



DOCUMENT TITLE

CONDUITS AND PIPES

SPECIFICATION NO. PES-507-27

VOLUME II B

SECTION D

REVISION 0

DATE: 27/10/2010

SHEET 5 OF 6

viii) Electrical Characteristics

b) Acceptance tests - as per IS:9537 (Part 1 & 3)

i) Dimension checks

ii) Bending test

iii) Compression test

iv) Collapse test

v) Resistance to burning

vi) Electrical characteristics

5.4 Sampling for the tests shall be done as per applicable standards mentioned above.

5.5 The testing shall be carried out as per agreed quality plan.

6.0 PACKING

6.1 The material shall be packed as per manufacturer's standard. Packing procedure shall be to the purchaser's approval.

7.0 DRAWING, DATA AND DOCUMENTS REQUIRED

7.1 The following information shall be furnished within two weeks of award of contract, for purchaser's approval.

a) Manufacturing drawings/details.

b) Recommended Field quality plan covering site handling, storing, laying etc.

c) Final quality plan.

7.3 The following information shall be furnished after testing and inspection

Type Test, routine test and special test certificates in bound volume in requisite number.



DOCUMENT TITLE

CONDUITS AND PIPES

SPECIFICATION NO. PES-507-27

VOLUME II B

SECTION D

REVISION 0

DATE: 27/10/2010

SHEET 6 OF 6

DATASHEET A

SPECIFIC TECHNICAL REQUIREMENTS

- 1.0 APPLICABLE STANDARDS: IS:9537,IS: 1239, IS:3480
- 2.0 RIGID STEEL CONDUITS & STEEL PIPES
 - a) Material: Cold rolled mild steel to IS:226
 - b) Applicable standard
 - i) Upto 63mm OD: IS:9537 Part I & II
 - ii) Above 63mm OD: IS:1239
 - c) Surface treatment: Hot dip galvanizing inside & outside as per IS:2629
 - d) Wt. of zinc: as per IS 4759
 - e) Duty: Medium
 - f) Fittings: Screw type as per IS:2667
- 3.0 FLEXIBLE CONDUITS:
 - a) Material: Strip steel cold rolled and annealed
 - b) Standard applicable: IS: 3480
 - c) Surface treatment: Electro galvanized as per IS: 3480
 - d) Whether lead coated: YES
 - e) Minimum thickness: 25 microns
of zinc coating
- 4.0 PVC CONDUITS
 - a) Material: PVC
 - b) Applicable standard: IS: 9537 (Part I & III)

	Design Calculations For LT Cable Selection & Sizing	
	1 x 660MW BHUSAWAL T.P.S UNIT-6	

CONSTRUCTIONAL DETAILS OF CABLES SELECTED

(A) LT POWER & CONTROL CABLES

S.NO.	PARTICULARS	DETAILS	
		LT POWER CABLES	LT CONTROL CABLES
1	REFERENCE STANDARD	IS: 7098 -PART -1	IS -1554 PART -1
2	SYSTEM	415 V AC , 240 V AC & 220V DC	220V DC & 110 V AC
3	VOLTAGE GRADE	1.1 KV	1.1 KV
4	CONDUCTOR		
4.1	MATERIAL	STRANDED COMPACTED PLAIN ALUMINIUM CONDUCTOR OF H2 GRADE CLASS 2 / STRANDED HIGH CONDUCTIVITY ANNEALED PLAIN COPPER.	STRANDED,NON COMPACTED, HIGH CONDUCTIVITY ANNEALED PLAIN COPPER
4.2	REFERENCE STANDARD	IS 8130	IS 8130
4.3	SHAPE	CIRCULAR/ SHAPED	CIRCULAR
4.4	MINIMUM SIZE	ALUMINIUM- 16 SQ.MM. COPPER- 2.5 SQ. MM.	2.5 SQ.MM.
4.5	MAXIMUM CONDUCTOR TEMPERATURE WHEN CARRYING CONTINUOUSLY CURRENT	90°C	70°C
4.6	MAXIMUM CONDUCTOR TEMPERATURE AT THE TERMINATION OF SHORT CIRCUIT CURRENT	250°C	160°C
5	NO. OF CORES	1C,2C,3C,3.5C,4C	AS PER CLAUSE 4.2.1
6	INSULATION	EXTRUDED XLPE	EXTRUDED HRPVC, TYPE-C
6.1	REFERENCE STANDARD	IS: 7098 -PART -1	IS -5831 & IS-1554 PART-I
7	CORE IDENTIFICATION	BY COLOR CODING AS PER IS: 7098 - PART -1	i) CONTROL CABLES UPTO 5 CORE- COLOR CODING AS PER IS 1554 (Part-1) (ii) CONTROL CABLES ABOVE 5 CORES- BY NUMBERING AS PER IS 1554 (Part-1). INSULATION TO HAVE BLACK COLOR.
8	INNER SHEATH	EXTRUDED HRPVC FRLS TYPE -ST2 FOR MULTI CORE CABLES. SINGLE CORE SHALL HAVE NO INNER SHEATH.	EXTRUDED HRPVC TYPE -ST2 FRLS FOR MULTI CORE CABLES. SINGLE CORE SHALL HAVE NO INNER SHEATH.
8.1	REFERENCE STANDARD	IS: 5831 & IS-7098 PART-I	IS: 5831 & IS-1554 PART I
9	ARMOUR	NON-MAGNETIC HARD DRAWN ALUMINIUM ROUND WIRE ARMOUR OF H4 GRADE FOR SINGLE CORE CABLES AND GS ROUND STEEL WIRE ARMOUR FOR MULTI- CORE CABLES	GS ROUND STEEL WIRE ARMOUR FOR TWIN & MULTICORE CABLES
9.1	REFERENCE STANDARD	IS:3975 & IS 7098 PART I	IS 3975 & IS-1554 PART I
10	OUTER SHEATH	EXTRUDED FRLSH HRPVC TYPE ST2	EXTRUDED FRLSH HRPVC TYPE ST2
10.1	REFERENCE STANDARD	IS: 5831 & IS-7098 PART-I	IS: 5831
11	MARKING	(i) CABLE SIZE (CROSS SECTION AREA AND NO. OF CORES, VOLTAGE GRADE, WORD 'FRLS', REF. IS, TYPE OF CABLE, TYPE OF INSULATION/ SHEATH, MANUFACTURER'S NAME AND/OR TRADE NAME, YEAR OF MANUFACTURE-AT EVERY 5M (BY EMBOSSING), 'BHEL-PEM' and 'CUSTOMER' Name @5m (by embossing), (ii) PROGRESSIVE SEQUENTIAL MARKING OF LENGTH OF CABLE IN METERS- AT EVERY 1M (BY EMBOSSING/PRINTING)	
12	CABLE DRUMS		
12.1	TYPE OF DRUM	WOODEN (HEAVY CONSTRUCTION) AS PER IS 10418	
12.2	STANDARD DRUM LENGTH	500M FOR LARGER SIZES / 1000M FOR SMALLER SIZES (±) 5% (AS SPECIFIED IN BOQ)	
12.3	PAINTING	ENTIRE SURFACE TO BE PAINTED. ALL FERROUS PARTS USED SHALL BE TREATED WITH SUITABLE RUST PREVENTIVE FINISH OR COATING TO AVOID RUSTING DURING TRANSIT OR STORAGE. WOODEN CABLE DRUMS SHALL BE TREATED BY IMMERSING IN COPPER-NITRATE SOLUTION. DRUM NUMBER SHALL BE INDICATED ON EACH DRUM.	
12.4	OUTERMOST LAYER	TO BE COVERED WITH WATERPROOF POLYETHYLENE	
12.5	CONSTRUCTION	ALL WOODEN PARTS FROM SEASONED WOOD AND FERROUS PARTS SHALL BE TREATED WITH SUITABLE RUST PREVENTIVE FINISH OR COATING. WOODEN DRUM SHALL BE TREATED BY IMMERSING IN COPPER NITRATE SOLUTION.	

	Design Calculations For LT Cable Selection & Sizing	
	1 x 660MW BHUSAWAL T.P.S UNIT-6	

12.6	PARTICULAR INFORMATION ON DRUM	BOTH THE END OF CABLES SHALL BE PROPERLY SEALED WITH HEAT SHRINKABLE SEAL. THE CABLE DRUMS SHALL CARRY THE FOLLOWING DETAILS IN PRINTED FORM: A) MSPGCL B) MANUFACTURER'S NAME OR TRADE MAKE C) TYPE OF CABLE & VOLTAGE GRADE D) YEAR OF MANUFACTURE E) TYPE OF INSULATION E.G. XLPE/HRPVC/IE2 F) NO. OF CORE AND SIZES OF CABLES G) CABLE CODE E.G. FRLS/FS H) SINGLE LENGTH OF CABLE ON DRUM I) DIRECTION OF ROTATION, BY ARROW J) APPROX GROSS MASS
------	--------------------------------	---

(B) SCREENED CONTROL CABLES

S.NO.	PARTICULARS	DETAILS
1	VOLTAGE GRADE	1100V
2	TYPE OF CABLES	TYPE F (INDIVIDUAL & OVERALL SCREENED) & TYPE G (OVERALL SCREENED)
3	CODES AND STANDARD	IS-1554 PART-1, IS-5831, IS-8130, IS-694, SEN-4241475, IEC-60332 (I).
3(i)	CONDUCTOR	
(a)	CROSS SECTION AREA	0.5 sq.mm
(b)	CONDUCTOR MATERIAL	STRANDED, TINNED ANNEALED HIGH CONDUCTIVITY COPPER
(c)	CONDUCTOR GRADE	ELECTROLYTIC
(d)	NO. & DIA OF STRANDS	7 X 0.3 mm
(e)	NO. OF PAIRS	0.5 sq.mm. - 2P, 4P, 8P, 12P, 24P
(f)	REFERENCE STANDARD	IS-8130
(ii)	INSULATION	
(a)	MATERIAL	EXTRUDED HR PVC TYPE-C AS PER IS-5831
(b)	THICKNESS IN mm	0.6 (NOMINAL) AS PER IS-694
(c)	VOLUME RESISTIVITY (MIN) IN ohm-cm	i. 1×10^{13} Ohm-cm at 27 deg.C / room temp. (Min). ii. 1×10^{10} Ohm-cm at 85 deg.C (Min.)
(d)	VOLTAGE RATING	1100V
(e)	REFERENCE STANDARD	IS-1554 PART-1 & IS-5831
(f)	OD OF COND. INCLUDING INSULATION	AS PER MANUFACTURER'S CALCULATIONS / STD. PRACTICE
(iii)	PAIRING & TWISTING	
(a)	MAX. LAY OF PAIRS (mm)	60
(b)	CONDUCTOR /PAIR IDENTIFICATION	AS PER ATTACHED ANNEXURE D
4	SHIELDING	
(a)	TYPE OF SHIELDING	AL-MYLAR TAPE
(b)	INDIVIDUAL PAIR SHIELDING	TO BE PROVIDED FOR TYPE-F CABLE ONLY
(c)	OVERALL SHIELDING	TO BE PROVIDED FOR BOTH TYPE-F & TYPE-G CABLES
(d)	MINIMUM THICKNESS OF INDIVIDUAL PAIR SHIELDING	28 MICRONS
(e)	MINIMUM THICKNESS OF OVERALL CABLE ASSEMBLY SHIELDING	60 MICRONS
(f)	SHIELDING COVERAGE	100% WITH AT LEAST 25% OVERLAP
5	DRAIN WIRE (To be provided separately for individual pair shield and overall shield.)	
	Material	Multi stranded Annealed tinned copper drain wire.
	Size (No. of strands/ Dia. of each strand)	0.5 sq. mm. (7/0.3 mm.)
6	FILLERS (if applicable)	
(a)	TYPE	NON -HYGROSCOPIC WITH FRLS PROPERTY (AS REQUIRED FOR MAINTAINING CABLE CIRCULARITY)
7	INNER SHEATH	
(a)	MATERIAL	EXTRUDED HR PVC TYPE ST-2 AS PER IS-5831
(b)	THICKNESS	AS PER IS-1554 PART-1
(c)	Whether FR-LSH Applicable	YES
(d)	COLOUR	BLACK
(e)	REFERENCE STANDARD	IS-1554 PART-1 & IS-5831
8	RIP CORD	NON-METALLIC RIP CORD UNDER THE INNER SHEATH
9	ARMOUR	GALVANISED STEEL ROUND WIRE / STRIP AS PER IS-3975 & IS-1554 PART-1

	Design Calculations For LT Cable Selection & Sizing	
	1 x 660MW BHUSAWAL T.P.S UNIT-6	

10	OUTER SHEATH		
(a)	MATERIAL	EXTRUDED HR PVC TYPE ST-2 AS PER IS-5831	
(b)	THICKNESS	AS PER IS-1554 PART-1	
(c)	Whether FR-LSH Applicable	YES	
(d)	COLOUR	GREY	
(e)	REFERENCE STANDARD	IS-1554 PART-1 & IS-5831	
(f)	MARKING	(i) CABLE SIZE (CROSS SECTION AREA AND NO. OF CORES, VOLTAGE GRADE, WORD 'FRLS', REF. IS, TYPE OF CABLE, TYPE OF INSULATION/ SHEATH, MANUFACTURER'S NAME AND/OR TRADE NAME, YEAR OF MANUFACTURE-AT EVERY 5M (BY EMBOSSING), 'BHEL-PEM' and 'CUSTOMER' Name @5m (by embossing), (ii) PROGRESSIVE SEQUENTIAL MARKING OF LENGTH OF CABLE IN METERS- AT EVERY 1M (BY EMBOSSING/PRINTING)	
11	TECHNICAL PARAMETERS (C & I) AT 20 DEG C	0.5 sqmm (IS & OS) Type F	0.5 sqmm (OS) Type G
(a)	MUTUAL CAPACITANCE (MAX.) AT 0.8 KHz, nF / Km	120	100
(b)	CONDUCTOR LOOP RESISTANCE (MAX.), Ohm / Km	78	78
(c)	INSULATION RESISTANCE (MIN.), M Ohm / Km	100	100
(d)	CROSS TALK ATTENUATION (MIN.) AT 0.8KHz, dB / Km	60	60
(e)	CHARACTERISTIC IMPEDANCE (MAX.) AT 1KHz, Ohm	320	340
(f)	ATTENUATION (MAX.) AT 1KHz, dB / Km	1.2	1.2
12	FR-LSH CHARACTERISTICS		
(b)	SMOKE DENSITY RATING	Max. 60% (As per ASTM D 2843): Area under coverage.	
(c)	ACID GAS EMISSION	Max. 20% by weight (As per IEC-60754-1)	
(d)	OXYGEN INDEX	Min 29 at room temperature (As per ASTM D 2863)	
(e)	TEMPERATURE INDEX	Min. 250 deg.C at oxygen index value of 21 (As per ASTM D 2863)	
13	FLAMMABILITY TEST	(1) AS PER IEC-332-1 (2) Swedish Chimney test SEN-SS-424-1475-F3	
14	TEST VOLTAGE & DURATION (High Voltage Test)		
(a)	Core to core	1.5 kV for 1 minute	
(b)	Core to shield	1 kV for 1 minute	
15	CABLE DRUM DETAILS		
(a)	Material Type	Wooden, as per IS 10418	
(b)	Standard drum length	1000 metres: upto and including 12 Pairs. 500 metres: above 12 pairs.	
(c)	Tolerance on drum length	±5%	
(d)	Painting	ENTIRE SURFACE TO BE PAINTED. ALL FERROUS PARTS USED SHALL BE TREATED WITH SUITABLE RUST PREVENTIVE FINISH OR COATING TO AVOID RUSTING DURING TRANSIT OR STORAGE. WOODEN CABLE DRUMS SHALL BE TREATED BY IMMERSING IN COPPER-NITRATE SOLUTION. DRUM NUMBER SHALL BE INDICATED ON EACH DRUM.	
(e)	Outermost layer	TO BE COVERED WITH WATERPROOF POLYETHYLENE	
(f)	Construction	ALL WOODEN PARTS FROM SEASONED WOOD AND FERROUS PARTS SHALL BE TREATED WITH SUITABLE RUST PREVENTIVE FINISH OR COATING. WOODEN DRUM SHALL BE TREATED BY IMMERSING IN COPPER NITRATE SOLUTION.	



TITLE

LV MOTORS DATA SHEET-A

1X660 MW BHUSAWAL TPP

SPECIFICATION NO.

VOLUME II B

SECTION D

REV NO. 00 DATE 28.01.2019

SHEET 1 OF 1

- 1.0 Design ambient temperature : 50 °C
- 2.0 Maximum acceptable kW rating of LV motor: 160KW
- 3.0 Installation (Indoors/ Outdoors) : As required
- 4.0 Details of supply system
 - a) Rated voltage (with variation) : 415V $\pm$ 10%
 - b) Rated frequency (with variation) : 50 Hz (+5% and -5%)
 - c) Combined voltage & freq. variation : 10% (sum of absolute values)
 - d) System fault level at rated voltage : 50 kA for 1 sec
 - e) Short time rating for terminal boxes
 - o 90 kW and upto 160kW : 50 KA for 1 sec.
(Breaker controlled)
 - o Below 90 kW : 50 KA protected by fuse for 0.2 sec
(SFU + Contactor controlled)
 - f) LV System grounding : Effectively grounded
- 5.0 Class of insulation : Class 'F', with temp rise limited to class B.
- 6.0 Minimum voltage for starting : 80% of rated voltage
(As percentage of rated voltage)
- 7.0 Power cables data : Shall be given during Detailed engg
- 8.0 Earth Conductor Size & Material : Shall be given during Detailed engg
- 9.0 Space heater supply : 240 V, 1 ϕ , 50 Hz
- 10.0 Rating up to which Single phase motor : Acceptable below 0.20 kW
- 11.0 Additional tests : As per QP and customer motor spec
- 12.0 Flame-proof motor
 - a) Enclosure suitable (As per IS:2148) : As per requirement
 - b) Classification of Hazardous area : As per requirement
(As per IS: 5572 part-I)
- 13.0 Makes : As per ANNEXURE-I
- 14.0 Paint shade : RAL 7032
- 15.0 Degree of Protection of enclosure (motors): INDOOR IP-55
OUTDOOR IPW-55
- 16.0 Energy efficiency : IE3 as per IS:12615: 2011

❖ Also detail Customer spec. for Motors to be referred as enclosed with spec.

ANNEXURE-I

SUB-VENDOR LIST

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

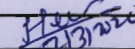
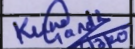
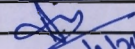
S.No.	LIST OF LT MOTORS
1.	BHARAT BIJLEE LTD.
2.	CROMPTON GREAVES
3.	ASEA BROWN BOVERI
4.	KIRLOSKAR ELECTRIC CO LTD.
5.	NGEF
6.	SIEMENS
7.	MARATHON
8.	GE-POWER
9.	RAJINDRA ELECT INDUSTRIES
10.	LAXMI HYDRAULICS PVT. LTD

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

[illegible]

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :		DATE: 27.02.2020
		CUSTOMER :		QP NO.: PED-506-00-Q-006, REV-02		
		PROJECT:		PO NO.:		
		ITEM: AC ELECT. MOTORS UPTO 55KW (LV (415V))		SYSTEM:	SECTION: II	

SI No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY		
1	2	3	4	5	6		7	8	9	*	**		
					M	C/N				D	M	C	N
1.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	-	MFG. SPEC.	MFG. SPEC.	-DO-		P	-	-
		2.DIMENSIONS	MA	-DO-	-DO-	-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	-DO-		P	-	-
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	-	MFG.SPEC./	MFG.SPEC.	-DO-		P	-	-
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	-	MFG. SPEC/ APPROVED DATASHEET	SAME AS COL.7	LOG BOOK		P	-	-
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST	MA	-DO-	100%	100%	IS-325 / IS-12615/ APPROVED DATA SHEET	SAME AS COL.7	TEST/ INSPN. REPORT		P	W	W
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET	TEST/ INSPN. REPORT		P	W	W
													NOTE -1 & NOTE-2
													NOTE -1 & NOTE-2

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		Hema K.	Checked by:		KUNAL GANDHI
Reviewed by:		P. Dutta	Reviewed by:		

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :		DATE:27.02.2020
		CUSTOMER :		QP NO.: PED-506-00-Q-006, REV-02		
		PROJECT:		PO NO.:		
		ITEM: AC ELECT. MOTORS UPTO 55KW (LV (415V))		SYSTEM:	SECTION: II	

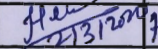
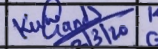
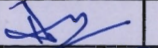
SI No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	.	..			
					M	C/N				D	M	C	N	
4.0	PACKING	3.NAMEPLATE DETAILS	MA	VISUAL	100%	100%	IS-325 / IS-12615 / APPROVED DATA SHEET	SAME AS COL.7	TEST/ INSPN. REPORT		P	W	W	#
		SURFACE FINISH & COMPLETENESS	MA	VISUAL	100%	100%	AS PER MFG. STANDARD / APPROVED PACKING DRAWING.(#)	AS PER MFG. STANDARD / APPROVED PACKING DRAWING.(#).	INSPC. REPORT		P	W	-	
#														

NOTES:

- 1 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL/CUSTOMER SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON
- 2 FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW , ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY.
- 3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE, THESE TEST MAY NOT BE REPEATED.
- 4 BHEL RESERVES THE RIGHT TO PERFORM REPEAT TEST, IF REQUIRED.
- 5 AFTER PACKING AND PRIOR TO ISSUE MDCC, PHOTOGRAPHS OF ITEMS TO BE DESPATCHED SHALL BE SENT TO BHEL FOR REVIEW.
- 6 IN CASE , ANY CHANGES IN QP COMMENTED BY CUSTOMER AT CONTRACT STAGE SHALL BE CARRIED OUT BY BIDDER WITHOUT ANY IMPLICATION TO BHEL/ CUSTOMER.

LEGENDS:

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

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		Hema K.	Checked by:		KUNAL GANDHI
Reviewed by:		P. D. H. S.	Reviewed by:		

02/3/2020

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO.:		DATE: 27.02.2020
		CUSTOMER :		QP NO.: PED-506-00-Q-007, REV-04		
		PROJECT:		PO NO.:		
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))	SYSTEM:	SECTION: II	SHEET 1 OF 9	

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

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	<i>Hema K.</i>	Hema K.	Checked by:	<i>P. Datta</i>	P. Datta
Reviewed by:	<i>2/3/2020</i>		Reviewed by:		

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO.:		DATE: 27.02.2020 SHEET 2 OF 9
		CUSTOMER:		QP NO.: PED-506-00-Q-007, REV-04		
		PROJECT:		PO NO.:		
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))	SYSTEM:	SECTION: II		

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

BHEL					
ENGINEERING			QUALITY		
Sign & Date	Name		Sign & Date	Name	
Prepared by: <i>[Signature]</i>	Hema K.		Checked by: <i>[Signature]</i>	KUNAL GANDHI	
Reviewed by: <i>[Signature]</i>	P. DUTTA		Reviewed by:		

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO.:	DATE: 27.02.2020
		CUSTOMER :		QP NO.: PED-506-00-Q-007, REV-04	
		PROJECT:		PO NO.:	
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))	SYSTEM:	SECTION: II	SHEET 3 OF 9

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

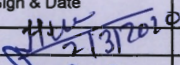
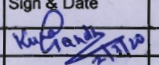
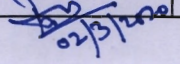
BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	<i>[Signature]</i>	Hema K.	Checked by:	<i>[Signature]</i>	KUNAL GANDHI
Reviewed by:	<i>[Signature]</i>	P. Dutt	Reviewed by:		

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO.:		DATE: 27.02.2020
		CUSTOMER :		QP NO.: PED-506-00-Q-007, REV-04		
		PROJECT:		PO NO.:		
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))	SYSTEM:	SECTION: II	SHEET 4 OF 9	

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

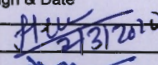
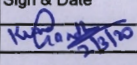
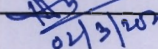
BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		Hema K.	Checked by:		RUNAL CHANDRA
Reviewed by:		P. Dutta	Reviewed by:		

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :		DATE: 27.02.2020
		CUSTOMER :		QP NO.: PED-506-00-Q-007, REV-04		
		PROJECT:		PO NO.:		
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))		SYSTEM:	SECTION: II	SHEET 5 OF 9

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

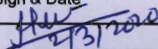
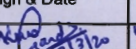
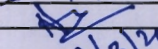
BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		Hema K.	Checked by:		KUNAL CHANDNI
Reviewed by:		P. Datta	Reviewed by:		

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO.:	DATE: 27.02.2020
		CUSTOMER :		QP NO.: PED-506-00-Q-007, REV-04	
		PROJECT:		PO NO.:	
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))	SYSTEM:	SECTION: II	SHEET 6 OF 9

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

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		Hema K.	Checked by:		KUNAL GANDHI
Reviewed by:		P. DUTTA	Reviewed by:		

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO.:		DATE: 27.02.2020
		CUSTOMER :		QP NO.: PED-506-00-Q-007, REV-04		
		PROJECT:		PO NO.:		
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))	SYSTEM:	SECTION: II	SHEET 7 OF 9	

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

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	<i>[Signature]</i>	Hema K.	Checked by:	<i>[Signature]</i>	RUNAL GANDHI
Reviewed by:	<i>[Signature]</i>	P. DUTTA	Reviewed by:		

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO.:		DATE: 27.02.2020
		CUSTOMER :		QP NO.: PED-506-00-Q-007, REV-04		
		PROJECT:		PO NO.:		
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))	SYSTEM:	SECTION: II	SHEET 8 OF 9	

SI No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY			
1	2	3	4	5	6		7	8	9	.	..			
					M	C/N				D	M	C	N	
3.0	TESTS	1.TYPE TESTS INCLUDING SPECIAL TESTS	MA	ELECT.TEST	1/TYPE/SIZE	1/TYPE/SIZE	IS-325//IS-12615/APPROVED DATASHEET	IS-325//IS-12615/APPROVED DATASHEET	TEST REPORT		P	W*	W*	* NOTE - 1
		2.ROUTINE TESTS INCLUDING SPECIAL TEST	MA	-DO-	100%	100%	-DO-	-DO-	-DO-		P	V/W [§]	V/W [§]	§NOTE - 2
		3.VIBRATION & NOISE LEVEL	MA	-DO-	100%	100%	IS: 12075 / IEC 60034-14 & IS-12065	IS: 12075 / IEC 60034-14 & IS-12065	-DO-		P	V/W [§]	V/W [§]	§NOTE - 2
		4.OVERALL DIMENSIONS AND ORIENTATION	MA	MEASUREMENT & VISUAL	100%	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET &	TEST//NSPC. REPORT		P	W	-	
		5.DEGREE OF PROTECTION	MA	ELECT. & MECH. TEST	1/TYPE/ SIZE	1/TYPE/ SIZE	IEC 60034-5//IS-12615	APPROVED DATASHEET	TC	✓	P	V	V	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		6. MEASUREMENT OF RESISTANCE OF RTD & BTD	MA	-DO-	100%	100%	IS-325//IS-12615/IEC-60034 PART-1//S: 12802	IS-325//IS-12615/IEC-60034 PART-1//S: 12802	-DO-		P	V/W [§]	V/W [§]	§ NOTE - 2
		7. MEASUREMENT OF RESISTANCE, IR OF SPACE HEATER	MA	-DO-	100%	100%	IS-325//IS-12615/IEC-60034 PART-1	IS-325//IS-12615/IEC-60034 PART-1	-DO-		P	V/W [§]	V/W [§]	§ NOTE - 2
		8. NAME PLATE DETAILS	MA	VISUAL	100%	100%	IS-325//IS-12615& DATA SHEET	IS-325//IS-12615 & DATA SHEET	TEST//NSPC. REPORT		P	V/W [§]	V/W [§]	§ NOTE - 2
		9.EXPLOSION FLAME PROOF NESS (IF SPECIFIED)	MA	EXPLOSION FLAME PROOF TEST	1/TYPE	1/TYPE	IS 2148 / IEC 60079-1	IS 2148 / IEC 60079-1	TC	✓	P	V	V	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		10. PAINT SHADE, THICKNESS & FINISH	MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	SAMPLE	APPROVED DATASHEET	APPROVED DATASHEET	TC		P	W\$	W\$	SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY § NOTE - 2

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	<i>[Signature]</i>	Hema K.	Checked by:	<i>[Signature]</i>	KUNAL GANDHI
Reviewed by:	<i>[Signature]</i>	P. Datta	Reviewed by:		

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO.:		DATE: 27.02.2020
		CUSTOMER :		QP NO.: PED-506-00-Q-007, REV-04		
		PROJECT:		PO NO.:		
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))	SYSTEM:	SECTION: II	SHEET 9 OF 9	

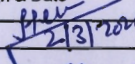
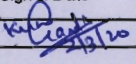
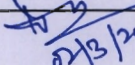
SI No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY		
1	2	3	4	5	6		7	8	9	.	..		
					M	C/N				D	M	C	N
4.0	PACKING	SURFACE FINISH & COMPLETENESS	MA	VISUAL	100%	100%	AS PER MANUFACT. STANDARD / APPROVED CROSS SECTION DRAWING.	AS PER MANUFACT. STANDARD / APPROVED CROSS SECTION DRAWING.	INSPC. REPORT		P	W	-

NOTES:

- 1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED.
- 2 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL/CUSTOMER SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON.
- 3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE, THESE TEST MAY NOT BE REPEATED.
- 4 BHEL RESERVES THE RIGHT TO PERFORM REPEAT TEST, IF REQUIRED.
- 5 AFTER PACKING AND PRIOR TO ISSUE MDCC, PHOTOGRAPHS OF ITEMS TO BE DESPATCHED SHALL BE SENT TO BHEL PURCHASE GROUP FOR REVIEW.
- 6 IN CASE , ANY CHANGES IN QP COMMENTED BY CUSTOMER AT CONTRACT STAGE SHALL BE CARRIED OUT BY BIDDER WITHOUT ANY IMPLICATION TO BHEL/ CUSTOMER.

LEGENDS:

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

BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		Hema K.	Checked by:		KUNAL GANDHI
Reviewed by:		P. Dutt	Reviewed by:		

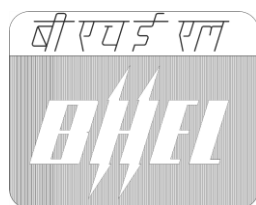
BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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

1X660 MW BHUSAWAL TPP UNIT 6

TECHNICAL SPECIFICATION
FOR
FUEL OIL UNLOADING & STORAGE SYSTEM

SECTION - IC
C&I PORTION SPECIFICATION.



BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR PROJECT ENGINEERING MANAGEMENT
PPEI, NOIDA-INDIA

	1X660 MW Bhusawal STPP	SECTION: C SUB SECTION : C&I

**CONTROL AND INSTRUMENTATION
SPECIFICATION
FOR
FUEL OIL HANDLING SYSTEM**

|

	1X660 MW Bhusawal STPP	SECTION: C SUB SECTION : C&I

TABLE OF CONTENTS

- A. General & Specific Technical requirement
- B. C&I deliverables list
- C. Specification for Motorized valve actuator
- D. Specification for field instruments
- E. Control panels specification
- F. Applicable codes and standards
- G. Specification for Quality assurance & Testing
- H. Mandatory spares
- I. Drawings

	1X660 MW Bhusawal STPP	SECTION: C SUB SECTION : C&I
GENERAL & SPECIFIC TECHNICAL REQUIREMENT		

	1X660 MW Bhusawal STPP	SECTION: C SUB SECTION : C&I

GENERAL REQUIREMENT

1.0 Bidder shall provide complete and independent control & instrumentation system with all accessories, auxiliaries and associated equipments for the safe, efficient and reliable operation of auxiliary systems.

2.0. The quantity of instruments for auxiliary system shall be as per tender P & ID, wherever provided, for the respective system as a minimum for bidding purpose. However, Bidder shall also include in his proposal all the instruments and devices that are needed for the completeness of the plant auxiliary system/ equipment supplied by the bidder, even if the same is not specifically appearing in the P & ID. During detail engineering if any additional instruments are required for safe & reliable operation of plant, bidder shall supply the same without any price implication.

3.0 Measuring instruments/equipment and subsystems offered by the bidder shall be from reputed experienced manufacturers of specified type and range of equipment, whose guaranteed and trouble free operation has been proven. Further all the instruments shall be of proven reliability, accuracy, and acceptable international standards and shall be subject to employer's approval. All instrumentation equipment and accessories under this specification shall be furnished as per technical specification, ranges, makes/ numbers as approved by the employer' during detail engineering.

4.0 The necessary root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifold and all the other accessories required for mounting/ erection of these local instruments shall be furnished, even if not specifically asked for, on as required basis. The contacts of equipment mounted instruments; sensors, switches etc for external connection including spare contacts shall be wired out to suitably located junction boxes.

5.0 In case of any contradiction most stringent clause/condition shall prevail.

	1X660 MW Bhusawal STPP	SECTION: C SUB SECTION : C&I

Specific Technical Requirements (C&I):

1) The control of Fuel Oil Handling System shall be DCS based. The operation and control philosophy of Fuel Oil handling system shall be as per design memorandum given elsewhere in the specification. Bidder to provide Local Control Panel for Fuel Oil Unloading System. The pumps, motorized valves, control valves etc. shall be operated from Lamp /Pushbuttons, selector switches etc. located on the Local Control panel. Integral type hardware annunciation system shall be provided at the top of the panel for alarm monitoring. Bidder to provide FO tank, Drain oil tank, OWS, Sump etc. level indication and FO storage tank temperature and drain oil tanks temperature indications on the Local Control Panel. Three nos. laptop units loaded with software shall be provided by the bidder.

2) All electrical actuators shall be integral type.

3) The make/model of various instruments/items/systems shall be subject to approval of owner/purchaser during detailed engineering stage. No commercial implication in this regard shall be acceptable. In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with.

4) All instruments provided on piping/equipment and junction boxes on Fuel oil services shall be explosion proof. Explosion proof certificate to be furnished by the bidder during contract stage.

5) For pressure/differential pressure measurement, instruments shall be provided with diaphragm seal.

6) Non-contact radar type level transmitters, mechanical type level gauges, level switches, temperature elements & gauges etc. as applicable shall be provided on fuel oil tanks, drain oil tank, OWS, sump etc. for control & monitoring.

~~7) Coriolis type mass flowmeter in HFO and LDO discharge header shall be provided.~~

8) Power supply shall be provided by BHEL at a single point. Further distribution to various instruments shall be in Bidder's scope. Bidder to include necessary power distribution board (ACDB)(as per details attached elsewhere in this specification) in his scope. Any power supply other than the above, if required by any instrument/device, has to be derived by the Bidder from the

	1X660 MW Bhusawal STPP	SECTION: C SUB SECTION : C&I

above supply and all necessary hardware for the same shall be in bidder's scope. Bidder to furnish UPS power requirement along with the bid.

9) The solenoid valves shall have limit switches for open/close feedback.

10) SMART positioner shall be provided for control valves.

11) All the instruments/drives shall be terminated on JBs/Panels in field. JBs/Panels shall be in Bidder's scope. RTD's shall be of duplex type.

12) Scope of Instrumentation cables (Screened Control Cables), Fibre Optic cable & Control cables shall be as per Electrical Cable scope matrix in Electrical portion of specification. Any cable in Bidder's scope shall be as per specification.

13) Atleast 10% spare channels and window facia shall be provided in each annunciator group in the local control panel.

14) Bidder to comply with codes and standards as mentioned in the specification.

15) All local gauges, transmitters and switches shall be mounted on suitable enclosures, racks subject to owner's approval. All transmitters shall be HART compatible.

16) Bidder to delegate /depute their persons/experts as per owner/consultants' requirement.

17) Bidder must offer general tools and tackles and special calibration instruments required during start-up, trial run, operation and maintenance of the system.

18) The above given scope is indicative & minimum. Any item/ equipment not indicated above however required for the completeness of the system is to be supplied by bidder without any technical, commercial and delivery implication to BHEL.

	1X660 MW Bhusawal STPP	SECTION: C SUB SECTION : C&I
C&I DELIVERABLES LIST		

LIST OF DELIVERABLES OF PEM - C&I DEPARTMENT						
1X660 MW BHUSAWAL TPP						
Sl.No.	DRAWING NO.	DRAWING/DOCUMENT TITLE	CUSTOMER	FROM	USER	REMARKS
INSTRUMENTATION						
1	PE-V9-415-XXX-I901	INSTRUMENT DATA SHEETS	-	VENDOR	C&I	
2	PE-V9-415-XXX-I902	INSTRUMENT SCHEDULE	-	VENDOR	C&I	
3	PE-V9-415-XXX-I903	INSTRUMENT INSTALLATION/ HOOK UP DIAGRAMS	-	VENDOR	C&I	
5	PE-V9-415-XXX-I905	INSTRUMENT QP/CHECK LIST	-	VENDOR	C&I	
LOCAL CONTROL PANEL						
1	PE-V9-415-XXX-I950	LOCAL CONTROL PANEL DATASHEET	A	VENDOR	C&I	
2	PE-V9-415-XXX-I951	WIRING DIAGRAM	-	VENDOR	C&I	
3	PE-V9-415-XXX-I952	PANEL GA DRAWINGS	-	VENDOR	C&I	
8	PE-V9-415-XXX-I956	BILL OF MATERIAL	-	VENDOR	C&I	
13	PE-V9-415-XXX-I957	LOCAL CONTROL PANEL QUALITY PLAN	`	VENDOR	C&I	
14	PE-V9-415-XXX-I958	LOCAL CONTROL PANEL O&M MANUAL	-	VENDOR	C&I	
19	PE-V9-415-XXX-I925	MANDATORY SPARES BILL OF MATERIAL	A	VENDOR	C&I	
	Notes:	415 - Project No.				
		XXX -MAX Package Code				
		\$\$ -Approval by BHEL if Vendor BBU Item. Approval by Customer if Customer BBU Item				

	1X660 MW Bhusawal STPP	SECTION: C SUB SECTION : C&I

SPECIFICATION FOR MOTORISED VALVE ACTUATOR

|

 MAHAGENCO MAHARASHTRA STATE POWER GENERATION CO. LTD.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: IV-A
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 11
REV: R0	ELECTRICAL EQUIPMENT & ACCESSORIES	Page 385 of 440
1.0 <u>SCOPE</u> 1.1 This Section covers the general requirements of Electric Motor Actuators for valves, dampers and gates. 1.2 All electric motor actuators shall be furnished in accordance with this general specification and the accompanying driven equipment specification. 2.0 <u>STANDARDS</u> 2.1 All electrical equipment shall conform to the latest applicable IS, ANSI and NEMA Standards, except when stated otherwise herein or in driven equipment specification. 2.2 Major standards, which shall be followed, are listed below. Other applicable Indian Standards for any component part even if not covered in the listed standards shall also be followed: (a) IS-9334 (b) IS-325 3.0 <u>SERVICE CONDITIONS</u> 3.1 The actuator shall be suitable for operation in hot, humid and tropical atmosphere, highly polluted at places with coal dust and/or fly ash. 3.2 Unless otherwise noted, electrical equipment/system design shall be based on the service conditions and auxiliary power supply given in the general specification. 4.0 <u>RATING</u> 4.1 For isolating service, the actuator shall be rated for three successive open-close operation of the valve/damper or 15 minutes, whichever is longer. 4.2 For regulating service, the actuator shall be suitably time-rated for the duty cycle involved with necessary number of starts per hour, but in no case less than 150 starts per hour.		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: IV-A
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 11
REV: R0	ELECTRICAL EQUIPMENT & ACCESSORIES	Page 386 of 440

5.0 **PERFORMANCE**

The actuator shall meet the following performance requirements:

- 5.1 Open and close the valve completely and make leak-tight valve closure without jamming.
- 5.2 Attain full speed operation before valve load is encountered and impart an unseating blow to start the valve in motion (hammer blow effect).
- 5.3 Operate the valve stem at standard stem speed and shall function against design differential pressure across the valve seat.
- 5.4 The motor reduction gearing shall be sufficient to lock the shaft when the motor is de-energised and prevent drift from torque switch spring pressure.
- 5.5 The entire mechanism shall withstand shock resulting from closing with improper setting of limit switches or from lodging of foreign matter under the valve seat.

6.0 **SPECIFIC REQUIREMENT**

6.1 **CONSTRUCTION**

- 6.1.1 The actuator shall essentially comprise the drive motor, torque/ limit switches, gear train, clutch, hand wheel, position indicator/ transmitter, in-built thermostat for over load protection, space heater and internal wiring. Actuator shall be integral type. Integral starter shall have facility to hook-up with Plant DCS for positioning of limit and torque switches.
- 6.1.2 The actuator enclosure shall be totally enclosed, dust tight, weather-proof suitable for outdoor use without necessity of any canopy.
- 6.1.3 All electrical equipment, accessories and wiring shall be provided with tropical finish to prevent fungus growth.
- 6.1.4 The actuator shall be designed for mounting in any position without any lubricant leakage or operating difficulty.

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO MAHARASHTRA STATE POWER GENERATION CO. LTD.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: IV-A
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 11
REV: R0	ELECTRICAL EQUIPMENT & ACCESSORIES	Page 387 of 440
6.2 <u>MOTOR</u> 6.2.1 The drive motor shall be three phase, squirrel cage, induction machine with minimum class B insulation and IPW-55 enclosure, designed for high torque and reversing service. 6.2.2 The motor shall be designed for full voltage direct on-line start, with starting current limited to 6 times full-load current. 6.2.3 The motor shall be capable of starting at 85 percent of rated voltage and running at 80 percent of rated voltage at rated torque and 85 percent rated voltage at 33 percent excess rated torque for a period of 5 minutes each. 6.2.4 Earthing terminals shall be provided on either side of the motor. 6.3 <u>LIMIT SWITCHES</u> Each actuator shall be provided with following limit switches: 6.3.1 Two (2) torque limit switches, one for each direction of travel, self-locking, adjustable torque type. 6.3.2 Four (4) end-of-travel limit switches, two for each direction of travel. 6.3.3 Two (2) position limit switches, one for each direction of travel, each adjustable at any position from fully open to fully closed positions of the valve/damper. 6.3.4 Each limit switch shall have 2 NO + 2 NC potential free contacts. Contact rating shall be 5A at 240V A.C. or 0.5A at 220V D.C. 6.4 <u>HAND WHEEL</u> Each actuator shall be provided with a hand wheel for emergency manual operation. The hand wheel shall declutch automatically when the motor is energized.		

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume: IV-A
	BID SPECIFICATION NO.: DG/BSL U-6/2011/T-1	Section – 12
REV: R0	ELECTRICAL EQUIPMENT & ACCESSORIES	Page 388 of 440
6.5 <u>POSITION INDICATOR/TRANSMITTER</u> The actuator shall have: 6.5.1 One (1) built-in local position indicator for 0-100% travel 6.5.2 One (1) position transmitter, potentiometer type, for remote indicator. 6.6 <u>SPACE HEATER</u> A space heater shall be included in the limit switch compartment suitable for 240V, 1 phase, 50 Hz supply. 6.7 <u>WIRING</u> All electrical devices shall be wired up to and terminated in a terminal box. The internal wiring shall be of sufficient size for the power rating involved but in no case less than 1.5 Sq.mm copper. All wiring shall be identified at both ends with ferrules. 6.8 <u>TERMINAL BOX</u> The terminal box shall be weather proof, with removable front cover and cable glands for cable connection. The terminal shall be suitable for connection of 2.5 Sq.mm copper conductor. 7.0 <u>TEST</u> 7.1 The actuator and all components thereof shall be subject to tests as per relevant Standards. In addition, if any special test is called for in equipment specification, the same shall be performed. 7.2 <u>TEST WITNESS:</u> Test shall be performed in presence of Owner/Purchaser's representative so desired by the Owner/Purchaser. The Contractor shall give at least fifteen (15) days advance notice of the date when the tests are to be carried out.		

CONSULTANT : PROCON ENGINEERS



Size A3

	1X660 MW Bhusawal STPP	SECTION: C SUB SECTION : C&I
SPECIFICATION FOR FIELD INSTRUMENTS		

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 221 of 718
SR. NO.	ITEM	DESCRIPTION	
1.0	<u>FIELD INSTRUMENTS</u>		
	This section provides general hardware guidelines for field instruments and equipment to be supplied under this specification.		
1.1	<u>PRESSURE TRANSMITTER</u>		
1.1.1	Working Principle	SMART, HART Protocol.	
1.1.2	Type	2 – Wire.	
1.1.3	Output Signal	4-20 mA DC.	
1.1.4	Signal Processing	Silicon solid state electronic circuitry.	
1.1.5	Measuring Element	Capsule/Diaphragm.	
1.1.6	Element material	AISI-316 (Stainless Steel) or better.	
1.1.7	Static Pressure	150 % of maximum span continuously, without affecting the calibration.	
1.1.8	Turn-down ratio	100:1	
1.1.9	Span and Zero	Locally adjustable non-interacting. Facility for elevation and suppression by 100% of span.	
1.1.10	Enclosure Class	IP-65.	
1.1.11	Output Indicator	LCD Type.	
1.1.12	Nameplate	Tag number, service engraved in SS tag plate.	
1.1.13	Body	Forged Carbon Steel for air and flue gas application and SS for other	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 222 of 718
SR. NO.	ITEM	DESCRIPTION	
		application.	
1.1.14	Operating Voltage	16 - 48 Volts D.C.	
1.1.15	Load	600 Ohms (min.) at 24 Volts D.C.	
1.1.16	Ambient Temperature	0 - 50 °C.	
1.1.17	Performance :		
	(a) Accuracy	± 0.1% of Span or better.	
	(b) Repeatability	± 0.05% of Span or better.	
	(c) Stability	a) +/- 0.1% of calibrated span for 5 year for ranges upto and including 70 Kg/cm ² b) +/- 0.25% of calibrated span for 5 years for ranges more than 70 kg/cm ² (g)	
1.1.18	Sealing/Isolation	Extended diaphragm with 5 meters SS armoured capillary for viscous fluid applications.	
1.1.19	Accessories	(a) Universal mounting bracket suitable for 2" pipe mounting.	
		(b) High tensile carbon steel U- bolts.	
		(c) Siphon for steam and hot water services.	
		(d) ½" NPT 2-valve stainless steel manifold, constructed from SS316 bar stock.	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 223 of 718
SR. NO.	ITEM	DESCRIPTION	
		(e) Companion flange with nuts, bolts and gaskets.	
		(f) Hand held configuration kit for calibration of SMART Transmitter.	
		(g) ½" NPT cable gland.	
1.2	<u>DIFFERENTIAL PRESSURE TRANSMITTER/FLOW TRANSMITTER</u>		
1.2.1	Working Principle	SMART, HART Protocol.	
1.2.2	Type	2-Wire.	
1.2.3	Output signal	4-20 mA DC.	
1.2.4	Signal Processing Unit	Silicon solid-state electronic circuitry.	
1.2.5	Measuring element	Capsule/Diaphragm.	
1.2.6	Element material	AISI-316 (Stainless Steel) or better.	
1.2.7	Static Pressure/Overload Pressure	Maximum line (or static) pressure on either side without permanent deformation or loss of accuracy.	
1.2.8	Turn-down ratio	100 : 1 minimum.	
1.2.9	Span and Zero	Locally adjustable, non-interacting.	
1.2.10	Enclosure class	IP-65.	
1.2.11	Zero suppression/elevation	At least 100% of Span.	
1.2.12	Output Indicator	LCD Type.	
1.2.13	Nameplate	Tag number and Service engraved in SS tag plate.	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 224 of 718
SR. NO.	ITEM	DESCRIPTION	
1.2.14	Body	Forged Carbon Steel for air and flue gas application and SS for other application.	
1.2.15	Ambient temperature	0 - 50 °C.	
1.2.16	Operating Voltage	16 - 48 Volts DC.	
1.2.17	Load	600 Ohms (min.) at 24 Volts DC.	
1.2.18	Performance:		
	(a) Accuracy	±0.1 % of span or better.	
	(b) Repeatability	± 0.05 % of span or better.	
	(c) Stability	a) +/- 0.1% of calibrated span for 5 year for ranges upto and including 70 Kg/cm ² b) +/- 0.25% of calibrated span for 5 years for ranges more than 70 kg/cm ² (g)	
1.2.19	Sealing / Isolation	Extended diaphragm with 5 meters SS armoured capillary for viscous fluid applications.	
1.2.20	Accessories	(a) Universal mounting bracket suitable for 2" pipe mounting.	
		(b) High tensile carbon steel U-bolts.	
		(c) Siphon for steam and hot water services.	
		(d) Companion flange with nuts, bolts and gaskets.	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 225 of 718
SR. NO.	ITEM	DESCRIPTION	
		(e) Hand held configurator kit for calibration of SMART Transmitter	
		(f) ½" NPT cable gland.	
		(g) ½" NPT generally 5-valve stainless steel manifold, constructed from SS316 bar stock. 3 valve manifold for DP application in flue gas and air.	
1.3	<u>DISPLACER TYPE LEVEL TRANSMITTERS</u>		
1.3.1	Type	SMART, HART Protocol.	
1.3.2	Stages of operation	Continuous.	
1.3.3	Material -		
(a)	Displacer	AISI 316 SS.	
(b)	Suspension wire	AISI 316 SS.	
(c)	Torque tube housing	Carbon steel or SS as per application.	
(d)	Torque tube	Inconel.	
(e)	Displacer chamber	CS or SS as per process application.	
(f)	Transmitter Housing	Die cast Aluminium or better.	
1.3.4	Operating Voltage	16-48 Volts D.C.	
1.3.5	Transmission	2-wire.	
1.3.6	Output Signal	4-20 mA DC.	
1.3.7	Signal processing	Solid-state electronic circuitry.	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 226 of 718
SR. NO.	ITEM	DESCRIPTION	
1.3.8	Static / overload pressure	Maximum static pressure without permanent deformation or loss of accuracy.	
1.3.9	Turn-down ratio	10 : 1 or better.	
1.3.10	Zero & Span	Easily accessible (local zero & span adjustment and non-interactive type).	
1.3.11	Enclosure Class	IP-65.	
1.3.12	Output Indicator	LCD type.	
1.3.13	Nameplate	Tag number and Service engraved in stainless steel tag plate.	
1.3.14	Ambient Temperature	0 - 50° C.	
1.3.15	Load Impedance	600 Ohms at 24 Volts (minimum).	
1.3.16	Process Connection	2" Companion flange with nuts, bolts and gaskets.	
1.3.17	Performance -		
	(a) Accuracy	±0.5 % of span or better.	
	(b) Stability	a) +/- 0.1% of calibrated span for 5 year for ranges upto and including 70 Kg/cm ² b) +/- 0.25% of calibrated span for 5 years for ranges more than 70 kg/cm ² (g)	
1.3.18	Accessories	(a) Counter Flange, nuts, bolts, gaskets etc.	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 227 of 718
SR. NO.	ITEM	DESCRIPTION	
		(b) Weights for 5 point calibration of instruments.	
		(c) Vent and drain plugs.	
		(d) Special calibration tool / configuration, if any.	
		(e) ½"NPT cable gland.	
1.3.19	Preferred Features	(a) Test plug connection and cutout terminals physically separated from other electronics.	
		(b) Electronic Damping facility (adjustable).	
1.4	<u>MASS FLOW METER</u>		
1.4.1	Sensor		
1.4.1.1	Measuring Principle	Coriolis Mass flow.	
1.4.1.2	Primary Element	Flow Tube of 316SS or better.	
1.4.1.3	Heating Arrangement	Integral.	
1.4.1.4	Temperature Control	For heavy fuel oil application.	
1.4.1.5	Process Connection	Flanged of rating as per process requirement.	
1.4.1.6	Drain	Self-draining facility.	
1.4.1.7	Enclosure	Stainless steel.	
1.4.1.8	Accessories	Counter flanges, Mounting nuts, bolts, gaskets etc.	
1.4.2	Transmitter		

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 228 of 718
SR. NO.	ITEM	DESCRIPTION	
1.4.2.1	Measured quantities	Mass Flow rate, Total Mass Flow, Density, Temperature.	
1.4.2.2	Input Signal Processing	Digital Processing.	
1.4.2.3	Display	Digital Display LCD Type.	
1.4.2.4	Output	2 off isolated 4-20mA DC output.	
1.4.2.5	Load	< 750 ohms.	
1.4.2.6	Power supply	240V AC, 50 Hz.	
1.4.2.7	Turn Down	100:1.	
1.4.2.8	Accuracy	± 0.2 % of measured value.	
1.4.2.9	Housing	IP 65.	
1.4.2.10	Nameplate	Tag number, service engraved in stainless steel tag plate.	
1.4.2.11	Accessories	(a) Handheld configurator.	
		(b) Mounting U-bolts, nuts, bolts, prefab cable etc.	
		(c) ½"NPT cable gland.	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1	Section – 5
REV: R0	CONTROL & INSTRUMENTATION	Page 231 of 718

1.7	<u>PRESSURE GAUGE AND DIFFERENTIAL PRESSURE GAUGE</u>	
1.7.1	Type	Bourdon / Bellows / Diaphragm.
1.7.2	Sensing & Socket	AISI-316 SS.
1.7.3	Movement Material	AISI-304 SS.
1.7.4	Case Material	Stainless steel, IP-65.
1.7.5	Dial Size	Generally 150 mm.
1.7.6	Scale	Black lettering on white in 270 ° arc.

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 232 of 718
SR. NO.	ITEM	DESCRIPTION	
1.7.7	Window	Shatterproof glass.	
1.7.8	Range Selection	Normal process pressure: 50~70% of range.	
1.7.9	Over-range Protection	125% of maximum range by internal stop. External stop at zero.	
1.7.10	Adjustment	Micrometer screw for zero. Internal micrometer screw for range.	
1.7.11	Element Connection	Argon welding.	
1.7.12	Process Connection	1/2" NPT(M) Bottom for local, back for panel mounting.	
1.7.13	Performance	Accuracy of ± 1.0 % of span or better.	
1.7.14	Operating ambient	0 - 50 °C.	
1.7.15	Safety Feature	Blow out disc /diaphragm at the back.	
1.7.16	Accessories	(a) Snubbers and Glycerin filled for pulsating fluid applications and at pump discharge.	
		(b) Stainless steel Diaphragm seals for viscous fluids	
		(c) 3-Way SS316 Gauge cock for pressure gauges.	
		(d) 5-valve SS316 manifold from barstock for differential pressure gauge.	
		(e) Siphons for steam and hot water services.	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 233 of 718
SR. NO.	ITEM	DESCRIPTION	
1.7.17	Applicable standard	IS-3624 / 1996.	
1.7.18	Nameplate	Tag number, service engraved in stainless steel tag plate.	
1.8	<u>TEMPERATURE GAUGE</u>		
1.8.1	Type	Mercury or gas filled.	
1.8.2	Sensing Element Material	Bourdon - AISI-316 SS.	
1.8.3	Capillary Armoring	Stainless steel flexible.	
1.8.4	Movement Material	AISI 304 SS.	
1.8.5	Bulb / Stem Diameter	12 mm.	
1.8.6	Bulb / Stem Material	AISI 316.	
1.8.7	Capillary	Stainless Steel.	
1.8.8	Connection to well	½" NPT.	
1.8.9	Case Material	Stainless steel.	
1.8.10	Dial Size	150 mm in general.	
1.8.11	Scale	Black lettering on white in 270 ° arc.	
1.8.12	Mounting	Surface/Panel.	
1.8.13	Over range Protection	125 % of range or more.	
1.8.14	Instrument connection	Bottom for local and back for panel mounting.	
1.8.15	Range	Normal temperature – 50~70% of range.	
1.8.16	Zero adjuster	Micrometer screw adjustable from front.	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 234 of 718
SR. NO.	ITEM	DESCRIPTION	
1.8.17	Window	Shatterproof glass.	
1.8.18	Accuracy	± 1 % or better.	
1.8.19	Enclosure Class	IP-65.	
1.8.20	Capillary	5 meters (local surface)/15.0 meters (local panel) - armoured stainless steel.	
1.8.21	Compensation	Capillary and Case Compensation.	
1.8.22	Accessories	(a) Forged barstock thermowell screwed as per ASME PTC code. Process connection M 33X2 (M). Material of construction of Thermowell: (i) SS 316: In general. (ii) Inconel: For flue gas application. (iii) Tungsten carbide: For coal mill application.	
1.8.23	Nameplate	Tag number, service engraved in stainless steel tag plate.	
1.9	<u>THERMOCOUPLES</u>		
1.9.1	Type	(a) Type-J (Iron Constantan) / Type-K (Chromel Alumel) / Type-R (Pt.-Rhodium Pt.). [As per application]	
		(b) Duplex.	
		(c) Ungrounded.	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 235 of 718
SR. NO.	ITEM	DESCRIPTION	
1.9.2	Wire gauge	16 AWG for Type-K, 24 AWG for Type-R.	
1.9.3	Standard	ANSI-MC 96.1.	
1.9.4	Protecting Tube		
(a)	O.D	8 mm.	
(b)	Material	316-SS Seamless.	
(c)	Filling	Magnesium Oxide (Purity above 99.4%).	
1.9.5	Response time	(a) < 20 seconds for measurement.	
		(b) < 10 seconds for control.	
1.9.6	Accuracy	$\pm 1.1^{\circ}\text{C}$ up to 300°C & 0.4% of measured temperature range above 300°C .	
1.9.7	Head		
(a)	Type	IP-65 universal screwed type.	
(b)	Material	Die cast aluminium or better.	
(c)	Terminal blocks	Nickel plated Brass - screw type/silver plated.	
(d)	Instrument connection to well	$\frac{1}{2}$ " NPT F.	
(e)	Cable connection	$\frac{1}{2}$ " NPT gland and grommet.	
(f)	Others	Terminal head cover with SS chain and suitable gasket. All thermowells in the high velocity steam service shall be checked for Strouhal's frequency limit to arrive at a safe size and design of	

CONSULTANT : PROCON ENGINEERS

		MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume : V
		BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1	Section – 5
REV: R0		CONTROL & INSTRUMENTATION	Page 236 of 718
SR. NO.	ITEM	DESCRIPTION	
		thermowells.	
1.9.8	Accessories	(a) Adjustable nipple-union-nipple (½", Sch 80 x ½" NPT M) with thermowell connection.	
		(b) Compression fittings/unions.	
		(c) Flanges etc. (for flanged connections only).	
		(d) Forged barstock thermowell as per ASME PTC code. Process connection M 33 x 2 (M) in general or 1½" Flanged for Flue gas / Furnace / Air etc. application. Material of construction of Thermowell: SS 316 : In general Inconel: For flue gas application Tungsten carbide : For coal mill application.	
1.9.9	Name plate	Tag number, service engraved in stainless steel tag plate.	
1.10	<u>RESISTANCE TEMPERATURE DETECTOR</u>		
1.10.1	Type	Platinum (Duplex), Ungrounded.	
1.10.2	Resistance	100 ohm at 0 °C.	
1.10.3	Base	Wound on ceramic (anti-inductive).	
1.10.4	Wiring	3 / 4 Wire.	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 237 of 718
SR. NO.	ITEM	DESCRIPTION	
1.10.5	Protecting Tube		
(a)	O.D.	8 mm.	
(b)	Material	SS-316, Seamless.	
(c)	Filling	Magnesium oxide (Purity above 99.4%).	
1.10.6	Response time	(a) < 20 seconds for measurement.	
		(b) < 10 seconds for control.	
1.10.7	Calibration	DIN 43760.	
1.10.8	Accuracy	± 0.5%.	
1.10.9	Head:		
(a)	Type	IP-65 universal screwed type.	
(b)	Material	Die cast aluminium or better.	
(c)	Terminal blocks	Nickel plated Brass-screw type / silver plated.	
(d)	Cable connection	½" NPT gland and grommet.	
(e)	Others	Terminal head cover with SS chain and suitable gasket. All thermowells in the high velocity steam service shall be checked for Strouhal's frequency limit to arrive at a safe size and design of thermowells.	
1.10.10	Accessories	(a) Adjustable nipple-union-nipple (½" Sch 80 x ½" NPT M) with Thermowell connection.	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 238 of 718
SR. NO.	ITEM	DESCRIPTION	
		(b) Compression fittings / unions.	
		(c) Flanges etc. (for flanged connections only)	
		(d) Forged / barstock Thermowell as per ASME PTC code. Process connection M33 x 2 (M). Material of construction of Thermowell: SS 316: In general. Inconel: For flue gas application. Tungsten carbide: For coal mill application.	
1.10.11	Name plate	Tag number, service engraved in stainless steel tag plate	
1.11	<u>PRESSURE SWITCH</u>		
1.11.1	Type	(a) Piston for high pressure application.	
		(b) Bellow / Diaphragm for low pressure application.	
1.11.2	Sensing element material	AISI SS-316. All other wetted part SS316.	
1.11.3	Case Material	Die-cast aluminium alloy, neoprene gasket.	
1.11.4	Setter Scale	Black graduation on white linear scale. Graduation 0-100% with red pointer for set points.	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 239 of 718
SR. NO.	ITEM	DESCRIPTION	
1.11.5	Over range	150 % of maximum pressure.	
1.11.6	Adjustments	(a) Internal Set Point.	
		(b) Differential adjustment.	
1.11.7	End Connection	½" NPT (M) bottom connected.	
1.11.8	Switch configuration	Two SPDT.	
1.11.9	Switch Rating	240V, 5A AC / 220V, 0.5A DC.	
1.11.10	Switch Type	Snap acting, hermetically sealed, shock & vibration proof.	
1.11.11	Terminal Block	Suitable for full ring lugs.	
1.11.12	Cable connection	½" NPT conduit connection.	
1.11.13	Enclosure Class	IP-65.	
1.11.14	Performance	(a) Repeat accuracy $\pm 1.0\%$.	
		(b) Accuracy of Setting Indication of $\pm 1.5\%$.	
1.11.15	Ambient temperature	0 – 50 Deg C.	
1.11.16	Nameplate	Tag number, service engraved in SS tag plate.	
1.11.17	Accessories	(a) Remote diaphragm seal with SS-316 capillary for viscous & corrosive application.	
		(b) Siphons for steam and hot water services.	
		(c) Retention ring and screws for surface mounting.	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 240 of 718
SR. NO.	ITEM	DESCRIPTION	
		(d) 1/2" NPT 2 Valve SS-316 barstock manifold.	
		(e) ½" NPT cable gland.	
1.12	<u>DIFFERENTIAL PRESSURE SWITCH</u>		
1.12.1	Type	Bellows/Diaphragm/Piston actuated.	
1.12.2	Sensing element material	AISI SS-316. For all other wetted part SS 316.	
1.12.3	Case Material	Die-cast aluminium alloy with neoprene gasket.	
1.12.4	Setter Scale	Black graduation on white scale with 0-100% graduation and provided with red pointer for set point adjustment.	
1.12.5	Over range	Static pressure on any one side, the other side being open to atmosphere.	
1.12.6	Adjustments	(a) Internal set point adjustment.	
		(b) Differential adjustment.	
1.12.7	Process Connection	1/2" NPT (M) bottom / back connected.	
1.12.8	Switch configuration	Two SPDT.	
1.12.9	Switch rating	240V, 5A AC/220V, 0.5A DC.	
1.12.10	Switch type	Snap acting type contacts, shock and vibration proof.	
1.12.11	Terminal Blocks	Suitable for full ring lugs for cable	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 241 of 718
SR. NO.	ITEM	DESCRIPTION	
		connection.	
1.12.12	Cable Connection	½" NPT conduit connection or compression gland.	
1.12.13	Performance	(a) Repeat accuracy $\pm 1.0\%$.	
		(b) Accuracy of set point Indication: $\pm 1.5\%$	
1.12.14	Operating Ambient	0 - 50 °C (Maximum Continuous).	
1.12.15	Enclosure	IP-65.	
1.12.16	Accessories	(a) Snubbers for pulsating fluid application.	
		(b) Syphons for steam and hot water services.	
		(c) Retention ring and screws for surface mounting.	
		(d) 1/2" NPT 3-Valve SS-316 manifold constructed from barstock.	
		(e) 1/2" NPT Cable gland.	
1.12.17	Nameplate	Tag number, service engraved in stainless steel tag plate.	
1.12.18	Remote Seal type for special application	(a) Silicone oil/fluorolube filled remote diaphragm seal for dirty/viscous/corrosive fluid.	
		(b) SS armoured capillary at least 3 meters each.	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 242 of 718
SR. NO.	ITEM	DESCRIPTION	
		(c) Adapter flanges with nuts, bolts and gaskets for instrument and process side.	
1.13	<u>LEVEL SWITCH</u>		
1.13.1	Type	External cage float operated. Magnetically coupled.	
1.13.2	Float Material	AISI-316 stainless steel or better.	
1.13.3	Other wetted parts	AISI-316 stainless steel or better.	
1.13.4	External Cage	Carbon steel/Stainless steel as per process requirements, welded type/ flanged construction. Cage pressure rating shall equal or exceed the rating of the main vessel.	
1.13.5	External cage mounting	Side-Side.	
1.13.6	External cage connection	25 NB socket welded.	
1.13.7	Switch housing	Epoxy coated die-cast aluminium alloy with neoprene gasket conforming to IP-65.	
1.13.8	Type of switch configuration	2 SPDT (two nos.).	
1.13.9	Contact rating	5A, 240V/AC, 0.25A, 220V DC.	
1.13.10	Accessories	(a) Counter flange, nuts & bolts, suitable gasket etc.	
		(b) Steel globe type drain valve.	
		(c) ½"NPT cable gland.	
		(d) Stainless steel nameplate with	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 243 of 718
SR. NO.	ITEM	DESCRIPTION	
		alpha-numeric engraved for service and tag.	
1.13.11	Preferred feature	Switch operating point marked on cage.	
1.13.12	Mounting	On standpipe.	
1.14	<u>CONDUCTIVITY TYPE LEVEL SWITCH</u>		
1.14.1	Type	Conductivity discrimination.	
1.14.2	Application	Drain pots viz. on CRH line.	
1.14.3	Mounting	Flanged – on external cage.	
1.14.4	Probe MOC	Stainless steel with high purity ceramic.	
1.14.5	Probe rating	> Maximum design pressure of vessel.	
1.14.6	Input	Four independent channel with selectable switching threshold for water conductivity.	
1.14.7	Relay Output	Four isolated output relays for Hi, Lo, Hi-Hi, Lo-Lo.	
1.14.8	Contact type & rating	2 SPDT or 1 DPDT @ 5A 30V DC.	
1.14.9	Local Display	Coloured LEDs for Hi, Lo, Hi-Hi, Lo-Lo, Power & fault.	
1.14.10	Power supply	Dual 240V AC, 50 Hz, 1Ph.	
1.14.11	Enclosure	IP-65, corrosion resistant & wall mounting type (Explosion proof for NEC Class-1, Division-1 area).	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 244 of 718
SR. NO.	ITEM	DESCRIPTION	
1.14.12	Accessories	(a) PTFE cable from probe to electronics.	
		(b) Mounting accessories.	
		(c) External cage.	
		(d) Washer & gasket.	
1.14.13	Test pressure	(e) Two times rated pressure.	
1.14.14	Cable connection	(f) ½" NPT with cable gland.	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1	Section – 5
REV: R0	CONTROL & INSTRUMENTATION	Page 247 of 718

1.18	<u>GAUGE GLASS</u>	
1.18.1	Type	Reflex.
1.18.2	Glass	Toughened borosilicate Resistant to mechanical and thermal shocks.
1.18.3	Body material	Carbon steel / stainless steel - As per process requirements (Flanged Connection).
1.18.4	Pressure rating	Twice the maximum working pressure.
1.18.5	Temperature rating	As required.
1.18.6	Bolts and nuts	Rust proof alloy steel.
1.18.7	Accessories	Suitable ball check valves of SS-304 /316 body, gaskets, companion flange etc.
1.19	<u>POWER CYLINDERS (PNEUMATIC)</u>	
1.19.1	Mounting Type	(a) Fixed position mounting. (End mounting)
		(b) Trunnion mounting.
1.19.2	Control Signal	4-20 mA DC to SMART positioner with Superimposed HART protocol for

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 248 of 718
SR. NO.	ITEM	DESCRIPTION	
		modulating purposes. 24V DC operated solenoid valve operating on pneumatic line for open & closing purpose of on & off drive.	
1.19.3	Supply Air	7 Kg / cm ² .	
1.19.4	Selection	Based upon thrust/torque, stroke length, angular movement, full-scale travel time, repeatability, space factor etc Provision for air-to-open and air-to-close operation.	
1.19.5	Casing	IP-65.	
1.19.6	Accessories	(a) Air lock relay.	
		(b) Hand wheel.	
		(c) Air filter regulator with gauge.	
		(d) Volume Booster.	
		(e) Limit Switches.	
		(f) Smart Positioner with Input and Output pressure gauges, local keypad & display.	
		(g) Solenoid Valve.	
		(h) Integral non contact type position Transmitter. (4-20 mA DC linear output)	
		(i) Junction box with cable gland.	
1.19.7	Fail-safe operation	For regulating duty- stay put against	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 249 of 718
SR. NO.	ITEM	DESCRIPTION	
		power & air fail.	
1.19.8	Repeatability	Better than 0.5% of full travel.	
1.19.9	Hysteresis	Less than $\pm 1\%$ of full travel.	
1.19.10	Operating Temp. limit	80 Deg. C (min.)	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1	Section – 5
REV: R0	CONTROL & INSTRUMENTATION	Page 259 of 718

1.26	<u>RADAR TYPE LEVEL MEASUREMENT</u>	
1.26.1	Type	Radar based on Time Domain Reflectometry.
1.26.2	Antenna	Co axial / single rod type guided wave or Horn type as required for the application.
1.26.3	Communication	Two wire 4-20mA DC, HART protocol.
1.26.4	Environmental temperature	0 – 50 °C.
1.26.5	Enclosure	Explosion proof/IP 65 as per application.
1.26.6	Cable Entry	½" NPT.
1.26.7	Calibration	Self calibration with internal reference.
		Zero & Span calibration.
1.26.8	Programming	Handheld programmer & Local keypad.
1.26.9	Process Connection	Flanged /screwed.
1.26.10	Electronic Housing	Epoxy painted Die-Cast aluminium alloy.

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 260 of 718
SR. NO.	ITEM	DESCRIPTION	
1.26.11	Antenna / Flange assembly	316 SS or Hest alloy. (as required)	
1.26.12	Output Indicator	Digital Integral Display.	
1.26.13	Accuracy	5 mm or 0.1% of probe length.	
1.26.14	Accessories	(a) Programming tool kit.	
		(b) Gasket.	
1.27	<u>ULTRASONIC LEVEL TRANSMITTER</u>		
1.27.1	Principle of operation	Detection of reflected ultrasonic pulse, HART Protocol	
1.27.2	Measuring ranges	Up to 30 meters (typical)	
1.27.3	Signal processing	Microprocessor Controlled Signal Processing	
1.27.4	Operating frequency	10 KHz to 50 KHz (typical)	
1.27.5	Display	Large alpha-numeric back lit LCD/ LED	
1.27.6	Calibration & Configuration	Accessible from front of panel	
1.27.7	Diagnosis	On-line	
1.27.8	Status	For power, Hi/Lo/V. Hi/V. Lo - level indication, fault etc.	
1.27.9	Construction	Plug-on board	
1.27.10	Power supply	240 V AC 50 Hz / 24V DC	
1.27.11	Signal Output	4-20 mA DC - 600 Ohm load.	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 261 of 718
SR. NO.	ITEM	DESCRIPTION	
1.27.12	Hysteresis	Fully adjustable preferred	
1.27.13	Output contacts	2 SPDT Potential free changeover contacts @ 240V, 5A AC/220V, 0.5A DC.	
1.27.14	Accuracy & Repeatability	0.25% of span or better	
1.27.15	Resolution	0.1% of span	
1.27.16	Operating Temperature	Transmitter- 50 °C and Sensor – 80 °C	
1.27.17	MOC Sensor	Body- PVC and Face – Polyurethane	
1.27.18	Humidity	1% to 95% non condensing.	
1.27.19	Enclosure	IP-65 Epoxy painted die cast aluminium or Polycarbonate housing.	
1.27.20	Cable connection	3/4" ET	
1.27.21	Mounting	2" for sensor and Transmitter on panel.	
1.27.22	Accessories	Cable gland, prefab cable, mounting accessories.	
1.28	<u>CAPACITANCE TYPE LEVEL SWITCH</u>		
1.28.1	Type	Capacitance type	
1.28.2	Probe	(i) Rod or suspended electrode	
		(ii) Rope type probes may be used only where required probe length is greater than 3 meters.	
1.28.3	Probe Mounting	Stainless steel 1½" ANSI RF Flange / ¾" NPT (M)	

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 262 of 718
SR. NO.	ITEM	DESCRIPTION	
1.28.4	Material of construction	316 SS	
1.28.5	Insulation	PTFE Part/ Full as per service.	
1.28.6	Enclosure	Powder/Epoxy coated Die cast aluminium with neoprene gasket conforming to IP-65. (Explosion proof for NEC Class-1, Division 1 area).	
1.28.7	Ambient temperature	0-60 °C.	
1.28.8	Mounting	On Tap	
1.28.9	Supply voltage	240V AC, 50Hz /24V DC	
1.28.10	Relay output	2 SPDT	
1.28.11	Contact rating	240V, 5A AC /220V, 0.5A DC.	
1.28.12	Response time	100 mSec or better	
1.28.13	Cable connection	¾" ET	
1.28.14	Accessories	Counter flange, Cable gland, prefab cable and stainless steel name plate engraved with alpha-numeric.	
1.29	<u>TEMPERATURE SWITCH</u>		
1.29.1	Type	Mercury filled-in.	
1.29.2	Sensing Element Material	Bellow / Bourdon AISI SS-316.	
1.29.3	Bulb Material	AISI SS-316.	
1.29.4	Capillary	Stainless steel armoured.	
1.29.5	Movement Material	AISI SS-304.	
1.29.6	Case material	Epoxy coated steel plate or die-cast aluminium alloy with neoprene gasket	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 263 of 718
SR. NO.	ITEM	DESCRIPTION	
		and clear glass where applicable cover conforming to IP-65. (Explosion proof for NEC Class-1, Division 1 area).	
1.29.7	Scale	Black lettering on white background.	
1.29.8	Over range Protection	120 %.	
1.29.9	Instrument connection	Bottom.	
1.29.10	Switch configuration	Two SPDT.	
1.29.11	Switch rating	240V, 5A AC/220V, 0.5A DC.	
1.29.12	Switch type	Snap acting, shock and vibration-proof.	
1.29.13	Adjustability	Internal Set point adjustable over span range.	
1.29.14	Cable connection	3/4" ET conduit connection or compression gland.	
1.29.15	Compensation	(a) Capillary compensation with invar wire throughout the capillary length.	
		(b) Case compensation.	
1.29.16	Performance :		
(a)	Scale Accuracy	±1.0 % of full scale.	
(b)	Repeatability	< 0.5 % of full range.	
(c)	Response time	Less than 40 seconds with thermowell.	
1.29.17	Capillary length	5 meters (minimum) for local mounting/15 meters for local panel mounting.	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 264 of 718
SR. NO.	ITEM	DESCRIPTION	
1.29.18	Nameplate	Tag number, service engraved in stainless steel tag plate.	
1.29.19	Accessories	Mounting accessories, 3/4"ET cable gland.	
1.30	<u>ROTAMETER</u>		
1.30.1	Type	On-line up to 2". By-pass above 2".	
1.30.2	Metering tube	Borosilicate glass.	
1.30.3	Float	AISI 316-SS unless the process fluid demands some other material.	
1.30.4	Body MOC	AISI 316-SS.	
1.30.5	Scale	Graduated- Engraved black on white background.	
1.30.6	Process connection	Flanged.	
1.30.7	Accuracy	$\pm 2\%$ of full scale detection or better for on-line type and $\pm 4\%$ of full-scale detection or better for by-pass type.	
1.30.8	Nameplate	Tag number, service engraved in stainless steel tag plate.	
1.30.9	Accessories	Slip-on orifice plate of 316-SS and taps of Stainless Steel as per application requirements. Applicable SS Isolation valves and SS Range Orifice - for bypass type rotameters.	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1	Section – 5
REV: R0	CONTROL & INSTRUMENTATION	Page 268 of 718

1.35	<u>I/P CONVERTER</u>	
1.35.1	Type	Electro-pneumatic (Outdoor Type)
1.35.2	Input level	4-20 mA DC
1.35.3	Output range	0.2 to 1.0 Kg/Sq. cm With 'Fail Freeze' feature. (i.e in case of wire snapping the last good value of pneumatic signal out put will hold for at least six hours)
1.35.4	Split range	For typical application wherever required.
1.35.5	Control Action	Selectable air to close, air to open and fail freeze application.
1.35.6	Supply pressure	1.2 to 1.6 Kg/cm ² (1.4 typical)
1.35.7	Max. supply pressure	7 Kg/ sq.cm.
1.35.8	Response Time	5 Seconds for 0 to 90% output pressure.
1.35.9	Housing	IP 55.
1.35.10	Repeatability	±0.1% of span.
1.35.11	Accuracy	± 0.25% of span.
1.35.12	Supply pressure effect	Less than 1%.
1.35.13	Span and Zero adjustments	Screw.
1.35.14	Pneumatic connection	¼" NPT.

CONSULTANT : PROCON ENGINEERS

 MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION	Page 269 of 718
SR. NO.	ITEM	DESCRIPTION
1.35.15	Stability	Less than 0.25% of Span / Zero for six months.
1.35.16	Cable connection	¾” ET.
1.35.17	Mounting	Field (pipe/wall mounting).
1.35.18	Accessories	Air filter regulator, mounting accessories, cable gland etc.
1.36	<u>AIR FILTER REGULATOR</u>	
1.36.1	Filter Element	Sintered Bronze.
1.36.2	Filter Size	5 microns.
1.36.3	Input Air	10.0 Kg/Sq. cm (maximum)
1.36.4	Output	Adjustable from 0-2.0 Kg / Sq. cm or 0-7.0 Kg/Sq. cm (continuous) as applicable for I/P converter, control drives and control valve.
1.36.5	Effect of Supply	Maximum 0.02 Kg/Sq. cm for a change pressure variation in supply pressure of 4 Kg/Sq. cm.
1.36.6	Bowl Material	Metallic cover around high temperature area/clear transparent polycarbonate with metallic cover for ordinary applications.
1.36.7	Accessories	2" dial size output pressure gauge.
1.36.8	Desirable Feature	No perceptible drop of pressure on opening the drain port.

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 270 of 718
SR. NO.	ITEM	DESCRIPTION	
1.37	<u>SOLENOID VALVE</u>		
1.37.1	Operating Principle	Electromagnetic. (noiseless)	
1.37.2	Coil voltage rating	240 V AC/220 V DC(as required. Any other voltage, if necessary, to be arranged by Bidder)	
1.37.3	Ways	Generally 3-ways other depending on requirement	
1.37.4	Port size	1/4" NPT all ports.	
1.37.5	Body	SS bar stock.	
1.37.6	Trim	SS-316.	
1.37.7	Duty	Suitable for continuous energization.	
1.37.8	Sealing	Airtight and leak proof.	
1.37.9	Ambient Temperature	0 - 50 °C.	
1.37.10	Fluid Temperature	0-150 °C (approx.)	
1.37.11	Coil Enclosure	Stainless Steel.	
1.37.12	Insulation	Class-H.	
1.37.13	Coil Casing	IP-65 (Explosion proof for NEC Class-1, Division-1 area)	
1.37.14	Mounting	On pipe or on panel.	
1.37.15	Cable Connection	3/4" ET.	
1.37.16	Accessories	Mounting brackets, nuts and bolts.	
1.37.17	Preferred feature	(a) Solenoid valve directly integral to actuator body shall have NAMOOR interface for uniformity.	

CONSULTANT : PROCON ENGINEERS

 MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION	Page 271 of 718
SR. NO.	ITEM	DESCRIPTION
		(b) Local indication for power.
1.38	<u>SIGHT GLASS</u>	
1.38.1	Type	Flap-type.
1.38.2	End connection	Screwed / Flanged.
1.38.3	Material	
(a)	Body	CS/SS as per process medium.
(b)	Indicator	Stainless steel.
1.38.4	Sight Glass	Toughened Borosilicate.
1.38.5	Gasket	Neoprene.
1.38.6	Bolts & Nuts	High tensile steel.
1.38.7	Hydraulic Test Pressure	1.5 times maximum working pressure.
1.38.8	Accessories	As required.
1.39	<u>LEVEL GAUGE (FLOAT & TAPE)</u>	
1.39.1	Type	Float and Tape
1.39.2	Float & Tape MOC	AISI 316
1.39.3	Pulley material	Aluminium
1.39.4	Guide wire	SS 316 Stainless steel
1.39.5	Accuracy	± 2 mm
1.39.6	Indication	On circular or vertical dial
1.39.7	Rating	Twice the design pressure

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 272 of 718
SR. NO.	ITEM	DESCRIPTION	
1.40	<u>FLOW INDICATING SWITCH</u>		
1.40.1	Type	On line metal tube Rotameter.	
1.40.2	End connection	Flanged.	
1.40.3	Material		
(a)	Body	CS/SS as per process medium.	
(b)	Float	Stainless steel.	
(c)	End fittings/flange	Stainless steel.	
(d)	Other wetted part	Stainless steel.	
(e)	Casing	Di cast Aluminium.	
1.40.4	Accuracy	+/- 2.0% of FSR.	
1.40.5	Rangeability	10:1.	
1.40.6	Electrical connection	¾" ET.	
1.40.7	Switch type	Snap acting hermitically sealed 2 nos. SPDT.	
1.40.8	Contact rating	5A, 240V AC.	
1.40.9	Protection class	IP-65.	
1.40.10	Accessories	As required.	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1	Section – 5
REV: R0	CONTROL & INSTRUMENTATION	Page 277 of 718

2.0	<u>CONTROL PANELS/DESK MOUNTED INSTRUMENTS AND ELECTRICAL SYSTEM ACCESSORIES</u>	
2.1	<u>COUPLING RELAY</u>	
2.1.1	Type	Octal base plug-in type/ DIN rail Mounting.
2.1.2	Coil voltage	24 V D.C. in general / other as required.
2.1.3	Contact	2 NO & 2 NC (Minimum).
2.1.4	Contact rating	250 V/5A (A.C)/220V/2A (D.C).
2.1.5	Operating range	70 to 110% of rated voltage.
2.1.6	Insulation	2 kV for 1 minutes between terminal & earth.
2.1.7	Mechanical life	20 million operations.
2.1.8	Coil protection	Diode.
2.1.9	Indication	Coil on LED.

CONSULTANT : PROCON ENGINEERS

 MAHAGENCO Maharashtra State Power Generation Co. Ltd.	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 278 of 718
SR. NO.	ITEM	DESCRIPTION	
2.1.10	Enclosure	Transparent cover.	
2.1.11	Connection	Screw terminals.	
2.1.12	Mounting	Projection mounting inside panel / DIN rail mounting.	
2.2	<u>DISTRIBUTION BOARDS</u>		
2.2.1	Type	Fixed, Modular.	
2.2.2	Power distribution	Through MCCB.	
2.2.3	Enclosure	Sheet Steel, IP54.	
2.2.4	Mounting	Free standing (Can be attended from both front & back).	
2.3	<u>RECEIVER RECORDER</u>		
2.3.1	Type	Microprocessor Based continuous video chart type. (Paper less)	
2.3.2	Display type	320 x 240 pixels high resolution coloured LCD graphics.	
2.3.3	Number of pen	2/4 as applicable.	
2.3.4	Input	4-20mA DC/1-5 Volt/ RTD/ Thermocouple.	
2.3.5	Display span rate	1, 5, 10, 20, 30 and 60 min / div. Selectable.	
2.3.6	Digital indication	Measured values with engineering unit.	
2.3.7	Trends	Coloured display on screen.	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 279 of 718
SR. NO.	ITEM	DESCRIPTION	
2.3.8	Colour of trends	Selectable.	
2.3.9	Performance		
(a)	Accuracy	$\pm 0.1\%$ of span or better. (Indication & Recording)	
(b)	Updation rate	1 Sec or better.	
2.3.10	Input open circuit	Up/Down Scale. (selectable)	
2.3.11	Reference Junction Compensation	Built-in cold junction compensation for thermocouple inputs.	
2.3.12	Power Supply	240 Volt, 1 Ph, 50 Hz A.C.	
2.3.13	Operating ambient temperature range	0-50 °C. (maximum)	
2.3.14	Face Dimension	144 mm (W) x 144 mm (H).	
2.3.15	Depth	300 mm (typical).	
2.3.16	Construction	Case - drawn steel, Bezel- Polycarbonate.	
2.3.17	Readable distance	3 meters (minimum)	
2.3.18	Mounting	Flush panel.	
2.3.19	Accessories	Engraved phenolic nameplate affixed to front flange to identify each recorder by tag number and each pen by color and measured variable. Shunt resistors, Ethernet port, RS232/422a/ 485 port.	
2.3.20	Features	(i) Hi, Hi-Hi, Lo and Lo-Lo contacts each channel.	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 280 of 718
SR. NO.	ITEM	DESCRIPTION	
2.3.21		(ii) 2 MB memory for Data acquisition and 100 MB Zip disk.	
		(iii) 3 ½" Floppy disk.	
		(iv) Computation functions like linear scaling, square root, differential and engineering unit and all other mathematical functions.	
		(v) Memory status display, LCD backlight saver.	
		(vi) Event sampling typically 125, 250, 500 msec.	
2.4	<u>MULTIPOINT RECORDER</u>		
2.4.1	Type	Microprocessor Based continuous video chart type. (Paper less)	
2.4.2	Number of Points	6,12 or 24. (as required)	
2.4.3	Input	4-20 mA/1-5V/Thermocouple/RTD.	
2.4.4	Recording	Channel number or dot with different color for each channel.	
2.4.5	Point Selection	Programmable for any combination of points by selection.	
2.4.6	Readable Distance	3 meters. (minimum)	
2.4.7	Data Display	Channel number, alarm status, measured data and engineering data (or Programming Display) in green LEDs.	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 281 of 718
SR. NO.	ITEM	DESCRIPTION	
2.4.8	Face Dimension	(i) 144 x 144 mm (approx.) for 6 point.	
		(ii) 252 x 206 mm (approx.) for 12 point.	
		(iii) 305 x 380 mm (approx.) for 24 point.	
2.4.9	Reference Junction Compensation	Built-in.	
2.4.10	Mounting	Flush Panel.	
2.4.11	Performance		
(a)	Accuracy	± 0.5% of span or better.	
(b)	Ambient Temperature effect	± 0.3% of span for 10 °C variation or better.	
(c)	Supply voltage variation effect	± 0.2% of span for 10% variation in supply voltage or better.	
(d)	Frequency variation effect	± 0.1% of span for 2 Hz variation in frequency or better.	
(e)	Operating Position effect	± 0.1% of span for 0-30 Deg. inclined or better.	
2.4.12	Input Open Circuit	Up/Down Scale.	
2.4.13	Power Supply	240 Volt, 1 Phase, 50 Hz AC.	
2.4.14	Operating Conditions :-		
(a)	Temperature	0-50 °C.	
(b)	Relative Humidity	25%-90%.	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 282 of 718
SR. NO.	ITEM	DESCRIPTION	
(c)	Supply Voltage	-15% to +10%.	
2.4.15	Accessories	Engraved phenolic nameplate affixed to front flange to identify each recorder by tag number and each pen by color and measured variable. Shunt resistors, Ethernet port, RS232/422a/485 port.	
2.4.16	Preferred Features	(i) Hi, Hi-Hi, Lo and Lo-Lo contacts for each channel.	
		(ii) 2 MB memory for Data acquisition and 100 MB Zip disk.	
		(iii) 3 ½" Floppy disk.	
		(iv) Computation functions like linear scaling, square root, differential and engineering unit and all other mathematical functions.	
		(v) Memory status display, LCD backlight saver.	
		(vi) Event sampling typically 125, 250, 500msec.	
2.5	<u>BAR GRAPH INDICATOR</u>		
2.5.1	Type	Bar graph.	
2.5.2	Number of channels	One/Two (as required)	
2.5.3	Input	4-20 mA/1-5 V/Thermocouple/RTD.	
2.5.4	Indication	Green LED / LCD.	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 283 of 718
SR. NO.	ITEM	DESCRIPTION	
2.5.5	Scale	100 mm vertical one for each channel graduated in engineering unit. (linear scale)	
2.5.6	Readable Distance	3 meters. (minimum)	
2.5.7	Mounting	Flush panel.	
2.5.8	Face Dimension	36(W) x 144(H) mm (approx) / 72 x 144 (H) mm.	
2.5.9	Resolution	1% of scale or better.	
2.5.10	Power Supply	240V, 1 Phase, 50 Hz AC.	
2.5.11	Operating Conditions :-		
(a)	Temperature	0-50 °C.	
(b)	Relative Humidity	5%-95%.	
(c)	Supply Voltage	-15% to +10%.	
2.5.12	Connection between Indicator and Tray	Prefab Cable.	
2.5.13	Accessories	(i) Mounting Tray.	
		(ii) Engraved phenolic nameplate affixed to front flange to identify each indicator by tag number and each point by measured variables.	
2.5.14	Alarm Facility	1 HI and 1 LO for each channel independently adjustable over span. Voltage free outputs.	
2.5.15	Reference Junction Compensation	Built-in cold junction compensation for	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 284 of 718
SR. NO.	ITEM	DESCRIPTION	
		thermocouple inputs.	
2.5.16	Feature	(i) Alarm level indication by flashing Cursor.	
		(ii) Green Digital display of parameter value in front panel with a 3.1/2 digit display.	
2.6	<u>VALVE POSITION INDICATOR</u>		
2.6.1	Input	4-20 mA DC/1-5 Volts DC.	
2.6.2	Indication	Pointer and Scale. Moving Coil Meter.	
2.6.3	Readable Distance	3 meters (minimum)	
2.6.4	Pointer Deflection	90 Deg Sector or linear.	
2.6.5	Mounting	Flush Panel (Horizontal/vertical)	
2.6.6	Accuracy	±1% or better.	
2.6.7	Protection Class	IP-42.	
2.6.8	Operating Ambient Temp.	0-50 °C.	
2.6.9	Scale	0-100%.	
2.6.10	Bezel Size	DIN Standard.	
2.7	<u>DIGITAL INDICATOR</u>		
2.7.1	Type	Four and half digit LED seven-segment display with sign.	
2.7.2	Face Dimension	72 x 144 mm / 48 x 96 mm. (as applicable)	
2.7.3	Display Character	13.8 mm, Green. (LED)	

CONSULTANT : PROCON ENGINEERS

		MAHARASHTRA STATE POWER GENERATION CO. LTD.	Volume : V
		BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1	Section – 5
REV: R0		CONTROL & INSTRUMENTATION	Page 285 of 718
SR. NO.	ITEM	DESCRIPTION	
2.7.4	Accuracy	0.1% of reading, ± 2 digit.	
2.7.5	Input	4-20Ma DC/1-5 V DC/ RTD/ Thermocouple.	
2.7.6	Mounting	Flush Panel.	
2.7.7	Power Supply	240V $\pm 10\%$, 50 ± 2.5 Hz.	
2.7.8	Output Contact	2 nos SPDT, contact rating 5A at 240V AC/ 0.25A at 220V DC.	
2.7.9	Power/Signal Connection	Screwed.	
	Large Display (150x300 mm) indicators shall be provided for MW, MVAR and frequency indications.		
2.8	<u>TOTALIZER / COUNTER</u>		
2.8.1	Type	Electronic.	
2.8.2	Number of digits and digit size	Six, 9 mm high.	
2.8.3	Input	4-20mA DC.	
2.8.4	Reset	Manual.	
2.8.5	Readable distance	3 meters. (minimum)	
2.8.6	Mounting	Flush.	
2.8.7	Performance		
(a)	Accuracy	$\pm 0.5\%$ of span.	
2.8.8	Operating ambient temp.	0 - 50 $^{\circ}\text{C}$.	
2.8.9	Accessories	Engraved phenolic nameplate affixed to front flange to identify tag number and measured variable.	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 286 of 718
SR. NO.	ITEM	DESCRIPTION	
2.8.10	Preferred Features	Power supply on/failure LED visible from front.	
2.9	<u>PUSH BUTTON</u>		
2.9.1	Type	Shrouded square format.	
2.9.2	Face Dimension	32 x 32 mm (maximum)	
2.9.3	Contact Configuration	2 NO + 2 NC.	
2.9.4	Contact Addition	Add-on block up to 4 each with 2 pairs of contacts.	
2.9.5	Contact Material	Hard Silver Alloy.	
2.9.6	Contact Rating	500V / 10 A.	
2.9.7	Utilization Category	AC11 / DC11.	
2.9.8	Insulation Voltage	2 kV for 1 minute between terminals and earth.	
2.9.9	Mechanical Life	1 million operation.	
2.9.10	Construction	Aluminium shrouding with plastic lens.	
2.9.11	Colours	Red, Green, Yellow, Black, etc.	
2.9.12	Connection	Screw terminals.	
2.9.13	Enclosure Class	IP-52.	
2.9.14	Legend	Engraving.	
2.10	<u>ILLUMINATED PUSH BUTTON</u>		
2.10.1	Type	Square format.	
2.10.2	Face Dimension	32 x 32 mm. (maximum)	

CONSULTANT : PROCON ENGINEERS

	MAHARASHTRA STATE POWER GENERATION CO. LTD.		Volume : V
	BID SPECIFICATION NO.:DG/BSL U-6/2011/T-1		Section – 5
REV: R0	CONTROL & INSTRUMENTATION		Page 287 of 718
SR. NO.	ITEM	DESCRIPTION	
2.10.3	Contact Configuration	2 NO + 2 NC. (minimum)	
2.10.4	Contact Addition	Add-on-Block up to 4 each with 2 pairs of contacts.	
2.10.5	Contact Material	Hard Silver Alloy.	
2.10.6	Contact Rating	500 V/ 10A.	
2.10.7	Utilization Category	A C11 / DC11.	
2.10.8	Insulation Voltage	2 kV for 1 minute between terminals and earth.	
2.10.9	Mechanical Life	1 Million Operation.	
2.10.10	Lamp	LED with built-in resistors as required.	
2.10.11	Lamp Rating :		
(a)	Voltage	240 V AC.	
(b)	Watt	2 Watt (approx.)	
2.10.12	Lamp and Lens Replacement	From front.	
2.10.13	Construction	Transparent Plastic Lens.	
2.10.14	Colour	Red, Green, Amber, Yellow etc.	
2.10.15	Connection	Screw terminals.	
2.10.16	Enclosure Class	IP-52.	
2.10.17	Legend	Engraving.	
2.11	<u>SELECTOR SWITCH</u>		
2.11.1	Type	2/3/4 position stay put type with rotary lever actuator.	

CONSULTANT : PROCON ENGINEERS