE GASKETS WILL BE USED. FRP JUNCTION BOXES, SHALL BE PROVIDED WITH POLYEUTHERENE COATING. ALSO REFER SUB SECTION INST CABLE, PART-B CABLE RACE WAYS SECTION-VI FOR DETAILES. THERMAL d by any DIMENSION OF 'C' SHALL BE BASED ON NO. OF TERMINAL BLOCKS. THE EXACT TYPE & DIMENSION OF JUNCTION BOXES TO BE USED FOR A PARTICULAR APPLICATION SHALL BE AS DECIDED DURING DETAIL NATIONAL ENGG. STAGE AND SHALL BE SUBJECT TO EMPLOYER'S APPROVAL WITHOUT ANY PRICE REPERCUSSION. THE KNOB FOR ALL THE JUNCTION BOXES SHALL BE IDENTICAL. of pe FRONT VIEW WITH COVER REMOVED GLAND PLATE ANY TYPE OF SEALED FIXING ARRANGEMENT AS PER MANUFACTURER'S STANDARD CAN ALSO BE PROVIDED SUBJECT TO EMPLOYER'S SIDE ELEVATION APPROVAL. FIXING SLOT WITH 투능 REMOVABLE BOLT (TYP) FOR TENDER PURPOSE ONLY (SEE NOTE-7) This N NTPCLIMITED एन टी पी सी ( A GOVERNMENT OF INDIA ENTERPRISE ) SECTION-AA KNOB HINGE FOR THE DOOR

NTPC PROJECT

ENGINEERING DIVISION

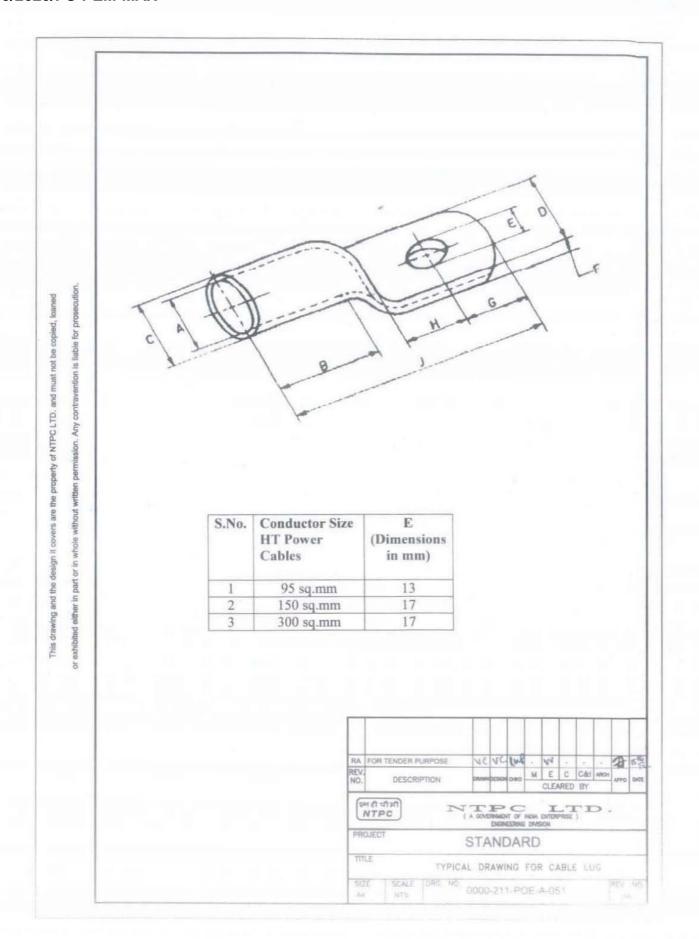
0000-999-POI-A-017

TYPICAL THERMAL POWER PLANT KS 21.08.12 JM GENERALLY REVISED TITLE KS 04.08.06 C GENERALLY REVISED G.A. OF JUNCTION BOX S.K. A.R PS GENERALLY REVISED PS A FIRST ISSUE S.K. A.R 04.05.05 REV.NO DRAWN DESIGN CHKD. APPD DATE SIZE SCALE DRG. NO.

DESCRIPTION

C C&I ARCH. A4 N.T.S. CLEARED BY

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FORMAT FOR SERIAL INTERFACE BETWEEN DCS SYSTEM & FOREIGN DEVICE

_		_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	 	 	_	_	_	_	_	 <u></u>
- opo J acitou	Register Type (Note-4)																											
	Modbus																											
	Device ID (Address)																											
	Data Format (Note-3)																											
to to il	Required (Y/N)																											
	Alarm SetPoint																											
	Alarm Priority (URGENT/HI/LO)																											
	Engg. Unit Requirement (Y / N)																											
	Engg. Unit																											
Range	Мах																											
Ra	Min																											
DCS (Engg.)	Мах																											
DCS	Min																											
	Point Type (Note-1)																											
Tag Description	(Maximum of 32 (Note-1) Char.)																											
Tagana	(Maximum 15 Char.)																											

<sup>1.</sup> Data type (AI/AO/DI/DO) shall be specified with respect to DCS.
2. For Digital points (IOs) please indicate the alarm state.
3. Data FormaSIGN16, USIGN16, SIGN32, USIGN32, FLOAT32, LONG32, BOOL, LOGIC
4. Function code: 1-Coil Status, 2-Input Status, 3-Holding Register, 4- Input Register, 5-Force single Coil, 6-Preset Single Register.

### 38045/2020/PS-PEM-MAX

	Cheklist for Serial Communication between DCS System and Foreign Device									
_										
	Device Specific :									
SN	Parameters	Options available Remarks if any								
	Model No.& Make of Device									
2	Communications Link Options	☐ Multidrop								
3	Protocol Mode (Device is a)	Master Slave Master/Slave								
4	Protocol	RTU ASCII Other								
5	Master	System maxDNA								
6	Redundancy Requirements	Yes / No								
7	Dist.bet.DCS System & Device*	FeetMeters								
В	Electrical Specific :									
1	Interface Type	□ RS232 □ RS422 □ RS485								
2	Wiring at Device end	2 Wire 4 Wire								
	Transmission Channel	☐ Half Duplex ☐ Full Duplex								
4	Baud Rates (bps)	□ 1200 □ 2400 □ 4800 □ 9600 □ 19200								
5	Databits	□ 8 □ 7								
6	Stopbits	□ 1 □ 2								
7	Parity	▼ None □ Odd □ Even								
8	H/w & Software Handshake	☐ Yes ☐ No								
9	Response Timeout time (Sec)	Configurable timeout								
10	Data Formats Supported	□ Boolean □ Real □ Char □ Sn.Int □ UnSn.Int								
	Transmission mode	☐ Asynchronous ☐ Synchronous								
C	Application Specific : *									
	Primary Function*	☐ Data Acquisition ☐ Data Acquisition & Control								
	Timary Function	□ Download parameter sets								
2	Analog Points to read	Nos. Details attached Details not attached								
	Analog Points to write	Nos. Details attached Details not attached								
		Nos. Details attached Details not attached								
	Digital Points to read Digital Points to write	Nos. Details attached Details not attached								
		Nos. Details attached Details not attached								
	Memory / Flag Points to read	Nos. Details attached Details not attached								
7	Memory / Flag Points to write	Potalis flot attached								
D	Hardware Specific :									
1	Cable type	▼ Boolean cable								
2	Cable Details Enclosed	☐ Yes ☑ No								
3	Any specific Converter required	☐ Yes ☐ No ☐ Details enclosed								
_	Dovino Dogumento :									
	Device Documents :	☐ Tech., Spec. ☐ Operating Manual								
1	Manufacturer's Documents*									
*N/	otes:									
	To identify converter requirement an	d cable length								
ΛŪ.	To lucituity converter requirement an	a cane lengui.								

- $\textbf{C:} Sr.no.1\ to\ 7\ are\ required\ to\ be\ furnished\ for\ interface: such\ as\ Tagname, Description, point\ type, modbus (Register)\ address, EU, range\ \&\ device\ address.$
- C1: What is the primary purpose of the communication link?
- E1: Reqd. Contents: This document must provide an overview of the device including its intended use.(a general tech, communication & electrical details)

38045/2020/PS-PFM-MAX SECTION: C **C&I SPECIFICATION FOR** SUB SECTION: C&I **HVAC SYSTEM** INSTRUMENTATION CABLE, CABLE INTERCONNECTION AND **TERMINATION PHILOSOPHY** 

CLAUSE NO.	8	TECHNICAL REQUIREMENTS										
1.00.00		INSTRUMENTATION CABLE, CONTROL & POWER SUPPLY CABLE, INTERNAL WIRING AND ELECTRICAL FIELD CONSTRUCTION MATERIAL (CABLE SUB-TRAYS ETC)										
1.01.00	Genera	ıl requirement	s									
1.01.01	shall c docume furnish	All cables including special cables, internal wiring and electrical field construction material shall conform to this specification, Employer approved detail engineering drawings & documents and the latest edition of the relevant standards & guidelines. The Bidder shall furnish all material and services required for the completeness of the work identified in his scope as per this specification.										
1.01.02	and ins	strumentation		ces/systems incli	all instrumentation cable uded under Contractor's							
1.01.03					entation cables are requ e provided by Contractor.	ired due to						
1.01.04					system bus, cables for cope furnished by the Contra							
1.01.05	branch	cable trays/su	b-trays, support	s, flexible condui	rdware from the main trun ts, cable glands, lugs, pu this specification.							
1.01.06	furnishe	ed by contracto		d basis within hi	required basis, the same s quoted lump sum price							
2.00.00	SPECIF	FICATION OF	INSTRUMENTA	TION CABLE								
2.01.00	Commo	on Requireme	nts									
	S. No.	Property		Requirement								
	1	Operating Vo	ltage	225 V (peak value)								
	2.	Codes and st	andard	0815, VDE 020 VDE 0472, SEN IS-10810 (lates	tion cables shall comply w 17, Part 4, Part 5, Part 6, V N 4241475, ANSI MC 96.1 It editions) and their amend this specification.	DE 0816, , IS-8784,						
	3.	Continuous of suitability	peration		for Type-C cables & he eg C for all other type of c							
FLUE GAS DES	IA PROJECT SULPHURISA TEM PACKA	ATION (FGD)	SECTION	SPECIFICATION -VI, PART-B NO.:CS-0011-109(1A)-2	SUB-SECTION-III-C4 INSTRUMENTATION CABLES	PAGE 1 OF 13						

CLAUSE NO.	0	TECHNICAL REQUIREMENTS											
	S. No.	Property		Requirement									
	4.	Marking :- a.Pro to be provided a			sequential marking ( heath.	of length in meters							
	b.Marking to read 'FRLS' to be provided at every 5 meters on outer sheaf for Type-C cable  c.Durable marking at intervals not exceeding 625 mm shall include marking at intervals.												
		name, insulation cable, year of m				Itage rating, type of							
	5.	Allowable Tolera overall diameter	TO COLUMN THE PARTY OF THE PART	+/- 2 mm (ma sheet	ximum) over the dec	clared value in data							
	6.	Variation in dian	neter	Not more than cable.	1.0 mm throughou	t the length of							
	7.	Ovality at any cr	oss-section	Not more than	1.0 mm								
	8.	CAGE-CLAMP	suitability	To be provide	ed .								
	9.	Color		The outer sheath shall be of blue color.									
	10.	Others	Repaired cables shall not be acceptable.										
2.02.00	Specif	ic Requirements											
		ification irements	Type-A cable	Type-B cable	Type F & G cable	Type-C cable							
	A. CC	NDUCTORS			•								
	Cross	section area		0.5 sq. mm									
	Cond	uctor material	ANSI type KX	ANSI type SX	Annealed bare copper	ANSI type KX							
	Colou	r code	Yellow-Red	Black-Red	As per VDE-815	Yellow-Red							
	Cond	uctor Grade	As per ANSI	MC 96.1	Electrolytic	As per ANSI MC 96.1							
	No &	dia of strands		7:	L x0.3 mm (nom)								
	No. of	f Pairs	2	2	2/4/8/12/16/ / 48	24 2							
	<u></u>		k.										
LOT-IA PROJECTS  FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE  TECHNICAL SPECIFICATION SUB-SECTION-III-C4 INSTRUMENTATION CABLES 2 OF													

CLAUSE NO.	TECHNICAL REQUIREMENTS							
	Specification Requirements	Type-A cable	Type-B cable	Type F & G cable	Type-C cable			
	Max. conductor loop resistance per Km (in ohm) at 20 deg. C	As per ANSI	MC 96.1	73.4	As per ANSI MC 96.1			
	Reference Standard	As per ANSI MC 96.1		VDE : 0815	As per ANSI MC 96.1			
	B. INSULATION							
	Material	Е	Extruded PVC type YI 3  0.25/0.35					
	Thickness in mm (Min/Max)							
	Volume Resistivity (Min) in ohm-cm	1 x 10 <sup>14</sup> at 20 deg. C & 1x10 <sup>11</sup> at 70 deg. C.			2.8x 10 <sup>14</sup> at 20 deg. C & 2x10 <sup>11</sup> a 205 deg. C.			
	C. PAIRING & TWISTING							
	Max. lay of pairs (mm)							
	Single layer of binder tape on each pair provided	Each core printed with number or Numbered binder tape to be provided on each pair  N.A To be provided		Each core printed with number or Numbered binder tape to be provided on each pair				
	Bunch ( Unit Formation) for more than 4P			N.A				
	Conductor /pair identification as per VDE0815	N.A	<b>A</b> .	To be provided	N.A.			
	D. SHIELDING							
	Type of shielding	Al-Mylar tape						
	Individual pair shielding	No To be provided for F-type cable  No 0.028mm (28 micron)		No				
	Minimum thickness of Individual pair shielding				No			
FLUE GAS DES	IA PROJECTS SULPHURISATION (FGD) TEM PACKAGE	TECHNICAL SF SECTION-V BID DOCUMENT NO	I, PART-B	SUB-SECTION INSTRUMENTATION	THE RESIDENCE OF SHARE STATES OF SHARE SHARE STATES OF SHARE S			

CLAUSE NO.	TECHNICAL REQUIREMENTS						
	Specification Requirements	Type-A cable	Type-B cable	Type F & G cable	Type-C cable		
	Overall cable assembly shielding		To be provided				
	Minimum thickness of Overall cable assembly shielding	0.055 mm (55 micron)					
	Coverage / Overlapping			100% / 20%			
	Drain wire provided for individual shield	N.A.		N.A.			
				No of strands-7  Dia of strands- 0.3mm  Annealed Tin coated copper			
	Drain wire provided for overall shield	Yes, Size- 0.5 sqmm,No of strands-7,Dia of s 0.3mm,Annealed Tin coated copper					
	E. FILLERS (if applicab	le)					
	Non-hygroscopic, flame retardant			To be provided			
	F. OUTER SHEATH						
	Material	Extruded PV properties	C compour	nd YM1 with FRLS	Teflon (i.e. extruded FRP)		
	Minimum Thickness at any point		1.8 r	nm	0.4 mm		
	Nominal Thickness at any point		>1.8	mm	0.5 mm		
	Resistant to water, fungus, termite & rodent attack			Required			
	Minimum Oxygen index as per ASTMD- 2863	29 % N.A.					
	Minimum Temperature index as per ASTMD-2863	250 deg.C			N.A.		
FLUE GAS DES	IA PROJECTS SULPHURISATION (FGD) TEM PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOCUMENT NO.:CS-0011-109(1A)-2  SUB-SECTION-III-C4 INSTRUMENTATION CABLES 4 OF 13					

CLAUSE NO.	TECHNICAL REQUIREMENTS (구경네회)							
	Specification Requirements	Type-A Type-B Type F & G cable cable			Type-C cable			
	Maximum Acid gas generation by weight as per IEC-60754-1		20%		N.A.			
	Maximum Smoke Density Rating as per ASTMD-2843	when the res	60% (defined as the average area under the curve when the results of smoke density test plotted on a curve indicating light absorption vs. time as per ASTMD-2843)					
	Reference standard	VI	VDE207 Part 5,VDE-816					
	G. Electrical Parameters							
	Mutual Capacitance Between Conductors At 0.8 Khz (Max.)			120 nF/km for F type	200 nF/km			
	At 0.0 Kilz (Wax.)			100 nF/km for G- type				
	Insulation Resistance (Min.)		100 M Ohm/Km					
	Cross Talk Figure (Min.) At 0.8 Khz	60	60 dB 60 dB		60dB			
	Characteristic Impedance (Max) At 1 Khz	N.A. 320 OHM FOR F-TYPE 340 OHM FOR G-TYPE		N.A.				
	Attenuation Figure At 1 Khz (Max)	N.A. 1.2 db/km		N.A.				
	H. COMPLETE CABLE							
	Complete Cable assembly	Shall pass Swedish Chimney test as per SEN-SS 4241475 class F3.		N.A.				
					<u>.</u>			
FLUE GAS DES	IA PROJECTS SULPHURISATION (FGD) FEM PACKAGE	TECHNICAL SF SECTION-V BID DOCUMENT NO	I, PART-B	SUB-SECTION-II INSTRUMENTATION				

CLAUSE NO.	TECHNICAL REQUIREMENTS							
	Specification Requirements	Type-A cable	Type-B cable	Type F & G cable	Type-C cable	е		
	Flammability		ammability as punction to this s	er IEEE-383 read pecification	As per manufacturer standard subje to employer's approval	ect		
	I. CABLE DRUM			I				
	Туре	from season		m (wooden drum to om defects with woo eel drum.				
	Length	1000 m <u>+</u> 5%	for up to & inc	luding 12 pairs				
		500 m <u>+ </u> 5%	for above12 pa	airs				
				elib session	G4 BAGE			
FLUE GAS DES	HA PROJECTS SULPHURISATION (FGD) TEM PACKAGE	TECHNICAL SP SECTION-V BID DOCUMENT NO		SUB-SECTION-III- INSTRUMENTATION C				

CLAUSE NO.	TECHNICAL REQUIREMENTS							
3.07.00	Penetration of water re	Penetration of water resistance and impact resistance shall be as per IEC standard.						
4.00.00	SPCIFICATION OF CO	ONTROL & POWER SU	PPLY C	ABLES				
	Refer Electrical sub-se	ctions						
5.00.00	INSTRUMENTATION	CABLE INTERCONNEC	TION A	ND TERMI	NATION PHILO	SOPHY		
	The cable interconnection philosophy to be adopted shall be such that extensive grouping of signals by large scale use of field mounted Group Junction Boxes (JBs) at strategic locations (where large concentration of signals are available, e.g. valves limit & torque switches, switchgear) is done and consequently cable with higher number of pairs are extensively used. The details of termination to be followed are mentioned in the given Table A.							
	TABLE A: CABLE TER	RMINATION TO BE FOLL	OWED					
	Арр	lication	Т	ype Of Ter	mination	Type Of Cable		
	FROM (A)	TO (B)	END A		END B	Cubic		
	Valves/dampers drives (Integral Junction box)	Marshalling / Marshalling – cum Termination Cubicle / local group JB	Plug in connec		Post mount cage clamp type.	G		
	Transmitters, Process Actuated switches mounted in LIE/LIR	Process Actuated of LIE/LIR connector switches mounted		Cage clamp (Rail mount) type.	F,G			
	RTD heads			Cage clamp (Rail mount) type.	F			
	Thermocouple	Local junction box / CJC box (if applicable)	Plug in connec		Cage clamp (Rail mount) type.	A, B, C*		
	Other Field mounted Instrument	Local JB / Group JB	Plug in connec		Cage clamp (Rail mount) type.	F,G		
	RTD	Temperature transmitter	Plug in connec		Screwed, Cage clamp type	F		
	Thermocouple Temperature Plug in connector			Screwed, Cage clamp type	A, B, C*			
				Cage clamp (Rail mount) type.	F,G			
LOT-IA PROJECTS  FLUE GAS DESULPHURISATION (FGD)  SYSTEM PACKAGE  TECHNICAL SPECIFICATION SUB-SECTION-III-C4 INSTRUMENTATION CAE BID DOCUMENT NO.:CS-0011-109(1A)-2					THE RESERVE OF THE PROPERTY OF THE PARTY OF	PAGE 7 OF 13		

CLAUSE NO.	TECHNICAL REQUIREMENTS						
	Appli	cation	Type Of Ter	mination	Type Of Cable		
	FROM (A)	TO (B)	END A	END B	Cable		
	Local Junction box, Temperature Transmitter, Int. Junction box of LIE/ LIR/ Group JB / MCC/SWGR	Marshalling / Marshalling – cum Termination Cubicle	Cage clamp (Rail mount) type.	Cage clamp (Post mounted) type.	F,G		
	Marshalling cubicle/ Termination Cabinet	Electronic system cabinet	Cage clamp (Post mounted) type.	Plug-in connector / other system as per Mfr.'s Standard	Internal wiring		
	Marshalling/ Termination System Cabinets	UCD mounted equipments	Cage clamp (Post mounted) type.	Plug in connector / Cage clamp type (rail mounted).	F,G (with plug-in connect or at one end)		
	DDCMIS/PLC cabinets	PC, Printers etc.	Plug in connector	Plug in connector	Mfr.'s Standar d		
	Notes  1 Normally 10% spare cores shall be provided when the numbers of pairs of cables are more than four pairs, except for pre-fabricated cables which shat be as per manufacturer's standard.  2 For analog signals, individual pair shielding & overall shielding & for Binary						
	signals,	only overall shielding of	f instrumentation ca				
	3	n temperature application		arshalling cabir	net		
	Minimu	um 4 pair instrumentatio	n cable shall be use	ed.			
	5 All the spare cores of instrumentation cable have to be terminated i Marshalling cabinets/ DCS panel end.						
	6 Not used.						
6.00.00	TERMINAL BLOCKS						
6.01.00	All terminal blocks shall be rail mounted/post mounted, cage clamp type with high quality non-flammable insulating material of melamine suitable for working temperature of 105 deg. C. The terminal blocks in field mounted junction boxes, temperature transmitters, instrument enclosures/racks, etc., shall be suitable for cage clamp connections. The terminal blocks in Control Equipment Room logic/termination/marshalling cubicles shall be suitable for post						
FLUE GAS DES	IA PROJECTS SULPHURISATION (FGD) TEM PACKAGE	TECHNICAL SPECIFICATI SECTION-VI, PART-B BID DOCUMENT NO.:CS-0011	INSTRUMEN	CTION-III-C4 ITATION CABLES	PAGE 8 OF 13		

CLAUSE NO.	TECHNICAL REQUIREMENTS  एन्हेपीसी  NTPG				
	mounted cage clamp connection at the field input end. The exact type of terminal blocks to be provided by the Bidder and the technical details of the same including width etc. shall be subject to Employer's approval.				
6.02.00	All the terminal blocks shall be provided complete with all required accessories including assembly rail, locking pin and section, end brackets, partitions, small partitions, transparent covers, support brackets, distance sleeves, warning label, marking, etc.				
6.03.00	The marking on terminal strips shall correspond to the terminal numbering on wiring diagrams. At least 20% spare unused terminals shall be provided everywhere including local junction boxes, instrument racks/enclosures, termination/marshalling cabinets, etc. All terminal blocks shall be numbered for identification and grouped according to the function. Engraved labels shall be provided on the terminal blocks.				
6.04.00	For terminating each process actuated switches, drive actuators, control valves, Thermocouple, RTD, etc. in Local Junction Boxes, etc, refer Drg no. 0000-999-POI-A-065.				
6.05.00	The terminal blocks shall be arranged with at least 100 mm clearance between two sets of terminal blocks and between terminal blocks and junction box walls.				
7.00.00	INTERNAL PANELS/ SYSTEM CABINETS WIRING				
7.01.00	Internal panel/cabinet wiring shall be of multi-stranded copper conductor with FRLS PVC insulation without shield and outer sheath meeting the requirements of VDE 0815.				
7.02.00	All internal wires shall be provided with tag and identification nos. etched on tightly fitted ferules at both ends. All wires directly connected to trip devices shall be distinguished by one additional red colour ferrule.				
7.03.00	All external connection shall be made with one wire per termination point. Wires shall not be tapped or spliced between terminal points.				
7.04.00	All floor slots of desk/panels/cabinets used for cable entrance shall be provided with removable gasketed gland plates and sealing material. Split type grommets shall be used for prefabricated cables.				
7.05.00	All the special tools as may be required for solder less connections shall be provided by Bidder.				
7.06.00	Wire sizes to be utilised for internal wiring.				
	(i) Current (4-20 mA), low voltage signals (48V); 0.5 Sq.mm. Ammeter/Voltmeter circuit, control switches etc. for electrical system.				
	(ii) Power supply and internal illumination. 2.5Sq.mm. minimum (shall be as per load requirement.)				
FLUE GAS DES	-IA PROJECTS TECHNICAL SPECIFICATION SUB-SECTION-III-C4 PAGE SULPHURISATION (FGD) SECTION-VI, PART-B INSTRUMENTATION CABLES 9 OF 13 DOCUMENT NO.:CS-0011-109(1A)-2				

CLAUSE NO.	TECHNICAL REQUIREMENTS					
8.02.00	Cables shall be segregated as per IEEE Std422. In vertically stacked trays, the higher voltage cable shall be in higher position and instrumentation cable shall be in bottom tier of the tray stack. The distance between instrumentation cables and those of other system shall be as follows:					
	From 11 kV/6.6 kV/3.3 kV tray system - 914 mm					
	From 415V tray system - 610 mm					
	From control cable tray system - 305 mm					
8.03.00	Cables shall terminate in the enclosure through cable glands. All cable glands shall be properly gasketed. Sealing (to prevent ingress of dust entry and propagation of fire) shall be provided for all floor slots used for cable entrance. Compression cable glands (double for armoured and single for other cables) shall be provided.					
8.04.00	Not in use					
8.05.00	The cables emanating from redundant equipment/devices shall be routed through different paths. The above segregation of cables & wiring for redundant equipments/devices shall be in accordance with IEEE-Std-422.					
9.00.00	CABLE LAYING AND ACCESSORIES					
9.01.00	CABLE LAYING					
	Cables shall be laid strictly in line with cable schedule.					
	2 Identification tags for cables.					
	Indelible tags to be provided at all terminations, on both sides of wall or floor crossing, on each conduit/duct/pipe entry/exit, and at every 20 m in cable trench/tray.					
	3 Cable tray numbering and marking.					
	To be provided at every 10m and at each end of cable way & branch connection.					
	4 No jointing is permissible for Instrumentation cables. For other cables Jointing for more than 250 Meters run of cable shall be permitted.					
	5 Buried cable protection					
	With concrete slabs; Route markers at every 20 Meters along the route & at every bend.					
	6 Road Crossings					
	Cables to pass through buried high density PE pipes encased in PCC. At least 300 mm clearance shall be provided between					
	- HT power & LT power cables,					
	- LT power & LT control/instrumentation cables,					
FLUE GAS DES	-IA PROJECTS TECHNICAL SPECIFICATION SUB-SECTION-III-C4 PAGE SULPHURISATION (FGD) SECTION-VI, PART-B TEM PACKAGE BID DOCUMENT NO.:CS-0011-109(1A)-2					

CLAUSE NO.	TECHNICAL REQUIREMENTS					
	Spacing between cables of same voltage grade shall be in accordance with the derating criteria adopted for cable sizing.					
	7 Segregation (physical isolation to prevent fire jumping)					
	a All cable associated with the unit shall be segregated from cables of other Units.					
	b Interplant cables of station auxiliaries and unit critical drives shall be segregated in such a way that not more than half of the drives are lost in case of single incident of fire.					
	8 Cable clamping					
	All cables laid on trays shall be neatly dressed up & suitably clamped/tied to the tray. For cables in trefoil formation, trefoil clamps shall be provided.					
	9 Optical fiber cables ( OFCs) :					
	Outside Building Area - to be laid necessarily inside GI conduit with support from cable tray/Trestle structure					
	Inside Building Area – to be laid on separate cable sub-trays					
	While buried- in separate burried trench approx.1.0 meter depth, to be laid in 2" rodent proof HDPE conduits covered with sand, brick, laid breadth-wise and soil along the pipe line route by contractor;					
	While crossing roads - to be laid in GI/ rodent proof HDPE conduits with sand filling at bottom and sand, soil filling at top with cement concrete;					
	While crossing canals/river- to be laid in rodent proof HDPE conduits within hume pipe.					
	10 Laying of Network Cable (UTP/STP):					
	Out side Building Area- to be laid necessarily inside GI conduits with support from cable tray / Trestle structure.					
	Inside Building Area- to be laid necessarily inside GI conduits on separate cable sub-trays.					
9.02.00	Bidder shall supply and install all cable accessories and fittings like Light Interface Units, Surge suppressors, Opto isolators, Interface Converters, Fibre Optic Card Cage, Fibre Optic Line Driver, Repeater / Modem (for Optical Fibre Cables), cable glands, grommets, lugs, termination kits etc. on as required basis.					
9.03.00	Cables, which terminate in cabinets of draw out sections shall have sufficient cable coiled in the bottom of the cabinet to permit full withdrawal of draw out sections without disconnecting the cables. When prefabricated cables with factory connectors on both ends are longer than required, the excess cable shall be coiled in the bottom of one or both termination cabinets.					
9.04.00	The Bidder shall be responsible for proper grounding of all equipment under this package. Further, proper termination of cable shields shall be verified and the grounding of the same shall be coordinated so as to achieve grounding of all instrumentation cable shields at same potential. This shall be completed prior to system tests.					
FLUE GAS DE	-IA PROJECTS TECHNICAL SPECIFICATION SUB-SECTION-III-C4 PAGE SULPHURISATION (FGD) SECTION-VI, PART-B INSTRUMENTATION CABLES 11 OF 13 BID DOCUMENT NO.:CS-0011-109(1A)-2					

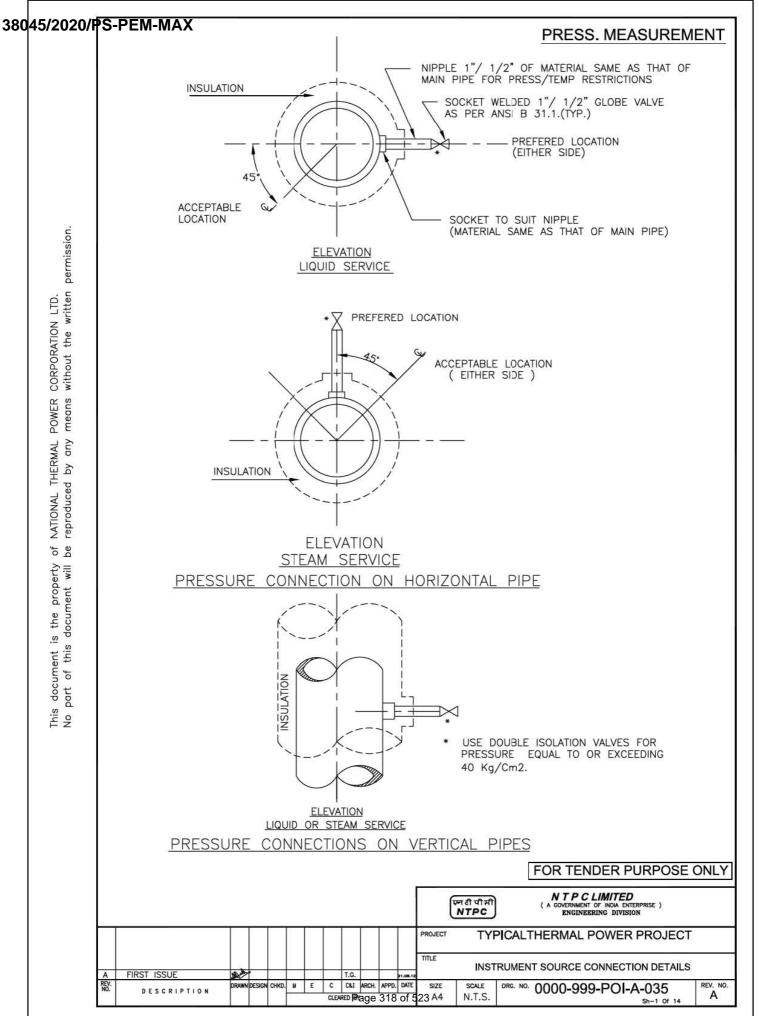
CLAUSE NO.	a)	TEC	CHNICAL REQUIREMENT	s	एनदीपीमी NTPC	
9.05.00	The Contractor shall take full care while laying / installing cables as recommended by cable manufacturers regarding pulling tensions and cable bends. Cables damaged in any way during installation shall be replaced at the expense of the Contractor.					
10.00.00	FIELD	MOUNTED LOCAL	JUNCTION BOXES			
	(i)	(i) No. of ways 12/24/36/48/64/72/96/128 with 20% spares terminals.				
	(ii)	(ii) Material and 4mm thick Fiberglass Reinforced Polyester (FRP). Thickness				
	(iii)	Туре	Screwed at all four corner synthetic rubber.	rs for door. Door gasket	shall be of	
	(iv)	Mounting clamps and accessories	Suitable for mounting on brackets, bolts, nuts, screv be of SS, included in Bidde	vs, glands required for ere		
	(v)	Type of terminal blocks	Rail mounted cage-clamp 2.5 mm <sup>2</sup> . A M6 earthing st	PARTIES AND AND ADDRESS OF THE PROPERTY OF THE PROPERTY OF THE PARTY OF THE PROPERTY OF THE PARTY OF THE PART	or size <mark>u</mark> pto	
	(vi)	Protection Class	IP: 55 minimum for indo applications.	oor & IP-65 minimum f	or outdoor	
	(vii)	Grounding	To be provided.			
	(viii)	Color	RAL 7035			
11.00.00	COND	UITS				
11.01.00	Conduits shall be generally used for interconnecting cables from field instruments to Local JB's. All rigid conduits, couplings and elbows shall be hot dipped galvanised rigid mild steel in accordance with IS: 9537 Part-I (1980) and Part-II (1981). The conduit interior and exterior surfaces shall have continuous zinc coating with an overcoat of transparent enamel lacker or zinc chromate. Flexible conduit shall be heat resistant terne coated steel with , water leak, fire and rust proof protected for the areas of Mills, Drum, Main Steam, RH steam Air Heaters and Furnace, BFPDT's.					
			tions, water leak, fire and ru rating of flexible conduit sha			
11.02.00	All rigid conduit fittings shall conform to the requirements of IS: 2667, 1976. Galvanized steel fitting shall be used with steel conduit. All flexible conduit fittings shall be liquid tight, galvanized steel. The end fittings shall be compatible with the flexible conduit supplied.					
11.03.00	Conduit sealing, explosion proof, dust proof and other types of special fittings shall be provided as required by these specifications and shall be consistent with the area and equipment with which they are installed. Fittings installed outdoors and in damp locations shall be sealed and gasketed. Hazardous area fittings and conduits sealing shall conform with NEC requirements for the area classification.					
11.04.00	Contractor shall provide double locknuts on all conduit terminations not provided with threaded hubs and couplings. Water tight conduit unions and rain tight conduit hubs shall be					
FLUE GAS DE	IA PROJEC SULPHURIS TEM PACK	SATION (FGD)	TECHNICAL SPECIFICATION SECTION-VI, PART-B ID DOCUMENT NO.:CS-0011-109(1A)-2	SUB-SECTION-III-C4 INSTRUMENTATION CABLES	PAGE 12 OF 13	

CLAUSE NO.	TECHNICAL REQUIREMENTS  एन्स्यास
	utilised for all the application which shall be exposed to weather. Moisture pockets shall be eliminated from conduits.
11.05.00	Conduits shall be securely fastened to all boxes and cabinets.
12.00.00	CABLE SUB-TRAY & SUPPORT
12.01.00	The cable sub-trays and the supporting system, to be generally used between Local/Grou JBs and the main cable trays and the same shall be furnished and installed by th Contractor. It is the assembly of sections and associated fittings forming a rigid structural system used to support the cable from the equipment or instrument enclosure upto the main cable trays (trunk route).
12.02.00	The covers on the cable sub-trays shall be used for protection of cables in areas wher damage may occur from falling objects, welding spark, corrosive environment, etc. & shall be electrically continuous and solidly grounded.
FLUE GAS DES	IA PROJECTS  SULPHURISATION (FGD)  TECHNICAL SPECIFICATION  SUB-SECTION-III-C4 INSTRUMENTATION CABLES  13 OF 13  TEM PACKAGE  BID DOCUMENT NO.:CS-0011-109(1A)-2

INSTRUMENT STUB DETAILS	माम्बर एस	C&I SPECIFICATION FOR	SECTION: C
	सम्भूषा	HVAC SYSTEM	SUB SECTION: C&I
		INSTRUMENT STUB DETAILS	

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FIRST ISSUE

## 38045/2020/PS-PEM-MAX PRESSURE MEASUREMENT (SYSTEM PR.>40Kg/Sq Cm CL 9000) (SYSTEM PR.>40Kg/Sq Cm CL 6000) -| Φ 33.4×9.09| <del>-</del> - d 33.4x6.35 -1.1 t A 1.1 t A 23.5-1/2 +6 17.5-1/2 +6 (SYSTEM PR. <40Kg/Sq cm Nb 25 CL 3000) (SYSTEM PR. <40Kg/Sq cm Nb 15 CL 3000) Φ 33.4×4.55 φ 21.3×3.73 1.1 t 0 1.1 t △ 46 50 121/2 +61 11/2 +6 NOTES:-MATERIAL OF THE BOSS AND NIPPLE SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED AND CONFIRM TO ANSI B 16.11. 2. THE LENGTH OF THE NIPPLE SHOULD BE 250mm. 3. THE OTHER END OF THE NIPPLE SHALL BE SOCKET WELDED WITH 1" GLOBE VALVE OF MATERIAL AS PER ANSI B 16.1. 4. TWO ISOLATED VALVES ARE TO BE USED FOR PRESSURE = >40 Kg/Cm2. 5. EDGE HOLE MUST BE CLEAN AND SQUARE OR ROUNDED SLIGHTLY (1/64" RADIUS) FREE FROM BURRS, WIRE EDGES OR OTHER IRREGULARITIES. 6. ORIENTATION OF TAP WILL BE VARY WITH TYPE OF PROCESS FLUID AND NATURE OF RUN OF THE PIPE. 7. ACTIVITIES TO BE COMPLETED AT THE SHOP, WELD THE COUPLING (OR BOSS) ON THE PIPE AND DRILL PRESSURE CONNECTION HOLE (SAME AS I D OF NIPPLE) IN THE PIPE IN ALLIGNMENT WITH HOLE IN THE COUPLING. FOR TENDER PURPOSE ONLY 8. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE STATED. N T P C LIMITED GOVERNMENT OF INDIA ENTERPRISE ) ENGINEERING DIVISION एन टी पी भी NTPC PROJECT TYPICALTHERMAL POWER PROJECT TITLE INSTRUMENT SOURCE CONNECTION DETAILS

C C&I ARCH. APPD. DATE

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SIZE

SCALE

N.T.S.

DRG. NO. 0000-999-POI-A-035

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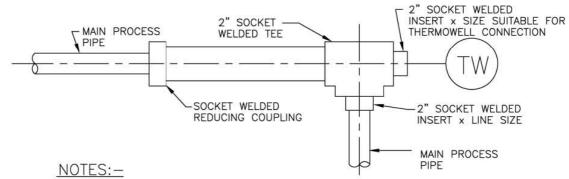
# 38045/2020/PS-PEM-MAX PRESS. MEASUREMENT SCREWED CONNECTION OF M 42×2 AND LENGTH OF THREADED ENGAGEMENT WILL BE NORMAL CATEGORY AS PER IS:4610 POWER CORPORATION LTD. means without the written permission. SCREWED CAP (GI) NATIONAL THERMAL reproduced by any GI CHAIN AIR OR FLUE GAS of be PIPE This document is the property No part of this document will DUCT WALL INSULATION NOTES:-1. THIS TYPE OF PRESSURE CONNECTON SHALL BE PROVIDED FOR PRESSURE MEASUREMENTS IN AIR AND FLUE GAS DUCT/FURNACE.

2. DIMENSIONS ARE INDICATIVE ONLY.

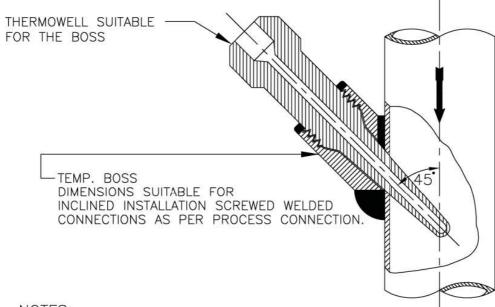
### FOR TENDER PURPOSE ONLY

												ਦਸਟੀ ਧੀ ਸੀ NTPC	NTPCLIMITED (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION
											PROJECT	TYF	PICALTHERMAL POWER PROJECT
A	FIRST ISSUE	10.10						T.G.		21.08.12	TITLE	INST	RUMENT SOURCE CONNECTION DETAILS
REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	u	E	C		APPD. 320		SIZE 23 A4	SCALE N.T.S.	DRG. NO. 0000-999-POI-A-035 Sh-3 of 14 REV. NO. A

### TEMP. MEASUREMENT



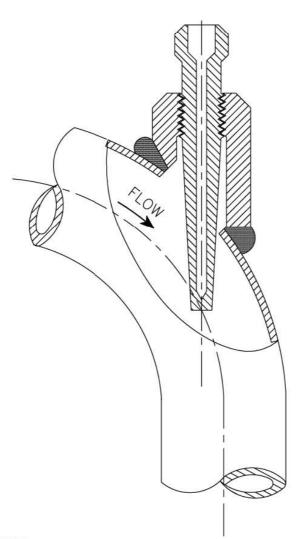
- THIS TYPE OF THERMOWELL INSTALLATION IS SUITABLE FOR THE PROCESS PIPE OF 2" NPS AND SMALLER.
- FOR STEAM SERVICE THIS TYPE OF THERMOWELL INSTALLATION 90\* BEND MAY BE USED ONLY IN VERTICAL PLANE.
- THE LENGTH OF THE LARGER PIPE SECTION SHALL BE MINIMUM 150mm (IT MUST BE GREATER THAN THERMOWELL LENGTH).



### NOTES:-

- INCLINED INSTALLATION OF THERMOWELL SHALL BE APPLICABLE FOR 4" AND SMALLER LINE SIZE BUT LIMITED TO MIN. 3" LINE SIZE.
- FOR 2" AND SMALLER LINE SIZE NECESSARY EXPANDER OF MIN. 3" SIZE OF MAIN PIPING SPECIFICATION SHALL BE USED.
- THIS TYPE OF INSTALLATION IS APPLICABLE FOR HORIZONTAL AND VERTICAL PIPE SECTION.
- 4. FOR STEAM SERVICES EXPANDER SECTION MAY BE USED ONLY IN VERTICAL RUN.
- 5. THE EXPANDER SECTION SHALL BE OF ADEQUATE LENGTH (ATLEAST 3-4 TIMES DIA OF THE MAIN PROCESS PIPE AT BOTH SIDE OF THE INSTALLED THERMOWELL).

#### FOR TENDER PURPOSE ONLY NTPCLIMITED GOVERNMENT OF INDIA ENTERPRISE ) एन टी पी भी NTPC ENGINEERING DIVISION PROJECT TYPICALTHERMAL POWER PROJECT (SG PACKAGE) TITLE INSTRUMENT SOURCE CONNECTION DETAILS FIRST ISSUE C&I ARCH. APPD. DATE и C SIZE SCALE 0000-999/102-POI-A-035 REV. NO. Α CLEARED Page 321 of 523 A4 N.T.S.



- 1. FLOW INSTALLATION OF THERMOWELL SHALL BE APPLICABLE FOR 4" AND SMALLER LINE SIZE BUT LIMITED TO MINIMUM 3" LINE SIZE.
- 2. FOR 2" AND SMALLER LINE SIZE NECESSARY EXPANDER OF ELBOW FORM (AS SHOWN) OF MINIMUM 3" SIZE SHALL BE USED.
- ELBOW EXPANDER SECTION IN HORIZONTAL PLANE MAY BE USED FOR LIQUID SERVICES. ONLY STEAM SERVICES EXPANDER SECTION MAY BE USED IN VERTICAL PLAN.

### FOR TENDER PURPOSE ONLY

PROJECT TYPICALTHERMAL POWER PROJECT

TITLE

A FIRST ISSUE

A FIRST ISSUE

RV.
NO.
DESCRIPTION

DRAWN DESIGN CHKD.
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RV.
NO.
CLEARED PROJECT TYPICALTHERMAL POWER PROJECT

TITLE

INSTRUMENT SOURCE CONNECTION DETAILS

REV. NO.
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TYPICALTHERMAL POWER PROJECT

TITLE

INSTRUMENT SOURCE CONNECTION DETAILS

REV. NO.
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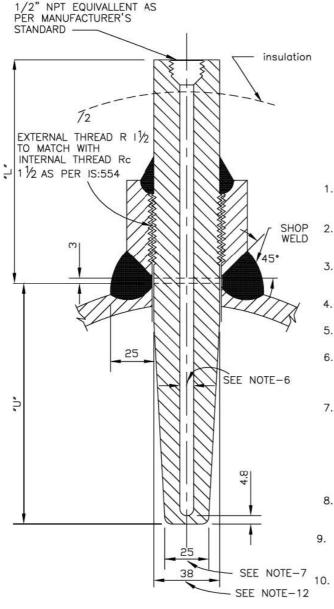
CLEARED PROJECT

TITLE

INSTRUMENT SOURCE CONNECTION DETAILS

REV. NO.
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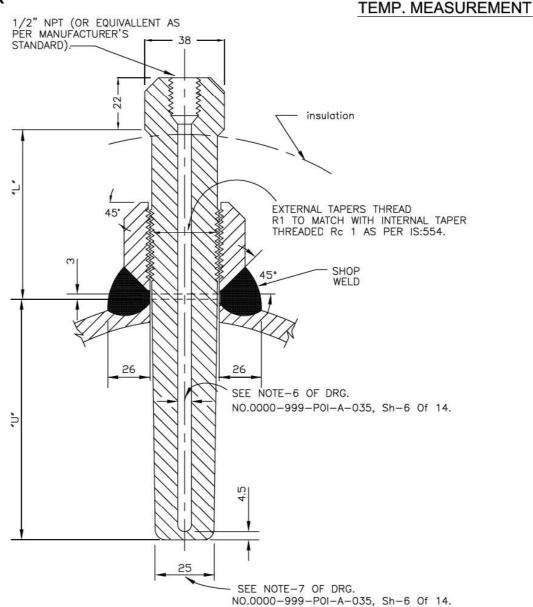
REV. NO.
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- THIS TYPE OF TEMPERATURE BOSS SHALL BE USED FOR THE PROCESS PRESS EQUAL/ABOVE 40 Kg/Cm2(g).
- THE MATERIAL OF THE BOSS SHOULD BE SIMILAR TO THAT OF PIPING MATERIAL OF SPECIFICATION.
- ALL WELD TO BE TESTED IN ACCORDANCE WITH APPLICABLE CODES BY MANUFACTURER.
- MATERIAL OF THE THERMOWELL SHALL BE OF 316SS.
- THERMOWELL SHALL BE DRILLED BARSTOCK TYPE.
- INTERNAL BORE OF THE THERMOWELL SHOULD BE SELECTED BASED ON THE NORMAL SIZE OF THE SENSING ELEMENT AS PER ASME,PTC-19.3.
- 7. THE BOTTOM DIAMETER OF THE THERMOWELL TYPICALLY SHOWN HERE SHALL BE SUBJECT TO VARIATION BASED ON THE INTERNAL BORE OF THERMOWELL AND THICKNESS OF THERMOWELL MATERIAL TO WITHSTAND THE PROCESS PRESS.AND TEMP.,AS PER ASME,PTC-19.3.
- B. THE TYPE OF TAPERED THERMOWELL SHALL BE USED FOR LIQUID VELO-CITIES UP TO 92M.P.S.(300F.T.P.S.).
- THERMOWELL WITH THE INSULATION LAG EXTENSIONS SHALL BE USED WHEREVER APPLICABLE.
  - ACTIVITIES TO BE COMPLETED AT THE SHOP. WELD THE BOSS ON THE PIPE AND DRILL THE HOLE IN THE PIPE IN ALLIGNMENT WITH HOLE IN THE BOSS. PROVIDE INTERNAL THREAD AS PER IS:554 TO MATCH WITH THE THERMO—WELL EXTERNAL THREAD.
- ALL DIMENSIONS ARE IN MM UNLESS OTHERWISE STATED.
- 12. WILL BE SUITABLE TO MATCH THE STUB DIMENSIONS AS PER RC 11/2
- 13. THE "U" & "L" DIMENSIONS SHALL BE BE SELECTED BASED ON PARTICULAR APPLICATION AND THE SAME SHALL BE SUBJECT TO OWNER'S APPROVAL DURING DETAILED ENGINEERING.
- 14. ALL DIMENSIONS ARE INDICATIVE ONLY.

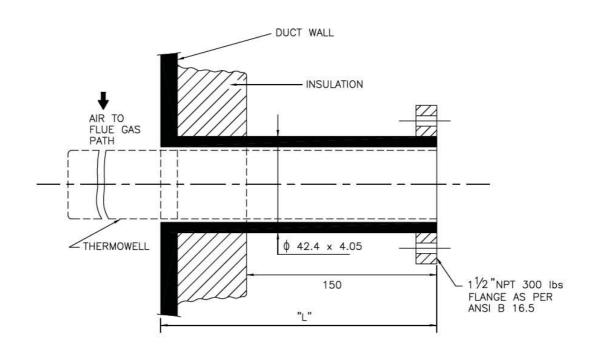
### FOR TENDER PURPOSE ONLY

NTPCLIMITED एन टी पी भी NTPC ENGINEERING DIVISION PROJECT TYPICALTHERMAL POWER PROJECT TITLE INSTRUMENT SOURCE CONNECTION DETAILS FIRST ISSUE DESIGN CHKD. M C C&I ARCH. APPD. DATE SIZE SCALE DRG. NO. 0000-999-POI-A-035 REV. NO. Α CLEARED Page 323 of 523 A4 N.T.S.



- 1. THIS TYPE OF TEMPERATURE BOSS IS APPLICABLE FOR THE PROCESS PRESSURE/TEMPERATURE BELOW 40 Kg/Cm2(g)/400°C
- 2. FOR PRESSURE TIGHT JOINTS THE BOSS SHOULD HAVE INTERNAL TAPERED PIPE THREAD Rc 1 AS PER IS:554. THE LENGTH OF THREAD ENGAGEMENT SHOULD BE AS PER ABOVE STANDARD.
- PIPES HAVING PROBABILITY OF PROLONGED VIBRATION SEAL WELDING MAY BE DONE ALL AROUND AFTER TIGHTENING THERMOWELL WITHIN THE BOSS.
- 4. SEE NOTES-2 TO 14 OF DRG. NO. 0000-999-POI-A-035, Sh-6 Of 14.

### FOR TENDER PURPOSE ONLY एन टी पी भी NTPC NTPCLIMITED ENGINEERING DIVISION PROJECT TYPICALTHERMAL POWER PROJECT TITLE INSTRUMENT SOURCE CONNECTION DETAILS FIRST ISSUE C&I ARCH. APPD. DATE C SIZE SCALE DRG. NO. 0000-999-POI-A-035 REV. NO. Α CLEARED Page 324 of 523 A4 N.T.S.

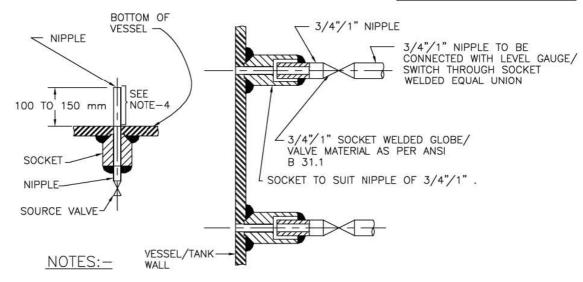


- THIS TYPE OF TEMPERATURE CONNECTIONS SHALL BE PROVIDED FOR TEMPERATURE MEASUREMENT IN AIR AND FLUE GAS DUCT.
- 2. MATERIAL OF THERMOWELL SHALL BE OF 316SS.
- 3. EXTERNAL CONNECTION SHALL BE OF SLIP ON FLANGED TYPE AND THERMOWELL DESIGN SHALL BE AS PER ASME.PTC-19.3 (REFER NOTES 9&10 OF DRG.NO. 0000-999-POI-A-035, Sh-6 Of 14).
- 4. BIDDER TO SUPPLY AND INSTALL THE COUNTER FLANGED AND THERMOWELL (ALONG WITH TEMP. ELEMENT).
- 5. ALL DIMENSIONS ARE INDICATIVE ONLY.

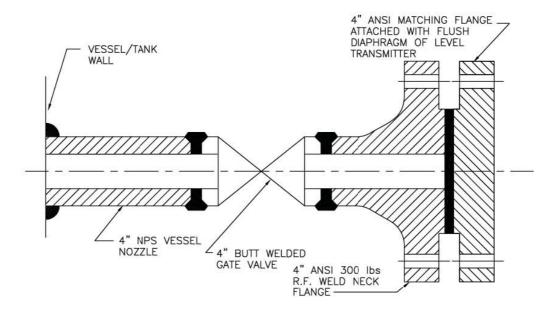
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												PROJECT	TYF	PICALTHERMAL POWER PROJECT
	FIRST ISSUE							T.G.			Other Di	TITLE	INST	FRUMENT SOURCE CONNECTION DETAILS
REV. NO.	FIRST ISSUE DESCRIPTION	DRAWN	DESIGN	CHKD.	и	E	C	C&I	-,	APPD.			SCALE N.T.S.	DRG. NO. 0000-999-POI-A-035 REV. NO. A

### LEVEL MEASUREMENT



- THIS TYPE OF PROCESS CONNECTION SHALL BE USED FOR LEVEL GAUGE AND EXTERNAL CAGE TYPE FLOAT OR DISPLACER OPERATED LEVEL SWITCH.
- FOR GAUGES 3/4" NIPPLE ALONG WITH 3/4" SW SOURCE VALVE AND FOR SWITCHES 1" NIPPLE ALONG WITH 1" SW SOURCE VALVE SHALL BE PROVIDED AS PROCESS CONNECTION.
- SOURCE CONNECTION ON VESSEL SHOULD NOT BE LOCATED AT PLACES SUBJECTED TO INTERFACE AND TURBULENCE FROM INLETS AND OUTLETS.
- IF LOWER CONNECTION IS TAKEN FROM BOTTOM OF THE VESSEL THEN THE NIPPLE MUST BE 100 mm TO 150 mm ABOVE THE BOTTOM OF THE VESSEL.

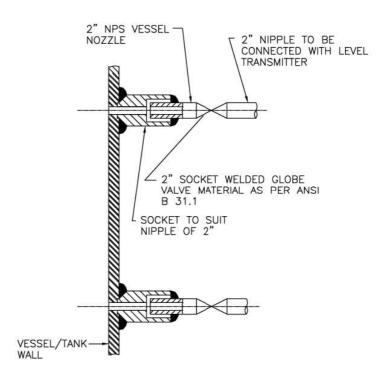


### NOTES:-

- THIS TYPE OF PROCESS CONNECTION SHALL BE PROVIDED FOR TANK LEVEL MEASUREMENT OF VISCOUS OR CORROSIVE LIQUID USING FLUSH DIAPHRAGM/WAFER TYPE LEVEL TRANSMITTER.
- 2. WELDING OF MATCHING FLANGE TO GATE VALVE SHALL BE DONE BY BIDDER.

### FOR TENDER PURPOSE ONLY

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Δ.	FIRST ISSUE	ALDE COLOR						T.G.			21.08.12	TITLE	INST	RUMENT SOURCE CONNECTION DETAILS
REV. NO.	DESCRIPTION	DRAWN	DESIGN	N CHKD.	и	E	С	C&I	ARCH.		DATE	SIZE	SCALE	DRG. NO. 0000-999-POI-A-035 REV. NO.
							CLE/	RED P	age	326	of 5	23 A4	N.T.S.	Sh-13 Of 14 A



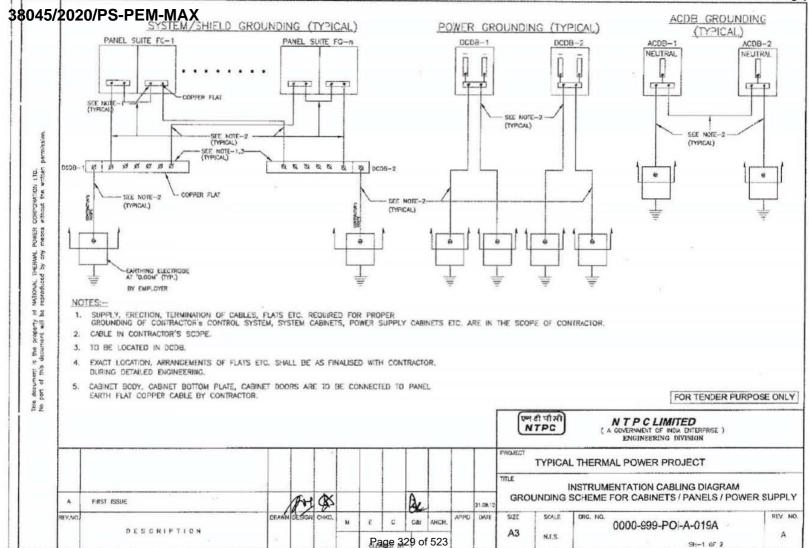
# NOTES:-

- THIS TYPE OF PROCESS CONNECTION SHALL BE USED FOR DISPLACER TYPE LEVEL TRANSMITTER.
- 2. SOURCE CONNECTION ON VESSEL SHOULD NOT BE LOCATED AT PLACES SUBJECTED TO INTERFACE AND TURBULENCE FROM INLETS AND OUTLETS.
- 3. IF LOWER CONNECTION IS TAKEN FROM BOTTOM OF THE VESSEL THEN THE NIPPLE MUST BE 100 mm TO 150 mm ABOVE THE BOTTOM OF THE VESSEL.

## FOR TENDER PURPOSE ONLY

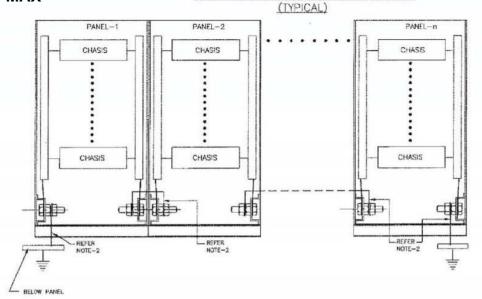
											ਇਸ ਹੀ ਸੀ NTPC	NTPCLIMITED ( A GOVERNMENT OF INDIA ENTERPRISE ) ENGINEERING DIVISION	
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Α	FIRST ISSUE	M. M.					T.G.		21.08.12	TITLE	INST	RUMENT SOURCE CONNECTION DETAILS	
REV. NO.	DESCRIPTION	DRAWN	CHKD.	и	Ε	C	C&I	 APPD.	DATE		SCALE N.T.S.	UUUU-999-PUI-A-U.33	/. NO. <b>A</b>

2020/PS-PFM-MA	C&I SPECIFICATION FOR HVAC SYSTEM	SECTION: C SUB SECTION: C&I
IN	ISTRUMENT INSTALLATION DRA	AWING
1		



# 38045/2020/PS-PEM-MAX

# GROUNDING FOR EACH ROW OF PANELS



#### NOTES: -

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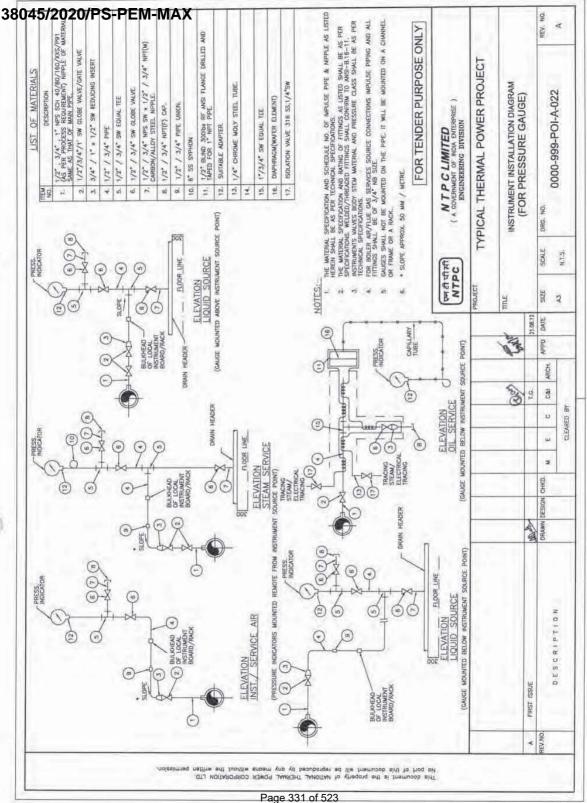
SUPPLY, ERECTION, TERMINATION OF CABLES, FLATS ETC. REQUIRED FOR PROPER GROUNDING OF CONTRACTOR'S CONTROL SYSTEM, SYSTEM CABINETS, POWER SUPPLY CABINETS ETC. ARE IN THE SCOPE OF CONTRACTOR.

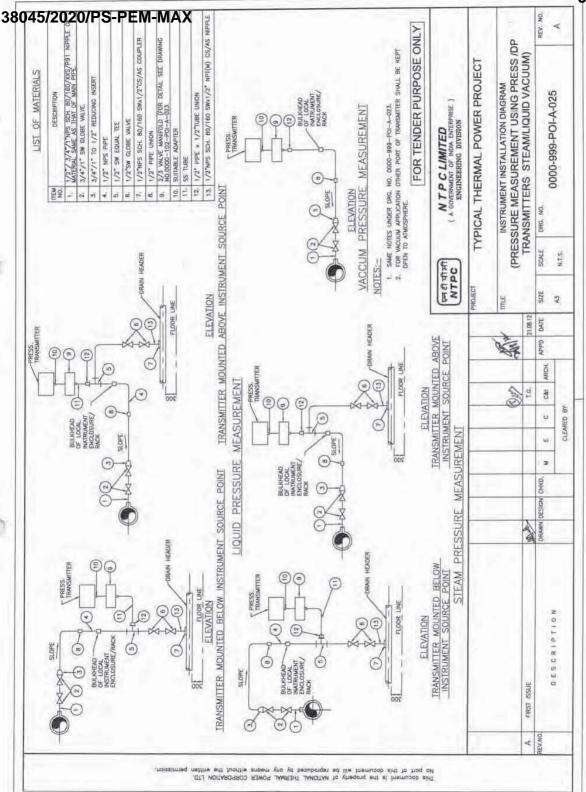
- 2. CABLE IN CONTRACTOR'S SCOPE.
- 3. TO BE LOCATED IN DCDB.
- 4. EXACT LOCATION, ARRANGEMENTS OF FLATS ETC. SHALL BE AS FINALISED WITH CONTRACTOR. DURING DETAILED ENGINEERING.

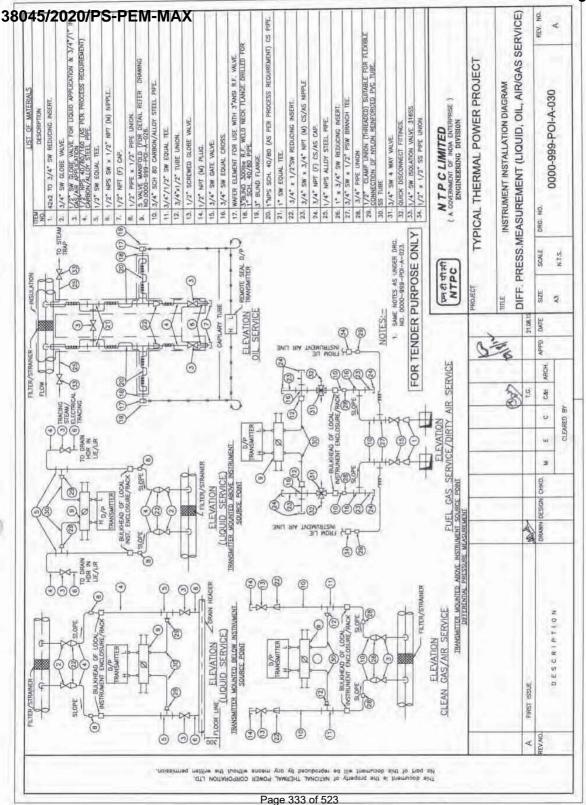
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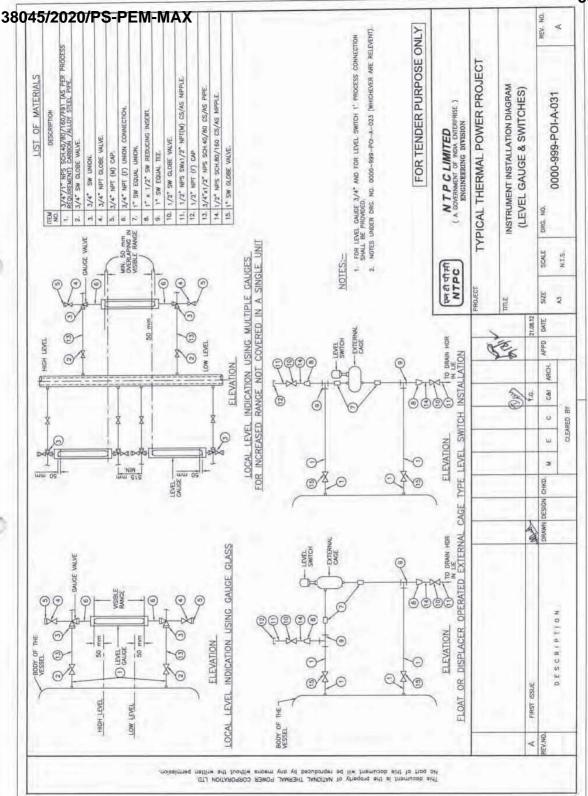
5.	5. CABINET BODY, CABINET BOTTOM PLATE, CABINET DOORS ARE TO BE CONNECTED TO PANEL EARTH FLAT COPPER CABLE BY CONTRACTOR.											(A GOVERNMENT OF INDA ENTERPRISE ) RNGINEERING DIVISION					
	- 11-12-11-11-11-11-11-11-11-11-11-11-11-1											TYPICAL THERMAL POWER PROJECT					
			64					Ne.				TITLE		NSTRUMENTATION CABLING DIAGRAM	el IDDI V		
A	FIRST ISSUE		(CM)	10x				1			21.08.12	GROU	NDING S	SCHEME FOR CABINETS / PANELS / POWER S	BUFFLI		
REV.NO.	. DESCRIPTION	DRAWN	DESIGN	CHKD.	м	E	С	Cal	ARCH.	APPD	DATE	SIZE A3	SCALE	0000-999-POI-A-019A	REV. NO.		
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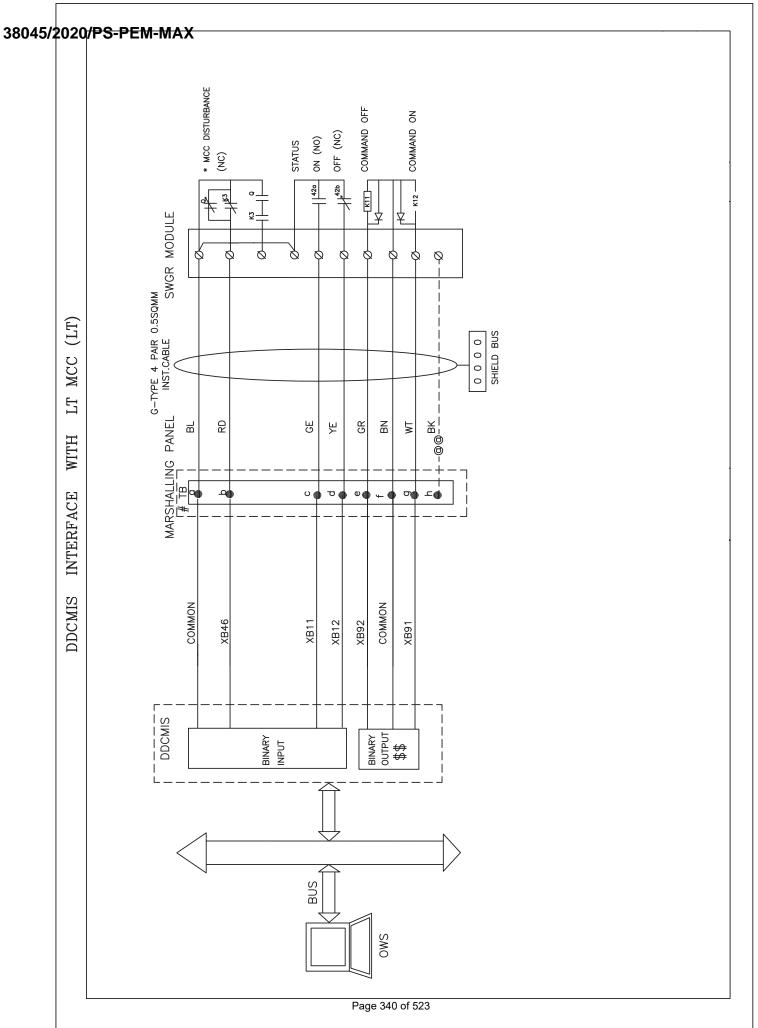
CLAUSE NO.			TECHNICAL REC	QUIREMENT	rs (	एनहीपीसी NTPC					
	a a		PROCESS CO	NNECTION A	ND PIPING						
1.00.00	PROCESS	CONNECT	ION PIPING								
1.01.00	Impulse Pip	oing System	and Air Piping Sys	stem as per th	quired material for comp ne requirements of this Sub and control equipments of e	-Section on					
1.01.01	IMPULSE I	PIPING, TU	BING, FITTINGS,	VALVES AND	VALVE MANIFOLDS						
1.01.02	numbers. T & Flue Gas	All impulse pipes shall be of seamless type conforming to ANSI B36.10 for schedule numbers. The size of impulse pipe shall be ½" for Steam & Water Application and ¾" for Air & Flue Gas applications. The rating of material of impulse pipes, tubes, fittings, valves and their installation thereof shall conform to the latest edition of standards as per following table:									
	Impulse Pip	oes, Tubes	(Material, Rating)	ANSI B31.1,	, ANSI B31.1a, ANSI/ISA 7	7.70					
	Valves (Ma	terial, Pr. C	lass, Size)	ASTM A182	ASTM A105 as per ASME	16.34					
	Fittings (Siz	ze, Rating, I	Material)	ANSI B31.1,	ANSI B31.1a, ASME B16	.11-2009					
	Installation	and the second to the same	one in proportion ( ₹n)	BS 6739-20	09, ANSI/ISA 77.70	Samuel States of the Arterior					
1.01.03	flue gas se be used wh of valves s (inside LIE, POI-A-036. The valve r provided as	manifold and then to instrument. The source shut-off (primary process root valve) and blow down valve shall be of 1/2 inch size globe valve type for all applications except for air and flue gas service wherein no source shut-off valves are to be provided. Two root valves are to be used wherever pressure is more than 40 Kg/cm² or Temp>280 °C. The end connections of valves shall be of socket welded type. Typical installation scheme of DP Transmitter (inside LIE/LIR) mounted below instrument source point is indicated in Drg. No. 0000-999-POI-A-036. Same scheme with necessary changes shall be applied for other instruments.  The valve manifolds of 316 SS with pressure rating suitable for intended application shall be provided as given below:									
	Manifold		on/Measurement		20 T 2 T						
	2 Valve 3 Valve				ansmitters/pressure switch pressure transmitter/ switch						
	5 Valve		l Pressure, Flow ar			1100					
			vo-way globe/gate & Flue Gas applica		provided on each impulsively .	e line to the					
2.00.00	AIR SUPPL	LY PIPING									
2.01.01	accessories be provide	s required f d. This will	or instrument air fo include as a mini	or the various mum air sup	regulator, purge rotamete pneumatic devices/ instru ply to pneumatically opera ent purging requirements o	ments shall ated control					
2.02.00	purging res	spectively for		of mill, dirty a	rided for continuous and air and flue gas applicatio						
2.03.00	suitable siz output to a	The Contractor shall also provide SS Tubing and associated fittings (screwed type) of suitable sizes for all pneumatic equipments/actuators (including supply air, signal air and output to actuators) conforming to ANSI 31.1 and 31.3 standard. All other air supply lines shall be of mild steel hot dipped galvanized inside and outside as per IS-1239, heavy duty									
FLUE GAS DES	HA PROJECTS SULPHURISATION TEM PACKAGE	N (FGD)	TECHNICAL SPE SECTION-VI, BID DOCUMENT NO.: C	PART-B	SUB-SECTION-III-C3 PCP	PAGE 1 OF 4					

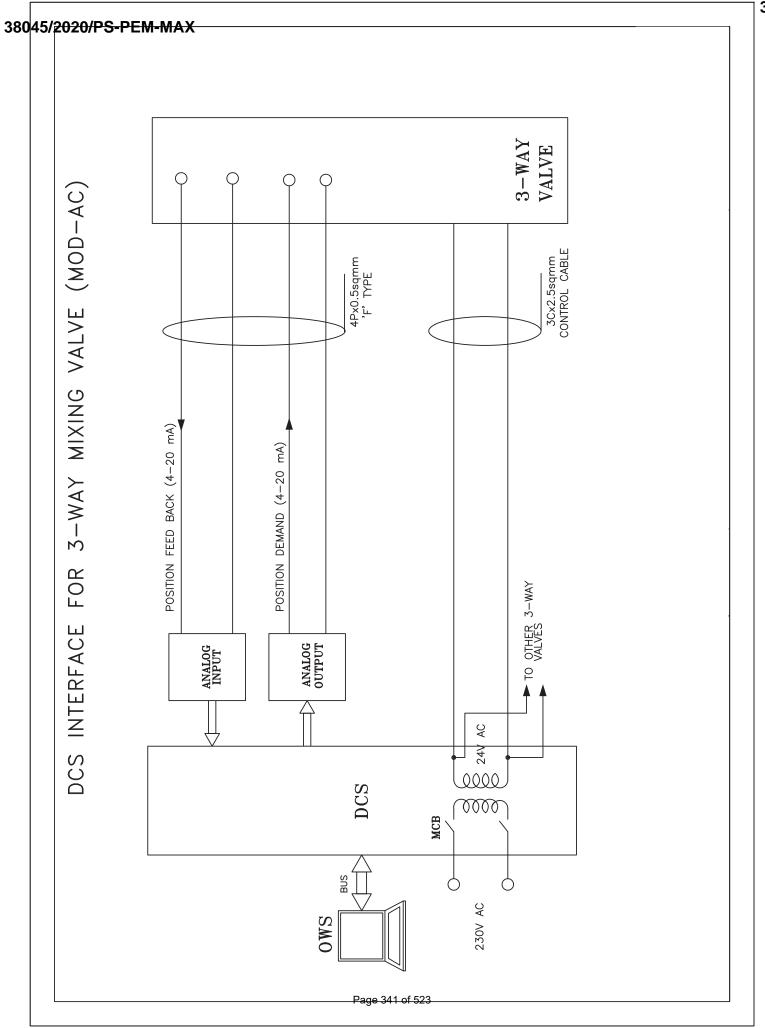
CLAUSE NO.		TECHNICAL REQUIREMENT	s	एनशैपीमी NTPC						
	galvanized inside and per ASA B16.11 of rai accumulation of conde	ittings for air supply line shall be outside, screwed as per ASA B ting 3000 lbs. Air supply piping s ensed water within the pipe. The supported properly by clamps or	<ol> <li>2.1. Dimensions of fittings shall be adequately sloped air supply headers, sub-h</li> </ol>	shall be as d to prevent						
2.04.00	provided by a well des 1" GI Pipe sub-header regulator set with me	e air supply to each equipment/ signed air distribution scheme con r feeding ½" pipe at each equipm ounting accessories shall be p except for Ash Handling Syste at each location.	mprising of 2" GI Pipe Hea nent/device. Instrument ai provided for each pneum	ader feeding r filters cum natic device						
2.05.00	screw rising stem, scre	s in the air supply line shall be ewed female ends as per ASA B e stainless steel, body rating 150	2.1. Valve bonnet shall be	union type						
2.06.00	pneumatic device requ max. Inlet pressure. The air set shall have 2-inc	cum regulator set with mountin uiring air supply. The filter regula he filter shall be of size 5 microns ch size pressure gauge and built e as per the requirement to be fir	tors shall be suitable for 1 s and of material sintered in filter housing blowdowr	0-kg/ sq.cm bronze. The n valve. The						
3.00.00	INSTALLATION AND	ROUTING								
3.01.01	prevent excessive vibrequipment. Impulse pislope of the impulse ANSI/ISA 77.70 lates	All instrument piping, tubing and its accessories shall be supported in a safe manner to prevent excessive vibrations and anchored sufficiently to prevent undue strain on connected equipment. Impulse piping shall be supported at an interval not exceeding 1.5 meters. The slope of the impulse pipe form the process connection to the instrument shall be as per ANSI/ISA 77.70 latest edition and BS 6739-2009. All impulse piping shall be installed to permit free movement due to thermal expansion. Wherever required expansion loops shall								
	all flow measurement in 120 Deg. C. Colour co	I be provided for all level measur in steam services and for flow moding of all impulse pipes shall be g followed for the parent pipes.	easurements in water ser	vices above						
4.00.00	SHOP AND SITE TES	TS								
4.01.01	test as per requirem	ork performed as per this Sub-se ents of Sub-section-IIIE-04 (Qu his Sub-section and Employer ap	ality Assurance & Inspe	ction) other						
4.01.02	Hydrostatic and Pneur and shall conform to A	natic leakage tests shall be perfo NSI B31.1.	rmed on all pipes, tubing a	and systems						
5.00.00	LOCAL INSTRUMENT	T ENCLOSURE AND RACKS								
	contract shall be su enclosures in case of covered areas. The G	hes etc. for FGD system and oth itably grouped together and m f open areas of the plant and (ii) A of LIE with purging indicated in ntractor. The GA of LIR shall be s.	nounted inside (i) local i In local instrument racks the Drg. No. 0000-999-Po	nstruments in case of OI-A-036 is						
FLUE GAS DE	-IA PROJECTS SULPHURISATION (FGD) TEM PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOCUMENT NO.: CS-0011-109(1A)-2	SUB-SECTION-III-C3 PCP	PAGE 2 OF 4						

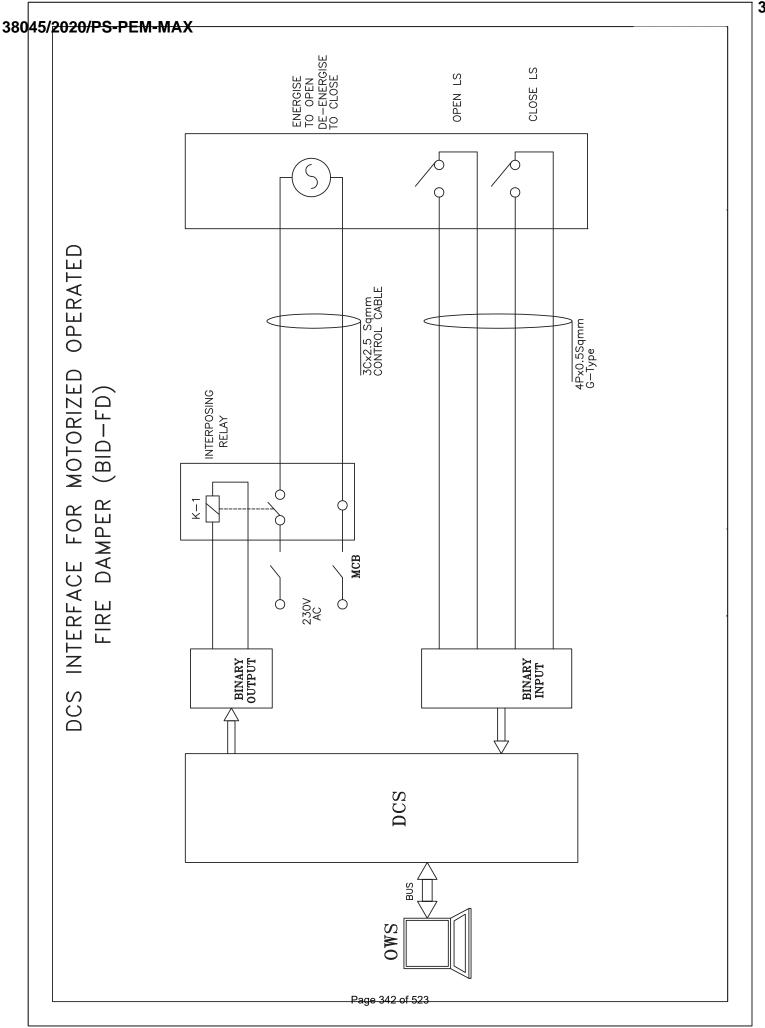
CLAUSE NO.	-	TECHNICAL REQUIREMENT	s	एनदीपीसी NTPC							
	from back side of the side for easy mainted process line vibration sensing line connect	nall be such that the impulse pipe enclosure / rack and the transr enance. Bulkheads, especially shall be installed on instrument of ion requirement. Vibration dam Degree of Protection of LIE and controls.	mitters etc. are accessible designed to provide isolenclosures/racks to meet to peners shall be installed	from front lation from he process d for each							
	construction with one enclosure. Double int locking type construc	I be constructed of 3 mm she or more modules and two end a er locking doors shall be provide ted of not less than 1.6 mm thic inned hinges and locking handle	ssemblies bolted together d. The doors shall be the k steel. Doors shall have	to form an three-point concealed							
	frame of steel and sh racks from falling obje	The instrument racks shall be free standing type constructed of suitable 5 mm thick channel frame of steel and shall be provided with a canopy to protect the equipment mounted in racks from falling objects, water etc. The canopy shall not be less than 3 mm thick steel, and extended beyond the ends of the rack.									
	adequate support for	Enclosures/Racks shall be reinforced as required to ensure true surface and to provide adequate support for instruments and equipment mounted therein. Centre posts or any member which would reduce access shall not be provided.									
		Contractor shall provide not more than three variants for LIE/LIR with respect to max. no. transmitters mounted in each LIE/LIR.									
5.01.00	ENCLOSURE / RAC	KS FOR DUAL I/P TEMPERA	TURE TRANSMITTER:	S							
	provided under the Enclosures in case of	erature transmitters for FGD s contract shall be suitably grou of open areas of the plant and ( ovided with each Enclosure and	ped together and mounte (ii) Racks in case of cove	d inside (i)							
		nall be such that the transmitters sure / rack for easy maintenance		h front and							
		all be of robust and rugged de losure / rack. The Degree of Pro									
	Enclosure and Racks	shall be free standing type.									
		all be reinforced as required to instruments and equipment mour		to provide							
	Contractor shall provide not more than five variants for Enclosure/ Rack with respect to max. no. transmitters mounted in each Enclosure/ Rack. However, the maximum number of Transmitters that can be grouped in one Enclosure/ Rack shall be decided during detail Engineering.										
FLUE GAS DES	LOT-IA PROJECTS  FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE  TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOCUMENT NO.: CS-0011-109(1A)-2  PAGE 9CP 3 OF 4										

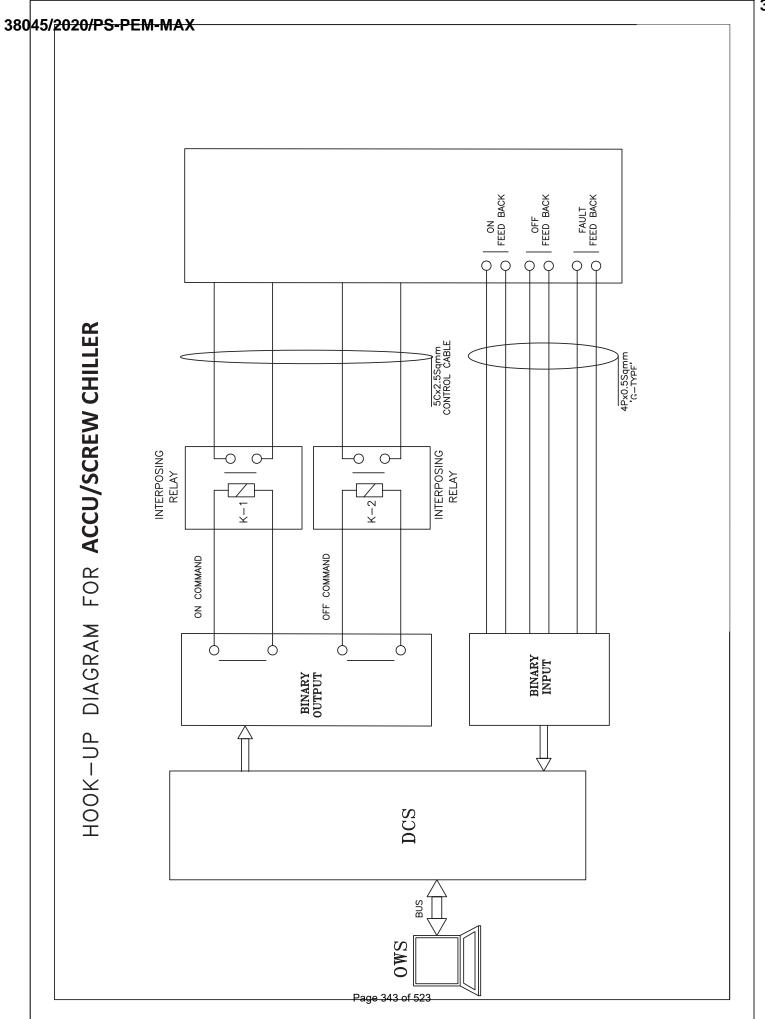
CLAUSE NO.		TECHNICAL REQUIREMENT	s	एनदीपीसी NTPC
6.00.00	INSTALLATION OF C	THER INSTRUMENTS:		
	For installation and ro No. 5.00.00, please n Contract (ECC) of Tec	outing of other field mounted inst efer Cl. No 52.04.00(J) of Secti chnical Specifications.	ruments which are not co on-VI, Part-D, Erection C	vered in CI. onditions of
FLUE GAS DE	-IA PROJECTS SULPHURISATION (FGD) TEM PACKAGE	TECHNICAL SPECIFICATION SECTION-VI, PART-B BID DOCUMENT NO.: CS-0011-109(1A)-2	SUB-SECTION-III-C3 PCP	PAGE 4 OF 4

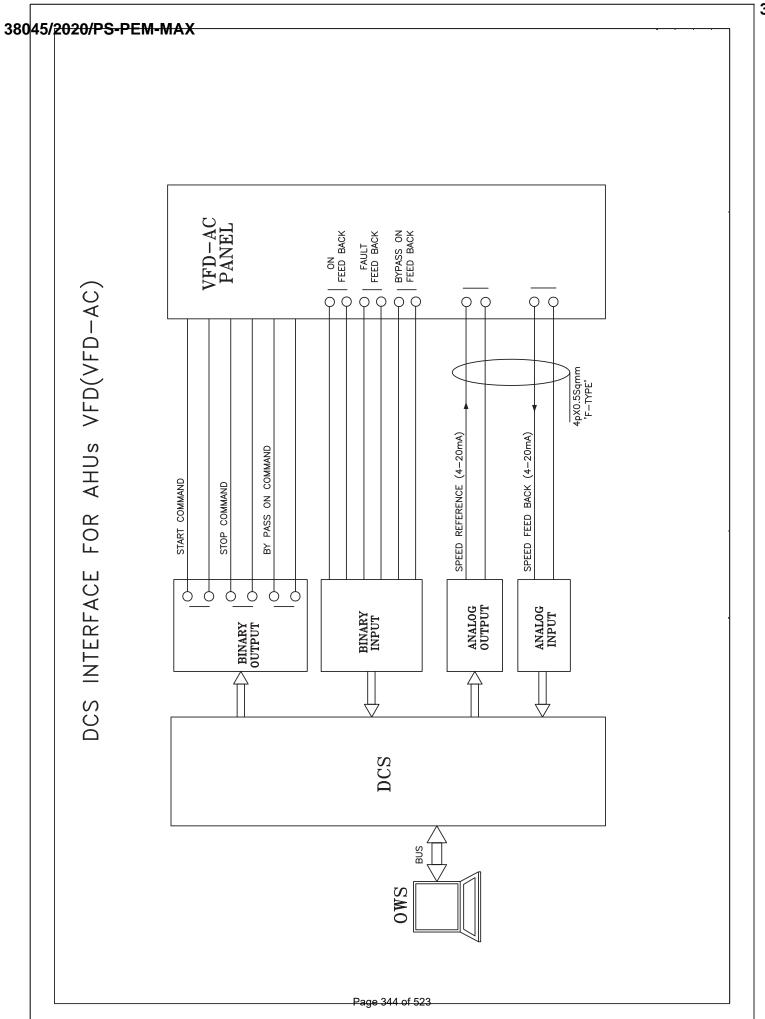
38045/2020/PS-PEM-MAX SECTION: C SUB SECTION: C&I **C&I SPECIFICATION FOR HVAC SYSTEM** SIGNAL INTERFACE **BETWEEN DRIVES AND DCS** 

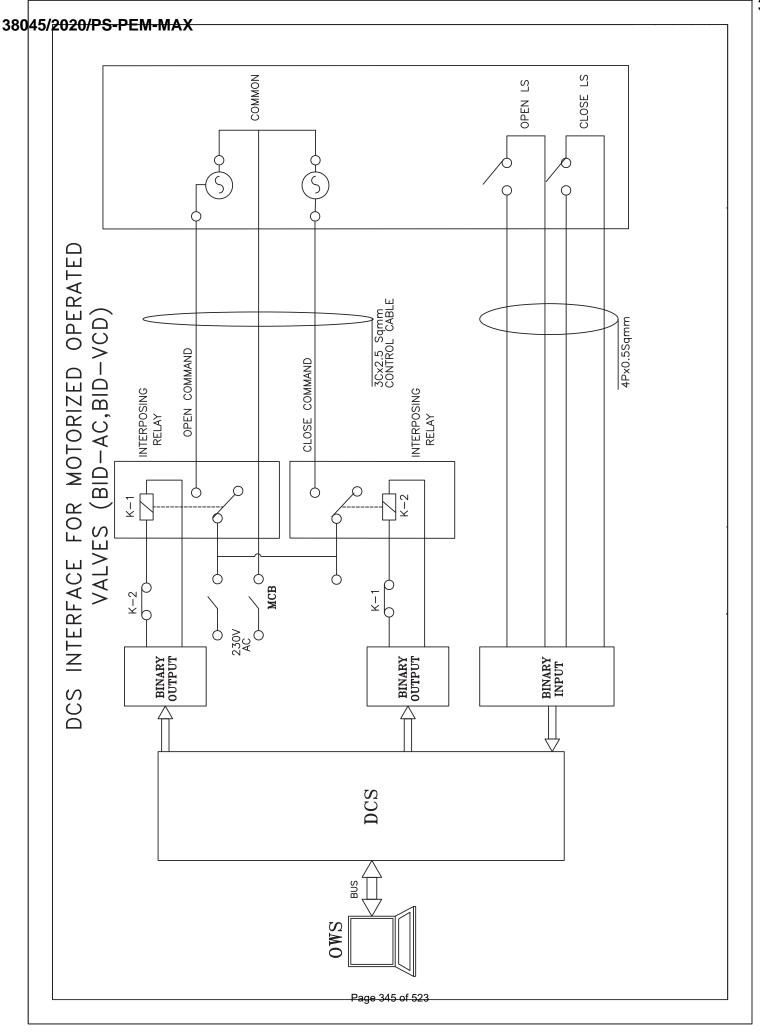




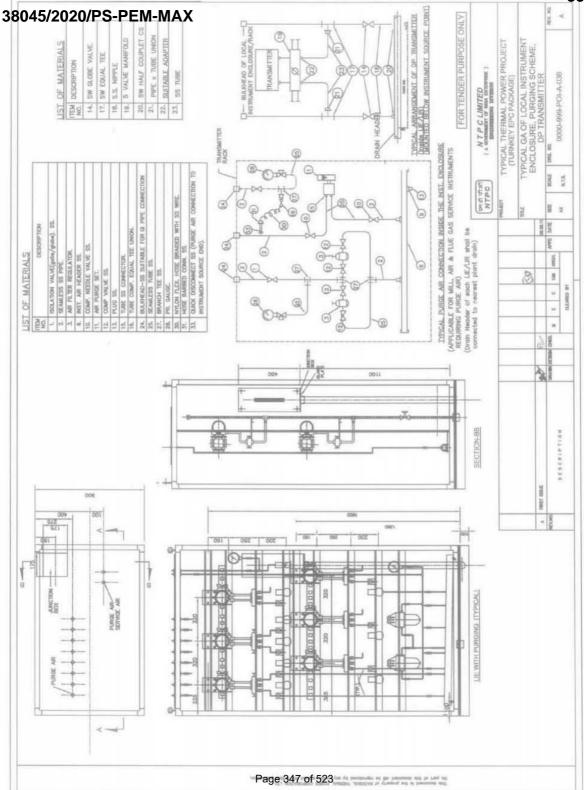




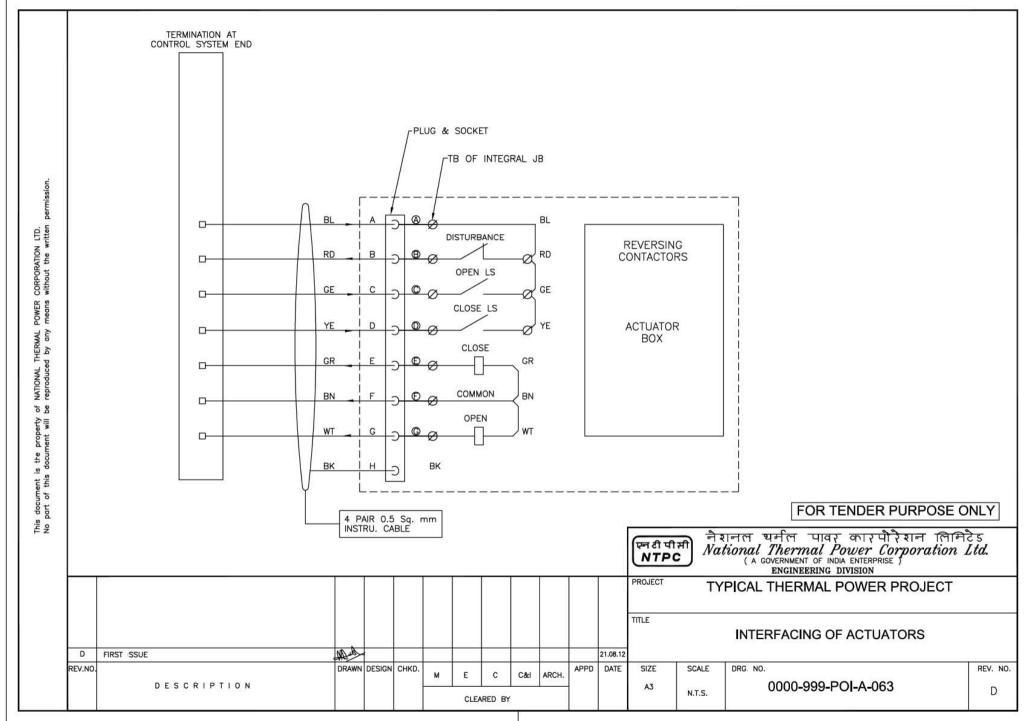




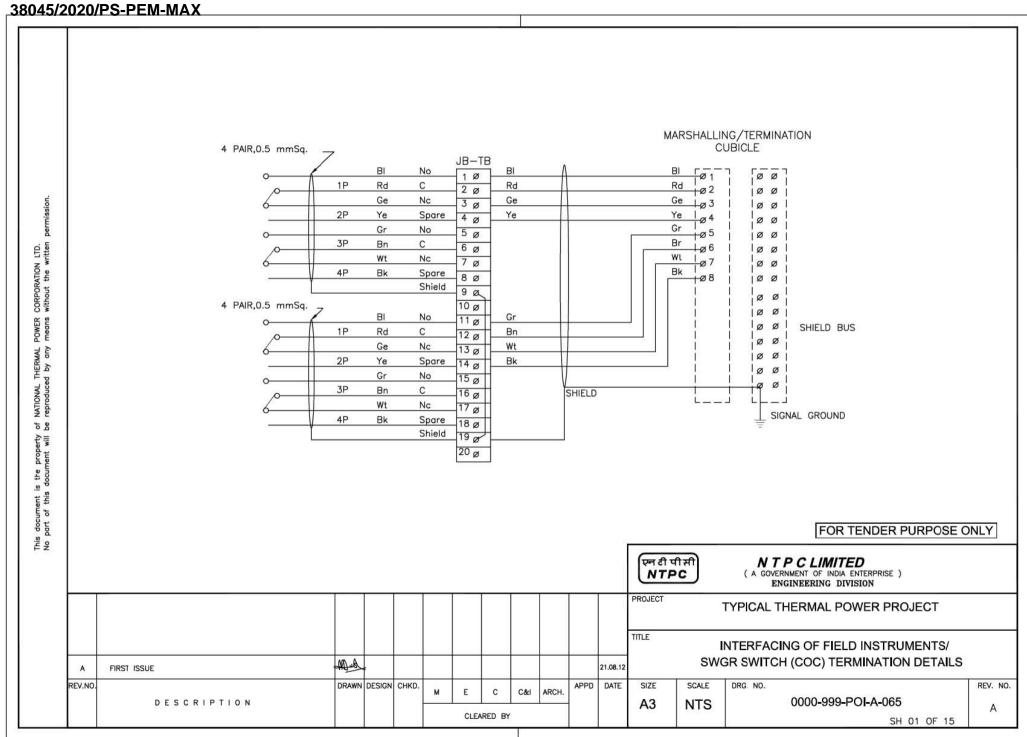
38045/20	20/PS-PEM-MAX			
	जी एवं ई एल <b>छ</b>  द्रीहा	C&I SPECIF HVAC S	ICATION FOR SYSTEM	SECTION: C SUB SECTION: C&I
		ORIVE & INSTRU	MENT INTERFACE	<u> </u>
		DIAC	GRAM	
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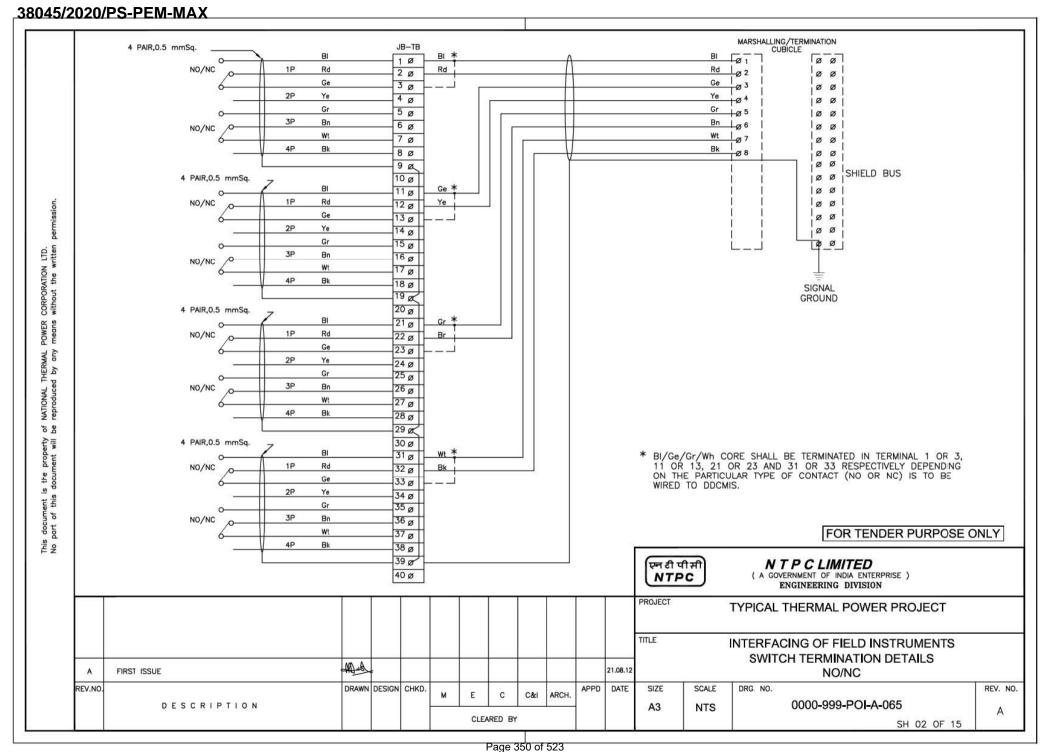
## 38045/2020/PS-PEM-MAX

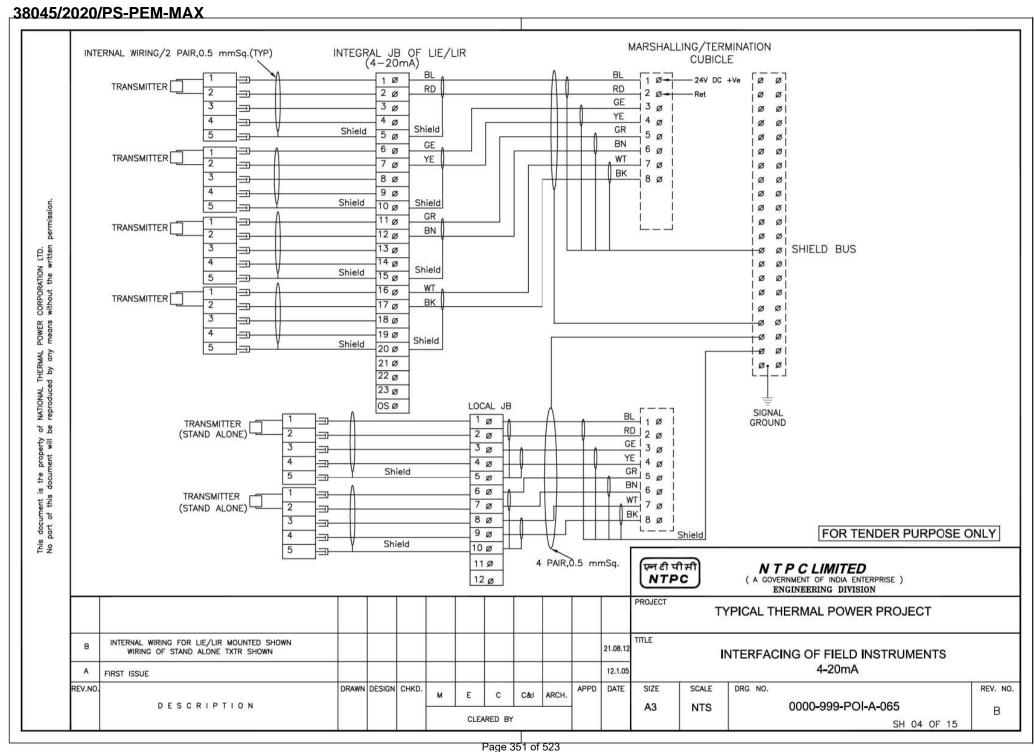


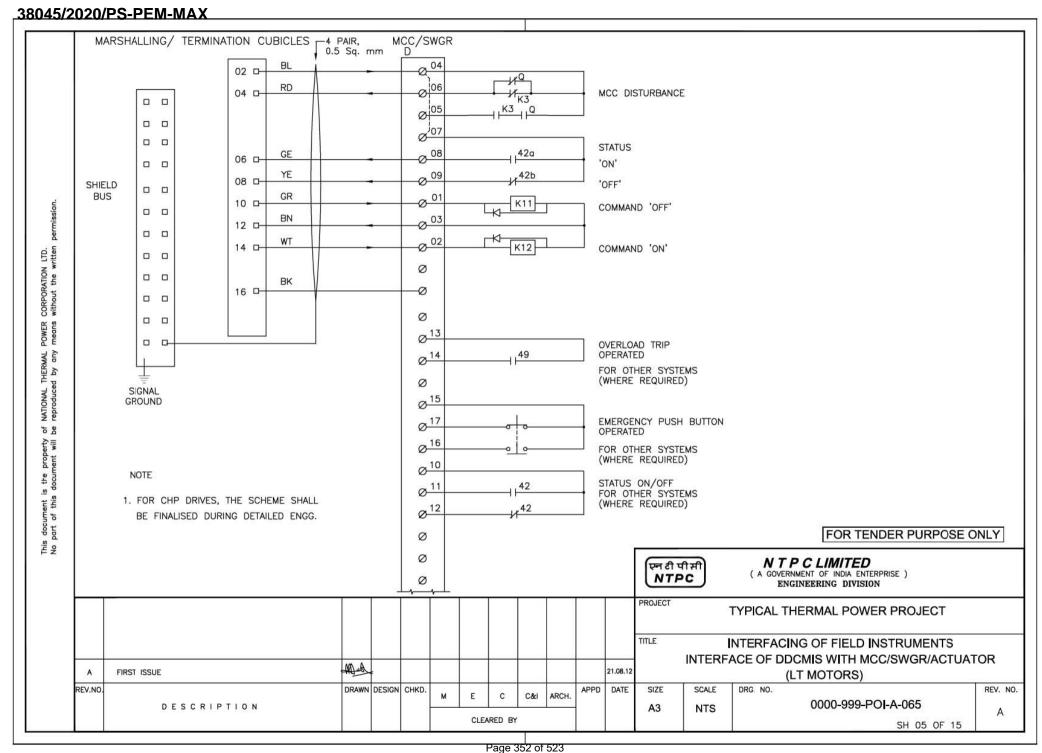
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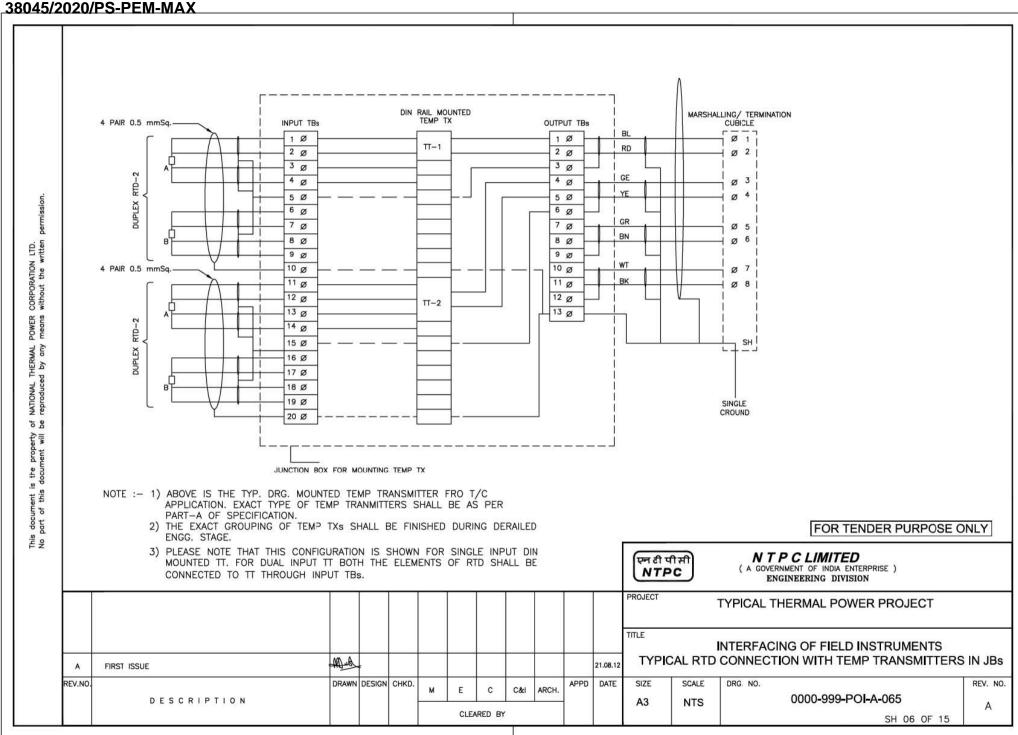


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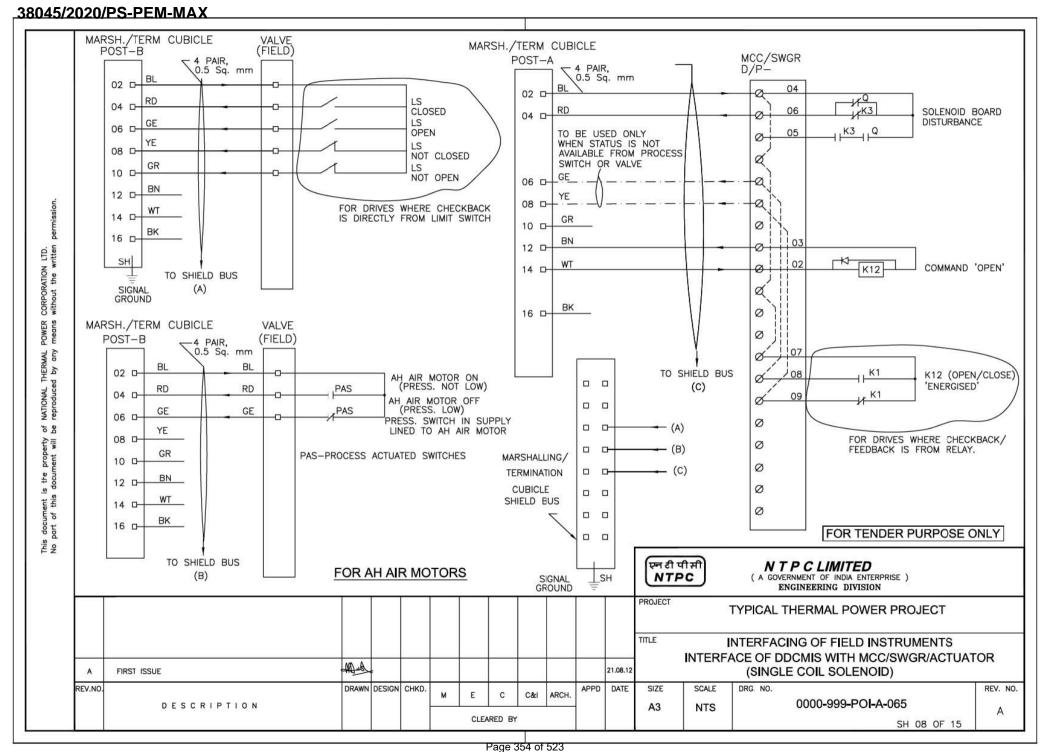


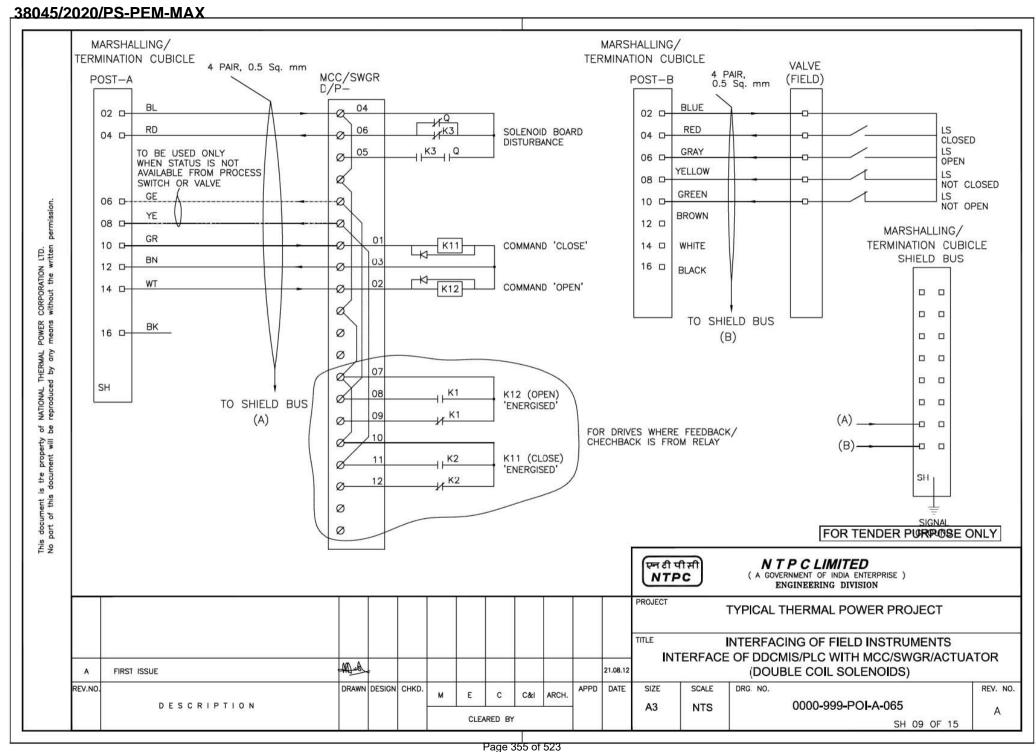






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SECTION: C SUB SECTION: C&I

वायाङ्क	C&I SPECIFICATION FOR
सम्भार	HVAC SYSTEM
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QUALITY ASSURANCE FOR INSTRUMENTS & LCP AND TYPE TEST REQUIREMENTS

LAUSE NO.	QUALITY ASSURANCE	E &	INS	PECT	ΓΙΟΝ				UK.	नहीं प्रमा
	MEASURING INSTRUMENTS (PRI	MAR	YA	ND S	ECC	OND	ARY)			
	TESTS									
	ITEMS	Dimensions (R)	Make, Model, Type, Rating (R)	Process / Electrical connection (R)	Calibration (R)	Test as per standard(R)	nsulation Resistance (R)	Certification (if applicable )(R)	Hydro Test(R)	Material Test certificate ®
			Ma	Pro	Ca	Te	lns	IBR	H	Ma
	1. PR Gauge (IS-3624)	Y	Y	Y	Y	Y				
	2. Temp. Gauge (BS-5235)	Y	Y	Y	Y	Y	V			
	S. Pr./D.P.Switch(BS-6134)     Electronic Transmitter(IEC-	Y	Y	Y	Y	Y	Y	$\vdash$		
	4. Electronic Transmitter(IEC-60770)	ĭ	T	Ĭ	ĭ	ĭ	T			
	5. Temp. Switch	Υ	Υ	Υ	Υ	Υ	Υ		-	
	6. Recorder(IS-9319/ANSI C-39.4)	Υ	Y	Y	Y	Y	Y		1	
	7. Vertical indicators	Y	Y	Y	Y	-1	Y			
	8. Digital Indicators	Y	Y	Y	Y		Y		-	
	9. Integrators	Y	Y	Y	Y					
	10. Electrical Metering Instrument (IS-1248)	Y	Y	Υ	Υ	Υ	Y			
	11. Transducer (IEC-688)	Υ	Y	Y	Y	Y	Y			
	12. Thermocouples (IEC - 754 / ANSI-MC-96.1)	Y	Y	Y	Υ	Y	Y			
	13. RTD(IEC-751)	Υ	Υ	Y	Y	Y	Y			2000
	14. Thermowell	Υ	Щ	Υ	L.		<u> </u>	Υ	Y	Y
	R-Routine Test A- Acceptance Te : Note: 1) Detailed procedure of Er as per Quality Assuran Conditions. Requiremen finalized during QP finali 2) This is an indicative list furnish a detailed quali	viro ice l it of ization	nme Prog tes on ests/	ental gram et an checl	Stre me d p	in G roced The	creer ienera dure manu	al Te (if re factu	chni quir rer is	ical red)

		49	
LOT-IA PROJECTS FLUE GAS DESULPHURISATION SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO CS-0011-109(1A)-2	SUB-SECTION-V-QC1 MEASURING INSTRUMENTS (PRIMARY & SECONDARY)	PAGE 1 OF 2

### **QUALITY ASSURANCE & INSPECTION**



MEASURING INSTR	UME	NTS	(PR	IMA	RY /	AND	SEC	ONI	DAR	Y)		
ITEMS	Dimensions (R)	Make, Model, Type, Rating (R)	Process / Electrical connection (R)	Calibration (R)	Requirement as per standard (R)	WPS approval (A)	Non-destructive testing (R)	Calculation for accuracy (R)	Insulation Resistance (R)	IBR Certification as applicable (R)	Hydro test (R)	Material test certificate (A)
15. Cold junction	Υ	Υ	Y	Y					Y			
compensation box										-		
16. Orifice plate(BS-1042)	Υ	Y	Y	Y *	Y	Y **	Y **			Y	Y **	Y
17. Flow nozzle(BS-1042)	Y	Y	Y	Y *	Y	Y	Y			Υ	Y	Y
18. Impact head type element	Υ	Υ	Υ		5			Υ				Y
19. Level transmitter/float	Y	Y	Y	Y					Y	Υ	Y	Y
type switch 20. Analysers	Υ	Y	Υ	Υ	8 3				s 8			8
21. Dust emission monitors	Y	Y	Y	Y								
*Calibration to be carried out	ĭ	T	ĭ	ĭ	S							
on one flow element of each												
type and size if calibration												
carried out as type test same												
shall not be repeated.												
** If applicable												

R-Routine Test A- Acceptance Test Y – Test applicable

Note: 1) Detailed procedure of Environmental Stress screening test shall be as per
Quality Assurance Programme in General Technical Conditions.

Requirement of test and procedure (if required) finalized during QP
finalization

 This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted along with relevant supporting documents.

LOT-IA PROJECTS
FLUE GAS DESULPHURISATION SYSTEM
PACKAGE

TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO CS-0011-109(1A)-2

SUB-SECTION-V-QC1 MEASURING INSTRUMENTS (PRIMARY & SECONDARY) PAGE 2 OF 2

## **QUALITY ASSURANCE & INSPECTION**



Pro	ces	s, C	onr	nect	ion	& p	oipii	ng F	OR	C8	I S	YST	EM	S			
ITEMS	Visual ®	GA, BOM, Layout of component & construction feature®	Dimension ®	Paint Shade/thickness ®	Flattening, flaring, hydrotest, hardness check as per ASTM standard	Component Ratings ®	Wiring ®	Make, Model, Type, Rating®	R&HV®	Review of TC for instrument/devices (R)	Accessability of TBs/Devices ®	Illumination,grounding ®	Tubing ®	Leak/Hydro test(A)	Chemical/physical properties of material (A)	Proof pressure test, Dismantling & reassembly test, Hydrulic impulse and vibration test (R)	Tests as per standards & specification
Local Instrument enclosure	Υ	Y	Υ	Y		Y	Y	Y	Υ	Υ	Y	Y	Y	Y			
Local instruments racks	Y	Υ	Υ	Υ		Υ	Υ	Υ	Υ	Υ	Υ	Υ	Υ	Υ			
Junction Box	Υ	Υ	Υ	Y *		Υ		Y	Υ								
Gauge Board	Υ	Y	Υ	Υ		Υ		Υ	- 4	Υ			Y	Υ			
Impulse pipes and tubes	Y		Υ		Υ			Υ							Y		
Socket weld fittings ANSI B- 16.11	Υ		Υ					Y							Υ		Υ
Compression fittings	Υ		Υ	15				Υ						Υ	Υ	Y	
Instrument valves & Valve manifolds	Y		Υ	<i>3</i> 6 8			25	Y	33	S S				Y	Y		
Copper tubings ASTM B75	Y		1 10	i i				Υ	76	is a						G.	Υ

<sup>\*-</sup>applicable for painted junction boxes.

Note: R-Routine Test

A- Acceptance Test

Y - Test applicable

Note: This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted alongwith relevant supporting documents.

LOT-IA PROJECTS
FLUE GAS DESULPHURISATION SYSTEM
PACKAGE

TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO CS-0011-109(1A)-2 SUB-SECTION-V-QC2 PROCESS CONNECTION PIPING PAGE 1 OF 1

#### **QUALITY ASSURANCE & INSPECTION**



INSTRUMENTATION CABLE	=		ç.				·								
ITEMS	Conductor Resistance ® & (A)	High Voltage ® & (A)	Insulation Resistance ® & (A)	Constructional detail, dimensions (A)	Outer-Sheathe/core marking, end sealing (A)	Thermal Stability (A) +	Visual, Surface finish (A) +	Electrical Parameters ** (A) +	Persulphate Test (A) +	Overall/Coverage/Continuity (A)	Swidesh chimney Test (SS-4241475) (A) ++	FRLS Test * (A) ++	Tensile & Elongation before & after aging (A) ++	Vol. Resistivity. at room & Elevated Temp. (A) ++	Spark test report review ®
1. Instrument cable twisted and shielded															
Conductor(IS-8130)	Υ		»	Y			Υ			1.5			71	15	
Insulation(VDE-207)				Y	Y	Y	Y						Υ		Y
Pairing/Twisting				Y	Y		Y								
Shielding				Υ			Υ			Y					
Drain wire	Υ			Υ			Y		Υ	Y			7.0	).t	
Inner Sheath				Υ	Υ	Y	Υ					Υ	Y		
Outer Sheath				Υ	Υ	Y	Y		5.1			Υ	Y		
Over all cable	Υ	Y	Υ	Υ	Υ		Y	Υ		y .	Y			Y	
Cable Drums(IS-10418)				Y			Y								

Note: High Temp. cables shall be subjected to tests as per VDE-207(Part-6) Compensating cables shall be checked for Thermal EMF/Endurance test as per IS 8784.

**Note**: This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating his practice & Procedure along with relevant supporting documents during QP finalization for all items.

Note: ® - Routine Test A - Acceptance Test

Y - Test Applicable

Note: Sampling Plan for Acceptance test shall be as per IS 8784 (As applicable)

- \* FRLS Tests: Oxygen / Temp Index ( ASTM D-2863), Smoke Density Rating ( ASTM D 2843), HCL Emission ( IEC-754-1)
- \*\* Characteristic Impedance, Attenuation, Mutual Capacitance, Cross Talk ( As applicable)
- + Sample size will be One No. of each size/type per lot.
- ++ Sample size will be One No. sample for complete lot offered irrespective of size/type.

LOT-IA PROJECTS FLUE GAS DESULPHURISATION SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION - VI, PART-B BID DOC. NO CS-0011-109(1A)-2	SUB-SECTION-V-QC3 INSTRUMENTATION CABLES	PAGE 1 OF 1
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#### **QUALITY ASSURANCE & INSPECTION**



CONTROL DESK, PLC PANEL, SMOKE DETECTOR, FIRE ALARM & CONTROL SYSTEM

TESTS	(8)	GA, BOM ,Lay Out of components®	Dimensions ®	Paint Shade/Thickness/Adhesion ®	Alignment of Section ®	Component Rating/ Make / Type ®	® £	1V ®	Review of TC for instruments/ Devices/ Recorders, Indicators/ osaic Items/ Transducers ®	Accessibility of TBS/ Devices ®	Illumination ®	ional Check for Control Element ,		Test as per IEC 1131 ® *	as per Std ® & ( A)
ITEMS	Visual ®	GA, B	Dimer	Paint	Alignn	Comp	Wiring ®	IR & HV®	Revie	Acces	Illumir	Functional	Mimic ®	Testa	Test as
1. Control Desk	Y	Y	Y	Y	Y	Υ	Y	Y	Y	Y	Y	Y	Υ		
Annunciation/ Control/ PLC     Panel	Y	Y	Y	Y	0,2	Υ	Y	Y	Y	Y	Y			Υ	Υ
3.Smoke Detectors															Υ
( UL-268,EN-54 PT-7), Heat Detectors( UL-521/EN 54 PT- 5 ) Annunciation/ Control Panel ( UL -864, EN-54, PT- 2)															

Note: 1) Detailed procedure of Environmental Stress Screening test shall be as per Quality Assurance Programme in General Technical Conditions

- 2) This is an indicative list of test/ checks. The manufacturer is to furnish a detailed quality plan indicating the Practice and Procedure alongwith relevant supporting documents.
  - \*Applicable for PLC
  - Y Test Applicable , ® Routine Test (A) Acceptance Test

LOT-IA PROJECTS
FLUE GAS DESULPHURISATION SYSTEM
PACKAGE

TECHNICAL SPECIFICATION SECTION - VI, PART-B BID DOC. NO CS-0011-109(1A)-2 SUB-SECTION-V-QC4 CONTROL DESK, PLC PANEL, SMOKE DETECTOR, FIRE ALARM & CONTROL SYSTEM PAGE 1 OF 1

### **QUALITY ASSURANCE & INSPECTION**



ELECT	RICA	L AC	TUA	IOTA	R WI	THI	NTE	GRA	L S	TAR	TER		
Test/Attributes Characteristics  ITEM/ COPONENT/ SUB SYSTEM ASSEMBLY/ TESTING  ELECTRICAL	RPM ®	No Load Current ®	IR & HV Test®	Mounting Dimension®	All routine Test as per Standard & Specification®	Correct Phase Sequence®	Operation & Setting of limit Switch/Torque Switch®	Stall Torque/Current (A)	Hand Wheel operation/ Auto de clutch function (A)	Function of Aux. like Potentiometer, space heater, position indicator	EPT output ®	Grease leakage ®	Local/ Remote (Open-Stop-Close) Operation® Safety check (Single phasing, Phase correction, Tripping etc.) (A)
ACTUATOR WITH INTEGRAL													
STARTER(IS_9334)													15
Motor	Y	Υ	Υ	Υ	Υ	2002		,					0
Final Testing	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Note: 1) Detailed procedure of Environmental Stress Screening test shall be as per Quality Assurance Programme in General Technical Conditions. Requirement of test and procedure finalized during QP finalization

 This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the practices and procedure adopted along with relevant supporting documents.

® - Routine Test (A) - Acceptance Test Y - Test applicable

LOT-IA PROJECTS
FLUE GAS DESULPHURISATION SYSTEM
PACKAGE

TECHNICAL SPECIFICATION SECTION - VI, PART-B BID DOC. NO CS-0011-109(1A)-2 SUB-SECTION-V-QC7 ELECTRICAL ACTUATOR WITH INTEGRAL STARTERS

PAGE 1 OF 1

#### **QUALITY ASSURANCE & INSPECTION**



	VFD MO	DULE SQ	E_28	
ATTRIBUTES / CHARACTERISTICS	Visual & Dimensional checks	Make / Type / Rating etc.	Final Inspectio n as ISS / IEC	Remarks
ITEMS/COMPONENTS, SUB SYSTEM ASSEMBLY	·			
HT Breaker (IEC 56)	Y	Y	Y	
DC Reactor	Υ	Y	,	For details refer table for DC Reactor
Transformer	Υ	Y		For details refer table for Transformer
Motor	Y	Y		For details refer separate table for Motor
VFD Panel	Y	Y		For details refer table for VFD

Note: 1) This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality

Plan indicating the practices & Procedure followed alongwith relevant supporting documents during QP finalisation.

2) Make of all major Bought Out Items will be subject to NTPC approval.

LOT-IA PROJECTS
FLUE GAS DESULPHURISATION
SYSTEM PACKAGE

TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO CS-0011-109(1A)-2 SUB-SECTION-V-QE13 VFD MODULE PAGE 1 OF 5

#### **QUALITY ASSURANCE & INSPECTION**



	DC	REA	CTOR					
ATTRIBUTES / CHARACTERISTICS  ITEMS/COMPONENTS, SUB SYSTEM ASSEMBLY	Visual	Dimensional	Mech. & Chem. Property	Electrical Characteristics	Pretreatment by Seven Tank	Painting by Stove Enameling	Final Inspection as per IS-2026	Welding/NDT
Winding Material (Aluminium)	Υ	Y	Y	Y				
Insulation Material	Υ	Υ		Y				
Sheet Steel	Υ	Υ	Y					
Winding	Υ	Υ		Y				
Fabrication of Enclosures	Υ	Y		2	Υ	Y		Y
Assembly	Y	Υ						
Routine Tests	Υ	Y					Y	

Note: 1) This is an indicative list of tests/checks. The manufacturer to furnish a detailed Quality Plan indicating their practice & procedure along with relevant supporting documents during QP finalisation for all items.

2) All major Bought Out Items will be subject to NTPC approval.

LOT-IA PROJECTS
FLUE GAS DESULPHURISATION
SYSTEM PACKAGE

TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO CS-0011-109(1A)-2 SUB-SECTION-V-QE13 VFD MODULE PAGE 2 OF 5

#### **QUALITY ASSURANCE & INSPECTION**



	1	TRANS	SFOR	MER	2	(OIL F	ILLI	ED)					
Attributes / Characteristics	1								No.	10		st	
Items/Components	Visual & Dimensional Checks	Mechanical properties	Electrical strength	Thermal properties	Chemical Composition	Compatibility with oil	NDT / DPT / MPI / UT	Ageing Test.	Voltage Ratio, Vector Group & Polarity, Magnetic Balance Test	Make / Type / Rating / Model / TC General Physical Inspection.	8 PQR	Routine Test as per relevant test	Routine Test
Sub Systems	Visu	Mec	Elec	The	Che	Con	NDI	Age	Volt	Mak Gen	WPS	Ron	Rou
Tank, H.V. & L.V. Cable Box / Flange throat	Y	Y					Υ						
Conservator / Radiator / Cooler / Pipes	Y	Y					Υ						
Copper Conductor (IS:191)	Y	Υ	Y		Y								
Insulating Material	Υ	Υ	Y	Υ	Υ	Υ							
CRGO Lamination & Built Core	Y	Υ	Y		Y	Υ							
Bushing / Insulator (IS:2544 / 5621)	Y	Y								Υ		Y	
Gasket	Y				Y	Υ		Y				Y	
Transformer Oil (IS:335 / IEC296)												Y	
Off-Circuit Tap Changer	Y									Y			
Core Coil Assembly & Pre-tanking	Y								Υ				
Marshalling Box	Y	Υ					Υ					Υ	
WTI, OTI, MOG, PRD, Breather, Terminal Connector, Bucholz Relay, Globe & Gate Valve,	Y									Y			
Welding (ASME Sect-IX)	Υ										Y		
Complete Transformer (IS:2026/ IEC-60076)	Y												Y

Note: 1) This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.

2) All major Bought Out Items will be subject to NTPC approval.

LOT-IA PROJECTS
FLUE GAS DESULPHURISATION
SYSTEM PACKAGE

TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO CS-0011-109(1A)-2 SUB-SECTION-V-QE13 VFD MODULE PAGE 3 OF 5

#### **QUALITY ASSURANCE & INSPECTION**



#### DRY TYPE TRANSFORMER Attributes / Measurement of capacitance & tan delta between winding Characteristics Test as per relevant standard Voltage Ratio, Vector Group & Polarity Make / Type / Rating / Model /TC. General Physical Inspection & Dimensional check Mechanical properties Chemical Properties Thermal Properties Electrical strength NDT / DP / MPI POR Routine Test Items/Components Routine WPS & F Visual & Sub Systems Enclosure door, H.V. & L.V. Cable Box / Flange Y Y Y Throat Copper Conductor Y Y Y Y Insulating Material Y Y **CRGO Lamination & Built** Core Bushing /Insulator Y Y Y (IS:2544 / 5621) Y Y Gasket Y Off-Circuit Tap Changer Y Y Core Coil Assembly Y Marshalling Box Y Y WTI, Thermister, Y Y **Terminal Connector** Y Welding Complete Transformer Y

- Notes: 1) This is an indicative List of test/checks. The manufacturer is to furnish a detailed Quality Plan indicating his practice and procedure along with relevant supporting documents during QP finalization for all item.
  - All major Bought out Items will be subject to NTPC approval.

LOT-IA PROJECTS
FLUE GAS DESULPHURISATION
SYSTEM PACKAGE

TECHNICAL SPECIFICATION SECTION - VI, PART-B BID DOC. NO CS-0011-109(1A)-2 SUB-SECTION-V-QE13
VFD MODULE

PAGE 4 OF 5

#### **QUALITY ASSURANCE & INSPECTION**



#### VFD PANEL

Attributes			-1						Т					
Characteristics							std.					_		
Item Components Sub System Assembly	Electrical Properties	Mechanical Properties	Chemical Properties	Dimensions / Finish	Type/ Rating/Functional check	HV/IR	Routine test as per relevant s	Constructional Features	IS:6005, Seven tank process	Paint finish/ shade/thickness	Mountings / BOM/ Make, Completeness	Interlock Functional & Operation Testing / Simulation check	Degree of Protection Test	Final testing as per Relevant
Sheet Steel (IS-513)		Υ	Υ	Υ										
Aluminum / Copper Bus- bar(IS-5082/IS-613/IS-1987)	Υ	Υ	Y	Υ										
Support Insulator (BS- 2782/IEC-660/IS-10912)	Υ	Υ	Υ	Υ										
Control / Selector Switch(IS- 6875)					Υ	Y	Υ							
Contactor/ MCB(IS-13947)					Υ	Y	Υ							
O/L Protection relays(IS-3231)					Υ		Y							
C.T /V.T/ Indicating Meter(IS- 2705/3156/1248)					Υ	Y	Y							
Fuse/ Fuse carrier(IS-13703)					Υ	Y	Y							
Terminals/lugs/pvc wires(IS- 13947//IS-694)	Y			Υ	Υ	Y	Υ							
Timers(IS-3231)					Υ	Y	Y							
Push Button/ Lamp/ (IS-6875)					Υ	Υ	Υ							$\neg$
Control Transformer (IS-					Υ	Y	Υ		T					$\neg$
12021)														
Mimic, Annunciater					Υ		Υ							
GASKET(IS-11149)		Y	Υ	Υ	Υ		Y							
Fabrication								Υ						
Pretreatment & Painting									Y	Y				
VFD panel										Y	Y	Υ	Y	Υ

#### NOTE:

- This is an indicative list of Test/ Checks. The manufacturer to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.
- 2. All major Bought Out Items will be subject to NTPC approval.

LOT-IA PROJECTS
FLUE GAS DESULPHURISATION
SYSTEM PACKAGE

TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO CS-0011-109(1A)-2 SUB-SECTION-V-QE13 VFD MODULE PAGE 5 OF 5

(-8	MAN	UFACTURER/ BIDDER/ SUPI	PLIER	STANDA	RD QU	JALIT	Y PLAN	SPEC.	NO:			D/	ATE:	
III	VI SUM NAM	E & ADDRESS		CUSTOMER	₹:			QP NO	: PE-QP-999-14	5-1050	5	D	ATE: 07.	02.2020
H	7?7#			PROJECT:				PO NO	:			D	ATE:	
				ITEM: LOC PANEL	AL CON	TROL	SYSTEM: C&I	SECTION	ON: C			SH	IEET 1	OF 9
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK		NTUM OF ECK	REFERENCE DOCUMENT	ACCEPTANC E NORMS	FORMA OF RECOR		,	AGEN	CY	REMARKS
1	2	3	4	5	M	6 C/N	7	8	9	D D	м	**	N	
	RAW MATERIAL													
1.0	Sheet Steel (CRCA & HR)	Chemical Composition	MA	Chemical analysis	Samp	Samp le	IS:1079 IS:513	IS:1079 IS:513	Test Certificate	٧	P/W	٧	*	
		2. Bend Test	CR	Mech, test	Samp	Samp le	IS:1079 IS:513	IS:1079 IS:513	Test Certificate	1	PW	٧		
		3. Surface finish	MA	Visual	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	1	P/W	-		
		4. Waviness	MA	Visual	100%	10%	Manufacturing Standard	No Waviness	Inspection Report	1	P/W	-		
		5. Thickness	MA	Measuremen	100%	10%	Approved Drg/Datasheet	Approved Drg/Datashee		1	P/W	٧		
		6. Mill marking	MA	Visual	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	٧	P/W	٧		
2.0	Flats / Angles / Channels	1. Dimensions	MA	Measuremen t	Samp	Samp	IS:2062	IS:2062	Test Certificate	1	PW			-
	-	Surface Defects	MA .	Visual	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	1	PW	-		
		3. Straightness	MA	Measuremen t	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	1	P/W			
		4. Mill marking	MA	Visual	100%	10%	IS:2062	IS:2062	Inspection Report	٧	P/W	V		

		BH	IEL		
	ENGINEERING	3		QUALITY	
	Sign &.Date	Name		Sign & Date	Name
Prepared by:	trall 14/2/2020	CHETAN MALIK	Checked by:	xundayorhara	KUNDAN PRASAD
Reviewed by:	Porchaze	RK RAINA	Reviewed by:	TUZZI	RK JAISWAL

BID	DER/ SUPPLIER
Sign & Date	
Seal	

	FOR CU	STOMER REVIE	W & APPROVAL	
Doc No:				
	Sign & Date	Name	Seal	
Reviewed by:				
Approved by:				

(-4	MAN	UFACTURER/ BIDDER/ SUPI	PLIER	STANDA	RD QU	ALITY	PLAN	SPEC.	NO:			D,	ATE:	
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	//			ITEM: LOC	AL CONT	ROL	SYSTEM: C&I	SECT	ON: C			SH	HEET 2	OF 9
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	0	NTUM OF ECK	REFERENCE DOCUMENT	ACCEPTAN E NORMS	FORMA OF RECOR		,	AGEN	CY	REMARKS
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1	2	3	4	5	M	C/N			9	D	M	С	N	
3.0	Cables / Wires	Visual / Surface defects	MA	Visual	100%	10%	IS:1554 or IS:694	IS:1554 or IS:694	Inspection Report	1	PW			
		2. IR and HV	MA	Electrical	100%	10%	IS:1554 or IS:694	IS:1554 or IS:694	Inspection Report	1	PW			
		Conductor     a) Resistance     b) Size     c) Sheet colour	MA MA MA	Electrical Measuremen t Visual	100% 100% 100%	10% 10% 10%	IS:1554 or IS:694	IS:1554 or IS:694	Inspection Report	1	P/W			
		Type / Routine Test     Certificates	MA	Verification	100%	10%	IS:1554 or IS:694	IS:1554 or IS:694	Inspection Report	1	PW			
4.0	Electrical Components like Annunciator	Verification at make and Type	CR	Visual	Samp	Samp	Approved Drg/Datasheet	Approved Drg/Datashee	Test Certificate	1	PW			
	Transformers Lamps Switches	Verification of Test Certificates	CR	Scrutiny of Type / Routine T.Cs.	100%	10%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Inspection Report	1	PW			
	PBs Contactors Relays	Operation / Functional check	CR	Electrical	Sampl e+ 100% @	Sampl e+ 10% @	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Inspection Report	1	PW			+ for relay & contactors only

		BH	IEL		
	ENGINEERING			QUALITY	
	Sign & Date	Name		Sigo & Date	Name
Prepared by:	July 2020	CHETAN MALIK	Checked by:	Xxxx alayas	KUNDAN PRASAD
Reviewed by:	Pare	RK RAINA	Reviewed by:	ועורומסים	RK JAISWAL

BID	DER/ SUPPLIER
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			ITEM: LOC PANEL	CAL CONT	TROL	SYSTEM: C&I	SECT	ON: C			SI	HEET 3	OF 9	
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	0	NTUM OF ECK	REFERENCE DOCUMENT	ACCEPTAN E NORMS	OF		AGENCY		ICY	REMARKS
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	Timers, Space Heaters, Thermostat,	4. I.R.	MA	Electrical	100%	10%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Inspection Report	1	PW			@ for all components except relays
	Indicating meters etc.	5. H.V.	MA	Electrical	100%	10%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Inspection Report	1	PW			& contactors.
		6. Calibration	MA	Electrical	100%	10%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Inspection Report	on √ PA	PW	V		
		7. Pick up / Drop off Voltage	MA	Electrical	100%	10%	Relevant Indian Std & Catalogue	Relevant Indian Std & Catalogue	Inspection Report	٧	PW			
5.0	Misc. Components like Gaskets.	Verification of Type /     Make	MA	Visual	Samp	Samp le	Manufacturing Standard	Manufacturin Standard	Test Certificate	1	PW			
	Terminal Blocks etc.	Surface defects	MA	Visual	Samp le	Samp le	Manufacturing Standard	Manufacturin Standard	Test Certificate	1	PW			
		IR / HV on Terminal Blocks	MA	Electrical	Samp le	Samp le	Manufacturing Standard	Manufacturin Standard	Test Certificate	1	PW			
	IN PROCESS INSPECTION								1					

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	ENGINEERING	3		QUALITY	
	Sign & Date	Name		Sign & Date	Name
Prepared by:	July 12020	CHETAN MALIK	Checked by:	X-magar langer	KUNDAN PRASAD
Reviewed by:	Paringo	RK RAINA	Reviewed by:	11/2/201	RK JAISWAL

BID	DER/ SUPPLIER
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SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS TYPE OF CHECK				REFERENCE DOCUMENT	ACCEPTANC E NORMS		E OF		AGEN		CY	REMARKS
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•					M	C/N			•		D	M	С	N	
6.0	Blanking / Bending / Forming	1. Dimensions	MI	Measuremen t	100%	10%	Approved Drg/Datasheet	Approv Drg/Da	red itasheet	Inspection Report	1	PAW			
	ronning	Surface defects after bending	MA	Visual	100%	10%	Manufacturing Standard	Manufa Standa	acturing ard	Inspection Report	1	P/W			
7.0	Nibbling / Punching	Cutout Sizes	МІ	Measuremen t	100%	10%	Approved Drg/Datasheet	Approv Drg/Da	ed tasheet	Inspection Report	1	P/W			
		2. Deburring	MA	Visual	100%	10%	Approved Drg/Datasheet	Approv Drg/Da	red itasheet	Inspection Report	1	P/W			
	ASSEMBLY														
8.0	Frame Assembly & Sheet fixing	1. Dimensions	MA	Measuremen t	100%	10%	Approved Drg/Datasheet	Approv Drg/Da	red tasheet	Inspection Report	1	P/W			
		2. Alignment	MA	Measuremen t	100%	10%	Approved Drg/Datasheet	Approv Drg/Da	ed tasheet	Inspection Report	٧	PW			
		3. Welding Quality	MA	Visual	100%	10%	Approved Drg/Datasheet	Approv Drg/Da	red itasheet	Inspection Report	٧	P/W			
		Surface defects	MA	Visual	100%	10%	Approved Drg/Datasheet	Approv Drg/Da	red stasheet	Inspection Report	٧	P/W			

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	ENGINEERING	3		QUALITY	
	Sign & Date	Name		Sign & Date	Name
Prepared by:	White a	CHETAN MALIK	Checked by:	X-myon VI elve	KUNDAN PRASAD
Reviewed by:	Originaro	RK RAINA	Reviewed by:	किया	RK JAISWAL د

BIC	DER/ SUPPLIER
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FOR CUSTOMER REVIEW & APPROVAL								
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D)	11	NAME	& A	ADDRESS		CUSTOMER	1:				QP NO.:	PE-QP-999-14	5-1056	,	D	ATE: 07.	02.2020
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SL. NO.	COMPONE			CHARACTERISTICS	CLASS	TYPE OF CHECK	_ C	NTUM OF ECK	REFERENCE DOCUMENT	100000000000000000000000000000000000000	EPTANC E DRMS	FORMAT OF RECORD		A	GEN	ICY	REMARKS
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9.0	Pre-treatme and Paintin		1.	Pretreatment Process	MA	Visual	100%	10%	Manufacturing Standard	Manuf Standa	acturing ard	Inspection Report	1	PAW	٧		
			2.	Process parameters like bath temp. concentration etc.	MA	Measuremen t	Perio dic	Perio dic	Manufacturing Standard	Manuf Standa	acturing ard	Inspection Report	1	P/W	v		
			3.	Dipping / Removal Time	MA	Measuremen t	100%	10%	Manufacturing Standard	Manuf Standa	acturing ard	Inspection Report	1	PAW	٧		
			4.	Surface quality after every dip	MA	Visual	100%	10%	Manufacturing Standard	Manuf Standa	acturing ard	Inspection Report	1	P/W	v		
			5.	Primer after phosphating	MA	Visual, Thickness	100%	10%	Manufacturing Standard	Manuf Standa	acturing ard	Inspection Report	1	P/W	v		
			6.	Putty Application & Rubbing after primer	MA	Visual	100%	10%	Manufacturing Standard	Manuf Standa	acturing ard	Inspection Report	1	P/W	v		
			7.	Paint first coat	MA	Visual, Thickness	100%	10%	Manufacturing Standard	Manuf Standa	acturing ard	Inspection Report	1	P/W	V		

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	ENGINEERING	3		QUALITY	
	Sign & Date	Name		Sign & Date	Name
Prepared by:	June 14/2/2020	CHETAN MALIK	Checked by:	XANGON ( SIGNOSO	KUNDAN PRASAD
Reviewed by:		RK RAINA	Reviewed by:	14/14/202	RK JAISWAL م

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		Putty Application and Rubbing after first coat of paint	MA	Visual	100%	10%	Manufacturing Standard	Manufa Standa	acturing ard	Inspection Report	٧	P/W	٧		
		9. Paint second coat	MA	Visual, Thickness, Scratch test Colour adhesion	100%	10%	Manufacturing Standard	Manufa Standa	acturing ard	Inspection Report	٧	P/W	٧		
10.	Panel Wiring	Wiring Layout	MA	Visual	100%	10%	Approved Drg/Datasheet	Approv Drg/Da	ved atasheet	Inspection Report	1	P/W			
		Wiring Termination (Crimped Lugs)	MA	Visual	100%	10%	Approved Drg/Datasheet	Approv Drg/Da	ved atasheet	Inspection Report	٧	P/W			
		3. Ferrule numbers	MA	Visual	100%	10%	Approved Drg/Datasheet	Approv Drg/Da	ved atasheet	Inspection Report	1	P/W			
		Colour of wiring	MA	Visual	100%	10%	Approved Drg/Datasheet	Approv Drg/Da	ved atasheet	Inspection Report	٧	P/W	٧		
		5. Size of Conductor	MA	Measuremen t	100%	10%	Approved Drg/Datasheet	Approv Drg/Da	ved atasheet	Inspection Report	1	P/W	٧		
11.	Component Mounting	Correct components	MA	Visual	100%	10%	Approved Drg/Datasheet	Approv Drg/Da	ved atasheet	Inspection Report	٧	P/W			
		2. Fixing	MA	Visual	100%	10%	Approved Drg/Datasheet	Approv Drg/Da	ved atasheet	Inspection Report	1	P/W			

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	ENGINEERING	3		QUALITY	
	Sign & Date	Name		Sign & Date	Name
Prepared by:	timel 19/2/1020	CHETAN MALIK	Checked by:	X7 you olave	KUNDAN PRASAD
Reviewed by:		RK RAINA	Reviewed by:	रितेय	RK JAISWAL

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	77					ITEM: LOCAL CONTROL PANEL			SYSTEM: C&I SECTION		ON: C				SHEET 7 OF 9		
SL. NO.	COMPONE		CHAI	RACTERISTICS	CLASS	TYPE OF CHECK	0	NTUM OF ECK	REFERENCE DOCUMENT		EPTANC E DRMS	FORMAT OF RECORD		A	GEN	CY	REMARKS
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							M	C/N					D	M	С	N	
12.	FINAL TESTING Final Inspe		Con (nea acc Mou fixin corr     Con ider	rkmanship  nponent layout atness, essibility & safety) unting / Proper ng of all nponents nponents ntification Marking / ne plates	MA MA	Visual Visual Visual	100%	10%	Manufacturing Standard Approved Drg/Datasheet Approved Drg/Datasheet	Appro Drg/D	ved atasheet	Inspection Report Inspection Report	1 1	P/W P/W	w w		At Random by BHEL, based on 100 % internal test reports by Mfr.
			6. Doc	or functioning	MA MA CR	Measuremen t Functional Visual	100%	10%	Approved Drg/Datasheet Approved Drg/Datasheet Approved Drg/Datasheet	Appro	atasheet ved atasheet	Inspection Report Inspection Report Inspection Report	1 1	P/W P/W	w		At Random by BHEL, based on 100 % internal test reports by Mfr.

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	ENGINEERING	3	QUALITY						
	Sign & Date	Name		Sign & Date	Name				
Prepared by:	19/2/2020	CHETAN MALIK	Checked by:	Xuman alalace	KUNDAN PRASAD				
Reviewed by:	De 15020	RK RAINA	Reviewed by:		RK JAISWAL				

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	Sign & Date	Name	Seal
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	77			PANEL SYSTEM			SYSTEM: C&I	SECTION: C				OF 9		
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	0	NTUM OF ECK	REFERENCE DOCUMENT	ACCEPTANC E NORMS	FORMA OF RECORI	70		GEN	CY	REMARKS
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		8. Paint Thickness	CR	Measuremen	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	1	P/W	W		
		Workmanship of Gaskets	MA	Visual	100%	10%	Manufacturing Standard	Manufacturing Standard	Inspection Report	1	PW	w		
× 1		10. Wiring Layout	MA	Visual	100%	10%	Approved Drg/Datasheet	Approved Drg/Datasheet	Inspection Report	1	P/W	w		
		11. Wire Termination	MA	Pulling manually	Samp le	Samp		Firm termination	Inspection Report	1	PW	w		
		12. Continuity	MA	Electrical	100%	10%		Continuity OK	Inspection Report	٧	PW	w		
13.	TYPE TEST	Degree of Protection	CR	Mech. Protection	Samp	Samp	Approved Drg/Datasheet	Approved Drg/Datasheet	Type Test Certificate	1	PW	v		
			*				Relevant IS- 13947 Part-1, IS-2148.	Relevant IS- 13947 Part-1, IS-2148.						
14	ROUTINE TEST	IR before & after HV Test	CR	Electrical	100%	10%	Approved Drg/Datasheet Relevant IS.	Approved Drg/Datasheet Relevant IS.	Inspection Report	1	P/W	w	-3	

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ENGINEERING QUALITY				Sign & Date	Doc No:							
Sign & Date	Name	Sig	n & Date	Name	Seal		Sign & Date	Name	Seal			
Prepared Tallow	CHETAN MALIK	Checked by:	- garlonoro	KUNDAN PRASAD		Reviewed by:	1					
Reviewed P	DE DAINA	Reviewed by:	14/2/2020	RK JAISWAL		Approved by:						

त्री	TINE OF TIME	UFACTURER/ BIDDER/ SUPP	PLIER	STANDA	RD QU	JALIT	Y PLAN	SPEC.	NO :			D.	ATE:	.1
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				ITEM: LOC PANEL	CAL CONT	TROL	SYSTEM: C&I	SECTION	ON: C			SH	IEET 9	<b>OF</b> 9
SL. NO.	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK		OF REFERENCE		ACCEPTANC E NORMS	E OF		AGENCY		CY	REMARKS
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15	FUCTIONAL TEST	Control Logic     Operation	CR	Electrical	100%	10%	Approved Drg/Datasheet	Approved Drg/Datashee	Inspection Report	1	PW	w		
		Instrument Calibration	CR	Electrical	10%	10%	Approved Drg/Datasheet	Approved Drg/Datashee	Inspection Report	1	PM	w		
		3. Temperature rise	CR	Electrical	100%	10%	Approved Drg/Datasheet Relevant IS.	Approved Drg/Datasheet Relevant IS.	Inspection Report	1	PW	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"(1) 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

		BH	IEL								
ENGINEERING QUALITY											
	Sign & Date	Name		Sign & Date	Name						
Prepared by:	July 2020	CHETAN	Checked by:	Xunday Olavaro	KUNDAN PRASAD						
Reviewed by:		RK RAINA	Reviewed by:	विय प्राथीय	RK JAISWAL						

BID	DER/ SUPPLIER
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	FOR CUSTOMER REVIEW & APPROVAL				
Doc No:					
	Sign & Date	Name	Seal		
Reviewed by:					
Approved by:					

### 38045/202<del>0/PS-PEM-MAX</del>

CLAUSE NO.	TECHNICAL REQUIREMENTS  एन्सेपीसी  NTPC					
	TYPE TEST REQUIREMENTS					
1.00.00	TYPE TEST REQUIREMENTS					
1.01.00	General Requirements					
1.01.01	The Contractor shall furnish the type test reports of all type tests as per relevant standards and codes as well as other specific tests indicated in this specification. It list of such tests are given for various equipment in table titled 'TYPE TES' REQUIREMENT FOR C&I SYSTEMS' at the end of this chapter and under the item Special Requirement for Solid State Equipments/Systems. For the balance equipment instrument, type tests may be conducted as per manufactures standard or if required by relevant standard.					
	(a) Out of the tests listed, the Bidder/ sub-vendor/ manufacturer is required to conduct certain type tests specifically for this contract (and witnessed by Employer or his authorized representative) even if the same had been conducted earlier, as clearly indicated subsequently against such tests.					
	(b) For the rest, submission of type test results and certificate shall be acceptable provided.					
	<ol> <li>The same has been carried out by the Bidder/ sub-vendor on exactly the same model /rating of equipment.</li> </ol>					
	<ol> <li>There has been no change in the components from the offered equipment &amp; tested equipment.</li> </ol>					
	<ol> <li>The test has been carried out as per the latest standards alongwith amendments as on the date of Bid opening but not more than five (5) year back.</li> </ol>					
	(c) 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/ sub-vendor within the quoted price and no extra cost will be payable by the Employer on this account.					
1.01.02	As mentioned against certain items, the test certificates for some of the items shall be reviewed and approved by the main Bidder or his authorized representative and the balance have to be approved by the Employer.					
1.01.03	The schedule of conduction of type tests/ submission of reports shall be submitted and finalized during pre-award discussion.					
FLUE GAS D	TECHNICAL SPECIFICATION DESULPHURISATION (FGD) SECTION-VI, PART-B TYPE TEST PAGE 1 OF 7 BID DOCUMENT NO.: CS-0011-109(1A)-2 REQUIREMENTS					

#### 38045/202<del>0/PS-PEM-MAX</del>

CLAUSE NO.	TECHNICAL REQUIREMENTS					
1.01.04	For the type tests to be conducted, Contractor shall submit detailed test procedure for approval by Employer. 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.					
1.01.05	The Bidder shall indicate in the relevant BPS schedule, the cost of the type test for each item only for which type tests are to be conducted specifically for this project. The cost shall only be payable after conduction of the respective test in presence of authorize representative of Employer. If a test is waived off, then the cost shall not be payable.					
2.00.00	SPECIAL REQUIREMENT FOR SOLID STATE EQUIPMENTS/ SYSTEMS					
2.01.00	The minimum type test reports, over and above the requirements of above clause, which are to be submitted for each of the major C&I systems Analyzer instruments, various PLCs etc. shall be as indicated below:					
	i) Surge Protections for Solid State Equipments/ Systems					
	All solid state systems/ equipments shall be able to withstand the electrical noise and surges as encountered in actual service conditions and inherent in a power plant. All the solid state systems/ equipments shall be provided with all required protections that needs the surge withstand capability as defined in ANSI 37.90a/ IEEE-472. Hence, all front end cards which receive external signals like Analog input & output modules, Binary input & output modules etc. including power supply, data highway, data links shall be provided with protections that meets the surge withstand capability as defined in ANSI 37.90a/ IEEE-472. Complete details of the features incorporated in electronics systems to meet this requirement, the relevant tests carried out, the test certificates etc. shall be submitted alongwith the proposal. As an alternative to above, suitable class of IEC-60255-4 which is equivalent to ANSI 37.90a/ IEEE-472 may also be adopted for SWC test.					
	ii) Dry Heat test as per IEC-68-2-2 or equivalent.					
	iii) Damp Heat test as per IEC-68-2-3 or equivalent.					
	iv) Vibration test as per IEC-68-2-6 or equivalent.					
	v) Electrostatic discharge tests as per IEC 61000-4-2 or equivalent.					
	vi) Radio frequency immunity test as per EN 50082-2 or equivalent.					
FLUE GAS D	TECHNICAL SPECIFICATION SUB-SECTION-III-C6 SESULPHURISATION (FGD) SECTION-VI, PART-B STEM PACKAGE BID DOCUMENT NO.: CS-0011-109(1A)-2 REQUIREMENTS					

#### 38045/202<del>0/PS-PEM-MAX</del>

CLAUSE NO.		CHNICAL REQUIREMENTS	ICAL REQUIREMENTS		
	vii) Electromagnetic	immunity as per EN 61131-2	or equivalent.		
	Test listed at item no defined under item (i)	. v, vi, vii, above are applicab above.	ole for front end ca	rds only as	
10	OT-IA PROJECTS	TECHNICAL SPECIFICATION	SUB-SECTION-III-C6		
FLUE GAS D	ESULPHURISATION (FGD) STEM PACKAGE	SECTION-VI, PART-B BID DOCUMENT NO.: CS-0011-109(1A)-2	TYPE TEST REQUIREMENTS	PAGE 3 OF 7	

#### 3.00.00 TYPE TEST REQUIREMENT FOR C&I SYSTEMS

SI No	Item	Test requirement	Standard	Test to be specifically conducted	NTPC's approval req. On test certificate	Remarks
Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7
1	Elect. Metering instruments	As per standard (col 4)	IS-1248	No	Yes	
2	Electronic transmitter	As per standard (col 4)	BS-6447 / IEC- 60770	No	Yes	
3	INSTRUMENTA	TION CABLES TWISTED & SH	IELDED	No	Yes	
4	Pressure gauge	Degree of protection test	IS-2147	No	No	
		Temp interference test	IS -3624	No	No	
5	Temperature gauge	Degree of protection test	IS-2147	No	No	
6	Pressure & DP switch	Degree of protection test	IS-2147	No	No	
		As per standard (col 4)	BS 6134	No	No	
7	Level switch	Degree of protection test	IS-2147	No	No	
8	Control valves	CV Test	ISA 75.02	No	Yes	
9	Flow Nozzles & Orifice plate	Calibration	ASME PTC , BS 1042	No	Yes	
10	PLCs	All tests as per IEC-1131	IEC-601131	No	Yes	

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LOT-IA PROJECTS	TECHNICAL SPECIFICATION	SUR SECTION III OS	
FLUE GAS DESULPHURISATION (FGD)	SECTION-VI, PART-B	SUB-SECTION-III-C6 TYPE TEST REQUIREMENTS	PAGE 4 OF 7
SYSTEM PACKAGE	BID DOCUMENT NO .: CS-0011-109(1A)-2	TIPE TEST REGUIREMENTS	The face of the control of the contr

SI No	Item	Test requirement	Standard	Test to be specifically conducted	NTPC's approval req. On test certificate	Remarks
Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7
11	Junction Box	Degree of protection test	IS-13947	No	Yes	
12	Battery charger (Not required for inbuilt chargers)	Degree of protection test	IS-13947	No	No	
		Short circuit current capability	IEC-60146-2	No	Yes	
		Temp rise test without redundant fans	Approved procedure, IEC 60146-2	No	Yes	
		SWC test	Approved procedure	No	Yes	
		Burn-in-test	Approved procedure	No	Yes	
		Efficiency	IEC-60146-2,	No	Yes	
		Audible Noise Test	IEC 60146-2	No	Yes	
		Fuse Clearing Capability	Approved procedure	No	Yes	
		Relative harmonic content	Approved procedure	No	Yes	

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LOT-IA PROJECTS	TECHNICAL SPECIFICATION	SUB-SECTION-III-C6		
FLUE GAS DESULPHURISATION (FGD)	SECTION-VI, PART-B	TYPE TEST REQUIREMENTS	PAGE 5 OF 7	
SYSTEM PACKAGE	BID DOCUMENT NO .: CS-0011-109(1A)-2	THE TEST REGULATION	50 to 190 53750 535 4 FO	

SI No	Item	Test requirement	Standard	Test to be specifically conducted	NTPC's approval req. On test certificate	Remarks
Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7
		ESD immunity test	IEC-61000-4-2- 9(1)	No	Yes	
		Radio interference	IEC 60146-2	No	Yes	
		Over Load Test on Inverter & charger	Approved procedure	No	Yes	
		Restart Test	IEC 60146-2	No	Yes	
		Output voltage tolerance	Approved	No	Yes	
		Output voltage Harmonic content	Approved procedure	No	Yes	
		Insulation test	IEC 60146	No	Yes	
		Load Tests	Approved procedure	No	Yes	
		Preliminary light load test	IEC 60146	No	Yes	
		Current division / Voltage division	IEC 60146-2	No	Yes	
13	Battery	As per standard (col 4)	IEC -623 / IS 10918 for Ni-Cd IS-1652 for Plante Lead Acid	No	Yes	
14	Voltage stabilizers	Over Load Test	Approved procedure	No	Yes	

LOT-IA PROJECTS FLUE GAS DESULPHURISATION (FGD)	TECHNICAL SPECIFICATION SECTION-VI, PART-B	SUB-SECTION-III-C6 TYPE TEST REQUIREMENTS	PAGE 6 OF 7
SYSTEM PACKAGE	BID DOCUMENT NO.: CS-0011-109(1A)-2		

SI No	Item	Test requirement	ent the search of the search	Test to be specifically conducted	NTPC's approval req. On test certificate	Remarks
Col 1	Col 2	Col 3	Col 4	Col 5	Col 6	Col 7
		Temp rise test without redundant fans	Approved procedure	No	Yes	

LOT-IA PROJECTS	TECHNICAL SPECIFICATION	SUB-SECTION-III-C6	1
FLUE GAS DESULPHURISATION (FGD)	SECTION-VI, PART-B	TYPE TEST REQUIREMENTS	PAGE 7 OF 7
SYSTEM PACKAGE	BID DOCUMENT NO.: CS-0011-109(1A)-2	THE TEST REGULEMENTS	

त्रायाः सम्बद्धाः	C&I SPECIFICATION FOR HVAC SYSTEM	SECTION: C SUB SECTION: C&I
	SUB VENDOR LIST	

#### PACKAGE WISE REGISTERED SUPPLIER LIST (PERMANENT CATEGORY) SI No **Package Name Supplier Name Supplier Communication Address** PRESSURE SWITCH/DIFF. PRESSURE Kaustubha Udyog, S.No. 36/1/1, Sinhgad Road, Vadgaon Khurd, Near SWITCH Lokmat Press, Pune, Phone- 020-24393577, Pincode: Email: pressure@vsnl.com, 2 PRESSURE SWITCH/DIFF. PRESSURE SWITZER PROCESS INSTRUMENTS PVT. LTD. Mr. V S Jayaprakash, 128, SIDCO North Phase, **SWITCH** Ambattur Estates CHENNAI Phone- 044-26252017/2018 Pincode: 600050 Email: sales@switzerprocess.co.in 3 PRESSURE SWITCH/DIFF. PRESSURE DRESSER INDUSTRIES INC. Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase SWITCH II, GIDC Chhatral Kalol Phone- 02764-233682 Pincode: 382729 Email: Nishit.patel@ashcroftindia.com 4 PRESSURE SWITCH/DIFF. PRESSURE GENERAL INSTRUMENTS CONSORTIUM Mr. Amarendra Kulkarni 194/195, Gopi Tank Road, **SWITCH** Off. Pandurang Naik Marg, Mahim Mumbai Phone-9323195251 Pincode: 400016 Email: amarendra@general-gauges.com 5 PRESSURE SWITCH/DIFF. PRESSURE Michael Weileder Dorn Assenheimer, Strasse 27 Barksdale GmbH, Germany SWITCH Reichelsheim Phone- +91-9999107840 Pincode: D-61203 Email: msingh@barksdale.de 6 PRESSURE SWITCH/DIFF. PRESSURE PRECISION MASS PRODUCTS PVT. LTD. Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase **SWITCH** II, GIDC Chhatral Kalol Phone- 9999464663 Pincode: 382729 Email: sales@precisionmass.com 7 PRESSURE SWITCH/DIFF. PRESSURE SOR INC. LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH SWITCH STREET LENEXA Phone- 09810905139, Pincode: 66215 Email: Ldegarmo@sorinc.com, avdhesh@sherman-india.com, 8 PRESSURE SWITCH/DIFF. PRESSURE INDFOS INDUSTRIES LIMITED B-20-21, INDUSTRIAL AREA, MEERUT ROAD, SWITCH GHAZIABAD Phone- 0120-2712016 Pincode: Email: mktg@indfos.com 9 PRESSURE SWITCH/DIFF. PRESSURE INDFOS (INDIA) LIMITED MR.L.C.VENKATRANGAN/MR.B.KANNAN New No.17, II **SWITCH** Floor, Adwave Towers, Dr.Sevalia Shivaji Salai, T.Nagar Chennai Phone- +91 44 24353407 Pincode : 600017 Email : delhi@indfos.com 10 PRESSURE GAUGE/ DIFF.PRESSURE BOSE PANDA INSTRUMENTS PVT.LTD. Mr. Partha Bose 44, Saheed Hemanta Kumar Bose, GAUGE Sarani, Kolkata Phone- +91 33 2548 7220 Pincode: 700074 Email: parthabosebpi@gmail.com; bosepanda@vsnl.net 11 PRESSURE GAUGE/ DIFF.PRESSURE A.N. INSTRUMENTS PVT. LTD. MARKETING DIVISION, 5th FLOOR, 59-B, **GAUGE** CHOWRINGHEE ROAD, KOLKATA Phone-24757784,22472509 Pincode : 700020 Email : anidel@bol.net.in 12 PRESSURE GAUGE/ DIFF.PRESSURE H.GURU INDUSTRIES Mr. G. D. Hazra/Mr. P. K. Mitra 10 B, HO-CHI-MINH GAUGE SARANI, KOLKATA Phone- 033 2282 2463 / 1637 Pincode: 700071 Email: mguru@vsnl.net 13 PRESSURE GAUGE/ DIFF.PRESSURE PRECISION MASS PRODUCTS PVT. LTD. Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase GAUGE II, GIDC Chhatral Kalol Phone- 9999464663 Pincode: 382729 Email: sales@precisionmass.com

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14	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFFMAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode : 400093 Email: sales.in@baumer.com
15	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD	32,INDUSTRIAL SUBURB YESWANTHAPUR BANGALORE Phone- 080-23370300, Pincode: 560022 Email: info@hgurusouth.com
16	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	FORBES MARSHALL (HYD) LTD.	MR SAILESH PATALAY/MR. M K SRINIVASAN PLOT NO.A-19/2, & T-4/2, IDA, NACHARAM, HYDERABAD Phone- 9849913704 Pincode : 500 076 Email : mksrinivasan@forbesmarshall.com
17	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	GAUGE BOURDON INDIA PVT. LTD.	194/195, Gopi Tank Road, Off Pandurang Naik Marg, Mahim Mumbai, Phone- 011-41607463, Pincode : 400016, Email : gicdelhi@general-gauges.com,
18	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	Nesstech Instruments Private Limited	26/2, G Type, Global Industrial Park Near Nahuli Railway Crossing, Valvada Vapi Phone- 9920576002 Pincode : 396105 Email : sales@nesstech.co.in
19	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone-9892230623, Pincode : 400 701, Email : sdbpl@vsnl.com
20	TEMPERATURE GAUGE	FORBES MARSHALL (HYD) LTD.	MR SAILESH PATALAY/MR. M K SRINIVASAN PLOT NO.A-19/2, & T-4/2, IDA, NACHARAM, HYDERABAD Phone- 9849913704 Pincode : 500 076 Email : mksrinivasan@forbesmarshall.com
21	TEMPERATURE GAUGE	GOA INSTRUMENTS INDUSTRIES PVT.LTD.,	D2/5, Mapusa Industrial Estate, Mapusa, Goa, Phone- 09326054551, Pincode : 403507, Email : sumukh@goainstruments.com,
22	TEMPERATURE GAUGE	H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD	32,INDUSTRIAL SUBURB YESWANTHAPUR BANGALORE Phone- 080-23370300, Pincode: 560022 Email: info@hgurusouth.com
23	TEMPERATURE GAUGE	GAUGE BOURDON INDIA PVT. LTD.	194/195, Gopi Tank Road, Off Pandurang Naik Marg, Mahim Mumbai, Phone- 011-41607463, Pincode : 400016, Email : gicdelhi@general-gauges.com,
24	TEMPERATURE GAUGE	H.GURU INDUSTRIES	Mr. G. D. Hazra/Mr. P. K. Mitra 10 B, HO-CHI-MINH SARANI, KOLKATA Phone- 033 2282 2463 / 1637 Pincode : 700071 Email : mguru@vsnl.net
25	TEMPERATURE GAUGE	GOA THERMOSTATIC INSTRUMENTS PVT.LTD.	FLAT -B , GF, HILL CROWN APTS., COLLEGE ROAD, MAPUSA Phone- Pincode : 403525 Email : qtilworks@pyro-electric.in
26	TEMPERATURE GAUGE	A.N. INSTRUMENTS PVT. LTD.	MARKETING DIVISION, 5th FLOOR, 59-B, CHOWRINGHEE ROAD, KOLKATA Phone- 24757784,22472509 Pincode : 700020 Email : anidel@bol.net.in
27	TEMPERATURE GAUGE	Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFFMAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com
28	TEMPERATURE GAUGE	PRECISION MASS PRODUCTS PVT. LTD.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase II, GIDC Chhatral Kalol Phone- 9999464663 Pincode: 382729 Email: sales@precisionmass.com

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29	LEVEL GAUGE	TOSHNIWAL BROTHERS PVT.LTD.	WORKS:TOSHNIWAL IND.PVT.LTD, INDUSTRIAL
			ESTATE MAKHUPURA, AJMER Phone- 441171
			Pincode: 305002 Email:
			toshniwalprocess@gmail.com
30	LEVEL GAUGE	SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ
			INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR
			LANE, BHANDUP (W) MUMBAI Phone-
			+919821038162 Pincode : 400078 Email :
			sales@sigmainstruments.co.in
31	LEVEL GAUGE	BLISS ANAND PVT. LTD.	Mr. Vikas Anand/ Mr.RGRajan 92B & 93 B , IMT
]	LEVEL GAOGE	DEISS ANAIND I VI. ETD.	MANESAR Gurgaon Phone- 0124-4366000 TO 9
			Pincode: 122001 Email: sales@blissanand.com
22	TEMP. ELEMENT	DETRIVE INICTRUMENTATION & ELECTRONICS	320, TV INDUSTIAL ESTATE, OFF.DR.A.BESANT
32	TEMP. ELEMENT		1 '
		LTD.	ROAD, BEHIND GLAXO, WORLI, MUMBAI Phone-
			24934125,24938403 Pincode : 400025 Email :
			trivtech@vsnl.com
33	TEMP. ELEMENT	Nesstech Instruments Private Limited	26/2, G Type, Global Industrial Park Near Nahuli
			Railway Crossing, Valvada Vapi Phone-
			9920576002 Pincode : 396105 Email :
<u> </u>			sales@nesstech.co.in
34	TEMP. ELEMENT	Thermal Instrument India Pvt. Ltd.	Mr. Raghavendra M. Kulkarni 194/195, Gopi Tank
			Road Behind Citylight Cinema, Mahim Mumbai Phone-
			09322664709 Pincode : 400016 Email :
			ramk@giconindia.com
35	TEMP. ELEMENT	Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI
33	TEM : ELEMENT	baumer recimologies maia i ve. Eta.	SHAMJI INDUSTRIAL COMPLEX, OFFMAHAKALI
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			CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91
			99589 25151 Pincode : 400093 Email :
			sales.in@baumer.com
36	TEMP. ELEMENT	GOA INSTRUMENTS INDUSTRIES PVT.LTD.,	D2/5, Mapusa Industrial Estate, Mapusa, Goa,
			Phone- 09326054551, Pincode : 403507, Email :
			sumukh@goainstruments.com,
37	TEMP. ELEMENT	PYRO ELECTRIC INSTRUMENTS GOA PVT.LTD.	M. D. BICHU/R. M. BICHU G.B, HILL CROWN
			APARTMENTS, COLLEGE ROAD, MAPUSA Phone-
			9326114601 Pincode : 403507 Email :
			priyanka.marketing@pyro-electric.in
38	TEMP. ELEMENT	GAUGE BOURDON INDIA PVT. LTD.	194/195, Gopi Tank Road, Off Pandurang Naik Marg,
			Mahim Mumbai, Phone- 011-41607463, Pincode :
			400016, Email: gicdelhi@general-gauges.com,
39	TEMP. ELEMENT	TOSHNIWAL INDUSTRIES PVT. LTD.,	Industrial Estate, Makhupura, Ajmer, Phone-
		<i>'</i>	9352009000, Pincode: 305002, Email:
			info@tipl.com,
40	TEMP. ELEMENT	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6,
1	TELLI LECTICIAL	SELECTION (DOPENT) I VI LID,	Sec-3, Ghansoli (East), Navi Mumbai, Phone-
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			9892230623, Pincode : 400 701, Email :
-	TEMP ELEMENT	Toward Took was to the second (TV D )	sdbpl@vsnl.com
41	TEMP. ELEMENT	Tempsens Instrument (I) Pvt Ltd	MR. V.P.RATHI/MR. HEMANT RATHI B-188A ROAD
			NO.5 , M.I.A UDAIPUR Phone- 09352420069
			Pincode: 313003 Email: info@tempsens.com
42	TRANSMITTERS	YOKOGAWA INDIA LIMITED,	PLOT NO.96, ELECTRONICS CITY COMPLEX, HOSUR
			ROAD, BANGALORE, Phone- 080-41586000,
			Pincode : Email : uday.shankar@in.yokogawa.com,
43	TRANSMITTERS	ABB INDIA LIMITED	MR. RAJIV GOVIL 14, MATHURA ROAD, FARIDABAD
	•		Phone- 09971085678 Pincode : 121003 Email :
			vipin.swami@in.abb.com
		<u> </u>	psamemabbicom

44	TRANSMITTERS	V. AUTOMAT & INTRUMENTS (P) LTD.	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA
			INDL.AREA, PH-1 NEW DELHI Phone- 9810005826
			Pincode: 110 020 Email: sales@vautomat.com
45	TRANSMITTERS	Pune Techtrol Pvt. Ltd.	N.P.Khatan/Sudhakar Badiger S-18, MIDC Bhosari,
			Pune Phone- 9850560042 Pincode : 411 026 Email
			: ho@punetechtrol.com
46	TRANSMITTERS	TOSHNIWAL INDUSTRIES PVT. LTD.,	Industrial Estate, Makhupura, Ajmer, Phone-
			9352009000, Pincode : 305002, Email :
			info@tipl.com,
47	TRANSMITTERS	SBEM PVT. LTD.	MR.N.K. BEDARKAR/MR. VISHWANATH KARANDIK 39,
			ELECTRONIC CO.OP. ESTATE, PUNE SATARA ROAD
			PUNE, Phone- 912041030100 Pincode : 411009
			Email: newdelhi@sbem.co.in
48	TRANSMITTERS	Endress + Hauser (India) Pvt. Ltd.,	Mr. Prakash Vaghela 215-216, DLF Tower 'A', Jasola
			District Centre, New Delhi, Phone- 9717593001,
			Pincode: 110025, Email:
			prakash.vaghela@in.endress.com,
49	TRANSMITTERS	Moore Industries International Inc.	Leonard.W. Moore/ Matt Moren 16650 Schoenborn St.
			North Hills Phone- +1 818 830 5548 Pincode:
			91343 Email: mmoren@miinet.com
	TO ANGLETTED C	DAMAN ENGINEEDS	
50	TRANSMITTERS	PANAM ENGINEERS	Mr. Santosh Shukla 203, Jaisingh Business, Parsiwada,
			Sahar road, Andheri (East), Mumbai, Phone-
			9892179529, Pincode: 400099, Email:
	TO ANGLETTED C	CHARLE THETELENERS LED DO A TV	santosh@panamengineers.com,
51	TRANSMITTERS	SMART INSTRUMENTS LTD, BRAZIL	Agents: Digital Electronic Ltd. 74/11 'C' Cross Road
			MIDC Andheri (East) MUMBAI Phone- 28208477
			Pincode: 400093 Email:
E2	TRANSMITTERS	SIEMENS LIMITED	corp@delbby.rpgms.ems.vsnl.net.in  Dr. Armin Bruck/Sandeep Mathur 130, Pandurang
32	TRANSMITTERS	SILIPILING LIPITIED	Budhkar Marg Worli Mumbai Phone- 0124 383 7377
			Pincode: 400018 Email:
			ankit.varshney@siemens.com
53	TRANSMITTERS	EMERSON PROCESS MANAGEMENT (INDIA)	Mr. Amit Paithankar/Vikram Raj Singh 206-
		PVT.LTD.	210,BALARAMA BUILDING 2ND FLR. BANDRA EAST
			MUMBAI Phone- 9619121500 Pincode : 400051
			Email: vikramraj.singh@emerson.com
54	TRANSMITTERS	Honeywell Automation India Limited	Mr. Ritwij Kulkarni 917, INTERNATIONAL TRADE
			TOWER, NEHRU PLACE, NEW DELHI Phone-
			9890200584 Pincode : 110019 Email :
			rajesh.chaudhary@honeywell.com
55	TRANSMITTERS	NIVO CONTROLS PVT. LTD.	Mr. Praveen Toshniwal 104-115, Electronic Complex,
			Indore Phone- 0731-4081305 Pincode : 452010
			Email: sales@nivocontrols.com
56	TEMPERATURE SWITCH	SOR INC.	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH
			STREET LENEXA Phone- 09810905139, Pincode:
			66215 Email: Ldegarmo@sorinc.com,
			avdhesh@sherman-india.com,
57	TEMPERATURE SWITCH	TOSHNIWAL BROTHERS PVT.LTD.	WORKS:TOSHNIWAL IND.PVT.LTD, INDUSTRIAL
			ESTATE MAKHUPURA, AJMER Phone- 441171
			Pincode: 305002 Email:
			toshniwalprocess@gmail.com
58	TEMPERATURE SWITCH	DRESSER INDUSTRIES INC.	Mr. Nishit Patel/Mr. Anuj Verma Plot No.2306, Phase
			II, GIDC Chhatral Kalol Phone- 02764-233682
			Pincode : 382729 Email :
			Nishit.patel@ashcroftindia.com

EO	TEMPERATURE SWITCH	INDEOS (INDIA) LIMITED	MR.L.C.VENKATRANGAN/MR.B.KANNAN New No.17, II
59	TEMPERATURE SWITCH	INDFOS (INDIA) LIMITED	Floor, Adwave Towers, Dr.Sevalia Shivaji Salai, T.Nagar Chennai Phone- +91 44 24353407 Pincode : 600017 Email : delhi@indfos.com
60	TEMPERATURE SWITCH	SWITZER PROCESS INSTRUMENTS PVT. LTD.	Mr. V S Jayaprakash, 128, SIDCO North Phase, Ambattur Estates CHENNAI Phone- 044- 26252017/2018 Pincode: 600050 Email: sales@switzerprocess.co.in
61	DIFFERENTIAL PRESSURE SWITCH	SOR INC.	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode: 66215 Email: Ldegarmo@sorinc.com, avdhesh@sherman-india.com,
62	JUNCTION BOX	K.S.INSTRUMENTS PVT.LTD.	S Raghavan No. 72, 3rd Main, 1st Stage Industrial Suburb, Yeshwanthpur Bangalore Phone- 9880385770 Pincode : 560022 Email : sales1@ksinstruments.net
63	JUNCTION BOX	SUCHITRA INDUSTRIES	NO-2,OPP-27 AECS LAYOUT 2ND STG REJAMAHALVILAS EXTN 2ND STG BANGALORE Phone- Pincode : Email : suchitra.industriesblr@gmail.com
64	JUNCTION BOX	Shrenik & Company,	Mr. Mitesh Shah/Mr. Pulin Shah 39 A/3 ,Panchratna Industrial Estate, Sarkhej-Bavla Road Ahmedabad Phone- 9825024921 Pincode : 382213 Email : sales@pustron.com, pulin@sumip.com
65	JUNCTION BOX	FLEXPRO ELECTRICALS PVT. LTD.	Mr. Dineshbhai Zaveri C-1/ 27&37, GIDC, Kabilpore, Navsari Phone- 02637-265140,265003 Pincode : 396424 Email : flexpro@flexproltd.com
66	JUNCTION BOX	AJMERA INDUSTRIAL & ENGINEERING WORKS	JIGNESH MAHENDRA AJMERA DENA BANK BLDG.,SHREE NAGESH INDL. ESTATE,STATION ROAD, MUMBAI Phone- 022 67973578 Pincode: 400 088 Email: ajmera@ajmera.net, jmajmera@yahoo.com
67	INSTRUMENTS TUBE FITTINGS	VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com
68	INSTRUMENTS TUBE FITTINGS	Fluid Controls Pvt. Ltd.	Sophie Y. Moochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI Phone- (022) 43338000 Pincode: 400013 Email: sales@fluidcontrols.com
69	INSTRUMENTS TUBE FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com
70	INSTRUMENTS TUBE FITTINGS	PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com
71	LEVEL SWITCH-CAPACITANCE TYPE	SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in

72	LEVEL SWITCH-CAPACITANCE TYPE	V. AUTOMAT & INTRUMENTS (P) LTD.	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI Phone- 9810005826 Pincode: 110 020 Email: sales@vautomat.com
73	LEVEL SWITCH-CAPACITANCE TYPE	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6, Sec-3, Ghansoli (East), Navi Mumbai, Phone-9892230623, Pincode: 400 701, Email: sdbpl@vsnl.com
74	LEVEL SWITCH-CAPACITANCE TYPE	LEVCON INSTRUMENTS PVT. LTD.	Mr Shayak Gupta/Badal Jana Rajkamal', 7th floor, 13, Camac Street KOLKATA Phone- 0 33 2283 2766 Pincode : 700017 Email : b_jana@levcongroup.com
75	LEVEL SWITCH-CAPACITANCE TYPE	Flow Star Engineering Pvt. Ltd.,	MR. KHALID AKHTAR/MR. TAPAN KUMAR JANA Plot No- 7 F/2, Northern India Industrial 20/3, Mathura Road FARIDABAD Phone- 9818176380 Pincode : 121005 Email: khalid@flowstar.co.in
76	LEVEL SWITCH-CAPACITANCE TYPE	Pune Techtrol Pvt. Ltd.	N.P.Khatan/Sudhakar Badiger S-18, MIDC Bhosari, Pune Phone- 9850560042 Pincode : 411 026 Email : ho@punetechtrol.com
77	LEVEL SWITCH-CAPACITANCE TYPE	Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFFMAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com
78	LEVEL SWITCH-CONDUTIVITY TYPE	Sapcon Instrument Pvt Ltd.	131, PALSHIKAR COLONY Contact Person- Mr. Ashwin (9826080207) INDORE Phone- +91-731- 4085751, Pincode: 452004 Email: sales@sapconinstruments.com
79	LEVEL SWITCH-CONDUTIVITY TYPE	LEVCON INSTRUMENTS PVT. LTD.	Mr Shayak Gupta/Badal Jana Rajkamal', 7th floor, 13, Camac Street KOLKATA Phone- 0 33 2283 2766 Pincode : 700017 Email : b_jana@levcongroup.com
80	LEVEL SWITCH-CONDUTIVITY TYPE	BLISS ANAND PVT. LTD.	Mr. Vikas Anand/ Mr.RGRajan 92B & 93 B , IMT MANESAR Gurgaon Phone- 0124-4366000 TO 9 Pincode : 122001 Email : sales@blissanand.com
81	LEVEL SWITCH-CONDUTIVITY TYPE	V. AUTOMAT & INTRUMENTS (P) LTD.	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI Phone- 9810005826 Pincode: 110 020 Email: sales@vautomat.com
82	LEVEL SWITCH-CONDUTIVITY TYPE	HI-TECH SYSTEMS & SERVICES LTD.	Mr. Vikash Agrawal/Mr. Tarun Debnath 119, PARK STREET , KOLKATA Phone- 033-22290045 Pincode : 700016 Email : sandeep@hitech.in
83	LEVEL SWITCH-CONDUTIVITY TYPE	RAMAN INSTRUMENTS PVT.LTD.	Mr. N R Shenoy/Mr G B Vijh 8, First Floor.Plot : 160A Bait-Ush-Sharaf, 29th Road,Bandra(W) MUMBAI Phone- 09892331381 Pincode : 400050 Email : ramanbpl@vsnl.com
84	LEVEL SWITCH-CONDUTIVITY TYPE	SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.in
85	LEVEL SWITCH-CONDUTIVITY TYPE	SOR INC.	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA Phone- 09810905139, Pincode: 66215 Email: Ldegarmo@sorinc.com, avdhesh@sherman-india.com,

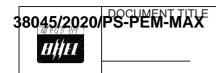
06	LEVEL SWITCH-FLOAT TYPE	Pune Techtrol Pvt. Ltd.	N.D. Khatan (Cudhakar Padigar C. 10, MIDC, Phasari
86	LEVEL SWITCH-FLOAT TYPE	Pune Techtroi Pvt. Ltd.	N.P.Khatan/Sudhakar Badiger S-18, MIDC Bhosari,
			Pune Phone- 9850560042 Pincode : 411 026 Email
			: ho@punetechtrol.com
87	LEVEL SWITCH-FLOAT TYPE	D.K. INSTRUMENTS PVT.LTD.	N.SIKDAR/ SUMIT SIKDAR 76/2,SELIMPUR RD
			DHAKURIA Kolkata Phone- 033-2415-1310.
			Pincode: 700031 Email: dkinst@vsnl.net
88	LEVEL SWITCH-FLOAT TYPE	V. AUTOMAT & INTRUMENTS (P) LTD.	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA
			INDL.AREA, PH-1 NEW DELHI Phone- 9810005826
			Pincode: 110 020 Email: sales@vautomat.com
			_
89	LEVEL SWITCH-FLOAT TYPE	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Office no. 53, Shree Manoshi Complex, Plot No. 5 & 6,
		0012.11.11.10.02.11020 (201.15/11) 1.11.21,	Sec-3, Ghansoli (East), Navi Mumbai, Phone-
			9892230623, Pincode : 400 701, Email :
			·
	LEVEL CUSTOM ELOAT TVDE	LEVOCAL THOTOLINENTO DUE LED	sdbpl@vsnl.com
90	LEVEL SWITCH-FLOAT TYPE	LEVCON INSTRUMENTS PVT. LTD.	Mr Shayak Gupta/Badal Jana Rajkamal', 7th floor, 13,
			Camac Street KOLKATA Phone- 0 33 2283 2766
			Pincode: 700017 Email: b_jana@levcongroup.com
91	LEVEL SWITCH-FLOAT TYPE	GENERAL INSTRUMENTS CONSORTIUM	Mr. Amarendra Kulkarni 194/195, Gopi Tank Road,
			Off. Pandurang Naik Marg, Mahim Mumbai Phone-
			9323195251 Pincode : 400016 Email :
			amarendra@general-gauges.com
92	LEVEL SWITCH-FLOAT TYPE	SBEM PVT. LTD.	MR.N.K. BEDARKAR/MR. VISHWANATH KARANDIK 39,
,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	LEVEL SWITCH FLOAT THE	SDEPT VI. ETD.	,
			ELECTRONIC CO.OP. ESTATE, PUNE SATARA ROAD
			PUNE, Phone- 912041030100 Pincode: 411009
			Email : newdelhi@sbem.co.in
93	LEVEL SWITCH-FLOAT TYPE	Baumer Technologies India Pvt. Ltd.	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI
			SHAMJI INDUSTRIAL COMPLEX, OFFMAHAKALI
			CAVES ROAD, ANDHERI(E) MUMBAI Phone- +91
			99589 25151 Pincode : 400093 Email :
			sales.in@baumer.com
94	LEVEL SWITCH-FLOAT TYPE	SIGMA INSTRUMENTS CO.	Gopal Kannan/R Gopinath 201, ANANDRAJ
			INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR
			LANE, BHANDUP (W) MUMBAI Phone-
			+919821038162 Pincode : 400078 Email :
			sales@sigmainstruments.co.in
0.5	LEVEL SWITCH-FLOAT TYPE	SOR INC.	
95	LEVEL SWITCH-PLOAT TYPE	SOR INC.	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH
			STREET LENEXA Phone- 09810905139, Pincode:
			66215 Email: Ldegarmo@sorinc.com,
			avdhesh@sherman-india.com,
96	INSTRUMENTS PIPE FITTINGS	VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6,
			NOIDA Phone- +91-9810122070 Pincode : 201301
			Email: naveensingh@vsnl.com
97	INSTRUMENTS PIPE FITTINGS	Fluid Controls Pvt. Ltd.	Sophie Y. Moochhala/Mayur Rajput J.V.PATEL, I.T.I
			CMPD, B.MADHUKAR MARG, ELPHINSTONE
			ROADSTN.(WR), MUMBAI Phone- (022) 43338000
			Pincode: 400013 Email: sales@fluidcontrols.com
			Timesae . Hoods Email . Sales@Halacondols.com
00	INSTRUMENTS PIPE FITTINGS	PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL
90	TING LICONICIA LO FILE ELL LINGS	I VECTOTON FINGTINEERING TINDOSTRIES	
			ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone-
			022 42631700 Pincode : 400 062 Email :
			peiks@vsnl.com
99	INSTRUMENTS PIPE FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER
			KAILASH-II NEW DELHI Phone- 9810182430
			Pincode: 110048 Email: niraj@aurainc.com
	l .		

100	INSTRUMENT FITTINGS	Perfect Instrumentation Control (India) Pvt. Ltd.	MD Hussain Shaikh/Shahanawaz Khan Gala No. 168, Loheki Chwal,216/ 218, Maulana Azad Rd. Nagpada Junction Mumbai Phone- 91-9324383121 Pincode: 400008 Email: shahanawaz.khan@perfectinstrumentation.com
101	INSTRUMENT FITTINGS	Arya Crafts & Engineering Pvt. Ltd.	Mr.Sanjay Brahman/Mr.Shyam Vazirani 102, Vora Industrial Estate No.4 Navghar, Vasai Road (E) Dist.Thane, Mumbai Phone- +91-250-2392246 Pincode: 401210 Email: arya@aryaengq.com
102	INSTRUMENT FITTINGS	AURA INCORPORATED	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com
103	INSTRUMENT FITTINGS	PRECISION ENGINEERING INDUSTRIES	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI Phone-022 42631700 Pincode: 400 062 Email: peiks@vsnl.com
104	INSTRUMENT FITTINGS	Comfit & Valve Pvt. Ltd.	Mr. Jeetu Jain/Mr. Vinay Sosa Survey No. 23/1, Part 2, Ahmedabad-Mehsana Highway Laxmipura, Nandasan Phone- 02764-267036/37 Pincode : 382705 Email: marketing@com-fit.com
105	INSTRUMENT FITTINGS	HP VALVES & FITTINGS INDIA PVT. LTD.	S. Harichandran/P.S. Pandi B-11, Mugappair Industrial Estate, CHENNAI Phone- 044 26252537 Pincode: 600037 Email: sales@hpvalvesindia.com
106	INSTRUMENT FITTINGS	FLUIDFIT ENGINEERS PVT. LTD.	Mr. Abbas Bhola Potia Building No. 2, Office No. 3,292, Bellasis Road, Mumbai Central (East) Mumbai Phone- 9920044113 Pincode: 400008 Email: ab@fluidfitengg.com
107	INSTRUMENT FITTINGS	VIKAS INDUSTRIAL PRODUCTS	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com
108	INSTRUMENT FITTINGS	Fluid Controls Pvt. Ltd.	Sophie Y. Moochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI Phone- (022) 43338000 Pincode: 400013 Email: sales@fluidcontrols.com
109	INSTRUMENT FITTINGS	PANAM ENGINEERS	Mr. Santosh Shukla 203, Jaisingh Business,Parsiwada, Sahar road,Andheri(East), Mumbai, Phone- 9892179529, Pincode : 400099, Email : santosh@panamengineers.com,

#### Notes:

<sup>1.)</sup>The above Sub-Vendor list is tentative & reference only. However Sub-Vendor List is subject to BHEL/End user approval without any commercial /delivery implication.

<sup>2.)</sup>New Sub-Vendor if proposed by Vendor during contract stage shall subject to BHEL/end user approval without commercial/delivery implication.



#### KKS NUMBERING PHILOSOPHY

For identifying (tagging) an instrument / equipment in Power plant KKS numbering scheme is used. The purpose is to assign a unique number to every equipment in the power plant. For C&I equipment unique number are to be provided up to the signal level so that a unique number Input / Output exist in DCS for every signal.

Normally KKS number is a 10 digit alpha-numeric code and is typically split into the following:

X
---

First three digits indicate the Sub-System. The Code for the major system are given as per **Annexure-1**.

Fourth and Fifth digits are the **Numerical Keys at System Code Level** and used to distinguish between main systems having same Alpha Codes.

Sixth and Seventh digits are the **Equipment / Apparatus / Measuring Circuit Code**. The code of various Equipment / Apparatus / Measuring Circuit is shown in **Annexure-2** 

Eight, Nine and tenth digits are the **Numerical Keys at Equipment / Apparatus / Measuring Circuit Code** and used to distinguish between various instruments in the same sub-group. Numerical keys at System / Equipment / Apparatus / Measuring Circuit is shown in **Annexure-3**.

\*\*

KKS TAGS ARE PROVIDED IN THE P&ID FURNISHED BY VENDOR.HOWEVER, IF THE KKS NUMBER OF EQUIPMENT/INSTRUMENTS CHANGES,THE SAME SHALL BE FINALIZED DURING DETAILED ENGINEERING.



#### **ANNEXURE-1**

#### List of System / Sub-System Codes used in Power Plant:

1) Refer the P&ID sheets.

#### **ANNEXURE-2**

#### **Standard Equipment Codes:**

AA Valves including drives, also hand operated

AB Seclusions, Lock, Gates, Doors

AC Heat Exchanger

AE Turning, Driving, Lifting equipment AF Continuous conveyors, Feeders

AG Generator Units

AH Heating and Cooling Units

AK Pressing and Packaging equipment

AM Mixer, Stirrer

AN Blower, Air Pumps / Fans, Compressor Units

AP Pump Units

AT Purification, Drying, Filter

AV Combustion Equipment e.g. grates

#### **Standard Apparatus Codes:**

BB Vessels and Tank
BF Foundation

Dr Foulidation

BG Boiler Heating Surfaces

BN Injector, Ejector

BP Flow and throughput limitation equipment (Orifice)

BQ Holders, Carrying Equipment, Support BR Piping, Ducts, Chutes, Compensator

BS Sound Absorber
BU Insulations, Sheatings

#### **Standard Measuring Circuits Codes:**

CD Density

CE Electrical Quantities CF Flow, throughput

CG Distance, Length, Position

CK Time

CL Levelage 394 of 523

CM	Humidity
CQ	Analysis (SWAS)
CS	Speed, Velocity, Frequency
CT	Temperature
CY	Vibration, Expansion

#### **ANNEXURE-3**

#### **Numerical Keys**

#### A) Numerical Keys at System Code Level

- i) Use 10, 20, 30... To distinguish between main systems having same Alpha Codes. Examples:
  - a) Main Steam (Left) and Main Steam (Right)
  - b) BFP A/B/C
  - c) ID Fan A/B, FD Fan A/B, AH A/B
- ii) For branch off from main system path having code say 10, keep the same alpha code and use 11, 12, 13 etc. Similarly for other branch off from main system path having code say 20, keep the same alpha code and use 21, 22, 23 etc and shall carry on further in the same way.
- iii) If the branch off from main system / sub system path is used for some other system, where different alpha codes can be applied, then in that case the said branch line will be designated by the alpha codes of the system to which it is providing the input.

#### B) Numerical keys at Equipment Code level:

There are three numerical keys available for each type of equipment code. Following has been agreed upon considering present practice, better flexibility and ease in sorting.

i) Valves and Dampers --- Equipment Code – AA

		N1	N2 N3
Motorised (on/off duty)	-	$\overline{o}$	01 to 50
Motorised (inching duty)	-	0	51 to 99
Pneumatic (Control)	-	1	01 to 50
Motorised (thyrestor Control)	-	1	51 to 99
Sol. Operated	-	2	01 to 99
(Open / Close duty (Valves, NRVs, Gate) Page 395 of 523			
Hydraulic Page 393 01 323		3	01 to 99

	NRV (Without actuation)	-	4	01 to 99
	Manual	-	5	01 to 99
	Manual	-	6	01 to 99
	Relief & Safety Valves	-	7	01 to 99
	Reserve	-	8	01 to 99
	Reserve	-	9	01 to 99
ii	) Field Instruments			
	Field Transmitters & Analog Signals	-	0	01 to 99
	Field Switches & Binary Signals	-	1	00 to 99
	PG Test Point	-	4	00 to 99
	Gauges	-	5	00 to 99
	Automatic Turbine Tester (ATT)-HWR	-	2	00 to 99
	(Reserved for protection Signals used by	Hardwa	r)	

#### **Example of Numerical Key Usage:**



# 4X250 MW BRBCL NABINAGAR HVAC (FGD SYSTEM PACKAGE) HVAC SYSTEM STANDARD TECHNICAL SPECIFICATIONS

SPECIFICATION No: PE-TS-463-(571-13000- A)-A001		
SECTION: I		
SUB-SECTION: D		
REV. 00		

**SECTION: I** 

**SUB-SECTION: D** 

STANDARD TECHNICAL SPECIFICATIONS

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## TECHNICAL SPECIFICATION AIR HANDLING UNITS

SPECIFICATION NO.PES-553-02		
VOLUME II B		
SECTION I	)	
<b>REV. 02</b>	DATE: 17.09.2012	
SHEET 1 OF 6		

# STANDARD TECHNICAL SPECIFICATION FOR AIR HANDLING UNITS

38045/2020/PS-PEM-MAX



### TECHNICAL SPECIFICATION AIR HANDLING UNITS

SPECIFICATION NO.PES-553-02		
VOLUME II B		
SECTION D		
REV. 02	DATE: 17.09.2012	
SHEET 2 OF 6		

#### 1. GENERAL

1.1 This specification covers the design, manufacture, Construction features, installation, commissioning, inspection and performance testing at site of AHUs.

#### 2. CODES AND STANDARDS

The design manufacture and performance of AHU shall comply with all currently applicable statutes, regulations and safety codes in the locality where the AHU is to be installed. The equipments shall also conform to the requirements of the latest editions of applicable Indian/British/US standards. Nothing in this spec. shall be construed to relieve vendor of this responsibility. In particular the equipment shall conform to the latest editions of the following standards:

2.1.1 IS-659 : Safety code for air conditioning

2.1.2 IS-660 : Safety code for mechanical refrigeration

2.1.3 ASHRAE: Method of testing forced circulation air-cooling and air heating coils.

standard 33

2.1.4 ARI 41 : Standard for forced circulation air cooling and air heating coils.

2.1.5 ARI 430/435 : Air-cooling and air heating coils Central Station AHU / Application

of Central Station AHU.

2.1.6 AMCA : 211 and 311

In case of any conflict in the standards and this specification the decision of PEM,BHEL shall be final and binding.

#### 3. CONSTRUCTION FEATURES

3.1 The casing of AHU shall be made of insulated double wall construction of min. 24 gauge galvanized sheet steel - IS 277 Gr. 120 (parent sheet: D/DD-IS-513) ribbed and reinforced for structural strength and rigidity with 25 mm thick polyurethane insulation of minimum 40 kg/m³ density in between. The external wall will be preplasticised over GI coating on the outside. Angle irons or channel sections made of 16 gauge galvanized sheet steel shall be used for reinforcing. The casing shall be of sectionalized construction with proper sealing at the joints to make them air tight. Fan section and panels with bearing support shall be reinforced with heavy gauge channels (min. 5 mm thick). Suitable number of forged hot dip galvanized (610 gm/sq.m) U brackets shall be provided for AHU suspended from ceiling/roof.

Necessary arrangement shall be provided on the casing for measuring temperature and pressure in cooling/heating coil. Class of instruments shall be min. 2.

3.2 Fan impeller shall be forwardly/backwardly inclined curved blade centrifugal type. Impeller shall be double width double inlet type. Fans shall be preferably low rpm (<=1500) to minimize vibration and noise. Noise shall be within 85 dB(A) at 1 metre distance from AHU casing. Max. Vibration level shall be acceptance and norms to be specified. Two to three wheels (impellers) shall be provided for each AHU. Impeller blades shall be fabricated from (min. 1.0 mm) galvanized/ epoxy powder coated sheet steel. Fan shall be of epoxy powder coated / galvanized sheet steel (min. 1.6



### TECHNICAL SPECIFICATION AIR HANDLING UNITS

SPECIFICATION NO.PES-553-02		
VOLUME II B		
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SHEET 3 OF 6		

mm) scroll with die formed inlets for uniform air flow. Fan shafts shall be solid cold rolled carbon steel (EN8 normalised), ground and polished. Fan shaft bearings shall be of heavy duty type selected for average operating life of 100,00 hours. Bearings shall be self-aligning, permanently lubricated type. Make of Brgs(SKF/FAG/NORMA/TATA) to be specified. Bearing Housing shall be of casting of min. IS Gr. 210, split type and suitably supported. The V-belt drive with belt guard shall be provided. Motors shall have minimum 15% margin over maximum BHP in working range.

- DX or chilled water cooling coils and steam/hot water coils shall be internally corrugated copper/ cupronickel tubes (as per manufacturer's standard) with smooth non corrugated external fins of aluminium (thickness 0.14 mm and grade 1100 as per spec) unless specified otherwise in specification. At least 5 fins /per cm. shall be provided. The chilled water/hot water coils shall have suitable (standardize class, size, threading) drain and vent connections.
- 3.4 The filters in the filter section shall be provided as detailed in data sheet A.
- 3.5 Humidifier shall be Pan type/as specified in the specification.

Pan type Humidifier consisting of SS304/316 tank, heater, geyserstat with piping connection to supply air duct shall be provided unless specified otherwise in data sheet A.

Heaters and branch line shall be of galvanized steel and nozzles shall be of brass (matl. grade) /SS 304.

- 3.6 Condenser water from coil or surplus water from spray humidifier shall be collected in 16 gauge SS-304 pan. Minimum 50mm dia GI pipe nipple shall be provided on each end for drain connection. The drains for these points shall be extended to the main drain in AHU room.Condensate drain pipe (GI) of required length with sealing loop shall be provided and insulated as specified in the specification for insulation. Minimum requirement For GI Pipes and fittings shall be ERW/Seamless of medium thickness as per IS-1239/3589 and Hot dip galvanized
- 3.7 Suitable number of Spring type vibration isolators shall be provided for fan and motor assembly. Neoprene rubber pads shall be provided below the AHU.

The AHU shall be provided with 18 G SS drain pan.



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SPECIFICATION NO.PES-553-02		
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#### 4. <u>TESTING AND INSPECTION AT MANUFACTURERS WORKS:</u>

List of TCs arranged as per Approved Quality Plan shall be furnished along with copy of TCs at the time of inspection.

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### TECHNICAL SPECIFICATION AIR HANDLING UNITS

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- 4.1 Visual inspection of GI sheets and angles, channels etc. dents, black spots, chipping of zinc coating, white dust on galvanised sheets shall be avoided. Pitting, lamination in angles and channels shall be avoided.
- 4.2 Galvanised sheets Test certificate shall be furnished for visual check, coating thickness, adhesion test, sheet thickness, uniformity of coating. For pipes and fittings compliance report shall be furnished by Manufacturer for visual check, coating thickness, adhesion test, sheet thickness, uniformity of coating.
- 4.3 Shaft: Mechanical and chemical.
- 4.4 Motors (of approved make): Routine TC.
- 4.5 Workmanship and dimensional check as per manufacturing drg. and approved Drgs.
- 4.6 Balancing of impellers- Dynamic balancing certificates shall be furnished –grade 6.3 or better to ISO-1940. Balancing weights shall be positively locked to avoid loosening. Balancing weights and fasteners used shall be galvanized.
- 4.7 Performance test of one Centrifugal fan/per type/per size as per AMCA standard (for indigenous make).
- 4.8 Centrifugal fans for AHUs will be 100% run tested by main contractor of BHEL. One centrifugal fan/per type/per size will be run tested. Vibration shall be within good zone of VDI 2056 / ISO 10816-1(group- K) machines when measured on bearing housing and noise level <85 dbA at 1 metre distance. Max. Temp. on bearing housing- 40 degrees Centigrade + ambient.
- 4.9 Complete assembly of one AHU/per type/ per size (excluding cooling coil and filter) shall be witnessed.
- 4.10 Run test of one complete assembly/per type/per size (excluding cooling coil and filter). Vibration shall be within satisfactory zone of VDI 2056 / ISO 10816-1(group-K) machines when measured on bearing housing and noise level <85 dbA at 1 metre distance. Max. Temp. on bearing housing- 40 degrees Centigrade + ambient.



## TECHNICAL SPECIFICATION AIR HANDLING UNITS

SPECIFICATION NO.PES-553-02

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SECTION D

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SHEET 6 OF 6

5.	DRAWINGS/DOCUMENT/DATA REQUIRED AFTER AWARD OF CONTRACT
5.1	GA drawing of AHU & data- sheet to be submitted along with technical schedules enclosed in Volume III.
5.2	Drawing including equipment layout, foundation & loading details etc. for civil works. These drawings must cover sufficient details so that design of civil works can be completed.
5.3	Inspection, operation & Maintenance Manuals.
5.4	Equipment description giving complete design calculations, basis of design, selection criteria etc.
5.5	Test Certificates.
5.6	Final as built documentation i.e. final-version of all drawings, data & information as per the requirement specified elsewhere.
5.7	Performance Test Certificates.



### AIR HANDLING UNIT DATA SHEET - A

VOLUME - II-B

SECTION - D

REV 00 DATE 17.09.2012

SHEET 1 OF 2

#### <u>DESCRIPTION</u> <u>DATA</u>

1. Nos. required/working : Refer to Section-C of Specific technical requirement.

2. Location : Refer to Section-C of Specific technical requirement.

3. Service/type : Air Conditioning /Double skin.

4. Fan type : Centrifugal (forward/backward curve Blade) limit

load.

a) Capacity : To Suit as per calculation.

b) Static pressure : To suit but not less than 60 mm wc for AHU's Micro-V

filters.

c) Discharge direction : To suit layout.

d) Motor : By Bidder,

e) Local push button station

(Start/Stop)

: By Others

f) Motor location : Inside AHU Casing.

g) Drive : Belt, pulley, belt guard.

5. Face and Bypass Damper : Required (Opposed blade type) DX AHU's having

6. Cooling coil

a) Duty sensible heat : To suit as per calculations

b) Duty latent heat : -do-

c) Type of coil : Chilled Water/DX/Hot Water.

d) No. of rows : To suit but not less than four (4)

e) Material of tube /Thickness : Seamless Copper to ASTME-75/Equivalent.

f) Material of fins : Aluminium to SAE-1100-/1145-0

g) Number of fins : Not greater than 5 per cm (13 per inch).

h) Max. face velocity : 2.5 m/sec.

i) Air flow quantity : To suit as per tender drawings/documents.

7. 3 - way motorised mixing valve : Required with thermostat & actuator for chilled

with thermostat. water system for each AHU.



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8. Damper at discharge : Manually operated at discharge of each AHU

outlet

a) Material of construction : Mild Steel, galvanised.

9. Filters (Pre-filters)

a) Type & thickness : Dry panel type/ 50 mm

b) Filter area. : To suit as per velocity requirements. "V" - Bank.

c) Filter efficiency : Average arrestance efficiency of 65-80 %

d) Press drop (Clean) : Not to exceed 2.5 mmwc when clean & 6.5 mmwc

while dirty.

10. Humidification section : As per the System requirement.

a) Type : Pan type, unless otherwise specified.

b) Operation : Automatic with Humidification.

11. Fresh air arrangement : Required.

a) Fresh air fan : Tube axial flow fans with motor.

b) Accessories : i) Inlet cone with Bird screen.

: ii) Dry panel pre-filters,

: iii) High efficiency filters for control room areas.

: iv) Volume Control Dampers,

: v) Supports etc.

12. Vibration isolator

required.

: Yes

13. Type of vibration

isolator.

: Neoprene ribbed Rubber for AHU's.

14. Any other requirement : i) In addition to dry panel filters on AHU, High

efficiency filters(average arrestance efficiency of 80-90 %) shall be provided in supply air duct side of AHU for

all control room and allied areas.

: ii) Bidder to also provide suitable electrical strip heaters for winter heating & monsoon reheating with Contactor

box etc. Heaters to be interlocked with airstat.

15. Instrument & controls : Lot.(including Control box for strip heaters, pan humidifiers

etc. in each AHU room.)

16. Insulation of drain piping : Lot.



#### **TECHNICAL SPECIFICATION**

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