30	145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	GAUGE BOURDON INDIA PVT. LTD.	
31	145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	
32	145-08000-A	PRESSURE GAUGE/ DIFF.PRESSURE GAUGE	Nesstech Instruments Private Limited	
33	145-10000-A	TEMPERATURE GAUGE	FORBES MARSHALL (HYD) LTD.	
34	145-10000-A	TEMPERATURE GAUGE	GOA INSTRUMENTS INDUSTRIES PVT.LTD.,	
35	145-10000-A	TEMPERATURE GAUGE	H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD	
36	145-10000-A	TEMPERATURE GAUGE	GAUGE BOURDON INDIA PVT. LTD.	
37	145-10000-A	TEMPERATURE GAUGE	H.GURU INDUSTRIES	
38	145-10000-A	TEMPERATURE GAUGE	GOA THERMOSTATIC INSTRUMENTS PVT.LTD.	
39	145-10000-A	TEMPERATURE GAUGE	A.N. INSTRUMENTS PVT. LTD.	
40	145-10000-A	TEMPERATURE GAUGE	Baumer Technologies India Pvt. Ltd.	
41	145-10000-A	TEMPERATURE GAUGE	PRECISION MASS PRODUCTS PVT. LTD.	
42	145-11000-A	LEVEL GAUGE	BLISS ANAND PVT. LTD.	
43	145-11000-A	LEVEL GAUGE	TOSHNIWAL BROTHERS PVT.LTD.	MAKE:NIVO CONTROLS
44	145-11000-A	LEVEL GAUGE	SIGMA INSTRUMENTS CO.	
45	145-12000-A	FLOW ELEMENT	MICRO PRECISION PRODUCTS PVT. LTD.	
46	145-12000-A	FLOW ELEMENT	TM TECNOMATIC SPA	
47	145-12000-A	FLOW ELEMENT	STAR-MECH CONTROLS (I) PVT.LTD.	
48	145-12000-A	FLOW ELEMENT	INSTRUMENTATION LTD.	
49	145-13000-A	TEMP. ELEMENT	DETRIVE INSTRUMENTATION & ELECTRONICS LTD.	
50	145-13000-A	TEMP. ELEMENT	Thermal Instrument India Pvt. Ltd.	
51	145-13000-A	TEMP. ELEMENT	Tempsens Instrument (I) Pvt Ltd	
52	145-13000-A	TEMP. ELEMENT	PYRO ELECTRIC INSTRUMENTS GOA PVT.LTD.	
53	145-13000-A	TEMP. ELEMENT	TECHNO INSTRUMENTS	
54	145-13000-A	TEMP. ELEMENT	Baumer Technologies India Pvt. Ltd.	
55	145-13000-A	TEMP. ELEMENT	TM TECNOMATIC SPA	
56	145-13000-A	TEMP. ELEMENT	TOSHNIWAL INDUSTRIES PVT. LTD.,	
57	145-13000-A	TEMP. ELEMENT	GOA INSTRUMENTS INDUSTRIES PVT.LTD.,	
58	145-13000-A	TEMP. ELEMENT	GAUGE BOURDON INDIA PVT. LTD.	
59	145-13000-A	TEMP. ELEMENT	Nesstech Instruments Private Limited	

60	145-13000-A	TEMP. ELEMENT	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	
61	145-14000-A	TRANSMITTERS	ABB LIMITED	PRESSURE TRANSMITTER, DP TRANSMITTER and TEMP TRANSMITTER
62	145-14000-A	TRANSMITTERS	Pune Techtrol Pvt. Ltd.	Only for capacitance Type Level Transmitter
63	145-14000-A	TRANSMITTERS	V. AUTOMAT & INTRUMENTS (P) LTD.	a)DISPLACEMENT TYPE TRANSMITTERS. b)PRESSURE AND DP TRANSMITTERS
64	145-14000-A	TRANSMITTERS	Moore Industries International Inc.	
65	145-14000-A	TRANSMITTERS	PANAM ENGINEERS	For Pressure and Diff. Pressure transmitter
66	145-14000-A	TRANSMITTERS	TOSHNIWAL INDUSTRIES PVT. LTD.,	
67	145-14000-A	TRANSMITTERS	Endress + Hauser (India) Pvt. Ltd.,	
68	145-14000-A	TRANSMITTERS	YOKOGAWA INDIA LIMITED,	
69	145-14000-A	TRANSMITTERS	SBEM PVT. LTD.	FOR CAPACITANCE TYPE.
70	145-14000-A	TRANSMITTERS	SIEMENS LIMITED	
71	145-14000-A	TRANSMITTERS	EMERSON PROCESS MANAGEMENT (INDIA) PVT.LTD.	
72	145-14000-A	TRANSMITTERS	SMART INSTRUMENTS LTD, BRAZIL	LD-301 & T-301 TRANSMITTER FROM M/S SMART EQUIPMENTS BRAZIL.
73	145-14000-A	TRANSMITTERS	NIVO CONTROLS PVT. LTD.	For Capacitance type only
74	145-14000-A	TRANSMITTERS	Honeywell Automation India Limited	
75	145-25000-A	JUNCTION BOX	Shrenik & Company,	
76	145-25000-A	JUNCTION BOX	SUCHITRA INDUSTRIES	
77	145-25000-A	JUNCTION BOX	FLEXPRO ELECTRICALS PVT. LTD.	Metal type junction box only
78	145-25000-A	JUNCTION BOX	K.S.INSTRUMENTS PVT.LTD.	
79	145-25000-A	JUNCTION BOX	AJMERA INDUSTRIAL & ENGINEERING WORKS	
80	145-32000-A	INSTRUMENTS TUBE FITTINGS	VIKAS INDUSTRIAL PRODUCTS	
81	145-32000-A	INSTRUMENTS TUBE FITTINGS	Fluid Controls Pvt. Ltd.	
82	145-32000-A	INSTRUMENTS TUBE FITTINGS	AURA INCORPORATED	
83	145-32000-A	INSTRUMENTS TUBE FITTINGS	PRECISION ENGINEERING INDUSTRIES	
84	145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	SIGMA INSTRUMENTS CO.	
85	145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	Sapcon Instrument Pvt Ltd.	
86	145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	V. AUTOMAT & INTRUMENTS (P) LTD.	
87	145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	

88	145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	Flow Star Engineering Pvt. Ltd.,	
89	145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	NIVO CONTROLS PVT. LTD.	For Capacitance type level switch.
90	145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	Baumer Technologies India Pvt. Ltd.	
91	145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	Pune Techtrol Pvt. Ltd.	
92	145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	BLISS ANAND PVT. LTD.	
93	145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	SOR INC.	
94	145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	LEVCON INSTRUMENTS PVT. LTD.	
95	145-36000-A	LEVEL SWITCH-CONDUTIVITY TYPE	SOR INC.	
96	145-36000-A	LEVEL SWITCH-CONDUTIVITY TYPE	LEVCON INSTRUMENTS PVT. LTD.	
97	145-36000-A	LEVEL SWITCH-CONDUTIVITY TYPE	V. AUTOMAT & INTRUMENTS (P) LTD.	
98	145-36000-A	LEVEL SWITCH-CONDUTIVITY TYPE	HI-TECH SYSTEMS & SERVICES LTD.	Vendor shall source import contents of Level Switch (Conductivity Type) from Levelstate Systems Ltd., United Kingdom.
99	145-36000-A	LEVEL SWITCH-CONDUTIVITY TYPE	RAMAN INSTRUMENTS PVT.LTD.	Vendor shall source import contents of Level Switch (Conductivity Type) from Mobrey Measurement, an operating unit of Morbey Ltd., Slough, Berkshire, United Kingdom.
100	145-36000-A	LEVEL SWITCH-CONDUTIVITY TYPE	Sapcon Instrument Pvt Ltd.	
101	145-36000-A	LEVEL SWITCH-CONDUTIVITY TYPE	SIGMA INSTRUMENTS CO.	
102	145-36000-A	LEVEL SWITCH-CONDUTIVITY TYPE	BLISS ANAND PVT. LTD.	
103	145-37000-A	LEVEL SWITCH-FLOAT TYPE	SIGMA INSTRUMENTS CO.	
104	145-37000-A	LEVEL SWITCH-FLOAT TYPE	Pune Techtrol Pvt. Ltd.	
105	145-37000-A	LEVEL SWITCH-FLOAT TYPE	D.K. INSTRUMENTS PVT.LTD.	
106	145-37000-A	LEVEL SWITCH-FLOAT TYPE	V. AUTOMAT & INTRUMENTS (P) LTD.	
107	145-37000-A	LEVEL SWITCH-FLOAT TYPE	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	
108	145-37000-A	LEVEL SWITCH-FLOAT TYPE	LEVCON INSTRUMENTS PVT. LTD.	
109	145-37000-A	LEVEL SWITCH-FLOAT TYPE	GENERAL INSTRUMENTS CONSORTIUM	
110	145-37000-A	LEVEL SWITCH-FLOAT TYPE	Baumer Technologies India Pvt. Ltd.	
111	145-37000-A	LEVEL SWITCH-FLOAT TYPE	SBEM PVT. LTD.	
112	145-37000-A	LEVEL SWITCH-FLOAT TYPE	SOR INC.	
113	145-37000-A	LEVEL SWITCH-FLOAT TYPE	BLISS ANAND PVT. LTD.	
114	145-38000-A	INSTRUMENTS PIPE FITTINGS	VIKAS INDUSTRIAL PRODUCTS	
115	145-38000-A	INSTRUMENTS PIPE FITTINGS	Fluid Controls Pvt. Ltd.	
116	145-38000-A	INSTRUMENTS PIPE FITTINGS	PRECISION ENGINEERING INDUSTRIES	
117	145-38000-A	INSTRUMENTS PIPE FITTINGS	AURA INCORPORATED	
118	145-42000-A	ULTRASONIC FLOW METERS	CHEMTROLS INDUSTRIES PVT. LTD.	For Flexim Fluxus non-invasive ultrasonic flowmeter only;
119	145-42000-A	ULTRASONIC FLOW METERS	Rockwin Flowmeter India Pvt. Ltd.	
120	145-42000-A	ULTRASONIC FLOW METERS	FLASH FORGE PVT LTD	

121	145-42000-A	ULTRASONIC FLOW METERS	NIVUS GMBH	
122	145-43000-A	FLOW ELEMENT - ORIFICE	MINCO (INDIA) FLOW ELEMENTS PVT. LTD.	
123	145-43000-A	FLOW ELEMENT - ORIFICE	STAR-MECH CONTROLS (I) PVT.LTD.	
124	145-43000-A	FLOW ELEMENT - ORIFICE	TANSA EQUIPMENTS PVT. LTD.	
125	145-43000-A	FLOW ELEMENT - ORIFICE	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	
126	145-43000-A	FLOW ELEMENT - ORIFICE	DYNAFLUID VALVES AND FLOW CONTROLS (P) LTD.	
127	145-43000-A	FLOW ELEMENT - ORIFICE	MICRO PRECISION PRODUCTS PVT. LTD.	
128	145-43000-A	FLOW ELEMENT - ORIFICE	INSTRUMENTATION LTD.	
129	145-43000-A	FLOW ELEMENT - ORIFICE	HYDROPNEUMATICS PVT. LTD.	
130	145-43000-A	FLOW ELEMENT - ORIFICE	Flow Star Engineering Pvt. Ltd.,	
131	145-43000-A	FLOW ELEMENT - ORIFICE	CHEMTROLS INDUSTRIES PVT. LTD.	
132	145-43000-A	FLOW ELEMENT - ORIFICE	INSTRUMENTATION ENGINEERS PVT LTD	
133	145-44000-A	FLOW ELEMENT - NOZZLE	DYNAFLUID VALVES AND FLOW CONTROLS (P) LTD.	except P91 material pipes;
134	145-44000-A	FLOW ELEMENT - NOZZLE	MINCO (INDIA) FLOW ELEMENTS PVT. LTD.	
135	145-44000-A	FLOW ELEMENT - NOZZLE	HYDROPNEUMATICS PVT. LTD.	
136	145-44000-A	FLOW ELEMENT - NOZZLE	STAR-MECH CONTROLS (I) PVT.LTD.	
137	145-44000-A	FLOW ELEMENT - NOZZLE	INSTRUMENTATION LTD.	
138	145-44000-A	FLOW ELEMENT - NOZZLE	MICRO PRECISION PRODUCTS PVT. LTD.	
139	145-45000-A	INSTRUMENT FITTINGS	Perfect Instrumentation Control (India) Pvt. Ltd.	
140	145-45000-A	INSTRUMENT FITTINGS	Arya Crafts & Engineering Pvt. Ltd.	
141	145-45000-A	INSTRUMENT FITTINGS	Comfit & Valve Pvt. Ltd.	
142	145-45000-A	INSTRUMENT FITTINGS	HP VALVES & FITTINGS INDIA PVT. LTD.	
143	145-45000-A	INSTRUMENT FITTINGS	AURA INCORPORATED	
144	145-45000-A	INSTRUMENT FITTINGS	PRECISION ENGINEERING INDUSTRIES	
145	145-45000-A	INSTRUMENT FITTINGS	FLUIDFIT ENGINEERS PVT. LTD.	
146	145-45000-A	INSTRUMENT FITTINGS	VIKAS INDUSTRIAL PRODUCTS	
147	145-45000-A	INSTRUMENT FITTINGS	Fluid Controls Pvt. Ltd.	
148	145-45000-A	INSTRUMENT FITTINGS	PANAM ENGINEERS	
149	145-47000-A	ELECTROMAGNETIC FLOW METER	Electronet Equipments Pvt Ltd.	
150	145-47000-A	ELECTROMAGNETIC FLOW METER	Adept Fluidyne Pvt. Ltd.	
151	145-47000-A	ELECTROMAGNETIC FLOW METER	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	
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NOTES:

i) The above sub-vendor list is tentative & for reference only. However Sub-Vendor List is subject to BHEL/ end user approval without any commercial/ delivery implication.

ii) New Sub-Vendor if proposed by Vendor during contract stage shall be subject to BHEL/ end user approval without any commercial/ delivery implication.

2 X 660 MW MAITREE STPP

LIST OF DELIVERABLES (C&I) FOR TRAVELLING WATER SCREEN

Sl.No.	DRAWING NO.	DRAWING/DOCUMENT TITLE	CATEGORY	SCH. SUBMISSION WEEK FROM LOI	Resubmission after incorporating comments
1	PE-V0-421-XXX-I901	CONTROL & OPERATIONAL WRITE-UP FOR THE SYSTEM	A	5	1 week
2	PE-V0-421-XXX-I902	INSTRUMENT SCHEDULE with set points	A	8	1 week
3	PE-V0-421-XXX-I903	FIELD JB/LIE/LIR,DRIVES TERMINATIONS	A	9	1 week
4	PE-V0-421-XXX-I904	DATASHEETS FOR INSTRUMENTS, JBs, etc. along with CATALOGUES*	A	8	1 week
5	PE-V0-421-XXX-I905	QUALITY PLANS (INSTRUMENTS, VMS, etc.)	A	6	1 week
6	PE-V0-421-XXX-I906	INSTRUMENT HOOK-UP DRAWING	A	6	1 week
7	PE-V0-421-XXX-I907	O & M MANUAL	A	10	1 week
8	PE-V0-421-XXX-I908	GA & Wiring diagram of Local Control Panels*	A	8	1 week

NOTES:

1. ANY OTHER DOCUMENT DECIDED DURING DETAILED ENGINEERING SHALL BE PROVIDED BY BIDDER WITHOUT ANY COMMERCIAL/TECHNICAL IMPLICATION.

2. CONTRACTOR TO SUBMIT REUSABLE DATABASE FORMATS IN BHEL/CUSTOMER APPROVED FORMATS LIKE MS EXCEL,MS ACCESS OF DOCUMENTS LIKE INSTRUMENT SCHEDULE, I/O LIST, DRIVE LIST,FIELD JB TERMINATIONS, CABLE SCHEDULE & INTERCONNECTION, etc.
SOFT COPY OF FORMATS SHALL BE PROVIDED TO SUCCESSFUL BIDDERS.

SECTION ID
DATA SHEET – A

	TITLE: TECHNICAL SPECIFICATION FOR TRAVELLING BAND SCREEN SYSTEM		SPEC NO: PE-TS-421-172-N001
	TECHNICAL DATA SHEET- A		SECTION : ID
			REV.NO: 00
S.no.	**Description**	**Units**	**Data/Parameters**
1	**General**		
1.1	Nos. of Traveling Band screening systems sets required	Nos.	5 Nos. for station
1.2	Nos. of Spray wash pumps common for all TBS (If applicable)	Nos.	2 Nos. (1 Working + 1 Standby)
1.3	Liquid handled		Sea Water (Analysis attached)
1.4	Type of Travelling Band Screen		Central Flow / Dual Flow
1.5	No. of speed levels for the TBS		Dual Speed
1.6	Hydraulic /Fluid coupling		Required
1.7	Drive Mechanism Safety Devices		Required (Type details :By Bidder)
2	**Site Data**		
2.1	FGL of the Site	m	RL 5.0 M
2.2	Elevation of the TBS Operating Floor	m	RL 5.6 M
2.3	Invert level of the Intake canal at TBS Inlet	m	RL (-)4.7 M
2.4	Min. W.L. at upstream of TBS	m	RL (-)2.0 M
2.5	Max. W.L. at upstream of TBS	m	RL 2.642 M
2.6	Clearance between bars of coarse bar screens at upstream of TBS(Not in Bidder scope)	mm	50
2.7	Maximum Chamber length (Excluding end walls) & width for the TBS		1350 mm X 1700 mm
2.8	Design Mechanical temperature	Deg. Cel.	50
2.9	Spray wash/Flushing water source		Raw water pump Discharge at Downstream of TBS
2.10	Pressure available at Tap off from discharge of purchaser's pump	mwc	25 to 32 MWC (g)
2.11	Max. Limit on shut off head of purchasers pump”	mwc	70 MWC (g)
3	**Design Data**		
3.1	Flow rate per stream		
-	Design/Normal	cum/hr	1650/1650
-	Maximum	cum/hr	2145
3.2	No. of Speed levels of TBS		By Bidder (Minimum 2)
3.3	Protection Mechanism for Differential level $\geq$ Design Differential		Required (Type Details: By Bidder)
3.4	Travelling Band Screen clear opeining	mm^2	5 mm X 5 mm
3.5	Screen wire mesh size (Diameter)	mm	2 (Minimum)
3.6	Maximum water velocity through screen at min. WL	m/sec	0.15

	TITLE: TECHNICAL SPECIFICATION FOR TRAVELLING BAND SCREEN SYSTEM TECHNICAL DATA SHEET- A		SPEC NO: PE-TS-421-172-N001 SECTION : ID REV.NO: 00
S.no.	**Description**	**Units**	**Data/Parameters**
3.7	Design differential head for Travelling Band screens	MWC	1.5
3.8	Maximum head loss permitted across TBS (i.e. between inlet and outlet) in clean condition at Min WL	MWC	0.1
3.9	Screen backwashing/flushing start "ON" Slow speed head loss across TBS	MWC	0.2
3.10	Screen backwashing/flushing start at fast speed	MWC	0.35
3.11	Corrosion Protection system		YES, with Sacrificial anode type Cathodic protection by Bidder. (Calculation for same to be furnished during contract stage for approval)
3.12	Service Factor for Gear Box		2 (minimum)
3.13	The velocities for Calculating the inside diameters shall be limited to		At Pump Suction: 1.5 m/sec At Pump Discharge and Headers: 3.0 m/sec
4	**Spray Wash/Flushing system**		
4.1	Spray wash/flushing water Piping		
	a) Material		• Pipe upto 50 NB: DUPLEX SS (AS PER SCH 40S) • Pipe above 50 NB and upto 300 NB: DUPLEX SS (AS PER SCH 10S)
	b) O.D.Xthickness of Stub at Terminal Point	mmXmm	219.1 X 3.76
4.2	Motor Rating of Spray Wash pump		Drive Motor shall be rated, at an ambient temp. of 50 Deg C, with a margin of at least 10 % above the maximum load demand at any condition in the entire operating range including voltage and frequency variation.
5	**Self Cleaning Strainer**		
5.1	Screen perforation size	mm	1.1 mm (Max.) & less than spray Nozzle hole
5.2	Free flow area in the Screen basket		Minimum 110 % of Pipe Inlet Area
6	**Debris Segregation and collection baskets**		
6.1	Quantity	Nos.	5 (1 No. for each TBS)
6.2	Size(Preferable) - L x B x H	MxMxM	1 X 1 X 0.75
6.3	Discharge mechanism for emptying the basket		Lever operated bottom mechanism

	TITLE: TECHNICAL SPECIFICATION FOR TRAVELLING BAND SCREEN SYSTEM		SPEC NO: PE-TS-421-172-N001
	TECHNICAL DATA SHEET- A		SECTION : ID
			REV.NO: 00
S.no.	**Description**	**Units**	**Data/Parameters**
6.4	Type of arrangement for handling by Gantry crane provided		YES, By Purchaser (5 Ton capacity with crane hook level RL 10.6 M)
6.5	Basket frame plate thickness	mm	Min. 6
6.6	Wire Mesh size dia	mm	Min. 5
6.7	Guide Ways		
6.7.1	Number (For each TBS)	Nos.	**4**
6.7.2	Type		Embedded in wall
7	**Guide ways section**		
7.1	Cathodic Protection to be provided against corrosion		YES, with Sacrificial anode type Cathodic protection by Bidder. (Calculation for same to be furnished during contract stage for approval)
7.2	Fixing method of guide ways to be supplied by Bidder		by Bidder
8	**Control and Instrumentation**		
8.1	Control Panel		N.A. (DDCMIS control). Only Starter cum Switchgear Panel to be provided by Bidder as per Section IC
8.2	Differential Level Switch		1 no. per stream
8.3	Differential Level Transmitters		1 no. per stream
8.4	Pressure Transmitters		
8.4.1	Spray wash Suction Header		NA
8.4.2	Spray wash Discharge Header		1 no . Common for all the pumps
8.5	Pressure Gauges		
8.5.1	Spray wash individual suction line		NA
8.5.2	Spray wash individual discharge line		1 no for each pump
8.6	Differential Pressure Very High Switch		1 no . Per SCS
8.7	Differential Pressure Transmitters		1 no . Per SCS
8.8	Differential Pressure Gauge		1 no . Per SCS
8.9	Limit Switches		1 No . Per suction valve (OPEN) of TBS Spray wash pumps
8.10	Pressure switch		1 No . at Spray wash pumps common suction header
9	**Operation**		
9.1	Travelling Band Screening sysetm shall be designed for the following operation modes:		

	TITLE: TECHNICAL SPECIFICATION FOR TRAVELLING BAND SCREEN SYSTEM		SPEC NO: PE-TS-421-172-N001
	TECHNICAL DATA SHEET- A		SECTION : ID
			REV.NO: 00
S.no.	**Description**	**Units**	**Data/Parameters**
9.1.1	Automatic start up initiated by High differential level		YES
9.1.2	Automatic start-up intiated by timer.		YES
9.1.3	Manual mode of operation		YES
9.1.4	Provision for manual operation of the Travelling band shall be made in case of control system failure.		YES
10	**Spray wash/Flushing system/Self Cleaning Strainer**		
10.1	Spray wash pumps		Applicability By Bidder based upon calculations
10.1.1	No. of Spray wash pumps	Nos.	2 Nos. (1 W + 1 S)
10.2	No. of Self Cleaning Strainer	Nos.	2 Nos. (1 W + 1 S)
10.3	Whether Inserts/embedments/packers for Spray wash pumps/distributors and nozzles being supplied.		YES, By Bidder
10.4	**Hydrostatic Test**		
10.4.1	Hydrostatic test pressure for Spray wash/ flushing system/Self Cleaning Strainer	Bar (g)	Refer Section IIA
10.4.2	Test duration	Min	Refer Section IIA
11.0	**Painting**		
11.1	Surface preparation		Refer Section IIA
11.2	Primer coating thickness		Refer Section IIA
11.3	Finish coating thickness		Refer Section IIA
12.0	**Materials of Construction**		
12.1	Screen Wire mesh		SS 316 Ti/ Equivalent or superior as per international code
12.2	Clamping Plates/Clamps		SS 316 Ti/ Equivalent or superior as per international code
12.3	Basket frame and wire damping bars		SS 316 Ti/ Equivalent or superior as per international code
12.4	Fasteners		SS 316 Ti/ Equivalent or superior as per international code
12.5	Head Shaft		SS 316 Ti/ Equivalent or superior as per international code
12.6	Foot Shaft (if applicable)		SS 316 Ti/ Equivalent or superior as per international code
12.7	Head/Foot Sprockets		SS 316 Ti/ Equivalent or superior as per international code
12.8	Carrying chain		DUPLEX SS

	TITLE: TECHNICAL SPECIFICATION FOR TRAVELLING BAND SCREEN SYSTEM TECHNICAL DATA SHEET- A		SPEC NO: PE-TS-421-172-N001 SECTION : ID REV.NO: 00
S.no.	**Description**	**Units**	**Data/Parameters**
12.9	Rubber Seals		As per International code equivalent to Appendix-B of IS: 4622
12.10	**Carrying chain & rollers**		
12.10.1	Carrying Chain pins,&Bushing		Duplex SS for Pin SS 420 Hardened to at least 450 BHN for Bush or vice versa
12.10.2	Drive Chain type		Duplex Type of Approved Make
12.10.3	Drive chain pin/Bushing		Duplex SS for Pin SS 420 Hardened to at least 450 BHN for Bush or vice versa
12.10.4	Shaft bearing Bushing spherical roller		SS 316 Ti/ Equivalent or superior as per international code
12.10.5	Sprocket		SS 316 Ti/ Equivalent or superior as per international code
12.10.6	Torque tube		SS 316 Ti/ Equivalent or superior as per international code
12.10.7	Main supporting frame		SS 316 Ti/ Equivalent or superior as per international code
12.10.8	Screen chain side bars		DUPLEX SS
12.10.9	Drive Chain guard		SS 316 Ti/ Equivalent or superior as per international code
12.10.10	Baffle plate in boot section		SS 316 Ti/ Equivalent or superior as per international code
12.10.11	Guide ways / Anchor		SS 316 Ti/ Equivalent or superior as per international code
12.10.12	Splash housing and refuse chute		MOULDED FIBRE GLASS/ SS 316 Ti/ Equivalent or superior as per international code
12.10.13	Basket frame		SS 316 Ti/ Equivalent or superior as per international code
12.11	Pipe & Nozzles		
12.11.1	Spray nozzle		DUPLEX SS/ PVC
12.11.2	Pipe work		
12.11.2.1	Upto 50 NB		Duplex SS
12.11.2.2	above 50 NB		Duplex SS
12.12	**Valves**		
12.12.1	**Valve 400 NB and above (Butterfly Valves only)**		
12.12.1.1	Body & Disc		CI ASTM A48 GRADE-35, rubber lined

	TITLE: TECHNICAL SPECIFICATION FOR TRAVELLING BAND SCREEN SYSTEM TECHNICAL DATA SHEET- A		SPEC NO: PE-TS-421-172-N001 SECTION : ID REV.NO: 00
S.no.	**Description**	**Units**	**Data/Parameters**
12.12.1.2	Shaft		Duplex SS
12.12.1.3	Seat		BUNA-N
12.12.1.4	Bearings		AS PER MANUFACTURER PRACTICE
12.12.2	**Valve 350 NB and Below (Gate/Globe Valves only)**		
12.12.2.1	Body, Bonnet & Trim		Duplex SS
12.12.3	**Check Valves**		
12.12.3.1	Body & Bonnet		Duplex SS
12.12.3.2	Seating surface &stem		Duplex SS
12.12.3.3	Disc		Duplex SS
12.12.3.4	Hinge Pin		Duplex SS
12.13	**Spray Wash pump**		
12.13.1	Spray Wash pump Casing		Duplex SS
12.13.2	Spray Wash pump impeller		Duplex SS
12.13.3	Spray Wash pump Shaft		Duplex SS
12.13.4	Material of Gland Packing /Mechnical Seal (If applicable)		AS PER MANUFACTURER PRACTICE
12.14	**Debris Segregation and collection baskets**		
12.14.1	Frame		SS 316 Ti/ Equivalent or superior as per international code
12.14.2	Wire Mesh		SS 316 Ti/ Equivalent or superior as per international code
12.14.3	Flanges		SS 316 Ti/ Equivalent or superior as per international code
12.15	**Self Cleaning Strainer**		
12.15.1	Body		Carbon Steel (Internally Rubber Lined)
12.15.2	Screen / Wetted Fasteners		Duplex SS
12.16	All Non-Wetted Fastners		SS 316 Ti/ Equivalent or superior as per international code
12.17	All Wetted Fastners		Duplex SS
13.0	**MANDATORY SPARES**		AS PER ANNEXURE-A OF THIS DATASHEET

	TITLE: TECHNICAL SPECIFICATION FOR TRAVELLING BAND SCREEN SYSTEM TECHNICAL DATA SHEET- A		SPEC NO: PE-TS-421-172-N001 SECTION : ID REV.NO: 00
S.no.	**Description**	**Units**	**Data/Parameters**
	NOTE: The material of construction of each component of the Travelling Band Screen shall be such as to resist corrosion/ erosion and give a long and satisfactory life for plant. MOC indicated above is minimum requirement and Bidder to provide suitable MOC for various components for the attached water analysis. For components not mentioned above, suitable compatible MOC shall be provided for the attached water analysis, same shall be subject to BHEL/End customer/consultant approval during detail engineering stage.		

MANDATORY SPARES

ANNEXURE-A

LIST OF BASIC MINIMUM SPARES

	Consumable like fillers/light sources	100%
	Calibration gases of all types and ranges.	one year supply
(vi).	***Measuring Instruments**	
a)	Electronic Transmitters	
(i)	Transmitters of all type, range and model no. (for the measurement of Pressure, differential pressure flow, level, etc.)	10% or minimum 1 No. which ever is more
(ii)	Electronic cards / PCB's for each type and model of transmitters.	10% of each type
b)	Temperature elements	
(i)	RTD's	10% of each type and length or minimum 1 No. which ever is more
(ii)	Thermocouples	10% of each type and length or minimum 1 No. which ever is more
(iii)	Thermo well for above applications	10% of each type and length or minimum 1 No. which ever is more
(iv)	Temperature Transmitters	10%
*List of Measuring instruments as specified with individual system / sub-system shall be applicable for the respective system. Spare list of measuring Instruments will be governed by this clause, for system/subsystem which are not mentioned/specified exclusively in the list of spares.		
3.	**Mandatory spare list AAQMS**	
(i)	SO2 analyser	
	SO2 analyser instrument	1 no. complete instrument
	Electronic Card Assemblies of each type	10%
	Sets of Gaskets/"O" rings	2 sets
	Heater Assembly/Thermister.	20%
	Air flow meter.	1 no.
	Consumables like filter elements light sources etc.	100%
	Calibration gases of all types and ranges.	One year supply.

ANNEXURE-A

Notes for Mandatory Spares:

1. Spares not applicable for the Package to be specifically quoted as “NOT APPLICABLE”.
2. In case if such items of spares indicated as “not applicable” by bidder in its offer, are found applicable at a later date during execution of the project, such items of spares are to be supplied within the ordered cost of the mandatory spares
3. Wherever % is indicated for the mandatory spares, the quantity shall be calculated for % of supply for total quantity for station, unless otherwise specified. The quantity to be reckoned for % indicated shall be rounded off to the next higher whole number. For example if the % arrived is 0.2 the quantity to be supplied shall be 1 and if the % arrived is 5.1 the quantity to be supplied shall be 6

4. In respect of quantity mentioned as 'Set' means the total quantity of all the components/items used in particular equipment unless otherwise specified.

Annex M-04
Wateranalysis

WATER ANALYSIS

SL	Sampling Location	pH Values	Temperature (^{0}C)	NTU	EC µs/cm	Alkalinity mg/L	p-alkalinity mg/L	m-alkalinity mg/L	Total hardness (mg/l)	TDS (mg/L)	Salinity (ppt)	TSS (mg/L)	DO (mg/l)	PO4 (mg/L)	Cl- (mg/L)	F- (mg/L)	NH4 (mg/L)	NO3 (mg/L)	NO2 (mg/L)	SO4 (mg/L)	BOD_5 (mg/L)	COD (mg/L)
1	High tide, Passur River, Mongla, Khulna	8,1	26,9	579	353	131	0	133		170		123		0,89	51	<.10	0,30	0,78	<.016	12	12	32
2	Low tide, Passur River, Mongla, Khulna	8,1	26,7	594	409	133	0	135		197		147		1,1	66	0,10	<.10	0,83	<.016	15	18	48
	Sampling 16 August 2014																					
3	Sampling April	7,9	31						2550	13190	12,00	54	5,7	2,1				1,3		1360	3,20	376
4	Sampling July	7,1	33						175	445	2,20	90	6,8	0,45				0,76		45	3,10	28
5	Sampling October	8,1	31								0,00		7,6								4,00	
															9724							
6	Sampling 23. May 2014: Jetty Side Passur River			77		138																

SL	Sampling Location	Al (mg/L)	Ba (mg/L)	Ca (mg/L)	Fe (mg/L)	Mn (mg/L)	Mg (mg/L)	K (mg/L)	Na (mg/L)	FC (CFU)	TC (CFU)	SiO2 (mg/L)	P (mg/L)	TOC (mg/L)	DOC (mg/L)	Oil and Grease (mgl)
1	High tide, Passur River, Mongla, Khulna	0,85	0,107	26,75	2,0	<.05	8,7	3,9	29,11	240	460	11,7	1,2	6,25	3,93	
2	Low tide, Passur River, Mongla, Khulna	0,962	0,165	26,94	4,2	<.05	9,4	6,68	41,77	270	520	13,6	2,3	7,91	4,49	
	Sampling 16 August 2014															
3	Sampling April															< 5
4	Sampling July															< 5
5	Sampling October															
6	Sampling 23. May 2014: Jetty Side Passur River			296	0,51		737	204	8505			14,3				

3 - 5: Sampling location: Left bank of Passur River at Project Site - Jetty

Consultancy Research and Testing Services (CRTS)
Department of Civil Engineering, Khulna University of Engineering & Technology

Test Results on Water Quality and Sedimentation Characteristics of Possur River at Intake Point (BIFPCL, Rampal)

Date	High Tide							Low Tide						
	Time	pH	Tur (NTU)	Elec Con (EC) mS/cm	Sedimentation (ml/L)			Time	pH	Tur (NTU)	Elec Con (EC) mS/cm	Sedimentation (ml/L)		
					30min	60min	120min					30min	60min	120min
17.01.15	1100	7.87	103	5.40	-	-	-	1730	7.78	63.5	5.25	-	-	-
18.01.15	1150	8.03	170	3.28	0.05	0.20	0.35	1830	8.03	49.5	1.80	Nil	Nil	Nil
19.01.15	1245	7.86	315	5.24	-	-	-	750	7.90	323	4.88	-	-	-
20.01.15	1330	7.90	178	5.38	0.10	0.25	0.35	830	7.90	208	4.53	0.15	0.35	0.50
21.01.15	1400	7.84	382	5.64	-	-	-	900	7.90	172	5.00	-	-	-
22.01.15	1450	7.86	337	5.50	0.45	0.60	0.70	940	7.84	239	4.94	0.15	0.25	0.40
23.01.15	1540	7.84	202	5.19	-	-	-	1020	7.84	108	5.14	-	-	-
24.01.15	1630	7.62	504	5.96	-	-	-	1050	7.41	92.7	6.24	-	-	-
25.01.15	1715	7.73	311	5.90	-	-	-	1130	7.78	144	5.85	-	-	-
26.01.15	1810	7.85	633	5.77	-	-	-	1210	7.82	299	5.49	-	-	-
27.01.15	1820	7.81	289	5.35	0.05	1.50	2.00	1300	7.85	635	5.66	1.50	3.50	5.00
28.01.15	720	7.86	332	5.47	-	-	-	1320	7.81	653	5.64	-	-	-
29.01.15	830	7.87	386	5.80	-	-	-	1500	7.86	101	5.67	-	-	-
30.01.15	1000	7.90	360	5.73	-	-	-	1630	7.89	258	11.44	-	-	-
31.01.15	1110	7.94	400	11.54	-	-	-	1745	7.97	132	9.22	-	-	-

A water analysis from the area adjacent to the site giving salinity and water quality is shown below:

location	Date	Temp.	pH	EC	Cl	T. Alkalinity	Turbidity	T S	TDS	SS	DO	BOD	COD	Salinity
		°C		µS/cm	mg/l	mg/l	NTU	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
1	7-Jan	27.4	7.74	3010	879	36	68.7	1565	1510	55	5.1	0.8	55	1.6
2	7-Jan	27.1	7.72	3020	878.8	36	68.5	1570	1510	60	5.1	0.8	55	1.6
3	7-Jan	27.8	7.71	3030	879	36	68.8	1565	1510	55	5.1	0.8	55	1.6
1	11-Feb	29.8	7.66	4380	1262	36	182	2390	2180	210	4.7	1	76	2.3
2	11-Feb	29.2	7.63	4380	1268	36	178	2390	2190	200	4.7	1	76	2.3
3	11-Feb	29.1	7.65	4380	1263	36	179	2380	2180	200	4.7	1	76	2.3
1	9-Mar	32.6	7.56	11780	2944.4	38	176	6080	5890	190	4.7	1.2	76	6.7
2	9-Mar	32.6	7.57	11780	2945.2	38	178	6080	5890	190	4.7	1.2	76	6.7
3	9-Mar	32.1	7.55	11780	2946.4	38	177	6090	5890	200	4.7	1.2	76	6.7
1	17-Apr	32.6	7.59	25300	8273	36	185.6	12950	12700	250	4.6	0.7	136	15.5
2	17-Apr	32.6	7.59	25300	8273	36	186.2	12950	12700	250	4.6	0.7	138	15.5
3	17-Apr	32.6	7.59	25300	8273	36	184.8	12950	12700	250	4.6	0.7	136	15.5
1	5-May	32.6	7.59	29200	9480	36	198.6	14900	14600	300	4.5	1.2	177	17.6
2	5-May	32.9	7.54	29200	9470	36	198.6	14900	14600	300	4.4	1.2	177	17.6

Figure 1 Water quality of the Passur River at Mongla point (Source: EIA-Report)

location	Date	Temp.	pH	EC	Cl	T. Alkalinity	Turbidity	T S	TDS	SS	DO	BOD	COD	Salinity
		°C		µS/cm	mg/l	mg/l	NTU	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
3	5-May	33.2	7.57	29200	9470	36	199.6	14900	14600	300	4.5	1.2	177	17.6
1	13-Jun	31.6	7.69	18000	5820	36	112.6	9200	9000	200	4.7	1.1	97	10.8
2	13-Jun	31.6	7.69	18000	5800	36	113.2	9200	9000	200	4.7	1.1	97	10.8
3	13-Jun	31.6	7.69	18000	5810	36	112.4	9200	9000	200	4.7	1.1	97	10.8
1	1-Jul	31.6	7.69	440	32.6	36	76.6	285	220	65	5.2	0.8	26	-
2	1-Jul	31.6	7.69	440	32.6	36	76.6	285	220	65	5.2	0.8	26	-
3	1-Jul	31.6	7.69	440	32.6	36	76.6	285	220	65	5.2	0.8	26	-
1	5-Aug	31.6	7.69	275	16.6	36	68.6	192	137	55	5.3	0.7	22	-
2	5-Aug	31.6	7.69	275	16.6	36	68.6	192	137	55	5.3	0.7	22	-
3	5-Aug	31.6	7.69	275	16.6	36	68.6	192	137	55	5.3	0.7	22	-
1	8-Sep	31.6	7.74	270	15.6	36	65.6	180	135	45	5.5	0.7	22	-
2	8-Sep	31.6	7.76	270	15.6	36	65.6	180	135	45	5.5	0.7	22	-
3	8-Sep	31.6	7.74	270	15.6	36	65.6	180	135	45	5.5	0.7	22	-
1	12-Oct	30.6	7.79	290	26.6	36	62.6	192	145	47	5.6	0.7	22	-
2	12-Oct	30.6	7.78	290	26.6	36	62.6	192	145	47	5.6	0.7	22	-
3	12-Oct	30.6	7.78	290	25.6	36	62.6	192	145	47	5.6	0.7	22	-
1	5-Nov	24.6	7.79	340	38.6	36	56.6	210	170	40	5.6	0.7	22	-
2	5-Nov	26.6	7.79	340	38.6	36	56.6	210	170	40	5.6	0.7	22	-
3	5-Nov	25.6	7.79	340	38.6	36	56.6	210	170	40	5.6	0.7	22	-
1	12-Dec	21.5	772	520	62.6	36	72.6	320	260	60	5.1	0.9	25	0.4
2	12-Dec	20.9	7.71	520	62.6	36	73.6	320	260	60	5.1	0.9	25	0.4
3	12-Dec	21.1	7.72	520	62.6	36	71.6	320	260	60	5.1	0.9	25	0.4

Figure 2 Water quality of the Passur River at Mongla point (Source: EIA-Report)

SECTION IIA
STANDARD TECHNICAL REQUIREMENT
FOR
MECHANICAL SYSTEMS

1. **GENERAL**

This specification covers the design, performance and operational requirements, configuration and constructional features, manufacture, assembly, inspection and testing at the manufacturer's and/or his sub-contractor's works and painting for delivery of Travelling Band Screening System complete with all accessories as specified hereinafter.

2. **CODES AND STANDARD**

2.1. The design, manufacture and performance of travelling water screens and accessories shall comply with all currently applicable statures, regulation and safety codes in the locality where the system will be installed. The equipment shall also conform to the latest applicable codes / standards. Nothing in this specification shall be construed to relieve the vender of this responsibility.

2.2. The design, materials, manufacture, inspection and testing of the travelling band screening system complete with all accessories, shall comply with the requirements of the latest versions of the following appropriate codes and standards.

2.2.1. ~~IS~~/BS/DIN/US Standards regarding pumps, piping, flanges and others as necessary.

2.2.2. ~~IS~~/BS/DIN/ASTM Standards for materials specification and testing procedures.

2.2.3. ~~IS~~/BS/DIN/AWWA Standards for valves and the testing.

2.2.4. In case of any conflict between the above codes/standards and this specification, the later shall prevail and in case of any further conflict in the matter, the interpretation of the specification by the Engineer shall be final and binding.

3. **DESIGN**

Unless otherwise necessary, manufacturer's standard and proven models of the Travelling Band Screening System shall be supplied.The Travelling Band Screening System shall be capable of safe, continuous and trouble-free operation under all prevailing climatic and load conditions, for removal of floating and suspended matter coming along with the Raw Water intake coming from the Raw water source, before the Pumps.Vibration, noise, mechanical stresses shall be kept within allowable limits specified by relevant codes/standards. In design, due attention shall be given to ease of maintenance, repair and cleaning.Suitable corrosion allowance shall be provided whenever necessary. The Travelling Band Screening System shall consist of Travelling Band Screens, Spray wash/flushing pumps, differential level measuring system, instrumentations, control panel, interconnecting cables and others as necessary. The configuration of the Travelling Band Screening System shall be as specified in Data Sheet-AEach travelling screen unit shall consist of appropriate quantity of screening elements arranged in a series to form an endless arrangement and fastened to two parallel vertical strands of chains.Material of construction shall be suitably selected to prevent Galvanic corrosion between various components.

3.1. The provision for sacrificial anode for corrosion protection shall be made for future use as specified in the Data sheet-A.

4. **CONSTRUCTION FEATURES**

4.1. **Main Frame**

4.1.1. The main frame of the screens shall be of rugged construction from structural material as mentioned in Data Sheet-A, not less than 10 mm thick.

4.1.2. All the members of the main frame shall be able to withstand the full hydraulic thrust on the upstream side when the screen becomes choked.

4.1.3. The main frames, sprocket shaft assemblies, bearings and all components of the drive system (except the shear pin. If provided) shall be designed to resist all forces without damage resulting from the full breakdown torque of the motor while the screen is jammed at any point in its travel.

4.1.4. Suitable guides shall be furnished for both sides of the screen frames so as to set in guideways on the sump pit walls.

4.1.5. Guide shall be continuous so that no open space exists for entrance of refuse between the screen frame and pit walls.

4.1.6. The guides shall prevent the front or ascending side of the chain from weaving.

4.1.7. The construction shall be such that no open space is left between the traveling screening media and the screen frame except the minimum running clearance required for satisfactory operation.

4.1.8. The main frame shall have a suitable provision for lifting the screen from the deck by means of an monorail hoist for erection and maintenance. Tension on the carrier chains shall be adjustable from accessible location near the head shaft by means of take-up screws made of stainless steel.

4.2. **Screening Elements**

4.2.1. The screening elements shall be constructed to offer minimum practical obstruction to free passage of water within the width of screen.

4.2.2. The screening elements shall have frames of welded steel construction provided with curved end plates/shrouds or any other suitable mechanism to provide sealing between adjacent screening elements and screening elements & the travelling band screen boots and frames, so as to stop the ingress of floating/suspended matter above guaranteed particle size as mentioned in the Data Sheet-A.

4.2.3. The screening materials shall be attached to the screen basket frames in a manner which provides easy replacement of screens without projecting bolting of clamping bars on the inlet side of the screen unit.

4.2.4. The min. size of the screening element wire and its material of construction mesh shall be as per Data Sheet-A.

4.3. **Carrying Roller Chains**

4.3.1. The screen chains to which the screening elements shall be fastened shall be made with side bars pins, bushings and rollers, with materials as per Data Sheet-A. The chain pitch shall be equal to the screening element's spacing.

4.3.2. The rollers shall be of high quality rust resistant material.

4.3.3. The pins, bushing and their respective side pars shall present a water tight, corrosion resistant assembly.

4.3.4. The chain side bar material shall be as per Data Sheet-A not less than 10 mm thick.

The chains shall be especially designed for travelling water screen service and shall operate

4.1.3. The main frames, sprocket shaft assemblies, bearings and all components of the drive system (except the shear pin. If provided) shall be designed to resist all forces without damage resulting from the full breakdown torque of the motor while the screen is jammed at any point in its travel.

4.1.4. Suitable guides shall be furnished for both sides of the screen frames so as to set in guideways on the sump pit walls.

4.1.5. Guide shall be continuous so that no open space exists for entrance of refuse between the screen frame and pit walls.

4.1.6. The guides shall prevent the front or ascending side of the chain from weaving.

4.1.7. The construction shall be such that no open space is left between the traveling screening media and the screen frame except the minimum running clearance required for satisfactory operation.

4.1.8. The main frame shall have a suitable provision for lifting the screen from the deck by means of an monorail hoist for erection and maintenance. Tension on the carrier chains shall be adjustable from accessible location near the head shaft by means of take-up screws made of stainless steel.

4.2. **Screening Elements**

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4.2.2. The screening elements shall have frames of welded steel construction provided with curved end plates/shrouds or any other suitable mechanism to provide sealing between adjacent screening elements and screening elements & the travelling band screen boots and frames, so as to stop the ingress of floating/suspended matter above guaranteed particle size as mentioned in the Data Sheet-A.

4.2.3. The screening materials shall be attached to the screen basket frames in a manner which provides easy replacement of screens without projecting bolting of clamping bars on the inlet side of the screen unit.

4.2.4. The min. size of the screening element wire and its material of construction mesh shall be as per Data Sheet-A.

4.3. **Carrying Roller Chains**

4.3.1. The screen chains to which the screening elements shall be fastened shall be made with side bars pins, bushings and rollers, with materials as per Data Sheet-A. The chain pitch shall be equal to the screening element's spacing.

4.3.2. The rollers shall be of high quality rust resistant material.

4.3.3. The pins, bushing and their respective side pars shall present a water tight, corrosion resistant assembly.

4.3.4. The chain side bar material shall be as per Data Sheet-A not less than 10 mm thick.

The chains shall be especially designed for travelling water screen service and shall operate

satisfactorily for the type water as specified in Data Sheet-A. Each pin shall be drilled for pressurized grease lubrication.

4.4. Shafts and Sprockets

4.4.1. Head Shaft

The head shaft shall be made of material as specified in Data Sheet-A and will have suitable bearings, provided with pressurized grease lubrication. The head shaft bearing shall be readily accessible and provided with an arrangement for maintaining adequate tension in the screen assembly and to compensate for any slackness during operation.

4.4.2. Sprocket Assemblies

Head sprocket wheel shall be constructed of material as specified in Data Sheet-A. Head wheels shall have replaceable tooth inserts of material as specified in Data Sheet-A and shall be interconnected using a torque tube or an extra large diameter solid shaft.

The tooth shall be adequately sized to withstand impact loading and starting torque of driving motor due to jamming. Bolts and nuts for attachment of the tooth to sprocket wheel shall be constructed of stainless steel.

4.4.3. Screen Drive Units

Each screen unit shall be provided with a drive unit assembly mounted on a welded steel based plate on top of the screen frame splash housing. The drive unit shall have an electric motor directly connected through an all metal flexible coupling to a reduction gear unit.

There shall be arrangement for jogging control of the screen drive motor in case of emergency.

The reduction gear unit shall be of the helical or herring bone gear type operation in an oil bath and completely enclosed in a waterproof, oil-tight housing.

The reduction gear unit shall drive the head sprockets through a hardened steel roller chain or it may be coupled as per manufacturer standard.

The drive sprocket (if supplied) on the output shaft of the reduction gear unit shall incorporate shear-pin safety device to provide protection against overload.

Alternatively suitable fluid coupling may also be incorporated in the screen drive system.

4.4.4. Guards

All couplings/ chain drives and exposed shafts shall be provided with suitable guards for protection of personnel.

4.4.5. Splash Housing

Each screen shall be provided with splash housing which will enclose the screens, spray system and chain drives above the deck level.

The housings including access doors shall be constructed of 5mm (minimum) nominal thickness moulded fibre glass reinforced with stainless steel.

Reinforcing shall be located on the inside of housing wherever possible. Enclosures for external drive chains and sprockets may be either integral with the main housing

enclosures or there may be separate stainless steel enclosures attached to the main housing.

Enclosures for external drive mechanism shall be of watertight designs and shall be furnished complete with shaft seals.

Inspection and access door hinges, latches and dogs shall be constructed of Carbon Steel and shall be designed to minimize the projection of these devices beyond the exterior surface of the main housing a system of Carbon steel or fibre glass deflector plates and seals shall be provided as necessary to direct the refuse into the refuse through and to prevent refuse from being deposited on the screen deck.

The refuse trough shall be provided common to all travelling water screens. Refuse removal shall be done by pressurized water or by other approved means.

4.4.6. **Spray Cleaning/Back Wash System**

A complete spray cleaning system with minimum two sets of spray system at different elevations shall be provided with each screen unit. The system shall be located near the top of the unit. The spray cleaning shall take place in the ascending run of the basket. The refuse chute shall be arranged accordingly.

The spray nozzles shall be removable and of non dogging type constructed from stainless steel. The nozzles shall be designed to pass any object passed by the travelling screen.

The spray nozzles headers and all feed piping between the spray nozzle header and the spray water valves shall be constructed of material as specified in Data Sheet-A. Flanged joints (125 lbs) shall be provided in the piping for easy removal of the spray nozzle headers. All counter flanges, gaskets, nuts, bolting etc. for terminal connections shall be furnished by the bidder.

4.5. **Spray wash/Flushing Pumps and Accessories**

4.5.1. Horizontal centrifugal type booster pumps (2x100% Capacity) shall be employed for screen washing, the pump shall be furnished complete with drive motors, base plates and other accessories along with suction and discharge pipe work. The total head developed by the pump shall meet the requirement of pressure at spray nozzle inlet including losses in the pipeline and fittings. Capacity of the pumps shall be so selected that it shall be possible to meet the spray water requirement of each screen with all rows of spray.

4.5.2. The design, and material features of construction of pumps shall be as per specification titled "Horizontal Centrifugal Pumps" annexed therewith. All the pumps shall be connected to one common discharge header through individual check valves and isolating valves. All the pumps shall be provided with pressure gauges on its discharge and suction lines and required instruments as per Control Philosophy described elsewhere.

4.5.3. The casing shall be designed to withstand 1.5 times the shut-off pressure or twice the operating pressure, whichever is higher.

4.5.4. The impeller shall be non-clog type. The impeller shall be secured suitably to the shaft and shall be retained against circumferential movement by keys, pins or lock rings. Loctite compound shall be applied after tightening of locknuts to prevent dislocation of impeller.

4.5.5. Replaceable type wearing ring shall be provided to prevent damage to the casing and impeller. Pumps shall be provided with mechanical seals to the extent feasible. If Gland packing is provided it should be of good quality to be provided to prevent leakage of water from pump glands. Shaft size selected shall take into consideration the critical speed which shall be away from the operating speed as recommended in applicable codes / standards. Renewable type fine finished shaft sleeves shall be integral with water thrower plates at the end and the length must extend beyond the outer faces of gland packing so as to distinguish between the leakage between shaft and the shaft sleeve and that past the seals / glands.

4.5.6. Bearings of adequate design shall be provided for taking the entire pump load arising from all probable conditions of continuous operation through its range of operation. The bearings shall be designed on the basis of 20,000 working hours minimum for the load corresponding to the duty point. Proper lubricating element does not contaminate the liquid being pumped. Bearings shall be easily accessible without disturbing the pump assembly.

4.5.7. Stuffing box of suitable design to permit replacement of packing without removing any part other than the gland shall be provided. The stuffing boxes shall be sealed / cooled by the fluid being pumped.

4.5.8. Pumps shall be of self-lubricated, self - sealed and self-cooled type. All pipework, fitters etc., for sealing, cooling and lubricating purpose shall be supplied and no external cooling/lubricating/sealing water will be supplied. Pump capacity shall take into account the cooling/lubricating/sealing water requirement.

4.5.9. All rotating components shall be statically and dynamically balanced.

4.5.10. The pump shall be designed such that pump impellers and other accessories of the pump, are not damaged due to flow reversal.

4.5.11. The pump shall be capable of developing the required total head at rated capacity for continuous operation. Also the pumps shall be capable of being operated to give satisfactory performance at any point on the head Vs. flow characteristic curve over a range or 40% of rated flow to 120 -130 % of rated flow.

4.5.12. The pump shall preferably be non-overloading type. The total head Vs. capacity curve shall be continuously rising from the maximum flow point towards shut-off without any zone of instability.

4.5.13. The pump shall run smoothly without undue noise and vibration. Peak to peak vibration limits and noise level shall be within the acceptable values of applicable codes/standards.

4.5.14. The pump and motor shafts shall be connected through a pin and rubber bush flexible type of couplings. Suitable coupling guards shall be provided for the couplings.

4.5.15. The pump shall be capable of being started with discharge valve fully opened. Motor rating shall be adequate for this condition.

4.5.16. Pump shall be Dynamically balanced to grade 6.3 or better as per ISO 1940 of assembled rotors.

4.5.17. Following shall be applicable for spray wash pumps

- Pumps with 1500rpm shall be preferred
- No negative tolerance shall be permitted in rated capacity & TDH.
- No negative tolerance shall be permitted in efficiency at rated capacity.
- The shut off head of pumps shall be at least 115% of pump rated TDH.

4.6. **Strainers on Spray wash System**

4.6.1. 2X100% strainers shall be provided on the common discharge header of the spray wash/back wash pumps, to prevent choking of the spray nozzles.

4.6.2. The Screen perforation size of Self Cleaning Strainer shall be lesser than spray nozzle opening but not to exceed 2 mm.

4.6.3. The free flow area in the Screen basket shall be at least 150% of inlet pipe.

5. **Differential Level Measuring System.**

Each travelling band screen shall be provided with a differential level measuring system for differential level across the Travelling Band screen, to check debris accumulation and to initiate the spray wash/flushing operation. This shall consist of a differential level switch/transmitter for automatic spray wash/flushing operation, a differential level indicator/display for manual observation.

The contacts for differential level switch/transmitter and for differential level gauge shall be independent so that in the event of failure of one, the other is available.

6. **Piping, Fittings, Valves, Distributors and Spray Nozzles.**

6.1. The Bidder shall supply all the piping, valves, fittings, pipe supports, flanges gaskets etc.

6.2. All piping shall be of ERW steel pipe as per IS-3589 (Pipes > 150 Nb) /IS – 1239 (Heavy Grade) Pipes ≤ 150 Nb).

6.3. The valve shall have cast body as specified in Data Sheet-A Counter flanges, gaskets, bolt, nuts, etc. shall be furnished by the bidder.

6.4. Interconnecting piping, valves, spray nozzles and other fittings shall be designed to withstand 2.0 times the operating pressure or 1.5 times the pump shut-off pressure whichever is higher.

6.5. Interconnecting piping shall be sized and routed optimally.

6.6. Necessary isolation valves, vent and drain valves for various equipments shall be provided. Valves shall conform to appropriate standards. Gland packing of all valve shall be of superior quality to avoid leakage.

6.7. Adequate number of spray nozzles be provided for proper distribution of spray along the width of the Travelling Band Screen . All joints in the spray wash system shall be flanged type for ease of removal during repairs or checking.

6.8. Bidder shall provide proper arrangement for draining and venting of the system.

6.9. **Debris Segregation Basket**

6.9.1. Debris Segregation Basket shall be kept at the end of the refuse trough to remove and

collect debris and shall have suitable arrangement of drainage of spray wash/flushing water.

6.9.2. Debris Segregation Basket shall have provision for handling using gantry crane/monorail etc. as specified in the Data Sheet-A.

6.9.3. Suitable emptying mechanism shall be made for emptying the Debris Segregation Basket by lifting it using the material Handling equipment as mentioned above and emptying the debris in a cart/truck etc. Bottom discharge baskets with a lever assisted discharge and a locking mechanism are preferable.

7. Actuators

Travelling Band Screening System shall be provided with actuators wherever necessary for various automatic operations. The actuators shall be electric motor operated and shall meet the requirements of the enclosed specification.

The actuator shall be provided with auxiliary hand wheel for manual operation in the event of control system failure.

8. Electric Motors

The drive motors for recirculation pump and other pumps if any shall conform to the requirements of the enclosed specification.

9. Instrumentation and Control System.

9.1. Complete instrumentation and control system for automatic operation of Travelling Band Screen, protection, interlocking, indication / annunciation of differential pressure and other malfunctions etc., shall be provided. This shall consist of adequate operational hardware, local control panel and interconnecting control and power cabling between the control panel and various equipments in the Travelling Band Screen.

9.2. The control panel shall house all necessary instruments, indicating / annunciation lamps, alarms, differential level indicator, timer, function selection switches, relays, protection and interlocking systems, start / stop push button etc., and shall be complete with internal wiring. The control panel shall meet the requirements of the enclosed specification.

9.3. Pressure gauges shall be provided at spray wash/flushing pump suction and discharge. All instrumentation shall be of reputed make and shall meet the requirements of the enclosed specifications.

10. Other Accessories

10.1. Counter flanges, flat faced slip on type, complete with gaskets, bolts and nuts etc., shall be supplied for inlet, outlet connections and all other terminal points. Fabrication, dimensions and drilling of the flanges shall conform to the codes/standards specified in Data Sheet-A

10.2. Spray wash/flushing pump with interconnecting piping and valves, shall be mounted on a frame/skid. For fixing the frame/skid, necessary foundation plates, bolts, nuts etc. shall be provided.

10.3. Suitable lifting arrangements shall be provided for various equipments of the travelling band system, for handling during erection and maintenance.

11. Materials of Construction

Materials of various equipments in the travelling band screening system shall be

corrosion resistant and consistent with the fluid handled. However, material specification for various components shall be equal to or superior to those specified in Data Sheet-A. Bidder to ensure that no galvanic corrosion takes place in any component, for the quality of water handled. Details of water analysis are as per Data Sheet-A.

12. **Performance Requirements.**

12.1. The Travelling Band Screening System shall perform satisfactorily under the flow and pressure drop/ differential level conditions specified in Data Sheet - A and shall be capable of removing the various forms of floating and suspended matter from raw water intake. The pressure drop/differential level maximum particle ingress shall be guaranteed that it will be permanently maintained as long as the system is in operation.

12.2. The travelling band screen, shall be designed such that the pressure drop/differential level across the system under clean conditions shall not be more than that specified in Data Sheet - A. The performance of the system shall be continuous with minimum number of flushing/spray wash operations.

12.3. The power consumption by Travelling Band screen actuators and spray wash/flushing pumps during various operations shall be minimum possible.

13. **Operational Requirements**.

13.1. The travelling band screens shall be designed with completely automatic system for continuous unattended operation.

13.2. The Travelling Water Screens shall be controlled through a Local Control Panel and shall be common for all Travelling Band Screens.

13.3. The drive motor shall have ample power to start the screen against design differential head as mentioned in the Data Sheet-A and operate continuously there after.

13.4. Level switches, alarms and annunciations shall be provided for each stream in Local Control Panel.

13.5. The start/stop facility, operation mode selection annunciation etc. for Travelling Band Screens shall be provided in LCP.

13.6. System interface of the Local control panel with the DDCMIS and other plant control panel as specified in the Data Sheet-A

14. **Safety Features and Mechanism**

14.1. Sufficient no. of safety mechanism of proven design shall be installed in the Travelling Band screening system to avoid failure in part or total of the system, if differential Level during choked condition exceeds the design differential Level.

14.2. Suitable (foolproof) isolation mechanism for drive isolation of TBS in case of overload, other than the motor overload shall also be provided.

15. **PAINTING**

15.1. The surface of SS, Gun metal, brass, bronze and non metallic component shall not be applied with any painting.

15.2. For all the steel surfaces, after surface preparation, shall be a coated with zinc chromite primer of min. thickness of 50 microns followed up with under coat of epoxy paint of min. thickness of 50 microns shall be applied. the top coat shall consist of two coats each of min. thickness of 50 microns of Epoxy paint and thus total thickness shall be min. 200

microns. Epoxy paint shall be of approved make and quality.

15.3. The surface preparation of the various equipments / components of the travelling band Screens shall be done as per the agreed procedure and shall include the following :

a) Removal of oil, grease, dirt and swarf etc.
b) Removal of rust and scale etc.
c) Sand blasting / shot blasting.

16. SHOP INSPECTION AND TESTS

16.1. General

16.1.1. Manufacturer shall conduct all tests and stage inspections as per the approved quality plan to ensure that the various equipments and other accessories of the travelling band screening system shall conform to the requirements of this specification and of the applicable codes / standards.

16.1.2. All materials used for manufacture / fabrication of the various equipments of the travelling band screening system shall be of tested quality. Relevant test certificates for chemical analysis, mechanical tests and heat treatment shall be made available before the final shop inspection. In case the relevant test certificates are not available, the manufacturer shall arrange to carry out the necessary tests as per the approved quality plan and applicable codes at his cost for which samples shall be identified by BHEL's representative.

16.1.3. All shop tests shall be conducted and test certificates / reports for the same shall be furnished to BHEL for approval.

16.1.4. Qualification of welding procedures and welders shall be as per applicable codes.

16.2. Travelling Band Screen

16.2.1. Chemical analysis, mechanical tests shall be carried out on materials used for body, Travelling Band Screen frame, Basket frame, screen and drive shaft and other appurtenances as per the applicable material specification standards.

16.2.2. All butt welded joints shall be subjected to radiographic/ ultrasonic testing as per applicable codes. However, all welded joints shall be subjected to 100% magnetic particle / penetrant testing to ensure freedom from defects.

16.2.3. Travelling Band Screen drive shafts shall be subjected to ultrasonic test as per ASTM-A388 for subsurface defects with acceptance norms as per applicable codes.

16.3. Spray Wash/ Flushing Pump

16.3.1. Chemical analysis, mechanical tests shall be carried out on materials used for casing, impeller, shaft, sleeves, wear rings etc., as per the applicable material specification standards.

16.3.2. The casting used for pump casing and impeller shall be sound, clean and free from porosity, blow holes, hard spots, cold shuts, distortion and other harmful defects. All accessible surfaces of the impeller shall be subjected to penetrant test as per ASTM-E165 for surface defects with acceptance norms as per ASME B&PV code, Section VIII, Division 1. No welding or repairs shall be carried out without prior permission of BHEL.

16.3.3. Pump shaft and sleeves shall be subjected to ultrasonic test as per ASTM - A388 for

sub-surface defects and penetrant test after finish machining as per ASTM-E165 for surface defects.

16.3.4. Wear rings shall be subjected to penetrant test as per ASTM-E165.

16.3.5. Pump impellers and rotor assembly shall be statically and dynamically balanced as per ISO-1940.

16.4. **Piping, Valves, Distributors, and Spray Nozzles.**

16.4.1. Chemical analysis, mechanical tests shall be carried out for materials used for piping, fittings, valves, distributors and injection nozzles.

16.4.2. All welded joints of distributors & injection nozzles shall be subjected to penetrant test as per ASTM-E165 for surface defects with acceptance norms as per ASME B&PV code, Section VIII, Division 1.

16.4.3. Inspection and testing of valves including leakage test shall be carried out as per the requirements of the applicable standards. Valve stem and ball shall be subjected to penetrant test as per ASTM-E165.

16.4.4. All materials for various nozzles, stubs, gaskets, nuts, bolts etc. shall be of tested quality and correlating test certificates for chemical and mechanical properties shall be furnished.

16.5. **Flanges**

16.5.1. Chemical and mechanical test certificates shall be furnished for flange materials.

16.5.2. In case of fabricated flanges, all the welds shall be subjected to 100% radiography

16.5.3. In case of forged flanges, ultrasonic testing shall be carried out as per ASTM-A 388.

16.5.4. If the thickness of the plate used for flanges is 40mm or more, the same shall be checked ultrasonically as per ASTM-A435 to demonstrate the absence of lamination and lack of fusion etc.

16.5.5. Flanges shall be checked for edge preparation, fit up and satisfactory working with matching parts.

16.6. **Dimensional Checks.**

Dimensional checks for various equipments/components of the travelling band screening system shall be carried out as per assembly drawing approved by BHEL. Alignment and fit up of movable parts shall be checked.

16.7. **Hydrostatic Test**

Hydrostatic test shall be conducted on various assemblies / equipments / components (wherever applicable) of the Travelling Band Screening System at a pressure of 1.5 times and design pressure. The duration of the test shall be minimum 30 minutes.

16.8. **Functional Tests**

16.8.1. Various assembles / equipments / components of the travelling band screening system shall be subjected to functional tests and the following shall be checked.

16.8.2. Smooth and free operation of all movable parts.
16.8.3. Interlock and sequential operation.

16.8.4. Satisfactory operations of actuators torque switches, limit switches etc.

16.9. **TESTING AT SITE**

After completion of installation at site, the travelling band screening system will be tested to check that the travelling band screening system performance meets the requirements of this specification. Rectification of all defects shall have to be done by the supplier at no extra cost to the owner / purchaser. However, the owner / purchaser reserves the right to reject the equipments / parts not meeting the requirement if the deficiency still persists.

17. **PERFORMANCE GUARANTEE**

17.1. The travelling band screening system complete with all accessories shall be guaranteed to meet the performance requirements as given in Data Sheet-A / Section-C and also for trouble-free operation after commissioning.

17.2. If the guarantees specified are not achieved by the supplier, the owner / purchaser, at his discretion, reject or accept the travelling band screening system after assessing the liquidated damages listed in Section-C / Data Sheet-A against the supplier and such amounts shall be deducted from the contract price.

17.3. Performance of the control scheme as specified.

17.4. Performance of the travelling water screen shall be free from vibration.

18. **QUALITY ASSURANCE & QUALITY PLAN**

18.1. The travelling band screening and other accessories to be supplied , shall have assured quality and workmanship.

18.2. Typical quality plans are enclosed herewith this specification for bidder's guidance. The bidder shall furnish his own quality plan based on materials, equipments and components of the Travelling Band Screening System being offered

19. **NAME PLATE AND TAG NUMBERS**

19.1. Various equipments and sub assembly of travelling band screening system shall be provided with a permanently attached brass or stainless steel plate indicating the following details :-

a) Design and maximum flow rates.
b) Design and test pressures(wherever applicable)
c) Design temperature.
d) Empty and operating weights.

19.2. Each valve in the travelling band screening system shall be provided with a name plate indicating the following :-

a) Service.
b) Design and test pressures.
c) Maximum flow and flow direction.
d) Size.
e) Engineer's Tag Number.

Tag Numbers will be indicated on the drawings submitted for approval during contract stage.

19.3. Each motor shall be provided with a name plate indicating the following details

a) Supply conditions.
b) KW Rating.
c) Make.

BHARAT HEAVY ELECTRICALS LIMITED

PROJECT | **PROJECT ENGINEERING MANAGEMENT**

VENDOR | **STANDARD QUALITY PLAN**

SECTION : **II A**
ITEM : **TRAVELLING BAND SCREEN**

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	CATE-GORY	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.0	**Raw Material**											
1.1	Head shaft, foot shaft Sprocket tooth insert, etc.	a) Verification of Mill TC for mech. / chem. Props., dimensional check.	MA	Visual, Measuremen Chemical analysis, Mech. Test	100%	ppvd. Data Sheet Drgs.	Appvd. Data Sheet / Drgs.	Mtrl. Test cert./ Lab. Report	3	3	2	For bar < 50 mm dia shall be MPI tested instead of UT Test certificates shall be submitted
		b) Ultrasonic test	MA	NDT	100%	ASTM A 388	ASTM A 388	Inspection report	3	3	2	Test certificates shall be submitted
		c) DPT on machined surface	MA	NDT	100%	ASME Sect V / ASTM E 165	ASME Sect VIII & No surface defect	Inspection report	3	3	2	Test certificates shall be submitted
1.2	Carrying chain side bars	a) Verification of Mill TC for mech. / chem. Props., dimensional check.	MA	Visual, Measurement Chemical analysis	100%	Appvd. Data Sheet /Drgs.	Appvd. Data Sheet /Drgs.	Mtrl. Test cert./ Lab. Report	3	3	2	Test certificates shall be submitted
		b) DPT on machined surface	MA	NDT	10%	ASTM E 165	No Surface Defects 100%	Inspection Report	3	3	2	Test certificates shall be submitted
1.3	Guides, embedments	Verification of Mill TC for mech /chem. props., dimnl.	`	Visual, Measurement	100%	ASTM E 165	No Surface Defects	Inspection Report	3	3	2	Test certificates shall be submitted
1.4	Fasteners	a.)Surface finish	MA	Visual	100%	SS : SA193 CS: IS 1364/ IS 1367	SS :SA193 Gr B8M CS: IS 1364/S 1367	Insp. Report	3	3	2	
		b.)Chemical properties	MA	Verification of MTC	1 per heat	SS : SA193 CS: IS 1364/S 1367	SS :SA193 Gr B8M CS: IS 1364/S 1367	Material Test Certificate	3	3	2	Test certificates shall be submitted
		c.)Physical properties	MA	Verification of MTC	1 per heat	SS : SA193 CS: IS 1364/S 1367	SS :SA193 Gr B8M CS: IS 1364/S 1367	Material Test Certificate	3	3	2	Test certificates shall be submitted
1.5	Rubber Seals	a.)Surface defects	MA	Visual	100%	No surface defect	No surface defect	Insp. Report	3	3	2	
		b.)Resistance to scratch	CR	Hardness	10% of the Lot	As per approved Drawing/Data Sheet	As per approved	Insp. Report	3	3	2	Test certificates shall be submitted
1.6	Screen wire mesh	a.) Visual, Dimension &	MA	Visual, Dimension	100% /	As per approved Drawing/Data Sheet	As per approved Drawing/Data Sheet	Insp. Report /	3	3	2	
		b.) Chemical composition	MA	and verification of MTC	1 / Lot	As per approved Drawing/Data Sheet	As per approved Drawing/Data Sheet	Material Test Certificate	3	3	2	Test certificates shall be submitted
1.7	Splash housing,	a.) Surface defects,	MA	Visual	100%	As per approved Drawing/Data Sheet	As per approved Drawing/Data Sheet	Insp. Report	3	3	2	

MANUFACTURER

SIGNATURE:

LEGENDS

P - Perform W - Witness V - Verification
1 - BHEL 2 - Vendor 3 - Vendor's Sub Vendor
MA - Major CR - Critical MTC - Material test certificate

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PROJECT | **PROJECT ENGINEERING MANAGEMENT** | SECTION **II A**

VENDOR | **STANDARD QUALITY PLAN** | ITEM : **TRAVELLING BAND SCREEN**

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
		b.) Dimension	MA	Measurement	100%	As per approved Drawing/Data Sheet	As per approved Drawing/Data Sheet		3	3	2	Test certificates shall be submitted
1.8	Head Sprocket	a.) Surface defects,	MA	Visual	100%	As per approved Drawing/Data Sheet	As per spec./	Insp. Report	3	3	2	
		b.) Dimension	MA	Measurement	100%	Drawing	Drawing	Insp. Report	3	3	2	Test certificates shall be submitted
		c.) NDT	CR	Ultrasonic testing	100%	As per approved procedure	As per approved procedure	Test report				
1.9	Reduction gearbox	a.)Routine test	CR	Functional test	100%	Appvd. Drgs./ Data Sheet	Appvd. Drgs./ Data Sheet	Supplier's test certificates	3	3	2	Test certificates shall be submitted
		b.)Surface finish	MA	visual	100%	Appvd. Drgs./ Data Sheet	Appvd. Drgs./ Data Sheet		3	3	2	
1.10	Fluid coupling	a.)Routine test	CR	Functional test	100%	Appvd. Drgs./ Data Sheet	Appvd. Drgs./ Data Sheet	Supplier's test certificates	3	3	2	Test certificates shall be submitted
		a.)Surface finish	MA	visual	100%	Appvd. Drgs./ Data Sheet	Appvd. Drgs./ Data Sheet	Test report	3	3	2	
1.11	Valves	Hydraulic Test of Body & Bonnet, Air Test, Phy./Chem. properties-TC reviews,	Major	Visual, Measurement Chemical analysis	100%	Appvd. Drgs./ Data Sheet	Appvd. Drgs./ Data Sheet	Supplier's test certificates/Test Report	3	3	2	Test certificates shall be submitted
1.12	Spray wash Pump	a.) Run Test	CR	Performance Test	100%	Appvd. Drgs./ Data Sheet	Appvd. Drgs./ Data Sheet	Supplier's test certificates	3	3	2	Test certificates shall be submitted
		b.) Surface finish	MA	Visual	100%	Appvd. Drgs./ Data Sheet	Appvd. Drgs./ Data Sheet	Test report	3	3	2	
1.13	Self cleaning Strainer	a.)Run Test	CR	Performance Test	100%	Appvd. Drgs./ Data Sheet	Appvd. Drgs./ Data Sheet	Supplier's test certificates	3	3	2	Test certificates shall be submitted
		b.) Surface finish	MA	Visual	100%	Appvd. Drgs./ Data Sheet	Appvd. Drgs./ Data Sheet	Test report	3	3	2	
1.14	Control Instruments: a) Pressure gauge, b) Pressure switch, c) Diff. Pr. Gauge, d) Diff. Pr. Switch e) Diff. Pr. Transmitter, f) Diff. Level transmitter & g) diff. Level switch	a.) Accuracy Class b.) Calibration	MA	AS per approved make				Supplier's test certificates	3	3	2	Test certificates shall be submitted
2.0	**Inprocess Inspection**											
2.1	All machined items	Visual Dimension	MA	Visual Measurement	100%	As per appvd dwg.	As per appvd dwg.	Insp. Report	2	2	1	

MANUFACTURER

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PROJECT | **PROJECT ENGINEERING MANAGEMENT**

VENDOR | **STANDARD QUALITY PLAN**

SECTION : **II A**
ITEM : **TRAVELLING BAND SCREEN**

SL. NO.	COMPONENT & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
2.2	Welding procedure qualification	Correctness of welding	CR	Scrutiny	100%	ASME sec IX	ASME sec.IX	QW-482 of ASME sec.IX	2	2	1	
2.3	Welder Performance Qualification	Ability of welder	MA	Welder qualification	100%	ASME sec IX	ASME sec IX	PQR / WPQ	2	2	1	
2.4	Root run	Surface defects	MA	LPE	100%	As per appvdprocedure	As per appvdprocedure	Insp. Report	2	2	1	
2.5	LPE on butt joints	NDE	MA	LPE	100%	As per appvdprocedure	As per appvdprocedure	Insp. Report	2	2	1	
3.0	**Final inspection**											
3.1	Part assembly and shop testing (Head shaft assy. with drive unit & few baskets)	No load dry run test	CR	Functional test	100%	As per appvd procedure	As per appvd procedure	Test Report	2	2,1	1	All TBS will be offered for functional test
3.2	a.)Sub-assembly (basket assly, link chain assly)	Dimension	MA	Measurement	100%	As per dwg	As per dwg	Insp. Report	2	2,1	1	
	b.) Sub-assembly (basket assly, link chain assly)	Surface defect	MA	Visual	100%	/Spec.	/Spec.	Insp. Report	2	2,1	1	
	c.) spray header assly & piping layout assly)	Leak test	CR	Hydro test	100%	As per appvd procedure	As per appvd procedure	Insp. Report	2	2,1	1	
3.3	Surface Preparation	Surface finish	MA	Visual	100%	As per appvd procedure	As per appvd procedure	Insp. Report	2	2,1	1	Compliance certificate/Inspection
	and Painting	Coating thickness	MA	DFT	At random	As per appvd procedure	As per appvd procedure		2	2,1	1	Report to be provided
3.4	Packing	Soundness & asthetics		Visual	100%	As per Manufacturer's practice	As per Manufacturer's practice		2	2	2	Packing as per attached Annexure-1.

MANUFACTURER

SIGNATURE:

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SECTION IIB
STANDARD TECHNICAL REQUIREMENT
FOR
ELECTRICAL SYSTEMS

		QUALITY PLAN	CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01			SPECIFICATION TITLE			
		SHEET 1 OF 2	SYSTEM			ITEM AC ELECT. MOTORS BELOW 55KW (LV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**			**11**
1.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	MANUF'S SPEC	MANUF'S SPEC	-DO-	2	-	-	
		2.DIMENSIONS	MA	-DO-	-DO-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	-DO-	2	-	-	
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	MFG.SPEC./ RELEVANT IS	MFG.SPEC. RELEVANT IS	-DO-	2	-	-	
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	MANUFR'S SPEC/BHEL SPEC./RELEVANT STANDARD	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	IS-325/ BHEL SPEC./ DATA SHEET	SAME AS COL.7	TEST REPORT	2	1		NOTE -1 & NOTE-3
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPN. REPORT	2	1	-	NOTE -1 & NOTE-3
	BHEL		**PARTICULARS**		**BIDDER/VENDOR**							
			NAME									
			SIGNATURE									

	QUALITY PLAN	CUSTOMER :		PROJECT TITLE			SPECIFICATION : NUMBER :			
		BIDDER/ VENDOR :		QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01			SPECIFICATION : TITLE :			
	SHEET 2 OF 2	SYSTEM		ITEM AC ELECT. MOTORS BELOW 55KW (LV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	W	V	REMARKS
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**			**11**
		3.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	2	1	-	

NOTES:

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

2 WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION, (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.

3 FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW , ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY.

Legends for Inspection agency

1. BHEL/CUSTOMER
2. VENDOR (MOTOR MANUFACTURER)
3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER)

P. PERFORM
W. WITNESS
V. VERIFY

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 1 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
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	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	-DO-	3	-	-	
		3.PROOF LOAD TEST (EYE BOLT)	MA	MECH. TEST	-DO-	-DO-	-DO-	INSPEC. REPORT	3	-	2	
1.2	HARDWARES	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, UN-EVENNESS ETC.	-DO-	3	-	-	
		2.PROPERTY CLASS	MA	VISUAL	SAMPLES	MANFR'S DRG./SPEC BOOK	RELEVENT IS/SPEC.	SUPPLIERS TC & LOG	3	-	2	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	3	-	2	
		2.CHEM. & PHY. PROP.	MA	CHEM & MECH TEST	1/HEAT NO.	MANFR'S DRG./SPEC	RELEVENT IS/	SUPPLIER'S TC	3	-	2	HEAT NO. SHALL BE VERIFIED
		3.DIMENSIONS	MA	MEASUREMENT	100%	MANUFR'S DRG.	MANUFR'S DRG.	LOG BOOK	3	-	2	
1.4	PAINT & VARNISH	1.MAKE, SHADE, SHELF LIFE & TYPE	MA	VISUAL	100% CONTINUOUS	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	LOG BOOK	3	-	2	

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 2 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED
		2. CHEM. & PHYSICAL PROPERTIES	MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO	MFG. DRG. SPEC.	RELEVANT IS	SUPPLIER'S TC	3	-	2	
		3. DIMENSIONS	MA	MEASUREMENT	100%	-DO-	MANUFR'S DRG.	LOG BOOK	3	-	2	
		4.INTERNAL FLAWS	CR	UT	-DO-	ASTM-A388	MANUFR'S SPEC. BHEL SPEC.	-DO-	3	2	1	FOR DIA OF 55 MM & ABOVE
1.6	SPACE HEATERS, CONNEC-TORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING	MA	VISUAL	-DO-	MANUFR'S DRG. SPEC.	MANUFR'S DRG. SPEC.	-DO-	3	-	2	
		2. PHYSICAL COND.	MA	-DO-	-DO-	-	NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY	-DO-	3	-	2	
		3.DIMENSIONS (WHEREVER APPLICABLE)	MA	MEASUREMENT	SAMPLE	MANUFR'S DRG./ SPEC.	MANUFR'S DRG. / SPEC.	-DO-	3	-	2	
		4.PERFORMANCE/ CALIBRATION	MA	TEST	100%	-DO-	-DO-	INSP. REPORT	3	-	2	

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 3 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**			**11**
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND. ETC.	MA	VISUAL	100%	-	NO VISUAL DEFECTS	INSPT. REPORT	3	-	2	
		2. OTHER CHARACTERISTICS	MA	TEST	SAMPLE	MANUF'S SPEC.	MANUF'S SPEC.	LOG BOOK AND OR SUPPLIER'S TC	3	-	2	
1.8	SHEET STAMPING (PUNCHED)	1. SURFACE COND.	MA	VISUAL	100%	-	NO VISUAL DEFECTS (FREE FROM BURS)	LOG BOOK	3	-	-	
		2.DIMENSIONS INCLUDING BURS HEIGHT	MA	MEASUREMENT	SAMPLE	MANUFR'S DRG. .	MANUFR'S DRG.	-DO-	3	-	2	FOR MV MOTOR INSULA-TION/VARNISH THICKNESS SHALL BE MORE THAN THE BURS HEIGHT
		3. ACCEPTANCE TESTS	MA	ELECT. & MECH TESTS	-DO-	MANUF'S SPEC./ RELEVANT IS	RELEVANT IS	SUPPLIER'S TC	3	-	2	
1.9	CONDUCTORS	1. SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	LOG BOOK	3*	-	2*	* 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	RELEVANT IS/ BS OR OTHER STANDARDS	RELEVANT IS/ BS OR OTHER STANDARDS	SUPPLIERS TC & VENDOR'S INSPN. REPORTS	3	-	2	

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN	CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
		BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 4 OF 9	SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III

SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
		3.DIMENSIONS	MA	MEASUREMENT	-DO-	-DO-	-DO-	Log Book	3	-	2	
1.10	BEARINGS	1.MAKE & TYPE	MA	VISUAL	100%	MANFR'S DRG./ APPROVED DATASHEET	MANFR'S DRG./ APPROVED DATASHEET	-DO-	3	-	2	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	BHEL DATA SHEET	BHEL DATA SHEET BEARING MANUF'S CATALOGUES	-DO-	3	-	2	
		3.SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	2	
1.11	SLIP RING (WHEREVER APPLICABLE)	1.SURFACE COND.	MA	VISUAL	100%	-	-DO-	-DO-	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	
		3.TEMP.WITH-STAND CAPACITY	MA	ELECT.TEST	-DO-	MANUF'S SPEC./ BHEL SPEC.	MANUF'S SPEC./ BHEL SPEC.	-DO-	3	-	2	
		4.HV/IR	MA	-DO-	100%	-DO-	-DO-	-DO-	3	-	2	
1.12	OIL SEALS & GASKETS	1.MATERIAL OF GASKET	MA	VISUAL	100%	MANUF'S DRG/SPECS	MANUF'S DRG./ SPECS.	-DO-	3	-	-	
		2.SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	
		3.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ : VENDOR			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 5 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
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	3/2	2	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-	
2.2	MACHINING	1.FINISH	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	2	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-	
		3.SHAFT SURFACE FLOWS	MA	PT	-DO-	RELEVENT SPEC./ ASTM-E165	MANUFR'S SPEC./ BHEL SPEC./	-DO-	2	-	1	
2.3	PAINTING	1.SURFACE PREPARATION	MA	VISUAL	100%	MANFR'S SPEC/BHEL SPEC./ RELEVANT STAND	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
		2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT)	MA	MEASUREMENT BY ELCOMETER	SAMPLE	-DO-	-DO-	-DO-	2	-	-	
		3.SHADE	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-	
		4.ADHESION	MA	CROSS CUTTING & TAPE TEST	-DO-	-DO-	-DO-	Log Book	2	-	-	

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ : VENDOR			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 6 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	**W**	**V**	
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**			**11**
2.4	SHEET STACKING	1.COMPLETENESS	MA	MEASUREMENT	SAMPLE	MANUFR'S SPEC.	MANUFR'S SPEC.	Log Book	2	-	-	
		2.COMPRESSION & TIGHTENING	MA	MEASUREMENT	100%	-DO-	-DO-	Log Book	2	-	-	
		3.CORE LOSS & HOTSPOT	MA	ELECT.TEST	-DO-	-DO-	-DO-	Log Book	2	1*	1	(FOR MOTORS OF 2MW AND ABOVE) * ON 10% RANDOM SAMPLE
2.5	WINDING	1.COMPLETENESS	CR	VISUAL	100%	MANUFR'S SPEC./BHEL SPEC.	MANUFR'S SPEC./BHEL SPEC.	Log Book	2	-	-	
		2.CLEANLINESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		3.IR-HV-IR	CR	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2	-	1	
		4.RESISTANCE	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
		5.INTERTURN INSULATION	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		6.SURGE WITH STAND AND TAN. DELTA TEST	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	FOR MV MOTOR
2.6	IMPREGNATION	1.VISCOSCITY	MA	PHY. TEST	AT STARTING	-DO-	-DO-	Log Book	2	-	-	
		2.TEMP. PRESSURE VACCUM	MA	PROCESS CHECK	CONTINUOUS	-DO-	-DO-	Log Book	2	-	-	
		3.NO. OF DIPS	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	THREE DIPS TO BE GIVEN
BHEL			**PARTICULARS**		**BIDDER/VENDOR**							
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

	QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :			
			BIDDER/ VENDOR :			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE			
	SHEET 7 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	W	V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
		4.DURATION	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	
2.7	COMPLETE STATOR ASSEMBLY	1.COMPACTNESS & CLEANLINESS	MA	VISUAL	100%	-DO-	-DO-	Log Book	2	-	-	
2.8	BRAZING/COMPRESSION JOINT	1.COMPLETENESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-	
		2.SOUNDNESS	CR	MALLET TEST & UT	-DO-	-DO-	-DO-	Log Book	2		1	
		3.HV	MA	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2		1	
2.9	COMPLETE ROTOR ASSEMBLY	1.RESIDUAL UNBALANCE	CR	DYN. BALANCE	-DO-	MFG SPEC./ ISO 1940	MFG. DWG.	Log Book	2		1	VERIFICATION FOR MV MOTOR ONLY
		2.SOUNDNESS OF DIE CASTING	CR	ELECT. (GROWLER TEST)	-DO-	MFG. SPEC.	MFG. SPEC.	Log Book	2		1	
2.10	ASSEMBLY	1.ALIGNMENT	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	-	
		2.WORKMANSHIP	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-	
		3.AXIAL PLAY	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	1	
		4.DIMENSIONS	MA	-DO-	-DO-	MFG.DRG./ MFG SPEC.	MFG. DRG/ RELEVANT IS	Log Book	2	-	-	
		5.CORRECTNESS, COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2	-	-	
		6. RTD, BTD & SPACE HEATER MOUNTING.	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2		1	

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN	CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :				
		BIDDER/ : VENDOR			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE				
	SHEET 8 OF 9	SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION			VOLUME III	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
3.0	TESTS	1.TYPE TESTS INCLUDING SPECIAL TESTS AS PER BHEL SPEC.	MA	ELECT.TEST	1/TYPE/SIZE	IS-325/ BHEL SPEC./ DATA SHEET	IS-325/ BHEL SPEC./ DATA SHEET	TEST REPORT	2	1*	1	* NOTE - 1
		2.ROUTINE TESTS INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1$	1	$ NOTE - 2
		3.VIBRATION & NOISE LEVEL	MA	-DO-	100%	IS-12075 & IS-12065	IS-12075 & IS-12065	-DO-	2	1$	1	$ NOTE - 2
		4.OVERALL DIMENSIONS AND ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPC. REPORT	2	1	-	
		5.DEGREE OF PROTECTION	MA	ELECT. & MECH. TEST	1/TYPE/ SIZE	RELEVANT IS	BHEL SPEC. AND DATA SHEET	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		6. MEASUREMENT OF RESISTANCE OF RTD & BTD	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1$	1	$ NOTE - 2
		7. MEASUREMENT OF RESISTANCE, IR OF SPACE HEATER	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1$	1	$ NOTE - 2
		8. NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPC. REPORT	2	1$	1	$ NOTE - 2
		9.EXPLOSION FLAME PROOF NESS (IF SPECIFIED)	MA	EXPLOSION FLAME PROOF TEST	1/TYPE	IS-3682 IS-8239 IS-8240	IS-3682 IS-8239 IS-8240	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3
		10. PAINT SHADE, THICKNESS & FINISH	MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	BHEL SPEC. & DATA SHEET	BHEL SPEC. & DATA SHEET	TC	2	1$	1	SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY $ NOTE - 2

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

	QUALITY PLAN		CUSTOMER :			PROJECT TITLE			SPECIFICATION : NUMBER :		
			BIDDER/ : VENDOR			QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03			SPECIFICATION : TITLE		
	SHEET 9 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION		VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P W V		REMARKS
1	2	3	4	5	6	7	8	9	10		11

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 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 WHEREVER CUSTOMER IS INVOLVED IN INSPECTION, AGENCY (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.

Legends for Inspection agency

1. BHEL/CUSTOMER
2. VENDOR (MOTOR MANUFACTURER)
3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER)

P. PERFORM
W. WITNESS
V. VERIFY

BHEL	**PARTICULARS**	**BIDDER/VENDOR**	
	NAME		
	SIGNATURE		
	DATE		BIDDER'S/VENDORS COMPANY SEAL

SECTION II C
STANDARD TECHNICAL SPECIFICATION
FOR
CONTROL & INSTRUMENTATION SYSTEMS

SECTION-D

INSTRUMENTS, JB & VALVES SPECIFICATIONS

B0.6.18.14 Requirements for local cubicles and local housings for e.g. switchgear, control, measurement and signalling equipment

Steel-clad cubicles and enclosures with fixed, integral switchgear and apparatus must be provided.

The switchgear cubicles must be partitioned off and incorporate a busbar system, the necessary instruments, control switches, switch panels of the individual switch and apparatus chambers. The main busbars are to be installed on the rear face, top side of the switchgear cubicle in a lockable shuttered compartment.

Connections to switching devices, MCB's fuses etc. are to be made from these busbars. The lower part of the cubicle will house the terminal strips and connecting blocks, the clamps for the cable terminals and, if required parallel connection copper straps for the connection of more than 2 cables in parallel. An adequate number of ball studs must be provided within the

switchgear cubicle suitable for earthing the main and distribution busbars as well as the switchgear itself by means of portable earthing and short circuiting equipment (to be provided once per switchgear panel row).

The space in the interior of the cubicles must be divided into a Section with 'live' parts, 'live' switching elements etc. and a Section with control and measuring equipment. The Sections are to be separated by reinforced sheet-steel.

Care must be taken that in the event of arcing hot gases will not escape to the front of the cubicles (the operational side).

Ammeters are to be provided on the cubicle front panel for the cubicle feeders and the supply outlets for motors higher than 55 kW or motors of lower rating, but particularly important for the process. A single voltmeter with 4-position voltmeter changeover switch must be provided for measurements of busbar voltage between each phase and neutral. Measuring instruments should, in general, be square in shape.

All cubicles, cabinets, panels, etc. shall be designed for an ambient temperature of 40 °C (outside the enclosure) in non-air conditioned areas. Special precautions shall be taken in the design of electronic devices for protection and control systems housed in the cubicle in order to allow for these conditions.

Heating elements are to be provided generally in each local cubicle or cabinet and shall be humidity controlled.

It must be possible to disconnect power supplies to the cabinets by means of manually operated power circuit-breakers (MCBs).

For easy monitoring and a rapid grasp of the operational state, collared mimic diagrams with the required switch position indicators, apparatus symbols and pilot lamps must be provided in every case on main process cubicles and switchgear cubicles. Lamp test facilities for all signed lamps connected shall be provided. All cubicles shall be provided with the required earthing screws.

Plastic-insulated, stranded conductors must be used for wiring within the switchgear cabinets, which must be numbered at each end with special tabs so that change by mistake is impossible.

Preferably plug-in type auxiliary relays are to be used. Apparatus being sensitive to impact must be protected against shock and vibration.

On completion of hand-over the cubicles must contain at least 5% of fully fitted spare terminal capacity and 5% of spare space for the future installation of extra equipment. It shall be possible to replace indicating lamps on the front panels of cubicle feeders and motor-supply outlets

without isolating the equipment concerned. Furthermore the control system must be designed in such a way that lamps operate at less than their rated voltage in order to avoid their being overheated.

Incoming and outgoing cables have to be fixed by suitable metallic cable glands.

B0.6.18.15 Local control points and level control cabinets

B0.6.18.15.1 General

Any electrical consumer unit, which is not controlled automatically or from the central control room, is to be fitted with a suitable local control cabinet. The local control cabinets are to be installed in the immediate vicinity of the motor drive to be controlled.

Pump motors, which are level controlled locally, will be given an automatic and manual control. The respective level control cabinets are to be fitted in the immediate vicinity of the pump motors, gauge glasses or level monitoring instruments.

B0.6.18.15.2 Construction requirements

In general local control cabinets and level control cabinets with plastic casings resistant to impact, sand, light and water, mounted on walls or hot-dip galvanized supporting constructions, are to be provided. Hot-dip galvanized casings will be acceptable.

Protection class must be at least IP 54 if installed indoors and IP 55W if located outdoors. The necessary earthing terminals must be provided for earthing purposes.

The cabinets must be equipped with the necessary mini circuit breakers, fuses, auxiliary relays, power contactors, terminal blocks and cable attachment components.

For motors with pre-selection control (operation/stand-by) operation hours counters are to be provided.

In hazardous areas, the necessary explosion proof control cabinets and level control equipment must be provided in accordance with IEC 60079, IEC 61241 and VDE 0165/170/171.

B0.6.18.15.3 Local control points

The local control points are to be equipped as the minimum requirement with:

- ON button
- OFF button
- Running lamp
- FAULT LAMP
- TRIP HEALTHY indication
- Lamp test.

When two motors are installed, serving as operation and stand-by unit, then in addition to a double set of the above items, the following equipment has to be installed as the minimum requirement:

- MOTOR 1 - MOTOR 2 (running motor/stand-by motor) pre-selection switch,
- automatic transfer to the stand-by motor in case of failure of the running motor.

B0.6.18.15.4 Level controls

In the case of pump motors controlled by levels, in addition to the level control in each case the MANUAL - AUTOMATIC selector switch and the necessary local points are to be fitted. Control of individual pump motors must be effected as follows as the minimum requirement:

- MANUAL- AUTOMATIC selector switch
- level control with maximum and minimum contacts
- low level contact on motor - OFF
- bottom maximum contact on motor - ON
- top maximum contact as warning to the central control room
- low-low level contact as pump dry-running protection and alarm signal to the central control room
- local control point with ON and OFF button, running and fault lamp.

When two pump motors are installed for the same purpose the control is to be effected as follows, as a minimum requirement:

- MANUAL - AUTOMATIC selector switch
- PUMP 1 - PUMP 2 (running pump / stand-by pump) pre-selection switch
- level control with three high level contacts:
- first (1): high level contact for pre-selected ON
- second (2): high level contact for alarm signal to the central control room
- low level contacts for pumps OFF
- low-low level contacts as pump dry-running protection and alarm signal to the central control room

- local control and lamps as listed above for local control cabinets, for each motor

B0.6.18.16 Terminal boxes and terminal cabinets

In order to minimize the amount of cables and distribution of signals and to centralize connections in the Plant, terminal boxes or, wherever necessary, by larger amounts of terminals, terminal cabinets shall be fitted on all the necessary

- cable crossover terminal points
- central collecting points for individual analog and binary signals and local transmitters
- signal collecting and distribution points for fire alarm, telephone, loudspeaker and clock system
- central distribution points for local signals.

Terminal boxes and cabinets must at least have class of protection IP 54 if installed indoors and IP 55W if installed outdoors and must be equipped with the necessary terminal strips, cable glands and fittings components for the connection of the cables.
The necessary earthing terminals are to be provided for the earthing of the boxes and cabinets.

In any area subject to the danger of explosion, the necessary explosion-protected terminal boxes and cabinets are to be provided in accordance with IEC 60079 and IEC 61241 and VDE 0165/0170/0171.

B0.6.19 Instrumentation and control equipment

B0.6.19.1 Main design criteria

This Section applies to the design of the general Instrumentation and Control equipment. The following general requirements shall be strictly observed with regard to design and execution. In the event of contradictions the Contractor shall be responsible for obtaining written clarification from the Employer/Engineer.

Reference within this Section does not automatically indicate that the particular form of instrumentation is required on this project or will be acceptable for a particular application. The particular requirements for control and instrumentation shall take preference in the event of any disagreement between the two Sections.

Only requirements for technical performance of the equipment are stated herein, whilst the detailed requirements of the tasks to be performed by the control systems and the scope of delivery for each individual item of plant is stated in the relevant Sections of this specification.

This specification does not however relieve the Contractor of his responsibility for the basic design and execution of the instrumentation and control system per scope of supply in relevant Sections of this specification. The rules of good engineering practice and the relevant approved standards and regulations shall be observed.

A consistent instrumentation and control philosophy shall apply throughout the Plant and shall be implemented in terms of a range of equipment exhibiting a minimum diversity of type and manufacture. The objective shall be to standardize all measurement and control equipment throughout the Plant in order to rationalize operation, maintenance and reduce spares holding.

Generally equipment shall be supplied from one composite range of measurements and control equipment as marketed by a reputable manufacturer of international standing and shall have a minimum of two years operational use on similar projects. Where particular equipment is not included in the products of the manufacturer thus necessitating diversity of supply, this equipment shall be identified by the Contractor.
The equipment shall be of modern, compact design incorporating the latest developments in proven technology. All instruments whether for local indication or remote transmission shall be of good quality and shall have an accuracy and repeatability appropriate to their duty. All fittings shall use metric threads.

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Measurement and control instruments shall be matched to the main plant equipment ratings in all aspects. Instrument ranges, installation codes of practice and precautionary measures for safety of the Plant and the operating and maintaining personnel shall be observed.

Special attention shall be paid to the Plant safety. As a general rule, measuring points and measuring equipment for critical protection shall be separate from and not combined with measuring equipment for the automatic control equipment.

The material of all equipment installed in pipes, tanks, etc., shall correspond to the material of the relevant pipes, tanks etc. and shall fully meet the requirements regarding safety and operational conditions of the media to be measured. All the equipment shall be suitable for the location in which it is to be mounted and in particular all outdoor equipment shall be suitable for the prevailing climatic conditions.

The diversity of makes and types shall be kept to a minimum. The Employer/Engineer reserves the right to stipulate make and type following award of contract.

Any equipment to be installed within potentially explosives atmospheres shall comply with the requirements of international standards and codes, e.g. IEC-60079, NEC 500 etc.

The instrumentation and control equipment shall have high electro-magnetic and radio frequency interference immunity and shall not be affected by portable radio transmitters operated in the vicinity of the equipment. Any limitations shall be stated.

All instruments shall be protected by cases. The cases shall have enclosure classification not less than IP 42 according to EN 60529 when mounted indoors in totally enclosed rooms with provision for limited ingress of dust, IP 54 else in a enclosed building and IP 55W for mounting outdoors.

Electronic instruments shall not be located close to hot lines, vessels or other hot equipment. Ambient sun temperatures exceeding 80 °C shall not result in calibration difficulties or rapid deterioration of electronic components.

B0.6.19.4 Control cubicles

DCS, PLC hardware and other associated control equipment shall be installed in suitable control cubicles. The cubicles shall be set up in local switchgear/ electronic rooms (CER or LER) or in local control centers (LCC). The protection class required is specified under **Section B0.6.18**.

Outdoor installed cubicles shall be provided with thermostatically controlled heating elements in order to prevent the formation of condensate which may occur due to large variations of ambient conditions, if necessary. Adequate lighting and sockets for hand tools protected by 30 mA Residual Current Differential Switch (RCDS) shall also be provided for cubicles and panels, if necessary.

The cubicles shall be secured in such a way that failure of one node cannot cause the failure of the whole system.

The required control elements and displays (annunciation and status lights, analogue displays, switches etc.) shall be so configured that as far as possible they can be viewed from the associated secondary system. Should it be necessary to place the control and monitoring elements in the field, these shall be installed in separate, robust housings (protection class IP 55W). All alarms/ annunciations shall as well be available in DCS.

In preference LED displays shall be used. Ease of access and operation of the equipment shall be ensured.

Visual display unit (VDUs) will be employed for field operation and monitoring.

All cubicles shall be adequately ventilated in order that the heat generated by the equipment mounted there shall remain within the specified limits, even in the case of high ambient temperatures that may occur in the event of failure of the air-conditioning system.

Locally installed cubicles shall be suitable for the location in which they are situated and shall provide adequate protection against dust, moisture or mechanical damage for the equipment mounted therein. Cubicles shall be designed in such a way that vibrations of the building shall be absorbed to a large extent. Sunshades shall be provided for all cubicle located outdoors.

Cable connections to cubicles, panels and desks shall be made via suitable seals so as to prevent the ingress of dust, vermin or the propagation of a possible fire. During installation period, a provisional sealing of cable penetrations shall be ensured.

B0.6.19.5 Racks, junction boxes

Marshalling racks

Separate cubicle type marshalling/ termination panels shall be provided, i.e. field signals shall not be terminated in the rear side of the system cabinets.

Open type racks constructed of angle steel may be used for the marshalling and termination of low voltage control cables within the Central Electronics Rooms (CER & LER). Cubicle type marshalling racks may also be considered.

For voltages exceeding 60 V, a suitably separated Section with isolation cover shall be provided.

Instrument racks

Wherever possible, instruments and devices, e.g. transmitters, thermo element cold junctions, terminal boxes, located in the field, shall be mounted on local instrument racks. The instrument racks shall be installed with due regard to control engineering needs, material-saving assembly and easy accessibility for maintenance and checking work, and shall be constructed of standard angle Section steel.

Junction boxes

In order to simplify local collection of cables and distribution of signals and to centralize connections in the Plant the junction boxes shall be fitted on all the necessary:

- cable crossover terminal points,
- electrical actuators,
- central collecting points for individual analog and binary signals and local transmitters,
- central distribution points for local signals.

The necessary intermediate terminal boxes must at least have degree of protection IP 55 in accordance with EN 60529 and must be equipped with the necessary terminal strips and attachment components for the connection of the cables. The necessary earthing terminals shall be provided for the earthing of the boxes. In hazardous areas, terminal boxes shall be in accordance with EN 50019 or 50020, depending on zone classification.

After commissioning, the junction boxes, marshalling racks, instrument racks, etc. must contain at least 10% of spare space. The Contractor shall furthermore provide at least 10% of fully fitted spare terminal capacity.

B0.6.19.8 Transmitters

All transmitters shall have an impressed output signal of 4 - 20 mA corresponding to zero to full range input. However, digital communication shall also be acceptable.

Generally, 2-wire transmitters shall be used. If for some special purposes (e.g. analyzers) 230 V AC power supply is required, the output circuit shall be isolated.

As far as possible, all transmitters shall be of the SMART-type. This applies also to field mounted temperature transmitters.

All transmitters shall be fitted with a local analog or digital indicator displaying appropriate physical units which may be read clearly from an easily accessible position.

Transmitters with accuracy class "0.5" or better must be used. The repeatability shall be within a range of ± 0.1% of full span.

The output signal of all transmitters must be independent of the burden of the transmitter output circuit including cable resistance over a wide range.

The removal of connected devices must not open the transmitter output circuit or cause malfunction of this circuit. In the case of failure and return of the supply voltage within a measuring circuit, no false signals endangering the system shall be issued. All transmitters shall be individually fused. If not specified otherwise, local parameterization at the transmitter or via modem and PC/laptop or hand held communicator using HART-protocol shall be possible.

For the continuous remote position indication of valves, dampers etc. also transmitters with impressed output signal of 4- 20 mA shall be employed.

All transmitters shall be suitable for field installation and shall have strong, moisture and dustproof cases of IP 65 or better according to EN 60529. This applies also for temperature transmitters when installed in the field.

Diaphragm seals shall be provided to serve as a barrier for corrosive process fluids, slurries or highly viscous oils. The seal shall be of the flanged type, suitable for the same conditions as those for the transmitter. The material selection shall be according to the requirements of the fluids to be measured. The seal shall be provided with a flushing connection.

Transmitters to be used in hazardous areas shall be explosion proof. Suitable intrinsically safe circuits are to be provided in accordance with EN 60079-11.

All transmitters potentially subjected to vacuum shall be capable of withstanding 100% vacuum without damage.

No stress shall be imposed through the connections between Plant and the transmitter. As far as possible, the transmitters shall be grouped together into enclosed racks or panels for easy access. Sunshades shall be provided for all outdoor panels.

Individually installed transmitters shall have their own weather proof enclosure of robust construction and be suitable for the proposed

environment. All field equipment terminals shall be wired to a terminal box using screwed connections.

Transmitters shall be provided with all necessary isolating, vent and blow-down valves and facilities shall be provided for the connection of test instruments at the input and output of each transmitter, to enable calibration to be carried out.

In general limits (for alarms or switching actions) shall be derived from the analogue measurement value in the DCS (use of switches shall be avoided). Where binary signals cannot be derived from an analog value, **binary transmitters** e.g. temperature switches, pressure switches etc. may be used. Indicators with integrated limit switches are allowed within package units. Preferably limit switches shall be of the proximity type.
All switches shall be of robust design and reliable performance. Temperature switches, pressure switches, level switches, and etc. shall be of the snap-action and change over type. The switches shall have an adjustable switching hysteresis. Parity checks shall be supplied for switches. (Note: Parity checks refer to the supervision of switches, i.e. it shall be supervised that switches have one defined state and are not undefined e.g. neither open nor closed. Finally this means that there have to be 2 DI to be used for each switch, one for "open" detection and one for "closed" detection.)

The set point and the deadband (reset point) of each switch shall be adjustable from inside the case, over the full range specified. The set point and reset point shall be indicated on the adjusting mechanism.

For the sensing of level in tanks, vessels or bunkers float switches, vibration level switches or other suitable switching devices with conductive or capacitive electrodes shall be provided.

For monitoring of machine coolant or lubricant flow (dry running protection) suitable flow or level sensors shall be employed.

The switches shall be housed in robust, dust and moisture proof cases having glanded cable entries and shall be suitable for the ambient conditions local to the equipment on which they are mounted.

B0.6.19.9 Temperature measurements

Glass thermometers, bi-metallic and capillary remote thermometers are to be used for local temperature measurement. For both, class 1.0 shall be provided.

Glass thermometers are to be inserted into pockets provided for the purpose. The use of mercury is forbidden.

Capillary remote thermometers shall be with a case diameter of preferably 160 mm and must be mounted on fixtures or instrument panels in such a

way that they are protected from vibration, jarring and sprayed water. The capillary tube must be laid in a protected position.

If possible, resistance thermometers (Pt-100) in accordance with IEC 60751 shall be used for remote measurements. All resistance thermometers shall be wired according to the four-conductor principle.

Otherwise, thermocouples with appropriate heat resistance in accordance with DIN IEC 60584-1 or equivalent may be used for remote measurements.

All thermocouples shall be of the quick response type, ungrounded and preferably of double element type.

Thermocouples shall be arranged in such a way that the ambient temperature of the head is lower than 100 °C, and that the measuring inserts can easily be exchanged.

All thermocouples and extension leads shall be terminated with a suitable gland and the conductor to sheath resistance shall be greater than 100 M-Ohms when tested after termination.

Thermometers and thermocouples shall generally be fitted in protective wells. They shall be provided with weatherproof terminal heads and shall be installed so as to totally prevent the ingress of foreign matter.

High speed response pockets shall be provided for all applications involving control of critical process temperatures. Thermowells with high speed of response shall be used.

Where more than one temperature measurement e.g. for redundant loops, recording, indication, automatic control is to be made at one location, individual protective wells with sensors shall be provided at the common place of measurement. Protective wells for unoccupied test measuring points shall be arranged with the opening inclined downwards wherever possible and shall be provided with a screw-on protection cover.

Insofar as local conditions or extreme temperature do not require otherwise, screw-in immersion wells for exhaust gas and air shall meet the following requirements:

- nominal length not less than 0.5 m
- attachment of the well in the wall of the exhaust gas channel or air duct must be gas-proof.

For the measurement of temperature of other media the following requirements shall be observed:

For all pipework a minimum immersion depth of 55 mm in the internal pipeline cross-section and a minimum distance of 15 mm from the opposite

pipe wall must be provided. If the diameter of the pipeline does not allow the thermometer to be inserted perpendicular to the pipe axis while still maintaining the above mentioned measurements, another solution must be found in cooperation with the Employer/ Engineer. When determining the lengths of the insertion and connecting tubes the insulation thickness is to be taken into consideration.

For all remote temperature measurements (i.e. for RTDs and TCs) transmitters shall be installed locally in a transmitter protecting box on a DIN rail.

B0.6.19.10 Pressure measurements

Pressure gauges of class 1.6 or better must be used. The standard measuring ranges must be selected with regard to the maximum operating pressure.

A pressure instrument installed for measurement of steady pressure at varying pressure shall operate in a band centered on 60% of its maximum range.

When the pressure impulse line is liquid filled the measuring unit shall be compensated for static head. The head correction shall be stated on the unit.

Pressure gauges shall have a dial size of 160 mm and shall be located in such a way that they can be easily observed or shall be combined in groups on local gauge boards or cubicles.

Pressure gauges shall be resistant against vibrations. Furthermore, pressure gauges shall be designed in such a way that the measured value may reach the end of the indicating range without affecting the calibration of the gauge.

Pressures to be remotely indicated, recorded or used for automatic control loop inputs shall be measured by means of pressure transmitters (refer to relevant part of **Section B0**).

Pressure measurement tapping points shall generally be in accordance with the specification for the pipeline in which they are installed and shall be equipped with one, and for high pressure installations (45 bar) two, isolating valves arranged directly at the tapping point. Excluded from this stipulation are measuring points for vacuum and measuring points for combustion air and exhaust gas.

Piping shall be of approved quality and sized for the particular service. In all cases the pipe size shall be chosen to ensure strength and freedom from blockage. Instrument impulse pipework shall be manufactured from a suitable grade of stainless steel to the approval of the Employer/Engineer.

Pressure transmitters for remote measurement shall not be mounted directly at the tapping point, but shall be arranged at a distance from the tapping

point by means of enclosures. The impulse line between tapping point and transmitter shall be arranged in such a way as to form a siphon loop, when steam pressure measurements are involved.

A valve combination or multiway cock shall be provided directly on each pressure gauge or transducer connection. They shall be equipped with a connection for test gauges, and it shall be possible to shut off the test connection without isolating the service pressure gauge at the same time.

Open blowdown / drain connections shall not be arranged within panels and local equipment. Instead it shall be led to a drain external to the panel. All valves shall be installed so that they are accessible for in-situ maintenance from a floor or permanent structure landing.

Transmitters are to be protected from the measuring media, if required.

In addition to the above requirements, special valve block equipment shall be provided, where differential pressure is to be measured. Alternatively, differential pressure type transmitter can be considered.

B0.6.19.11 Flow measurements

Remote flow measurements of water, steam, combustion air, flue gas etc. shall, unless otherwise specified, be carried out by means of differential pressure, ultrasonic, electromagnetic, annubar, corriolis, turbine meters, oval-wheel flow meters.

The transmitters shall be as specified under **Section B0**. Changes in density, pressure or temperature of the measured medium shall be compensated wherever necessary.

Tags on orifice plates shall be stamped with the basic design information (i.e. flow rate, pressure and temperature of the passing fluid, the orifice diameter and the pressure differential generated).

Primary elements such as orifices or nozzles located in steam or high pressure feed water pipes shall be of the weld-in type. Material, dimensions and installation of orifices, nozzles and tapping points etc. shall be in accordance with the specification for the pipes in which they are installed.

Orifice Plate installation using Weldneck Flange assemblies shall be offered. Tappings shall be on the flange and not on pipe.

Isolating valves shall be provided at the tapping points of the orifices/ nozzles. In the case of steam flow measurements condensing vessels (steam traps) shall be provided between the tapping point and the isolating valve.

The material and dimensions of the piping shall conform to those laid down for the piping concerned. The welds shall be executed in such a manner as to avoid turbulence that can affect the measurement.

In order to achieve exact installation, the vendor supplying the orifice plate or nozzle for high pressure pipes shall install the orifice plate or nozzle in its own works in a Section of pipe of about 3.5 times the pipe diameter (1.0 x NB in the outlet, 2.5 x NB in the inlet). For orifice plates or nozzles installed in pipes with a nominal bore smaller than 80 mm, complete meter runs shall be supplied.

Orifice plates and nozzles shall be manufactured of ANSI 316 Stainless Steel unless specified otherwise. Orifice plates shall be sized according ISO 5167-2.
Orifice plates shall be sized for a d/D ratio not less than 0.20 and not greater than 0.70. Higher rather than lower d/D ratio are preferred to minimize line restrictions. All sizing calculations shall be submitted to the Employer/ Engineer for approval.

Tags on orifice plates shall be stamped with the basic design information (i.e. flow rate, pressure and temperature of the passing fluid, the orifice diameter and the pressure differential generated).

Venturi tubes according to ASME MFC-3M shall only be considered when operating economy requires low permanent pressure losses.

The erection welding seams shall be executed in such a manner that no turbulence, which will affect the measurement, can occur.

Rectangular venturi tubes may be considered where other measuring devices are impossible or impractical (e.g. in large rectangular air duct of boilers).

For flow measurements in LP-systems e.g. water or condensate, orifice plate installation using slip-on orifice flanges shall be provided. All orifice plates for installation between flanges shall have their own tapings for differential pressure measurements incorporated in the plate. Simple orifice plates with the tapings situated in the pipe are not allowed. The flow direction shall be consistently marked on the orifice or nozzle by means of an arrow.

Special conditions may dictate the use of devices such as:

- venturi tubes for low pressure gases
- pitot tubes such as Annubar.

Ultrasonic flow sensors shall provide a double transmitter/ receiver system and be for installation with a calibrated pipe. The tube lining material shall be as required for the fluid and its temperature and be as specified in other chapters of this **Section B0**. The use of ultrasonic clamp on flow meters shall be avoided and requires dedicated approval of the Employer/ Engineer.

The accuracy shall be 1% of the calibrated span. An overpressure security shall be provided of 50% above the maximum pressure range.

Electromagnetic measurements may be used for flow measurements of inhomogenous liquids with or without solids content in completely filled pipes. The limits of application of the measuring system due to the medium parameters planned on a case-by-case basis shall be observed. Inductive flow sensors shall be of alternating field or pulsating DC field type and be for inline installation with a pipe.
The tube lining material shall be as required for the fluid and its temperature and be as specified in other chapters of this **Section B0**. The accuracy shall be 1% of the calibrated span. An overpressure security shall be provided of 50% above the maximum pressure range.
Corriolis measurements shall be used for mass flow measurements of homogenous liquids and gases without solids content in completely filled pipes, in particular for natural gases, fuel oils and solvents as well as other media with fluctuating densities. The accuracy shall be typically at 0.5% of the measured value.

B0.6.19.12 Level measurements

Where detection of discrete levels is required, the simple float operated switch should be used, however each switch shall have snap action with limited hysteresis to prevent contact bounce caused by small fluctuations in level. For sumps the level should be measured using non-contactive measuring principles such as ultra sonic with local control box.

Switches used for level detection shall provide facilities for testing the mechanical and electrical operation of the switch without its removal from the process. Isolation by means of shut-off valve will be allowable during testing.

Generally, the use of switches shall be avoided. Instead limit values shall be derived from analog transmitters.

For measurement of large storage tanks, the load indication and transmitting mechanism shall be located at the base of the tank.
For the measurements of boiler separator water level, feed water tank levels etc., differential pressure transmitters shall preferably be used.

The transmitters shall be as specified under **Section B0**.

For special applications such as chemical tanks, techniques such as ultrasonic, radar, capacitance probes, etc. should be considered. For level measurement in tanks with underpressure (vacuum) guided wave radar shall be used.

For level measurement of the fabric filter (FF) hopper dust radio frequency (RF) / Capacitance type level switch can be considered.

For measurements where a reference leg of process fluid is used, the design of the system shall ensure that the reference leg is fully maintained at its prescribed height during all conditions of process level change and changes in process conditions and the density of the reference leg does not vary from that of the process fluid due to temperature changes or other reasons.

All measurement transmitters for differential pressure shall be provided with:

a. shut-off valves to be arranged directly at the condensing vessels and active pressure tapping points
b. valve blocks enabling the transmitter to be isolated from the active pressure and enabling the transmitter zero point to be checked
c. separate blow-off valves for cleaning the active pressure tubes.
d. 2 ways for relative pressure, 5 ways for DP.

The aforementioned valves shall be of the weld-in type.

Where a standpipe exists, the level transmitters or level switches must be connected to the standpipe by means of shut-off valves, so that the units can be replaced easily in service.

Local level indicators for water shall be provided with an illumination device and indicators shall be designed so that the water column can be seen as whole, i.e. level indicators only showing the level as a point will not be accepted. Level indicators shall be equipped with shut-off valves which permit exchange or replacement of glasses or mica during operation.

The indicating range of local level indicators shall cover all switching points of level switches mounted on the tank or similar as a minimum requirement.

On all forms of measurement all parts of the switch, transmitter, etc. in contact with the process fluid shall be made of material compatible with the process fluid. Stainless steel shall normally be used for all corrosive duties.

MEASURING INSTRUMENTS (PRIMARY AND SECONDARY)

1.1. Measuring instruments / equipment and subsystems offered by the Bidder shall be from reputed experienced manufacturers of specified type and range of equipment. The instrumentation vendor shall be subject to BHEL's / customer's approval. Further, all instruments shall be of proven reliability, accuracy, repeatability requiring a minimum of maintenance. All instrumentation equipment and accessories under this specification shall be furnished as per technical specifications, ranges, makes / numbers as approved by BHEL / customer during detailed engineering.

1.2. Every panel-mounted instrument, requiring power supply, shall be provided with a pair of easily replaceable glass cartridge fuses of suitable rating. Every instrument shall be provided with a grounding terminal and shall be suitably connected to the panel grounding bus.

1.3. All local gauges as well as transmitters, sensors and switches for parameters like pressure, temperature, level, flow etc. as required for the safe and efficient operation and maintenance under the scope of specification shall be provided. The necessary root valves, impulse piping, drain cock, gauge-zeroing cocks, valve manifolds and all the other accessories required for mounting / erection of these local instruments shall be furnished even if not specifically asked for. The proposal shall include the necessary cables, flexible conduits, junction boxes and accessories for the above purpose. Double root valves shall be provided for all pressure tapping where the pressure exceeds 40 Kg / Cm2.

1.4. Instruments envisaged for sea water application shall be provided with wetted parts made of Monel / Hastelloy C.

1.5. All instruments shall be provided with durable epoxy coating for housing and all exposed surfaces of the instruments.

1.6. Specification for Pr. Gauge, D.P. Gauge, Temp. Gauge and Level Gauge

Sl. No.	Features	Essential / Minimum Requirements		
		Pr. Gauge / D.P. Gauge	Temp. Gauge	Level Gauge
1	Sensing Element and Material	Bourdon for high pressure, Diaphragm / Bellow for low pr. of 316 SS	Mercury in steel below 450 Deg.C and inert gas actuated for above 450 Deg.C of SS bulb and capillary	Tempered toughened Borosilicate gauge glass steel armoured reflex or transparent type.
2	Body material	Die-cast aluminium	Die-cast aluminium	Forged carbon steel / 304 SS
3	Dial size	150 mm	150 mm	Tubular covering entire range.
4	End connection	½ inch NPT (M)	¾ inch NPT (M)	Process connection as per ASME PTC and drain / vent 15 NB.
5	Accuracy	±1% of span	±1% of span	±2%
6	Scale	Linear, 270 Deg. Arc graduated in metric units.	Linear, 270 Deg. Arc graduated in Deg. C	Linear vertical
7	Range selection	Cover 125% of max. of scale	Cover 125% of max. of scale	Cover 125% of max. of scale
8	Over range test	Test pr. For the assembly shall be 1.5 to the max. design pr. at 38 Deg. C.		
9	Housing	Weather and dust proof as per IP-55	Weather and dust proof as per IP-55	CS/304 SS leak proof
10	Zero / Span adjustment	Provided	Provided	--
11	Identification	Engraved with service legend or engraved phenolic laminated tag plate	Engraved with service legend or laminated phenolic name plate	Engraved with service legend or laminated phenolic name plate
12	Accessories	Blow out disc, siphon, snubber, pulsation dampener, chemical seal (if required by process) gauge isolation valve	SS Thermowell	Gasket for all KEL-F shield for transparent type vent and drain valves of Steel / SS as per CS / Alloy process requirement.
13	Material of Bourdon movement	316 SS / 304 SS	316 SS / 304 SS	

1.7. SPECIFICATION FOR ELECTRONIC TRANSMITTER FOR PRESSURE, D.P., FLOW AND LEVEL ELECTRONIC TRANSMITTERS:

Sr. No.	Features	Essential/Minimum Requirements
1.	Type of Transmitter	Microprocessor based 2 wire type, Hart protocol compatible.
2.	Accuracy	± 0.1% of calibrated span (minimum)
3.	Output signal range	4-20 mA DC (Analog) along with superimposed digital signal based on HART protocol
4.	Turn down ratio	10:1 for vacuum/very low pressure applications. 30:1 for other applications.
5.	Stability	± 0.1% of calibrated span for six months for Ranges up to and including70 Kg/cm². ± 0.25% of calibrated span for six months for Ranges more than 70 Kg/cm² (g).
6.	Zero and span drift	+/- 0.015% per deg.C at max span. +/-0.11% per deg.C at min. span.
7.	Load impedance	500 ohm (min.)
8.	Housing	Weather proof as per IP-55 with durable corrosion resistant Coating.
9.	Over Pressure	150% of max. Operating pressure
10.	Connection (Electrical)	Plug and socket type
11.	Process connection	1/2 inch NPT (F)
12.	Span and Zero	Continuous, tamper proof, Remote as well as adjustability Manual from instrument with zero suppression and elevation facility.
13.	Accessories	-Diaphragm seal, pulsation dampeners, siphon etc. as required by service and operating condition. -2 valve manifold for absolute pressure transmitters (3-valve manifold for gauge/ vacuum pressure transmitters) and 5 valve manifold for DP/level/flow transmitters. -For hazardous area, explosions proof enclosure as described in NEC article 500.
14.	Diagnostics	Self Indicating feature
15.	Power supply	24V DC ± 10%.
16.	Adjustment/calibration/	Centralized PC based system.

Notes :

In case it becomes necessary to use a DP transmitter for pressure measurement then a 3-valve manifold should be used in place of 2-valve manifold.

LVDT type is not acceptable.

Where the process fluids are corrosive, viscous, solid bearing or slurry type, diaphragm seals shall be provided. Parts below the diaphragm shall be removable for cleaning. The entire volume above the diaphragm shall be completely filled with an inert liquid suitable for the application.

1.8 Ultrasonic Type Level Transmitter

Sl. No Features	Essential/Minimum requirements
1. Type of Transmitter	Non contact Microprocessor based 2 wire type, HART protocol compatible Ultrasonic transmitter.
2. Output signal	Galvanically isolated 4-20mA DC (Analog) along with superimposed digital signal (based on HART protocol).
3. Sensor Accuracy	+/- 0.5% of calibrated span.
4. Sensor Repeatability	3 mm or better.
5. Power supply	24 V DC +/- 10%
6. Temperature compensation	To be provided within transducer.
7. Configuration	Sensor unit and Electronic units are to be separate. It shall be possible to mount the Electronic unit at a remote accessible location from the transducer. All cables and weather proof fittings to interconnect transducer to electronic unit shall be provided.
8. Housing	Weather proof as per IP-55 with durable corrosion resistant epoxy coating.
9. Calibration	Through HART Communicator.
10. Zero and Span adjustment	Continuous, tamper proof, remote as well as manual adjustability from instrument. It shall be possible to calibrate the instrument without any level in the tank/sump etc
11. Sensor Material	Corrosion resistant material to suit individual application requirement.
12. False signal tolerance	Transmitter shall be capable of ignoring false echoes from internal tank/sumps obstructions such as pipes, heating coils or agitator blades. Also transmitter shall have adjustable damping circuitry
13. Range	Range of transmitter shall be capable of covering the complete level span of tank taking care of blocking distance, frequency attenuation due to surface, obstructions, vapors etc
14. Display	Minimum 4 character display with integral keypad, access protected by user code.
15. Diagnostics	Loss of echo alarm etc
16. Load Impedance	500 ohms minimum
17. Electrical Connection	Plug and socket

18. Accessories	• All weather canopy for protection from direct sunlight and direct rain. • All mounting hardware and accessories required for erection and commissioning mounting fittings material shall be SS 316. • For hazardous areas, explosion proof enclosure as described in NEC article 500.

1.9 Guided Wave Radar Type Level Transmitter

Type	Guided wave Radar
Principle	TDR (Time domain reflectometry)
Probe Type & Material	Coaxial, SS316/316L. If required probe shall be suitable for overfill Prevention.
Signal o/p	4-20mA with HART signal suitable for overfill prevention.
Display	Integral
Power supply	24 VDC
Accuracy	5mm
Electromagnetic compatibility	Shall meet EN 61326-1 (1997) and Amdt A1, class A equipment/EN 50081-2 & EN 5008 1-2 & EN 50082-2
Mounting	External cage mounting

The transmitters shall be provided with IP-55 protection class with durable corrosion resistant coating.

The transmitters shall be able to provide digital signals super imposed on 4-20 mA signal as per HART protocol.

FORM NO. PEM-6666-0

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR	SPECIFICATION NO.: PE-SS-421-145-I007
		VOLUME II B
		SECTION D
		REV. NO. 00 DATE: 06.10.16
		SHEET 1 OF 3

Data Sheet A & B

	DATA SHEET-A (TO BE FILLED BY PURCHASER)		DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
GENERAL*	* PROJECT	2X660MA BIFPCL, MAITREE BANGLADESH		
	OFFER REFERENCE			
	* TAG NO. SERVICE			
	* DUTY	☐ ON / OFF ☐ INCHING		
	* LINE SIZE (inlet/outlet): MATERIAL			
	* VALVE TYPE	☐ GLOBE ☐ GATE ☐ REG. GLOBE ☐ BUTTERFLY		
	* OPENING / CLOSING TIME	☐		
	* WORKING PRESSURE	☐		
	AMBIENT CONDITION	SHALL BE SUITABLE FOR CONTINUOUS OPERATION UNDER AN AMBIENT TEMP. OF 0-55 DEG C AND RELATIVE HUMIDITY OF 0-95%		
	VALVE SEAT TEST PRESS	BIDDER TO SPECIFY		
	REQUIRED VALVE TORQUE	BIDDER TO SPECIFY		
	ACTUATOR RATED TORQUE	BIDDER TO SPECIFY		
CONSTRUCTION AND SIZING	CONSTRUCTION	TOTALLY ENCLOSED, DUST TIGHT, WEATHER PROOF, SUITABLE FOR OUTDOOR USE WITHOUT CANOPY, IP:65		
	MECHANICAL POSITION INDICATOR	TO BE PROVIDED FOR 0-100% TRAVEL		
	BEARINGS	DOUBLE SHIELDED, GREASE LUBRICATED ANTI-FRICTION.		
	GEAR TRAIN FOR LIMIT SWITCH/TORQUE SWITCH OPERATION	METAL (NOT FIBRE GEARS). SELF-LOCKING TO PREVENT DRIFT UNDER TORQUE SWITCH SPRING PRESSURE WHEN MOTOR IS DE-ENERGIZED.		
	SIZING	OPEN/CLOSE AT RATED SPEED AGAINST DESIGNED DIFFERENTIAL PRESSURE AT 85% OF RATED VOLTAGE. FOR ISOLATING SERVICE THREE SUCCESSIVE OPEN-CLOSE OPERATIONS OR 15 MINS. WHICHEVER IS HIGHER. **FOR INCHING SERVICE - 150 STARTS/HR MINIMUM & FOR REGULATING SERVICE - 600 STARTS/HR MINIMUM.**		
HANDWHEEL	* REQUIRED	■ YES ☐ NO		
	* ORIENTATION	☐ TOP MOUNTED ☐ SIDE MOUNTED		
	*TO DISENGAGE AUTOMATICALLY DURING MOTOR OPERATION.			
ELECTRIC ACTUATOR	ACTUATOR MAKE/MODEL	BIDDER TO SPECIFY		
	MOTOR MAKE / MODEL / TYPE / RATING (KW)	BIDDER TO SPECIFY		
	@ MOTOR TYPE	SQUIRREL CAGE INDUCTION MOTOR, STARTING CURRENT LIMITED TO SEVEN TIMES THE RATED CURRENT as per IEC-60034-30		
	ACTUATOR APPLICABLE WIRING DIAGRAM	■ ENCLOSED (BIDDER TO CONFIRM) A: ☐ DRG. NO. 3-V-MISC-24227 R00 B: ☐ DRG. NO. 3-V-MISC-24550 R00 C: ■ DRG. NO. 3-V-MISC-24283 R00 D: ☐ DRG. NO. 4-V-MISC-90271 R11 E: ☐ For Thyristor based Integral starter, Bidder/Vendor to furnish wiring diagram		
	COLOUR SHADE	■ BLUE (RAL 9003) ☐		
	PAINT TYPE **(## Refer Notes)**	☐ ENAMEL ■ EPOXY ☐		
	SHAFT RPM	BIDDER TO SPECIFY		
	OLR SET VALUE	BIDDER TO SPECIFY		
	@ STARTING / FULL LOAD CURRENT	BIDDER TO SPECIFY		Starting current shall not exceed 7 times rated current as per IEC 60034 for IE-3 motors.
	NO. OF REV FOR FULL TRAVEL	BIDDER TO SPECIFY		

BHEL	**SPECIFICATION FOR MOTORISED VALVE ACTUATOR**	SPECIFICATION NO.: PE-SS-421-145-I007 VOLUME II B SECTION D REV. NO. 00 DATE: 06.10.16 SHEET 2 OF 3

Data Sheet A & B

	DATA SHEET-A (TO BE FILLED BY PURCHASER)	DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
	@ PWR SUPP TO MTR / STARTER	415V, 3PH, AC
	@ CONTROL VOLTAGE REQUIREMENT	TO BE DERIVED FROM THE POWER SUPPLY TO THE STARTER ☐ 230 V ☐ 110 V
	@ ENCLOSURE CLASS OF MOTOR	☐ IP 67 ☐ FLAME PROOF
	@ INSULATION CLASS	CLASS-F TEMP. RISE LIMITED TO CLASS-B
	@ WINDING TEMP PROTECTION	■ THERMOSTAT (3 Nos.,1 IN EACH PHASE) ☐ ----------
	SINGLE PHASE / WRONG PHASE SEQUENCE PROTECTION	REQUIRED
INTEGRAL STARTER	INTEGRAL STARTER	■ REQUIRED ☐ NOT REQUIRED
	TYPE OF SWITCHING DEVICE	■ CONTACTORS ☐ THYRISTORS
	TYPE	■ CONVENTIONAL ☐ SMART (NON-INTRUSIVE)
	IF SMART	
	a) SERIAL LINK INTERFACE	☐ INTEGRAL ☐ FIELD MOUNTED
	b) SERIAL LINK PROTOCOL	☐ FOUNDATION FIELD-BUS ☐ PROFI-BUS ☐ DEVICE NET ☐.....
	c) SERIAL LINK MEDIA	☐ TWISTED PAIR Cu-CBL ☐ CO-AXIAL Cu-CBL ☐ OFC
	d) HAND HELD PROGRAMMER	☐ REQUIRED ☐ NOT REQUIRED
	e) TYPE OF HAND HELD PROGRAMMER	☐ BLUETOOTH ☐ INFRARED ☐.....
	f) MASTER STATION	☐ REQUIRED ☐ NOT REQUIRED
	g) MASTER STN INTRFACE WITH DCS	☐ MODBUS ☐ TCP/IP
	h) DETAILS OF SPECIAL CABLE	☐ ENCLOSED ☐ NOT REQUIRED
	STEP DOWN CONT. TRANSFORMER	■ REQUIRED
	OPEN / CLOSE PB	■ REQUIRED ☐ NOT REQUIRED
	STOP PB	■ REQUIRED ☐ NOT REQUIRED
	INDICATING LAMPS	■ REQUIRED ☐ NOT REQUIRED
	LOCAL REMOTE S/S	■REQUIRED ☐ NOT REQUIRED
	STATUS CONTACTS FOR MONITORING	■ REQUIRED ☐ NOT REQUIRED
	INTEGRAL STARTER DISTURBED SIGNAL	REQUIRED (O/L RELAY OPERATED, CONT./POWER SUPPLY FAILED, S/S IN LOCAL, TORQUE SWITCH OPTD. MID WAY)
INTERPOSING RELAY/OPTO COUPLER (Applicable for integral Starter)	TYPE OF ISOLATING DEVICE	■ INTERPOSING RELAY ☐ OPTO COUPLER ☐ EITHER
	QUANTITY	■ 2 NOs. ☐ 3 NOs.
	DRIVING VOLTAGE	■ 20.5 – 24V DC ☐ _____V DC
	DRIVING CURRENT	■ 125mA MAX ☐ _____mA MAX
	LOAD RESISTANCE	■ > 192 ohms - <25 k ohms ☐ > _____ohms - < _____ohms
TORQUE SWITCH (Not Applicable for Smart Actuator) **($$ Refer Notes)**	MFR & MODEL NO.	BIDDER TO SPECIFY
	OPEN / CLOSE	■1 No. ☐2Nos. / ■1 No. ☐2Nos
	CONTACT TYPE	2 NO + 2 NC
	RATING	5A 240V AC AND 0.5A 220V DC
	CALIBRATED KNOBS(OPEN&CLOSE TS)	REQUIRED FOR SETTING DESIRED TORQUE
	ACCURACY	+3% OF SET VALUE
LIMIT SWITCH (Not Applicable	MFR & MODEL NO.	BIDDER TO SPECIFY
	OPEN : INT : CLOSE	■1 No ☐2 Nos. 2 Nos. (ADJ.) ■1 No. ☐2Nos.

As per IEC-60034
The coils of interposing relays shall be connected to freewheeling diode.

BHEL	**SPECIFICATION FOR MOTORISED VALVE ACTUATOR**	SPECIFICATION NO.: PE-SS-421-145-I007 VOLUME II B SECTION D REV. NO. 00 DATE: 06.10.16 SHEET 3 OF 3

Data Sheet A & B

	DATA SHEET-A (TO BE FILLED BY PURCHASER)	DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
for Smart Actuator) **($$ Refer Notes)**	CONTACT TYPE	2 NO + 2 NC	
	RATING (AC / DC)	5A 240V AC AND 0.5A 220V DC	

POSITION TRANSMITTER	POSITION TRANSMITTER (For inching duty & other specific applications)	■ REQUIRED ☐ NOT REQUIRED	
	MFR & MODEL NO.	BIDDER TO SPECIFY	
	TYPE	☐ ELECTRONIC (2 WIRE) R/I CONVERTER ■ ELECTRONIC (2 WIRE) CONTACTLESS	
	SUPPLY	■ 24V DC ☐	
	OUTPUT	■ 4-20mA	
	ACCURACY	± 1% FS	
SPACE HEATER	@SPACE HEATER	REQUIRED	
	@ POWER SUPPLY (NON INTEGRAL)	230V AC,1 PH.,50 Hz	
	@ POWER SUPPLY (INTEGRAL)	BIDDER TO SPECIFY	
	@ RATING		
TERMINAL BOX	ACTUATOR/MOTOR TERMINAL BOX	REQUIRED	
	ENCL CLASS ACTUATOR/MOTOR T.B.	@☐ IP 68 @☐.....	
	@ EARTHING TERMINAL	REQUIRED	
	PLUG & SOCKET (9 PIN) (FOR COMMD, LS/TS FEED BACK, PoT)	■ REQUIRED ☐ NOT REQUIRED☐ ■ 2 NOS. ☐ ----------	
CABLE GLANDS	@ POWER CABLE GLAND	SIZE:----------	
	@ SPACE HEATER CABLE GLAND	SIZE:----------	
	OTHER CONTROL CABLE GLANDS-1	☐ 1No. for BFV of CW PUMP(Cable size 2Px1.5mm2)	
	OTHER CONTROL CABLE GLANDS-2	QUANTITY & SIZE :----------	
WEIGHT	TOTAL WEIGHT (ACTUATOR + ACCESSORIES)	BIDDER TO SPECIFY	_____ Kg.

NOTES:

1. **SCOPE**: DESIGN, MANUFACTURE, INSPECTION, TESTING AND DELIVERY TO SITE OF ELECTRIC ACTUATOR FOR INCHING OR OPEN / CLOSE DUTY.
2. **CODES & STANDARDS**: DESIGN AND MATERIALS USED SHALL COMPLY WITH THE RELEVANT LATEST INTERNATIONAL STANDARD (INDIAN CODES ARE NOT ACCEPTABLE).
3. TEMPERATURE RISE SHALL BE RESTRICTED TO 70 DEG. C FOR AMBIENT TEMPERATURE OF 50 DEG C.
4. CABLE GLANDS OF DOUBLE COMPRESSION TYPE, BRASS MATERIAL SHALL BE PROVIDED.
5. THE TORQUE SWITCHES SHALL BE PROVIDED WITH MECHANICAL LATCHING DEVICE TO PREVENT OPERATION WHEN UNSEATING FROM THE END POSITIONS. THE LATCHING DEVICE SHALL UNLATCH AS SOON AS THE VALVE LEAVES THE END POSITION. IF SUCH PROVISION IS NOT POSSIBLE, THE TORQUE SWITCHES SHALL BE BYPASSED BY END-POSITION LIMIT SWITCHES WHICH OPENS ON VALVE LEAVING END POSITION.THESE LIMIT SWITCHES ARE ADDITIONAL TO THE NUMBER OF LIMIT SWITCHES SPECIFIED ELSEWHERE.
6. THE MOTOR SHALL OPERATE SATISFACTORILY UNDER THE +/- 10% SUPPLY VOLTAGE VARIATION AT RATED FREQUENCY, -6% TO +4% VARIATION IN FREQUENCY AT RATED SUPPLY VOLTAGE, SIMULTANEOUS VARIATION IN VOLTAGE & FREQUENCY THE SUM OF ABSOLUTE PERCENTAGE NOT EXCEEDING 10%.
7. THE MOTOR SHALL BE SUITABLE FOR DIRECT ON LINE STARTING.

$$ TORQUE SWITCH & LIMIT SWITCH SHALL ACT INDEPENDENT OF EACH OTHER. TANDEM OPERATION IS NOT ACCEPTABLE.

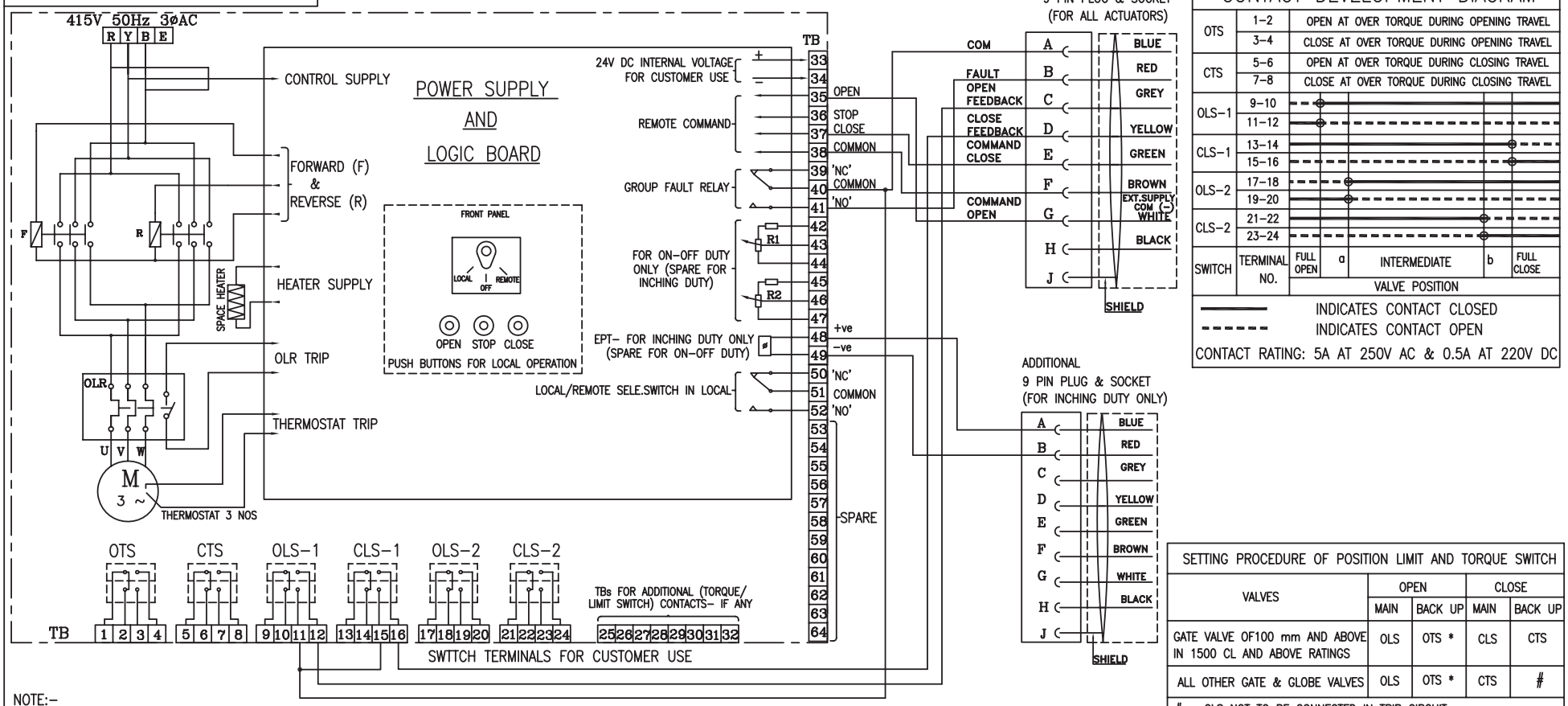
EPOXY PAINT IS RECOMMENDED FOR COASTAL AREAS.

.

NOTES* = TO BE FILLED BY MPL (LEAD AGENCY). @= TO BE FILLED BY ES

ALL DIMENSIONS ARE IN MILLIMETRES. FOR TOLERANCES OF UNTOLERANCED DIMENSIONS DURING MANUFACTURE REFER RELEVANT QCP / QP.

DRAWING NO. 3-V-MISC-24283



CONTACT DEVELOPMENT DIAGRAM

OTS	1–2	OPEN AT OVER TORQUE DURING OPENING TRAVEL
	3–4	CLOSE AT OVER TORQUE DURING OPENING TRAVEL
CTS	5–6	OPEN AT OVER TORQUE DURING CLOSING TRAVEL
	7–8	CLOSE AT OVER TORQUE DURING CLOSING TRAVEL
OLS–1	9–10	
	11–12	
CLS–1	13–14	
	15–16	
OLS–2	17–18	
	19–20	
CLS–2	21–22	
	23–24	

SWITCH TERMINAL NO. — FULL OPEN | a | INTERMEDIATE | b | FULL CLOSE — VALVE POSITION

INDICATES CONTACT CLOSED

INDICATES CONTACT OPEN

CONTACT RATING: 5A AT 250V AC & 0.5A AT 220V DC

SETTING PROCEDURE OF POSITION LIMIT AND TORQUE SWITCH

VALVES	OPEN		CLOSE	
	MAIN	BACK UP	MAIN	BACK UP
GATE VALVE OF100 mm AND ABOVE IN 1500 CL AND ABOVE RATINGS	OLS	OTS *	CLS	CTS
ALL OTHER GATE & GLOBE VALVES	OLS	OTS *	CTS	#

\# – CLS NOT TO BE CONNECTED IN TRIP CIRCUIT

* – BYPASS OTS FOR INITIAL 5% OF TRAVEL(FOR GATE VALVES ONLY)

NOTE:–

1. ALL TORQUE AND LIMIT SWITCHES (OTS,CTS,OLS1&2, CLS1&2) ARE WITH 2NO+2NC CONTACTS '1NO+1NC' IS TERMINATED IN TBS 1–24, REMAINING CONTACTS ARE FOR INTERNAL USE. ANY SPARE CONTACTS WHICH ARE NOT USED INTERNALLY ARE TO BE TERMINATED IN TBS 25–32
2. CTS – TORQUE SWITCHES FOR CW ROTATION (CLOSE)
3. OTS – TORQUE SWITCHES FOR CCW ROTATION (OPEN)
4. OLS–1, OLS–2 – LIMITSWITCHES FOR POSITION OPEN
5. CLS–1, CLS–2 – LIMITSWITCHES FOR POSITION CLOSE
6. EPT – ELECTRONIC POSITION TRAMSMITTER (CONTACTLESS TYPE, FOR INCHING DUTY)
7. R1–R2–POTENTIOMETER 2 x 100 OHMS (FOR ON–OFF DUTY)
8. FOR COMMANDS & EPT EITHER INTERNALLY GENERATED 24 VDC OR EXTERNAL SUPPLY OF 24VDC CAN BE USED
9. M – MOTOR 3ø 415V 50 Hz AC SUPPLY
10. TORQUE SWITCH BYPASS WITH LIMITSWITCH BOTH ON OPEN & CLOSE DIRECTION TO BE DONE INTERNALLY.

REV	DATE	ALTERED
		CHD & APPD

TYPE OF PRODUCT OR NAME OF CUSTOMER/PROJECT: ELECTRICAL VALVE ACTUATORS (AC) WITH INTEGRAL STARTERS FOR NTPC PROJECTS (DRAWN FOR INTERMEDIATE POSITION OF VALVES)

BHARAT HEAVY ELECTRICALS LTD.,
UNIT: HIGH PRESSURE BOILER PLANT.
TIRUCHIRAPALLI–620014.
365–121

	NAME	SIGN	DATE	NO.OF VAR.
DRN	N.P.ESWAR	N.P	17.03.05	–
CHD	D.DINAKARAN	D.D	17.03.05	
APPD	K.ARUNACHALAM	K.A	17.03.05	

DEPT	SCALE	WEIGHT (KG).	REFERENCE INFORMATIONS	NO. OF ITEMS
VL	NTS	–		–
CODE –				

TITLE: WIRING DIAGRAM (TERMINAL PLAN) FOR ACTUATOR WITH INTEGRAL STARTER WITH PLUG & SOCKET FOR NTPC PROJECTS

CARD CODE: U 01

DRAWING NO.: 3–V–MISC–24283

REV: 0

Size A3

B0.6.18.10 Actuator drives

As far as applicable the above "Technical conditions for low voltage motors" shall apply.

In addition, all actuators for valves, dampers etc are to be fitted with socket and plug of well-established make to IEC 60309 or equivalent for the power cable connection. For the control cable connection separate socket and plug shall be provided.

Self-cooling at respective ambient temperature conditions is mandatory. Fan cooling is not accepted.

Actuators shall have integrated starters. Regulation type shall be continuous modulation type (min. 3000 starts per minutes).

B0.6.19.16 Actuators

Intelligent drives with integrated power switch unit and further electronics shall be installed.

Unless otherwise specified actuators for modulating valves and dampers shall either be pneumatic or electrically operated. Self contained sealed hydraulic units may be considered where high thrusts or high speeds of operation are required.

Actuators for ON/OFF duty or manually positioned units shall generally be electrical motor and/or pneumatic driven, however the use of solenoid types on small valves shall be allowed dependent on duty.

The various types and sizes of actuators shall be rationalized and as far as possible each type shall be from a common manufacturer to facilitate interchangeability and spares.

In order to prevent the risk of fire or explosion pneumatic actuators shall be used in hazardous areas and associated equipment (e.g. positioners) must be intrinsically safe in accordance with IEC 60079-11.

Pneumatic actuators must be designed in such a way that in the event of air failure the actuator will remain in the position immediately prior to loss of power, or assume a position which is safe for the process.

With either action the failure mode shall be suitably monitored and the Plant operator informed by some form of alarm. The failure response of all actuators in the event of the loss of the prime mover (air pressure, oil pressure, electrical power) shall be indicated on the Piping and Instrumentation (P&I) diagrams, valve schedules, etc.

All pneumatic tubing to control drives or actuators shall, unless otherwise agreed to by the Employer/Engineer, be in copper which shall be sheathed in PVC or alternatively in stainless steel.

For all actuators of control valves and dampers of main systems local indicating pointer and position transmitters for remote indication and closed loop feedback shall be provided in accordance with the most severe operating conditions to be expected. The transmitters shall be designed to withstand conditions such as high temperature, vibrations and leakage of steam and of hot water wherever required. The protection class shall be IP 65 according to IEC 60529.

All actuators shall have a handwheel for direct manual operation. The diameter of the handwheel and geared effort shall be such that they can be reasonably operated by one man. A lockable mechanical clutch mechanism shall be provided to inhibit power control of the actuators when the handwheel is operated.

The speed of response of actuators used for modulating control shall be chosen to suit each particular application. Facilities shall be provided for limiting the actuator movement in each direction.

Special attention must be paid to adequately dimensioned drives and care must be taken to avoid any unintended displacement of the actuator on sudden rises of pressure in the piping.

Actuators shall have fail safe operation and actuator locking device in the event of abnormal conditions. Any abnormality on the valve shall be transmitted to the DCS.

All electrical actuator drives necessary for the safe operation and shut-down of the Plant in the event of 0.4 kV switchgear failure shall be connected to the UPS.

LCP SPECIFICATION
&
DATASHEET

	SPECIFICATION FOR LOCAL PANELS	SPECIFICATION NO.: PE-SS –999- 145 –054A	
		VOLUME II B	
		SECTION D	
		REV. NO. 03	DATE : 20-11-2017
		SHEET 1	OF 5

1.0 SCOPE

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

2.0 CODES AND STANDARDS

2.1 All the equipments specified herein shall comply with the requirements of the latest issue of the relevant International standards as mentioned in codes and standard section of this specification.

3.0 TECHNICAL REQUIREMENTS

3.1 Panel Construction

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

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

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

3.1.4 The salient features of construction shall be:

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

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

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

3.1.7 The class of protection shall be in accordance with Cl. No. B0.6.18.4 – "Installation conditions and protection class for electrical operational equipment and control and monitoring equipment" under section IA-Customer's general technical specification – B0). Also refer Cl. No. B0.6.18.15 for Local control points.

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

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

3.1.10 All operable and indicating devices shall be mounted on the front of the panel while aux. Relays / timers MCBs etc. required for realization of control logics shall be mounted on a mounting plate inside the panel. Auxiliary relays and timers etc. shall be grouped according to the control function.

No operable or indicating devices shall be mounted below 750 mm and above 1800 mm (w.r.t. finished ground level). The devices shall be located in such a way so as to ensure easy access for operation / maintenance.

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

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

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

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

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

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

3.1.17 Local Panel shall be provided with main name plate of 150 mm x 40 mm size having inscription of 20 mm height. The individual devices on the panels shall be as provided with separate name plate with inscription of 3 mm height. The instrument / devices shall be provided with stick on label plates inside the panel. The material of the main and individual labels shall be three (3) ply 3 mm thick Traffolyte Sheet / 2 mm Anodised Aluminium Plate. The inscription shall be with white letters on black background on traffolyte sheet. The labels shall be fixed by self tapping non-rusting screws.

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

3.2 Hazardous Area Panel Requirement

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

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

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

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

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

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

3.3 Control & Monitoring devices

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

3.3.2 Alarm Annunciator System

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

3.3.3 Relays

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

3.3.4 Timers

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

3.3.5 Control / Selector Switches

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

3.3.6 Push Buttons / Indicating Lights

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

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

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

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

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

3.3.8 Miniature Circuit Breaker (MCB)

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

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

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

4.0 TESTING AND INSPECTION

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

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

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

4.3.1 Routine Tests

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

4.3.2 Type Tests

1. Enclosure Class Test

5.0 SPARES AND CONSUMABLES

5.1 Commissioning Spares and consumables

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

5.2. Mandatory Spares

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

5.3. Recommended Spares

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

6.0 DRAWINGS AND DOCUMENTS

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

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

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

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

7.0 MARKING AND PACKING

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

8.0 APPLICABLE DATA SHEET FORMS

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

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

	DATA SHEET FOR LOCAL PANELS	SPECIFICATION NO.: PE-SS-421-145-054A	
		VOLUME	
		SECTION	
		REV. NO. 02	DATE: 02.12.2017
		SHEET 1 OF 3	

TAG No. ……. Qty..... Data Sheet No.: **PES-145A-DS1-0**

Data Sheet A & B

			DATA SHEET-A FOR LOCAL PANEL (TO BE FILLED BY PURCHASER)	DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
GENERAL	MANUFACTURER			
	CONSTRUCTION		■ FOLDED ☐ WELDED (As per requirement EDN)	
	ENCLOSURE SHEET THICKNESS	FRONT	■ 2.0 mm	
		OTHER	■ 2.0 mm	
		DOOR	■ 1.6 mm	
		HEIGHT	■ 2365 mm for stand alone panels. ☐ Other ……	
		OTHER	■ Load bearing sheet front shall have 3mm thickness	
TECHNICAL	INPUT POWER SUPPLY * (ANY OTHER POWER REQUIREMENT TO BE DERIVED FROM THIS SUPPLY ONLY)		☐ 415V 3 PHASE 3W ■ 415V 3 PHASE 4W / 240V AC	
	NO. OF FEEDERS		☐ ONE ☐ TWO	
	STARTER WITH MCC (CHECK WITH MAUX/ELEC)		☐ REQUIRED ■ NOT REQUIRED	
	IPR POSITION		■ MCC ☐ RELAY PANEL	
	CONTACT RATING OF RELAY		☐ 5 Amp, 230 V AC ☐ 0.25 Amp, 220V DC	
	CONTROL SUPPLY		☐ 110V AC ☐ 220V AC ☐ 220V DC ☐ Other. ■ (As per requirement)	
	ALARM ANNUNCIATOR WINDOW (EXCLUDING SPARES)		__During Detailed Engineering____NOS. (AS REQUIRED)	
	TEMP SCANNER (IF REQUIRED –NO. OF CHANNELS TO BE SPECIFIED UNDER SEC-C)		☐ REQUIRED ☐ NOT REQUIRED	
	PAINT TYPE		☐ EPOXY ENAMEL ☐ EPOXY POWDER COATED	
	MIMIC (TYPE OF MIMIC- MATERAIL, THICKNESS TO BE SPECIFIED DURING DETAILED ENGG.)		☐ REQUIRED ■ NOT REQUIRED	
	PANEL COLOUR (EXTERNAL)		FOR PAINT TYPE & COLOUR :- REFER Cl. No. B0.6.9 – SIGNS & COLOUR CODE	
	FINISH (EXTERNAL)			
	PANEL COLOUR (INTERNAL)			
	FINISH (INTERNAL)			
	CLASS OF PROTECTION		REFER Cl. No. B0.6.18.4 of Specification	
	CONTROL HARDWARE		Local START & Emergency STOP along with status indications.	
	FOUNDATION ARRANGEMENT		■ FOUNDATION BOLTS ☐ ANCHOR FASTENERS ☐ SKID MOUNTED	

TAG No. ……. Qty..... Data Sheet No.: **PES-145A-DS1-0**

Data Sheet A & B

DATA SHEET-A FOR LOCAL PANEL (TO BE FILLED BY PURCHASER)		DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
WEIGHT OF PANEL (Kg.)	……..(Vendor to specify)	
PANEL TYPE	☐ PRESSURISED ■ UNPRESSURISED As per Requirement	
CABLE GLAND	■ DOUBLE COMPRESSION	
AMMETER (TYPE OF INPUT) *	☐ 1 Amp CT ☐ 4-20 mA	
SCOPE OF SUPERVISION FOR ERECTION & COMMISSIONING	☐ APPLICABLE ☐ NA	
* TO BE CO-ORDINATED WITH PEM ELECTRICAL		

TAG No. ……. Qty..... Data Sheet No.: **PES-145A-DS1-0**

Data Sheet C

DATA SHEET-C FOR LOCAL PANEL
(TO BE FILLED BY CONTRACTOR AFTER AWARD OF CONTRACT)

GENERAL	MANUFACTURER			
	CONSTRUCTION		☐ FOLDED ☐ WELDED (As per requirement EDN)	
	ENCLOSURE SHEET THICKNESS	FRONT		
		OTHER		
		DOOR		
		HEIGHT		
		OTHER		
TECHNICAL	INPUT POWER SUPPLY			
	NO. OF FEEDERS			
	CONTACT RATING OF RELAY			
	TEMP SCANNER			
	CONTROL SUPPLY			
	ALARM ANNUNCIATOR WINDOW (EXCLUDING SPARES)			
	PAINT TYPE			
	PANEL COLOUR (EXTERNAL)			
	FINISH (EXTERNAL)			
	TYPE OF MIMIC MATERIAL OF MIMC THICKNESS OF MIMIC			
	PANEL COLOUR (INTERNAL)			
	FINISH (INTERNAL)			
	CLASS OF PROTECTION			
	CONTROL HARDWARE			
	FOUNDATION ARRANGEMENT			
	WEIGHT OF PANEL (Kg.)			

	DATA SHEET FOR LOCAL PANELS	SPECIFICATION NO.: PE-SS-999-145-054A	
		VOLUME	
		SECTION	
		REV. NO. 02	DATE: 16.09.2013
		SHEET 3 OF 3	

TAG No. ……. Qty..... Data Sheet No.: **PES-145A-DS1-0**

Data Sheet C

DATA SHEET-C FOR LOCAL PANEL
(TO BE FILLED BY CONTRACTOR AFTER AWARD OF CONTRACT)

	PANEL TYPE		
	CABLE GLAND		
	AMMETER (TYPE OF INPUT)		
	SCOPE OF SUPERVISION		

	PREPARED BY	CHECKED BY	APPROVED BY	COMPANY SEAL
NAME				NAME:
SIGNATURE				SIGNATURE:
DATE				DATE:

B0.6.9 Signs & colour code

General
Safety colours, safety symbols and safety signs must comply in construction, geometrical form, colour and meaning with the ISO 3864.

Signs for plant identification during the erection period must be to Employer's approval.

The signs should be of a material which is weather-resistant and of sufficient durability for the conditions prevailing on site.

Mounting and installation
The positions for the signs must be chosen so that they are within the field of vision of the persons to whom they apply. The signs should be permanently attached. Temporarily dangerous areas (e.g. construction sites, assembly areas) may also be marked by movable signs. The safety signs

must be mounted or installed in such a manner that there is no possibility of misunderstanding.

Information signs
Information signs should supply the necessary information to acquaint personnel with the physical arrangement and structure of site, buildings and equipment, e.g. floor numbers, load-carrying capacities including marking of floor areas, working loads of cranes, lifting gear and lifts, room identification, etc. The routing of underground pipes and cables is to be indicated by substantial marker blocks showing the relevant identification numbers.
In the choice of information signs in situations not covered by ISO Draft Recommendation 507 the possibility of using pictograms should be considered. Pictograms are particularly suitable for the identification of rooms, areas and buildings in the non-technical areas of the Plant, sanitary and amenities buildings, etc.

Emergency signs
In the event of accidents, all necessary information should be available immediately to those affected. Thus, a sufficient number of signs of appropriate size should be installed, e.g. escape routes (including marking of floor areas), emergency exits, fire alarms, fire extinguishers, instructions for special fire-extinguishing agents, warnings against fire-extinguishing agents (CO_2), first aid equipment, first aid points, accident reporting points, telephones, etc.

Mandatory signs
Signs indicating obligatory actions must be provided installed wherever certain action is necessary, e.g. do not obstruct the entrance; keep right, etc. Signs should also indicate when the wearing of protective clothing and equipment is necessary and obligatory, e.g., protective goggles, protective clothing, helmets, head guards, breathing equipment, ear muffs, etc.

Warning Signs
Warning signs should refer to the existence or possible existence of danger, e.g., flammable substances, explosive substances, corrosive or noxious substances, suspended loads, general danger, width/height restriction, steps, risk of trapping, slipping, falling, etc.
In addition to warning signs, appropriate black-yellow strip markings should also be used where necessary.

Equipment and Piping Colour Code
For colour code for all equipment and piping see table below, for any other items Employer’s approval shall be obtained. For safety issues relevant standards and regulations shall prevail in case of discrepancy. Final colour selection is to be discussed and approved by Employer.

Colour Code (based on DIN 2403:2007-05 & DIN 5381)

Medium	Base	RAL	Band/ Ring	RAL	Let-tering	RAL
Flammable liquids and solids e.g. high speed diesel, lube oil, seal oil, hydraulic oil, coal	Signal Brown	8002	Signal Red	3001	Signal White	9003
Flammable gases e.g. hydrogen	Signal Yellow	1003	Signal Red	3001	Signal Black	9004
Non-flammable liquids and solids e.g. ash	Signal Brown	8002	Signal Black	9004	Signal White	9003
Non-flammable gases e.g. nitrogen, carbon dioxide	Signal Yellow	1003	Signal Black	9004	Signal Black	9004
Fire fighting, e.g. fire fighting water	Signal Red	3001			Signal White	9003
Water e.g. service-, demin-, condensate, feed-, river-, cooling-, closed cooling water; except fire fighting water	Signal Green	6032			Signal White	9003
Steam e.g. main steam, HRH, CRH, aux. steam	Signal Red	3001			Signal White	9003
Acids e.g. HCl, ferrous sulphate	Signal Orange	2010			Signal Black	9004
Alkali, e.g. ammonia, caustic	Signal Violet	4008			Signal White	9003
Air e.g. station air, service air, instrument air	Signal White	9003			Signal Black	9004
Oxygen	Signal Blue	5005			Signal White	9003
Driven machines (e.g. fans and pumps) including motor; Vents, drains, vacuum	Follow medium color					
Structural steel, steel skids for equipment	Window Grey RAL 7040					
Safety caution, e.g. fall or trip hazards, handrails, head room clearance	Alternating stripes Signal Yellow RAL 1003 / Signal Black RAL 9004					
Panels, cubicles, junction boxes	Light Grey RAL 7035					

B0.6.18.4 Installation conditions and protection class for electrical operational equipment and control and monitoring equipment

If not specified otherwise the electrical operational equipment must be designed to meet protection classes stated below.

Switchgear, housings for electrical equipment and electrical equipment itself must be designed according to IEC 60529 at least to:

- Class IP 41 if located indoors in air-conditioned/ventilated areas
- Class IP 42 for ventilated enclosure of DDCMIS equipment if located indoors in air-conditioned/ventilated areas with suitable cannope ontop to prevent ingress of dripping water
- Class IP 22 for non-ventilated enclosure of DDCMIS equipment if located indoors in air-conditioned/ventilated areas with suitable cannope ontop to prevent ingress of dripping water
- Class IP 54 if located indoors
- Class IP 65 for all I&C field devices
- Class IP 55 for motors located outdoors and in indoor areas with high dust and humidity
- Class IP 65 for other outdoor electrical and control system equipment such as cubicles or panels with additional measures) if located outdoors in accordance with IEC 60529 (degrees of protection provided by enclosures (IP Code) or equivalent). The additional measures shall consist of sunshades, protection covers against splashing water, additional sealing, special acid resistive coating etc., depending upon the particular site conditions at the place of installation, subject to the approval of the Employer.
- Class IP 21 if located indoors with open doors.

The lamps for external lightning and internal lighting of not completely closed buildings must have protection class IP 55W. Furthermore for dust prone areas the lamps shall have protection class IP 65.

Electrical operational equipment which must be installed in areas exposed to danger from explosions must have the required explosion-proof design appropriate to the flash-point group classification of the explosive mixture as laid down in IEC 60079. Attention must be paid with respect to the use of electrical operational equipment in workshops and storage premises exposed to the risk of explosions.

In all rooms and areas where the local and operational conditions and surroundings can lead to the accumulation of gases, vapors, mists or dusts which, in combination with air, form explosive mixtures, the operational equipment and installations to be used in these circumstances must be of explosion-proof design. All operational equipment must be designed to comply with the class of protection dictated by the ignitable mixture (e.g. compression-proof casing, external ventilation, inherent safety, etc.).

Electrical operational equipment should be located indoors in adjoining buildings rather than inside buildings or other structures exposed to the risk of explosion. Whenever operational equipment has to be installed within areas liable to the risk of explosion, protection against explosion must, in general, be applied wherever explosive mixtures can arise. In this connection, the ignition of explosive mixtures must be reliably prevented by adopting the correct choice of design and construction of the operational equipment and the incorporation of supplementary safeguards where applicable.

Electrical, chemical, thermal and mechanical influences must on no account impair, in any way, the protection afforded against explosion. In particular the high ambient temperatures and the influence of nearby heat sources at the installation point must be taken fully into account.

LCP Quality Plan

PEM :: C&I

STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.:	**PE-QP-999-145-I056**
VOLUME	IIB
SECTION	D
REV. NO.	01 DATE: 22-02-2008
SHEET	1 OF 7

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency $ P	Agency $ W	Agency $ V	Remarks
	INCOMING											
1.0	Sheet Steel (CRCA & HR)	1. Chemical Composition	MA	Chemical analysis	Sample	Relevant standard	Relevant standard	Test Certificate	3	---	2	
		2. Bend Test	CR	Mech. test	Sample	Relevant standard	Relevant standard	Log Book	2	---	---	
		3. Surface finish	MA	Visual	100%	Factory Standard / Sample	Factory Standard / Sample	Log Book	2	---	---	
		4. Waviness	MA	Visual	100%	Factory Standard	No Waviness	Log Book	2	---	---	
		5. Thickness	MA	Measurement	100%	BHEL Spec.	BHEL Spec.	Log Book	2	---	---	
		6. Mill marking	MA	Visual	100%	Factory Standard	Factory Standard	Log Book	2	---	1	
2.0	Flats / Angles / Channels	1. Dimensions	MA	Measurement	Sample	Relevant standard	Relevant standard	Log Book	2	---	---	
		2. Surface Defects	MA	Visual	100%	Factory Standard / Sample	Factory Standard / Sample	Log Book	2	---	---	
		3. Straightness	MA	Measurement	100%	Factory Std.	Factory Std.	Log Book	2	---	---	
		4. Mill marking	MA	Visual	100%	Relevant standard	Relevant standard	Log Book	2	---	1	
3.0	Cables / Wires	1. Visual / Surface defects	MA	Visual	100%	BHEL Spec. and Relevant standard	BHEL Spec. and Relevant standard	Log Book	2	---	---	
		2. IR and HV	MA	Electrical	100%	BHEL Spec. and Relevant standard	BHEL Spec. and Relevant standard	Log Book	2	---	---	

LEGEND: * CR - Critical characteristics; MA - Major characteristics; MI - Minor characteristics

$ P - Agency Performing the Test.; W - Agency Witnessing the Test.; V - Agency Verifying the Test.

1 - BHEL; 2 - Vendor; 3 - Sub-vendor

PEM :: C&I

STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.:	**PE-QP-999-145-I056**
VOLUME	IIB
SECTION	D
REV. NO.	01 DATE: 22-02-2008
SHEET	2 OF 7

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency $ P	Agency $ W	Agency $ V	Remarks
		3. Conductor a) Resistance b) Size c) Sheet colour	 MA MA MA	 Electrical Measurement Visual	 100% 100% 100%	BHEL Spec. and Relevant standard	BHEL Spec. and Relevant standard	Log Book	2	---	---	
		4. Type / Routine Test Certificates	MA	Verification	100%	BHEL Spec. and Relevant standard	BHEL Spec. and Relevant standard	Log Book	3	---	2	
4.0	Electrical Components like Annunciator Transformers Lamps Switches PBs Contactors Relays Timers Space Heaters Thermostat Indicating meters etc.	1. Verification at make and Type	CR	Visual	Sample	BHEL Spec. and BOM	BHEL Spec. and BOM	Log Book	2	---	---	
		2. Verification of Test Certificates	CR	Scrutiny of Type / Routine T.Cs.	100%	Relevant standard	Relevant standard	Log Book	2	---	---	
		3. Operation / Functional check	CR	Electrical	Sample+ 100%@	Relevant standard & Catalogue	Relevant standard & Catalogue	Log Book	2	---	---	+ for relay & contactors only
		4. I.R.	MA	Electrical	100%	Relevant standard & Catalogue	Relevant standard & Catalogue	Log Book	2	---	---	@ for all components except relays & contactors.
		5. H.V.	MA	Electrical	100%	Relevant standard & Catalogue	Relevant standard & Catalogue	Log Book	2	---	---	
		6. Calibration	MA	Electrical	100%	Relevant standard & Catalogue	Relevant standard & Catalogue	Log Book	2	---	1	
		7. Pick up / Drop off Voltage	MA	Electrical	100%	Relevant standard & Catalogue	Relevant standard & Catalogue	Log Book	2	---	---	

LEGEND: * CR - Critical characteristics; MA - Major characteristics; MI - Minor characteristics

$ P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test.

1 - BHEL 2 - Vendor 3 - Sub-vendor

PEM :: C&I

STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.:	**PE-QP-999-145-I056**
VOLUME	IIB
SECTION	D
REV. NO.	01 DATE: 22-02-2008
SHEET	3 OF 7

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency $ P	Agency $ W	Agency $ V	Remarks
5.0	Misc. Components like Gaskets, Terminal Blocks etc.	1. Verification of Type / Make	MA	Visual	Sample	BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue	Log Book	2	---	---	
		2. Surface defects	MA	Visual	Sample	BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue	Log Book	2	---	---	
		3. IR / HV on Terminal Blocks	MA	Electrical	Sample	BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue	Log Book	2	---	---	
	IN PROCESS											
6.0	Blanking / Bending / Forming	1. Dimensions	MI	Measurement	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	2	---	---	
		2. Surface defects after bending	MA	Visual	100%	Factory Standard	Factory Standard	Log Book	2	---	---	
7.0	Nibbling / Punching	1. Cutout Sizes	MI	Measurement	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	2	---	---	
		2. Deburring	MA	Visual	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	2	---	---	
	ASSEMBLY											
8.0	Frame Assembly & Sheet fixing	1. Dimensions	MA	Measurement	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2	
		2. Alignment	MA	Measurement	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2	
		3. Welding Quality	MA	Visual	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2	
		4. Surface defects	MA	Visual	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	2	

LEGEND:
* CR - Critical characteristics
MA - Major characteristics
MI - Minor characteristics

$ P - Agency Performing the Test.
W - Agency Witnessing the Test.
V - Agency Verifying the Test.

1 - BHEL
2 - Vendor
3 - Sub-vendor

PEM :: C&I

STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.:	**PE-QP-999-145-I056**
VOLUME	IIB
SECTION	D
REV. NO.	01 DATE: 22-02-2008
SHEET	4 OF 7

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency $			Remarks
									P	W	V	
9.0	Pre-treatment and Painting	1. Pretreatment Process	MA	Visual	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1	
		2. Process parameters like bath temp. concentration etc.	MA	Measurement	Periodic	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1	
		3. Dipping / Removal Time	MA	Measurement	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1	
		4. Surface quality after every dip	MA	Visual	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1	
		5. Primer after phosphating	MA	Visual, Thickness	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1	
		6. Putty Application & Rubbing after primer	MA	Visual	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1	
		7. Paint first coat	MA	Visual, Thickness	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1	
		8. Putty Application and Rubbing after first coat of paint	MA	Visual	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1	
		9. Paint second coat	MA	Visual, Thickness, Scratch test Colour adhesion	100%	Factory Standard & Relevant standard	Factory Standard & Relevant standard	Log Book	2	---	1	

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STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.:	**PE-QP-999-145-I056**
VOLUME	IIB
SECTION	D
REV. NO.	01 DATE: 22-02-2008
SHEET	5 OF 7

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency $ P	Agency $ W	Agency $ V	Remarks
10.	Panel Wiring	1. Wiring Layout	MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	---	
		2. Wiring Termination (Crimped Lugs)	MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	---	
		3. Ferrule numbers	MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	---	
		4. Colour of wiring	MA	Visual	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	1	
		5. Size of Conductor	MA	Measurement	100%	Approved drgs. & Specs.	Approved drgs. & Specs.	Log Book	2	---	1	
11.	Component Mounting	1. Correct components	MA	Visual	100%	Approved drgs., Specs. & BOM	Approved drgs., Specs. & BOM	Log Book	2	---	---	
		2. Fixing	MA	Visual	100%	Approved drgs., Specs. & BOM	Approved drgs., Specs. & BOM	Log Book	2	---	---	
	FINAL											
12.	Final Inspection	1. Workmanship	MA	Visual	100%	Factory Standard	Factory Standard	Inspection Report	2	1	1	At Random by BHEL, based on 100 % internal test reports by Mfr.
		2. Component layout (neatness, accessibility & safety) Mounting / Proper fixing of all components	MA	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	
		3. Components identification Marking / Name plates	MA	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	

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PEM :: C&I

STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

STD QUALITY PLAN NO.:	**PE-QP-999-145-I056**
VOLUME	IIB
SECTION	D
REV. NO.	01 DATE: 22-02-2008
SHEET	6 OF 7

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency $ P	Agency $ W	Agency $ V	Remarks
		5. Dimensions	MA	Measurement	100%	BHEL approved drg. / Spec., BOM	BHEL approved drg. / Spec., BOM	Inspection Report	2	1	1	
		6. Door functioning	MA	Functional	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	
		7. Paint Shade	CR	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	
		8. Paint Thickness	CR	Measurement	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1	
		9. Workmanship of Gaskets	MA	Visual	100%	Factory Standard	Factory Standard	Inspection Report	2	1	1	At Random by BHEL, based on 100 % internal test reports by Mfr.
		10. Wiring Layout	MA	Visual	100%	BHEL approved drg.	BHEL approved drg.	Inspection Report	2	1	1	
		11. Wire Termination	MA	Pulling manually	Sample	-----	Firm termination	Inspection Report	2	1	1	
		12. Continuity	MA	Electrical	100%	-----	Continuity OK	Inspection Report	2	1	1	

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STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

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SHEET	7 OF 7

Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency $ P	Agency $ W	Agency $ V	Remarks
13.	TYPE TEST	Degree of Protection	CR	Mech. Protection	Sample	BHEL approved spec., drg relevant IEC-60947, IEC-60079	BHEL approved spec., drg relevant IEC-60947, IEC-60079	Type Test Certificate	3	---	1	
14	ROUTINE TEST	IR before & after HV Test	CR	Electrical	100%	BHEL approved spec., drg., BOM & relevant standard	BHEL approved spec., drg., BOM & relevant standard	Test Report	2	1	1	
15	FUCTIONAL TEST	1. Control Logic Operation	CR	Electrical	100%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1	
		2. Instrument Calibratio	CR	Electrical	10%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1	
		3. Temperature rise	CR	Electrical	100%	BHEL approved spec/drg. & relevant standard	BHEL approved spec/drg & relevant standard	Inspection Report	2	1	1	

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INSTRUMENTS CHECK LIST

Important notes for Quality assurance and checks shall be as follows:

1) The requirement indicated in the check list is minimal. Vendor has to submit Quality Plans/ Checklists for addressing the minimal requirement indicated in the check list and also those indicated under **clause B0.7** in the customer's General Technical Specification – B0, as relevant to instruments. Vendor submitted quality plans shall be subject to customer approval during detail engineering without any commercial and time implication. For instruments for which checklist is not attached, vendor's Quality Plan for such items will also be subject to customer approval during detail engineering without any commercial and delivery implication.

2) The inspection agencies indicated in the Checklists in specification may be ignored. These will be aligned in line with approved Inspection categorisation plan during detail engineering without any commercial and delivery implication.

B0.7.2.5 Control and monitoring equipment

All control and monitoring equipment shall be tested at the manufacturers' works before dispatch to site. Certificates shall be issued for

- synchronizing units
- flow evaluators

On request the correct operation of equipment with specified temperature and humidity limits shall be demonstrated by tests conducted within the limits.

Electrical measuring instruments
All electrical measuring instruments shall be tested in accordance with the following rules and regulations. Alternatively, equivalent standards approved by the Employer's Representative may be used.

IEC 60051 Recommendations for direct-acting indicating electrical measuring instruments and their accessories

IEC	60258	Direct acting recording electrical measuring instruments and their accessories
IEC	61036	Alternating current static watt-hour meters for active energy
IEC	61010	Safety requirements for electrical equipment for measurement, control and laboratory use

Electrical remote indication
Meters for active power, reactive power and similar remote indication equipment:

VDE	0418	Regulations for electric integrating meters
IEC	60338	Telemetering for consumption and demand

Calibration Tests
The Contractor shall conduct calibration tests of the following instruments and equipment:

- all local indicators over the full range of the indicator
- all transmitters over the full range of the transmitter
- all binary transmitters over the full range including initial setting
- all remote indicators over the full range of the indicator
- all recorders over the full range of the recorder
- one of each type of indication loop with circuit resistance of the loop increased to a value which is equal to the highest value expected, and under worst case operating conditions
- all superheated steam thermocouples
- one of each type of thermocouple or resistance element
- all kinds of analogue transmitters over the full measuring range
- all modules and subassemblies for measuring and control e.g. analogue limit monitors, flow evaluators, function generators
- all quantity meters
- all synchronizing units according to IEC standards
- the actual dimensions of all orifices, nozzles, Venturi nozzles have to be checked as per ISO5167.

Closed-loop control systems
All main closed-loop control systems shall be tested for polarity and function in accordance with the applicable standards. Control valves shall be tested in accordance with mechanical functional tests on control valves and shall be performed with the actuator mounted (open to closed position and vice-versa). Actuators shall be subject to mechanical and electrical function tests.

Sequence logic equipment
All sequence logic equipment shall be tested using simulated inputs.

Alarm annunciator and fault printing system

The alarm annunciator and fault printing system shall be tested using simulated inputs.

DCS system

The system shall be thoroughly tested at the manufacturers' workshops before dispatch to site. Test programs shall be devised and these shall subsequently be made available to the Employer's Representative. Tests shall be made to ensure that the system operates correctly within the ambient conditions as specified by the manufacturer and that if these conditions are exceeded, i.e. in the case of failure of the air-conditioning system, that the system will automatically fail safe and that neither hardware nor software will be damaged.

Further I&C equipment

Type test reports shall be provided for the following: As applicable

- UPS
- 24 V DC battery chargers
- Batteries
- Control valves
- Instrumentation cables
- Flow nozzle orifice plates
- Measuring instruments
- Local instrument enclosures
- Local instrument racks
- PLCs
- Etc.

Type test reports

The minimum type test reports for each of the major I&C systems shall be as follows:

1. Surge Withstand Capability (SWC) for solid state equipment/ systems
   All solid state systems/ equipment shall be able to withstand the electrical noise and surges as encountered in actual service conditions and inherent in a Power Plant. All the solid state systems/ equipment shall be provided with all required protections that needs the surge withstand capability as defined in ANSI 37.90.1/ IEEE-472. Hence all front end cards which receive external signals like analogue input & output modules, binary input & output modules, etc. including power supplies, data highway, data links shall be provided with protections that meet the surge withstand capability as defined in ANSI 37.90.1/ IEEE-472. Complete details of the features incorporated in electronic systems to meet this requirement, the relevant tests carried out, the certificates etc. shall be submitted with the proposal. As an alternative to above, suitable class of EN61000-4-12 which is equivalent to ANSI 37.90.1/ IEEE-472 may also be adopted for SWC test.
2. Dry heat test as per IEC 60068-2-2 or equivalent
3. Damp heat test as per IEC 60068-2-3 or equivalent

4. Vibration test as per IEC 60068-2-6 or equivalent
5. Electrostatic discharge tests as per EN 61000-4-2 or equivalent
6. Radio frequency immunity test as per EN 61000-4-6 or equivalent
7. Electromagnetic field immunity as per EN 61000-4-3 or equivalent

Tests as listed under items number 5 to 7 as applicable for electronic cards only as defined under item 1 above.

STANDARD CHECK LIST FOR C&I INSTRUMENTS

CHECK LIST FOR TRANSMITTER

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

Legend :

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

Note :

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

STANDARD CHECK LIST FOR C&I INSTRUMENTS

CHECK LIST FOR PRESSURE & DP GAUGE

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

Legend :

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

Note :

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

STANDARD CHECK LIST FOR C&I INSTRUMENTS

CHECK LIST FOR LEVEL GAUGE

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

Legend :

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Note :

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

STANDARD CHECK LIST FOR C&I INSTRUMENTS

CHECK LIST FOR ANNUNCIATORS

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	W	V	
	TYPE/ MODEL						
	DIMENSIONS OF HARDWARE						
	MODULARITY						
	SEQUENCE						
	FACIA DETAILS						
2	FUNCTIONAL TEST	100%		P	W	V	
3	IMMUNE TO STEP VARIATIONS IN THE POWER SUPPLY	SEE NOTE-1 BELOW		P	W	V	
4	DEGREE OF PROTECTION FOR ENCLOSURE	TYPE TEST		P	W	V	
5	I/R CHECK	SEE NOTE-1 BELOW		P	W	V	
6	RESPONSE			P	W	V	

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Note :

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

APPLICABLE CODES & STANDARDS

The regulations, standards and guidelines listed in the Specification as well as all applicable laws and governmental decrees, regulations, orders, etc. shall be observed in the design, calculation, manufacture, erection, installation, testing, commissioning and start-up of all parts of the Plant.

The following shall be considered in the design and engineering of the Plant facilities:

- All parts of the Plant shall be suitable in every respect for continuous operation at maximum output as well as part loads and expected transient operating conditions peculiar to the site and shall be able to safely withstand the stresses arising from the operating conditions without any reduction in its planned life.
- The Contractor shall familiarize himself with the conditions on site.
- Suitable and automatically acting protection and safety measures shall be provided for automatic load reduction or shut down of equipment in case of abnormal operating conditions.
- Switchover to stand-by units shall be automatically, as far as required for continuous Plant operation without interruption of Plant operation.
- In case of equipment and/or system shut down process conditioned drainage of components (such as pipelines, tanks, etc.) shall be performed automatically from the control room.
- Minor equipment which, in case of failure would cause a failure of a power generation unit and/or the Plant is to be provided with a stand-by facility in order to ensure further operation of the power generation unit or the Plant.
- All live, moving and rotating parts shall be provided with appropriate effective protection in order to avoid danger to the operating staff. All metal parts shall be electrically grounded.
- All equipment shall be designed to ensure start-up from any condition, i.e. from long term shut-down, cold, warm or hot condition without necessitating special or preparatory measures.
- The project language shall be English.

B0.6.2 Standards and codes

The work must be performed according to the most recent relevant codes, standards, accident prevention regulations and local rules and legal regulations.

All materials and equipment supplied and all work carried out as well as calculation sheets, drawings, quality and class of goods, methods of inspection, specific design features of equipment and parts and acceptances of partial plants shall comply in every respect with the applicable standards, codes and regulations to be chosen from the following:

- American Association of State Highway and transportation Officials — AASHTO

• American Concrete Institute	ACI
• American Gear Manufacturers Association	AGMA
• American Institute of Steel Construction	AISC
• American Iron & Steel Institute	AISI
• American Moving and Conditioning Association	AMCA
• American National Standards Institute	ANSI
• American Petroleum Institute	API
• American Public Health Association	APHA
• American Society for Testing and Materials	ASTM
• American Society of Civil Engineers	ASCE
• American Society of Heating, Refrigeration & Air Conditioning Engineers	ASHRAE
• American Society of Mechanical Engineers	ASME
• American Water Works Association	AWWA
• American Welding Society	AWS
• American Wire Gauge	AWG
• Anti-Friction Bearing Manufactures Association	AFBMA
• Architectural Institute of Japan	AIJ
• Association Francaise de Normalisation	AFNOR
• British Standards Institute	BS
• Chlorine Institute	CI
• Crane Manufacturers Association of America	CMAA
• Deutsches Institut für Normung	DIN
• Diesel Engine Manufacturers Association	DEMA
• European Norm	EN
• Expansion Joint Manufacturer Association	EJMA
• Fédération Européene de Manutention	FEM
• Heat Exchanger Institute	HEI
• Hydraulic Institute	HI
• Illuminated Engineers Society	IES
• Institute of Electrical and Electronics Engineers	IEEE
• Instrument Society of America	ISA
• Insulated Power Cable Engineers Association	IPCEA
• International Electrotechnical Commission	IEC
• International Standards Organization	ISO
• Japanese Architectural Standard Specification	JASS
• Japanese Electrical Manufacturers Association	JEMA
• Japanese Electrotechnical Institute	JEC
• Japanese Industrial Standards	JIS
• Manufacturers Standardization Society	MSS
• National Association of Corrosion Engineers	NACE
• National Electrical Code (USA)	NEC
• National Electrical Manufacturer's	NEMA

Association (USA)	
• National Electrical Safety Code	NESC
• National Fire Protection Association	NFPA
• National Structural Code for Building	NSCB
• Occupation Safety and Health Administration	OSHA
• Portland Cement Association	PCA
• Properties of Water and Steam	IFC
• Scientific Apparatus Manufacturers Association	SAMA
• Society of Automotive Engineers	ASE
• Standards of Japanese Electrotechnical Committee	JEC
• Steel Structures Painting Council	SSPC
• Technische Vereinigung der Grosskraftwerksbetreiber	VGB
• Tubular Exchanger Manufacturers Association	TEMA
• Underwriters Laboratory	UL
• Uniform Building Code	UBC
• Verband Deutscher Elektrotechniker	VDE
• Verein Deutscher Ingenieure	VDI
• Vereinigung Deutscher Elektrizitätswerke (Association of German Power Plants)	VDEW
• Water Pollution Control Federation	WPCF

Generally, all internationally and nationally recognized standards as above will be applied, except if specific standards called for by:

a) Occupational Safety Board of Bangladesh
b) Department of Inspection for Factories and Establishments, Bangladesh
c) Department of Environment, Bangladesh
d) Bangladesh Power Development Board
e) Bangladesh Energy Regulatory Commission
f) Ministry of Power, Energy and Mineral Resources
g) Bangladesh Fire Service and Civil Defence Ministry
h) All relevant Bangladesh National Statutory Regulations
i) Bangladesh National Building Code
j) Bangladesh Standards
k) Local Authorities.

All steam boilers and unfired pressure vessels together with associated pipework and fittings shall comply with the Bangladesh Boiler Act, 1923 with amendments.

All pressure parts shall be designed in accordance with applicable ASME codes.

All services, supplies and works shall comply with the requirements of the relevant laws of Bangladesh and the IFC/World Bank Group Standards and Guidelines in their latest edition, including but not limited to:

- Environmental Conservation Rules
- Bangladesh Energy Regulatory Commission Act;
- BERC Licensing Regulation
- BERC Technical Quality Standards;
- Bangladesh National Building Code;
- other applicable laws in Bangladesh;
- IFC Performance Standards on Environmental and Social Sustainability;
- IFC / World Bank Group Environmental, Health and Safety (EHS) General Guidelines ;
- IFC / World Bank Group EHS Guidelines for Thermal Power Plants;
- IFC / World Bank Group EHS Guidelines for Electric Power Transmission and Distribution.

It is the Contractor's responsibility to provide sufficient evidence that any national or other standard the Contractor proposes (other than those mentioned above) will ensure an equivalent or higher standard.

Immediately after effective date of the Contract the Contractor shall supply an indexed list of all standards, codes and associated standards referred to, to which the work is to be performed. A copy of all applied standards shall be forwarded to the Employer. The Contractor shall supply preferably two (2) searchable softcopies, else two (2) hardcopies each.

B0.6.3 Plant and equipment identification

The Contractor shall apply a plant identification system showing the name and number of each item of Plant and its respective arrangement drawing number and add any additional items necessary to fully identify the Plant.

All design submissions shall include a detailed labelling list indicating the label text, size of the lettering and fixing details for the approval of the Employer or its representative.

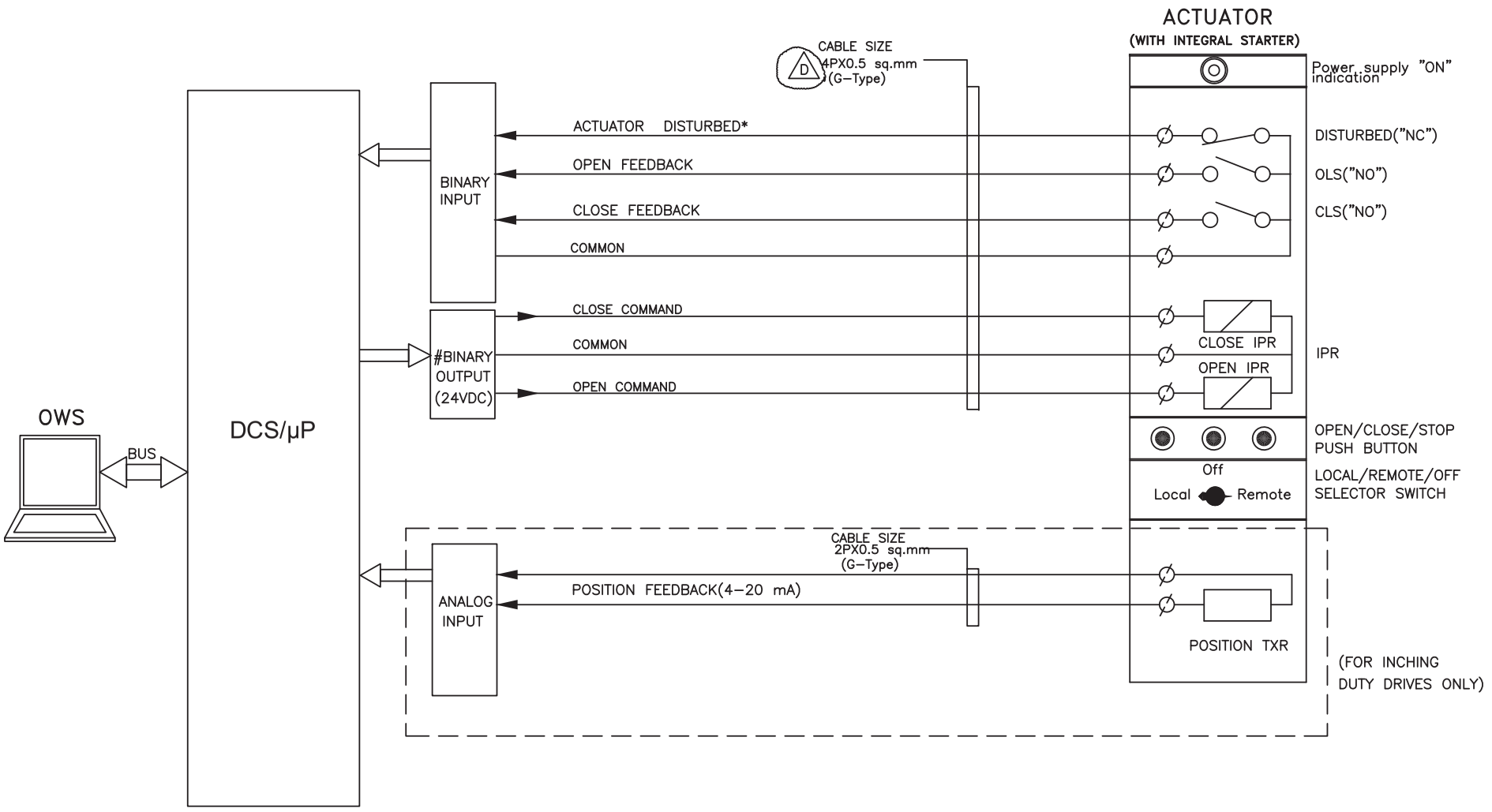
The identification and numbering of equipment, systems, items, etc. of supply, as well as of all documents and drawings shall be in accordance with the VGB guideline RDS-PP (Reference Designation System for Power Plants - KKS system).

There is to be only one approved description for any one item of Plant and this must be used consistently for Plant, electrical and instrumentation designations throughout.

The Contractor shall supply all labels (Plant and Equipment Identification Plates), nameplates, manufacturer's equipment nameplate, instruction and

DRIVE CONTROL PHILOSOPHY

DCS/µP INTERFACE FOR BIDIRECTIONAL DRIVE(WITH INTEGRAL STARTER)



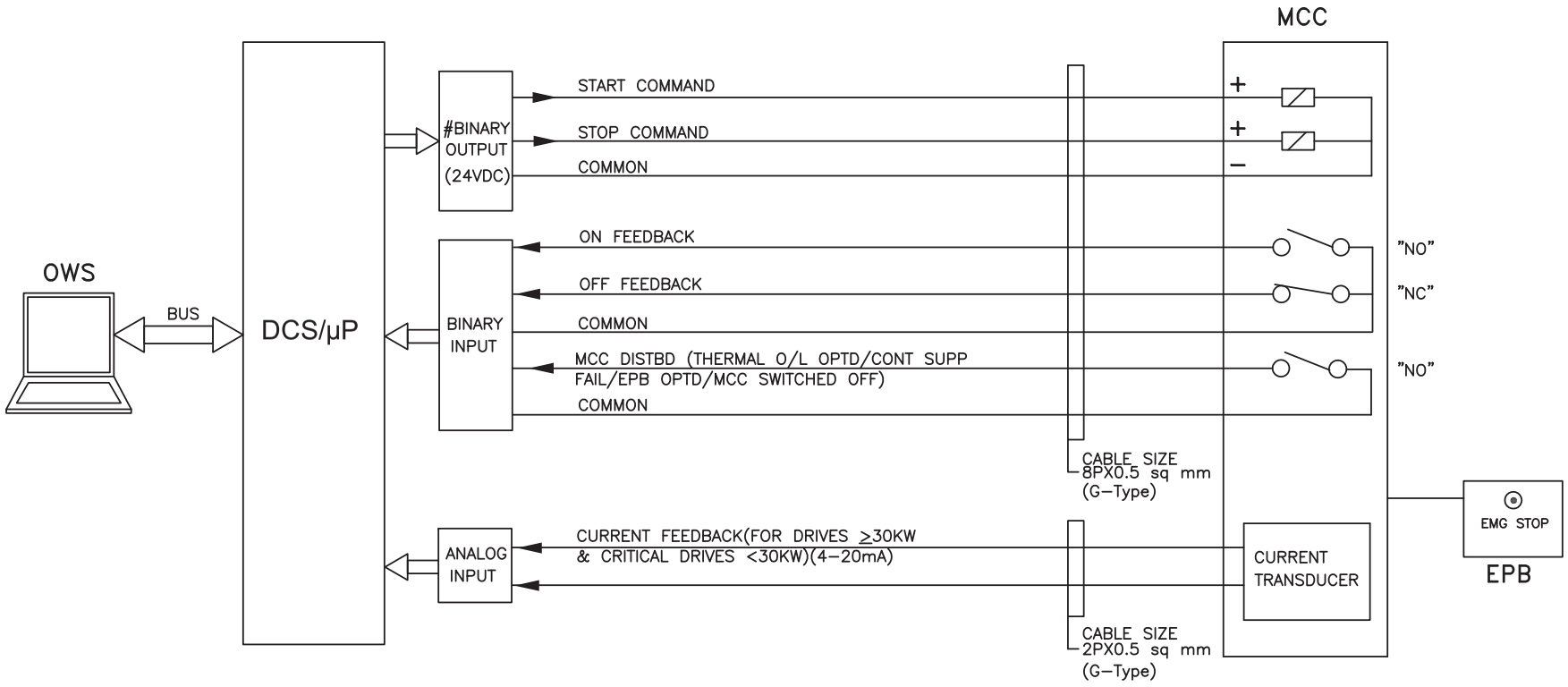
NOTE:

* DISTURBED= Loss of Power supply (1 Phase/3 Phase)/ Loss of control supply/ Motor thermostat trip/ Thermal over load/ Local/Off/Remote Sel. switch in local or off mode/ Stop PB optd.

#BINARY= OUTPUT # Redundant output shall be provided C

BHEL	PROJECT: 2X660MW BIFPCL MAITREE	DRG.NO. Maitree–01–CD–FF–123002–PEM–D
	TITLE DCS/µP INTERFACE FOR BIDIRECTIONAL DRIVE	DATE 10.08.2017
		SHT 7 OF 11

DCS/µP INTERFACE FOR UNIDIRECTIONAL LT DRIVE



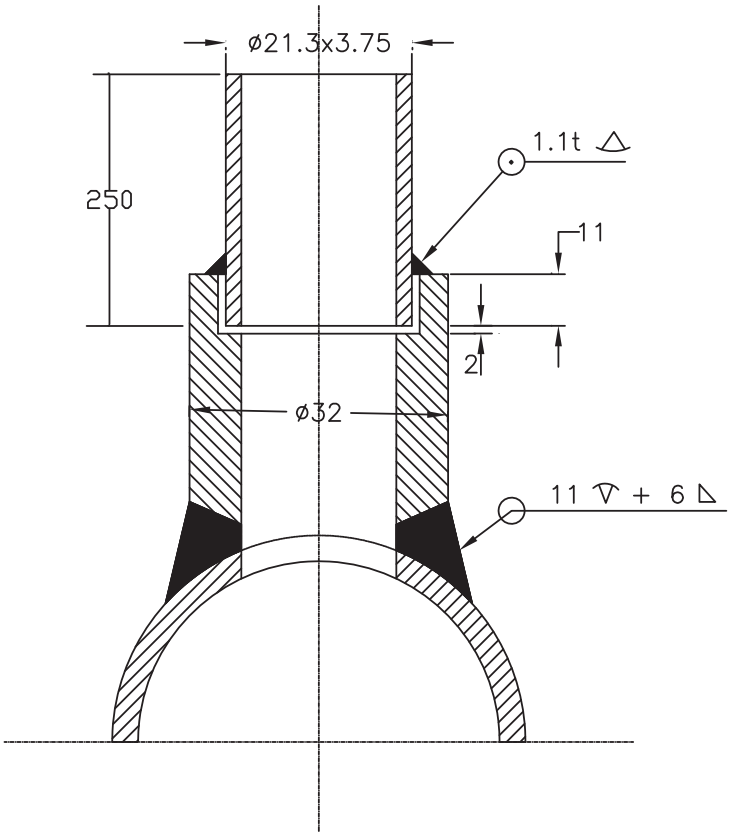
NOTE:

#BINARY= OUTPUT

Redundant output shall be provided (C)

BHEL	PROJECT: 2X660MW BIFPCL MAITREE	DRG.NO. Maitree-01-CD-FF-123002-PEM-D
	TITLE DCS/µP INTERFACE FOR UNIDIRECTIONAL LT DRIVE	DATE 10.08.2017
		SHT 8 OF 11

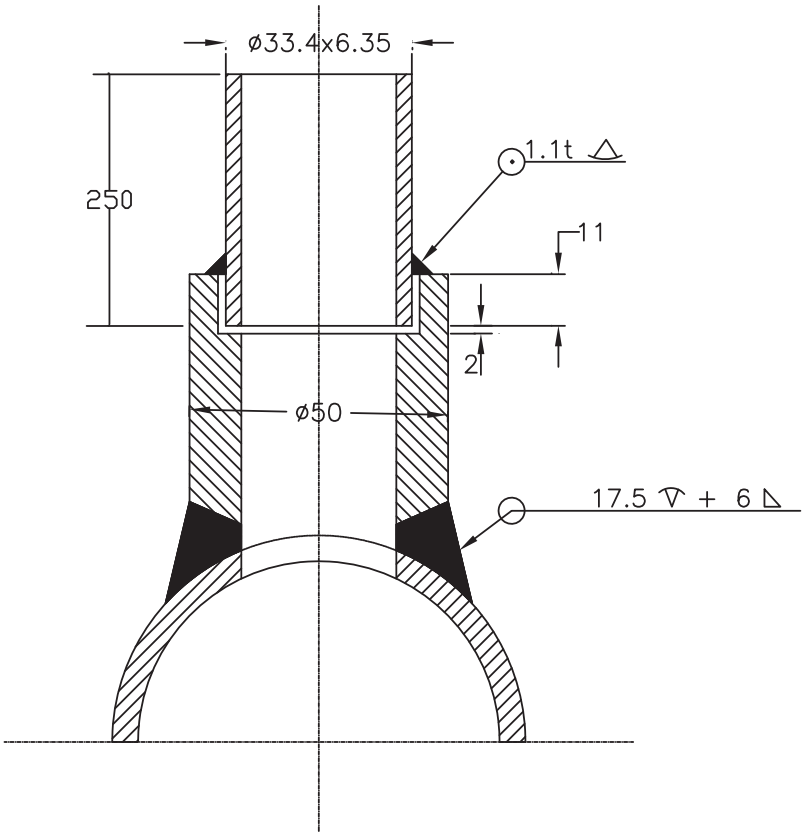
INSTRUMENT STUB DETAILS



NOTE :

1. MATERIAL OF THE BOSS AND NIPPLE SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED AND CONFORM TO ANSI B16.11.
2. THE LENGTH OF NIPPLE SHOULD BE 250 MM.
3. STUB LENGTH SHALL BE 64mm UPTO 200Nb PIPE, 45mm ABOVE 200Nb PIPE SIZE.
4. STUB AND NIPPLE SHALL HAVE IBR CERTIFICATION, AS APPLICABLE, ACCORDING TO PROCESS DATA

भेल BHEL	TITLE : INSTRUMENT STUB DETAILS FOR PRESSURE MEASUREMENT (SYSTEM PRESS UPTO 40Kg/Cm2, CLASS 3000#)	DRG. NO. REV. 00



NOTE :

1. MATERIAL OF THE BOSS AND NIPPLE SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED AND CONFORM TO ANSI B16.11.
2. THE LENGTH OF NIPPLE SHOPULD BE 250 MM.
3. STUB LENGTH SHALL BE 64mm UPTO 200Nb PIPE, 45mm ABOVE 200Nb PIPE SIZE.
4. STUB AND NIPPLE SHALL HAVE IBR CERTIFICATION, AS APPLICABLE, ACCORDING TO PROCESS DATA

BHEL	TITLE : INSTRUMENT STUB DETAILS FOR PRESSURE MEASUREMENT (SYSTEM PRESS > 40Kg/Cm2, CLASS 6000#)	DRG. NO. REV. 00

INSTRUMENT INSTALLATION DIAGRAM

INSTALLATION NOTES

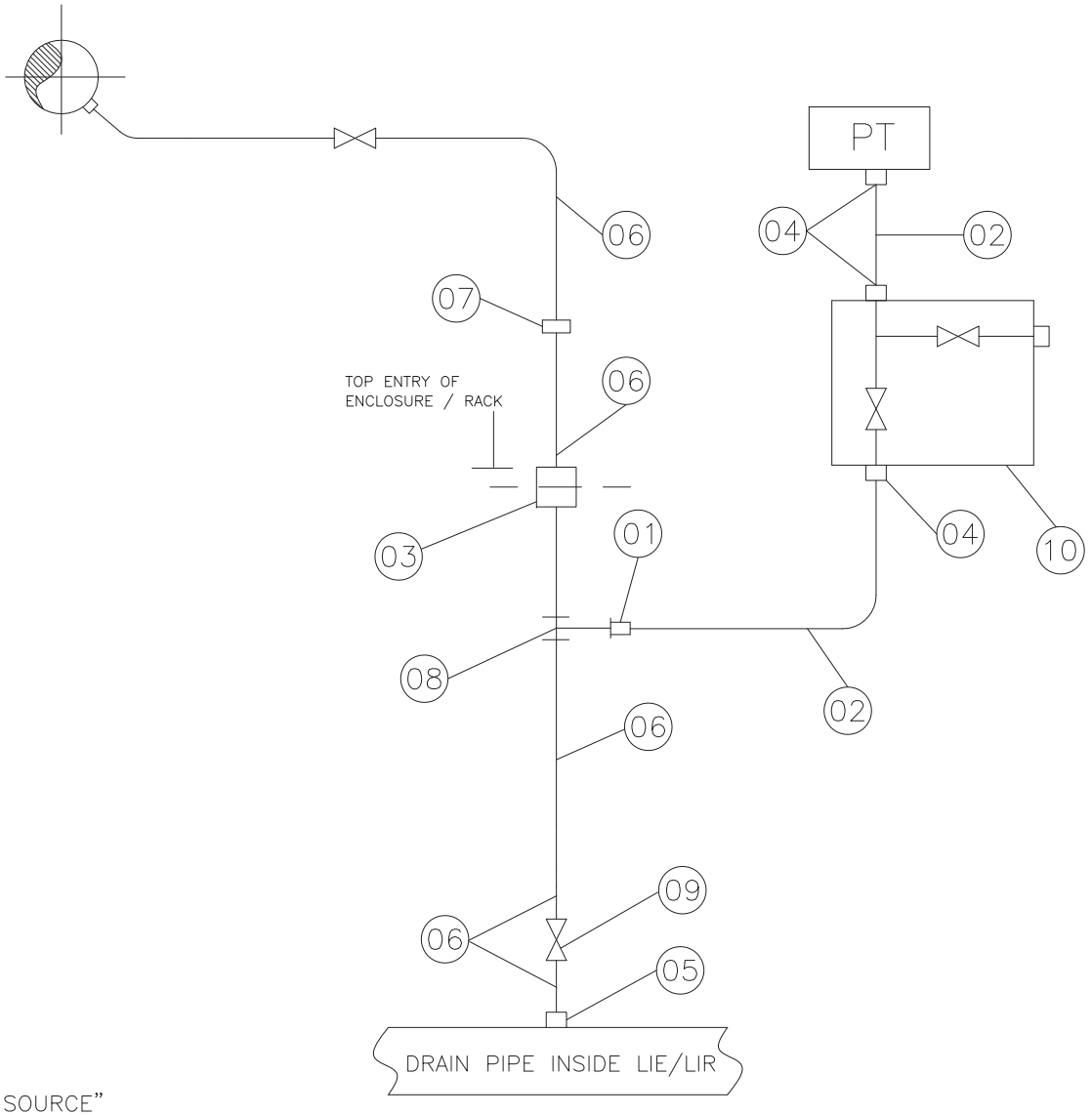
01. HORIZONTAL PIPE RUNS SHALL HAVE A SLOPE OF 50 MM'S IN ONE METER

02. LEGEND/ABBREVATIONS USED IN THE INSTALLATION SCHEMES.

- A/R : AS REQUIRED
- PT : PRESSURE TRANSMITTER
- DPT : DIFFERENTIAL PRESSURE TRANSMITTER (FT or LT or DPT type).
- DFDC : DOUBLE FERRULE DOUBLE COMPRESSION
- INST : INSTRUMENT

03. DRAIN PIPE INSIDE LIE / LIR SHALL BE OF A106 Gr. C– 2" NB Sch. 80 ALONGWITH WITH SUITABLE ADAPTER / ELBOW ON ONE SIDE & CAP ON OTHER SIDE.

04. DRAIN FROM LIE / LIR SHALL BE CONNECTED TO NEAREST PLANT DRAIN THROUGH OPEN FUNNEL (1/2" SIZE).



NOTE:

1. " TRANSMITTER BELOW SOURCE"
2. FOR BILL OF MATERIAL REFER PAGE 8

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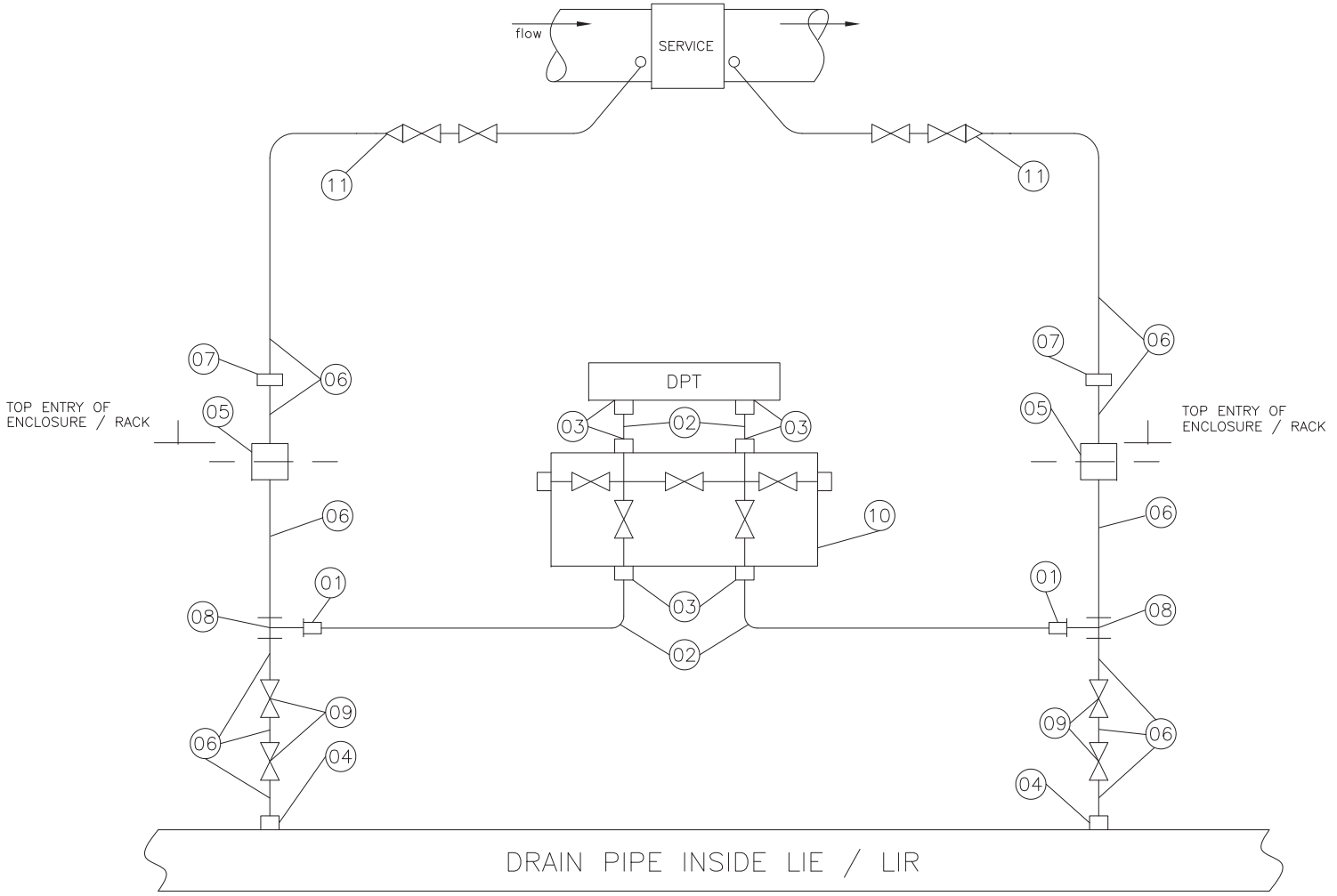
PE-DG-421-145-I555

REV. NO. 00

PAGE : 7

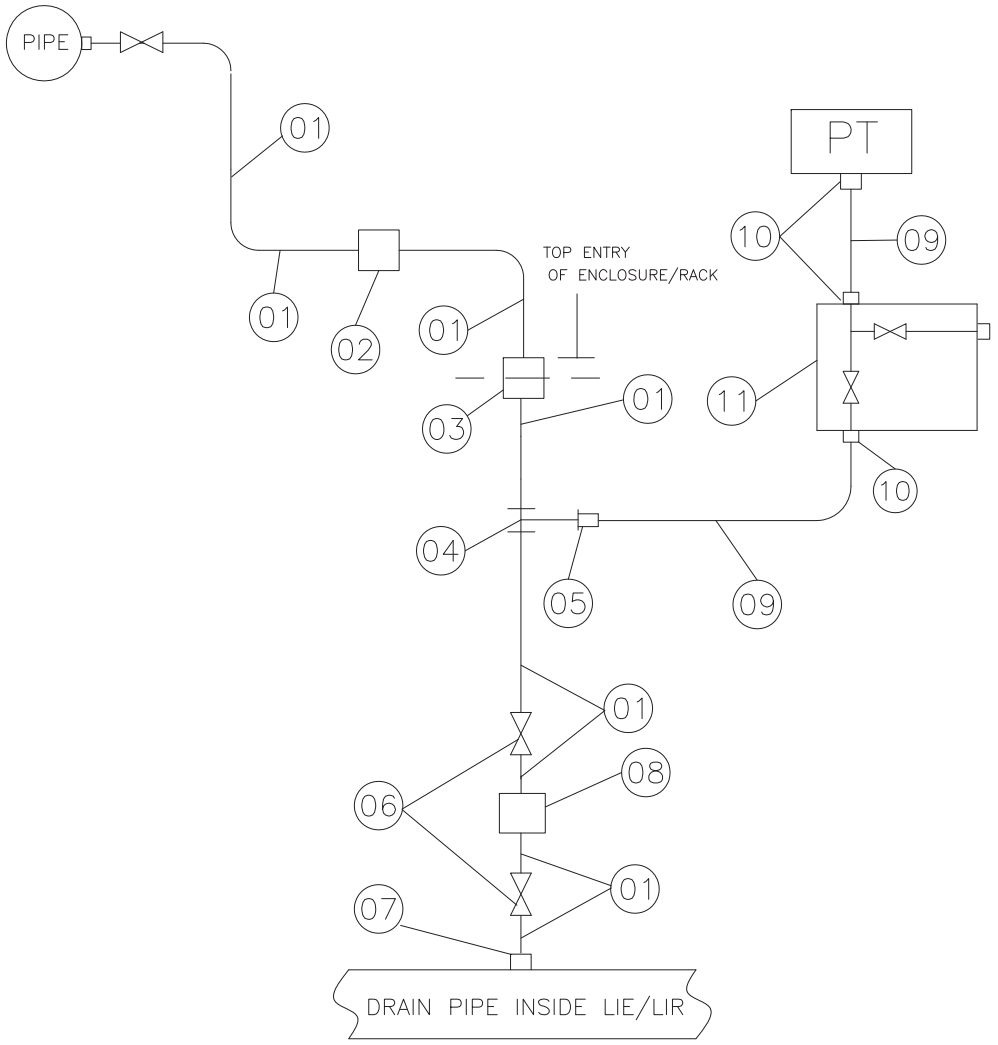
ITEM NO.	ITEM DESCRIPTION	QTY/INST.
10	TWO VALVE MANIFOLD WITH VENT PLUG PORT SIZE : 1/2" NPTF / MATL : SS316 PR. TESTING : 3000PSI	01
09	FORGED GLOBE VALVE BODY : ASTM A105 SIZE : 1/2" NB–SW / CL : 800	01
08	FORGED TEE / AS PER ANSI B16.11 MATL. : ASTM A105 SIZE : 1/2" NB–SW / CL : 3000	01
07	FORGED COUPLING / AS PER ANSI B16.11 MATL : ASTM A105 SIZE : 1/2" NB–SW / CL. 3000	A/R
06	IMPULSE PIPE MATL : ASTM A106 Gr. C SIZE : 1/2" NB–SCH 80	A/R
05	HALF COUPLING / 1/2" NB–SW /AS PER ANSI B16.11 MATL : ASTM A105 /CL. 3000	01
04	TUBE FITTING / DFDC MATL. : SS316 SIZE : 1/2" NPTM X TO SUIT 1/2" OD SS TUBE	03
03	BULK HEAD UNION / COUPLING CL : 3000 LBS / 1/2" NB–SW MATL : ASTM A105/AS PER ANSI B16.11	1No.
02	TUBE / MATL. : SS316 ASTM A 213 TP 316 H SIZE : 1/2" OD X 2.1 mm THK.	A/R
01	TEE TUBE UNION / MATL. : SS316 SIZE : OD OF 1/2" NB – PIPE X TO SUIT TO 1/2" OD SS TUBE	01



NOTE:

1. " TRANSMITTER BELOW SOURCE"
2. FOR BILL OF MATERIAL REFER PAGE 10

ITEM NO.	ITEM DESCRIPTION	QTY/INST.
11	FORGED REDUCER / AS PER ANSI B16.11 MATL.: ASTM A105 SIZE: OD OF 1" NB TO 1/2" NB – SW CL 6000	02
10	FIVE VALVE MANIFOLD WITH VENT PLUG PORT SIZE : 1/2" NPTF / MATL. : SS316 PR. TESTING : 6000PSI	01
09	FORGED GLOBE VALVE BODY MATL : ASTM A105 SIZE : 1/2" NB–SW / CL. 2500	04
08	FORGED TEE / AS PER ANSI B16.11 MATL. ASTM A105 SIZE : 1/2" NB–SW /CL : 6000	02
07	FORGED COUPLING / AS PER ANSI B16.11 MATL. : ASTM A105 SIZE : 1/2" NB–SW / CL. 6000	A/R
06	IMPULSE PIPE MATL. ASTM A106 Gr.C SIZE : 1/2" NB–SCH 160	A/R
05	BULK HEAD UNION COUPLING / AS PER ANSI B16.11 MATL. : ASTM A105/ 1/2" NB–SW CL : 6000	02
04	HALF COUPLING / AS PER ANSI B16.11 MATL. : ASTM A105 / 1/2" NB–SW /CL.6000	02
03	TUBE FITTING / DFDC MATL. : SS316 SIZE : 1/2" NPTM X TO SUIT 1/2" OD SS TUBE	06
02	TUBE / MATL. : ASTM A 213 TP 316 H SIZE : 1/2" OD X 2.1 THK.	A/R
01	TEE– TUBE UNION MATL. : SS316 / SIZE : OD OF 1/2" NB X TO SUIT 1/2" OD SS TUBE	02



NOTE:

1. " TRANSMITTER BELOW SOURCE"
2. FOR BILL OF MATERIAL REFER PAGE 16

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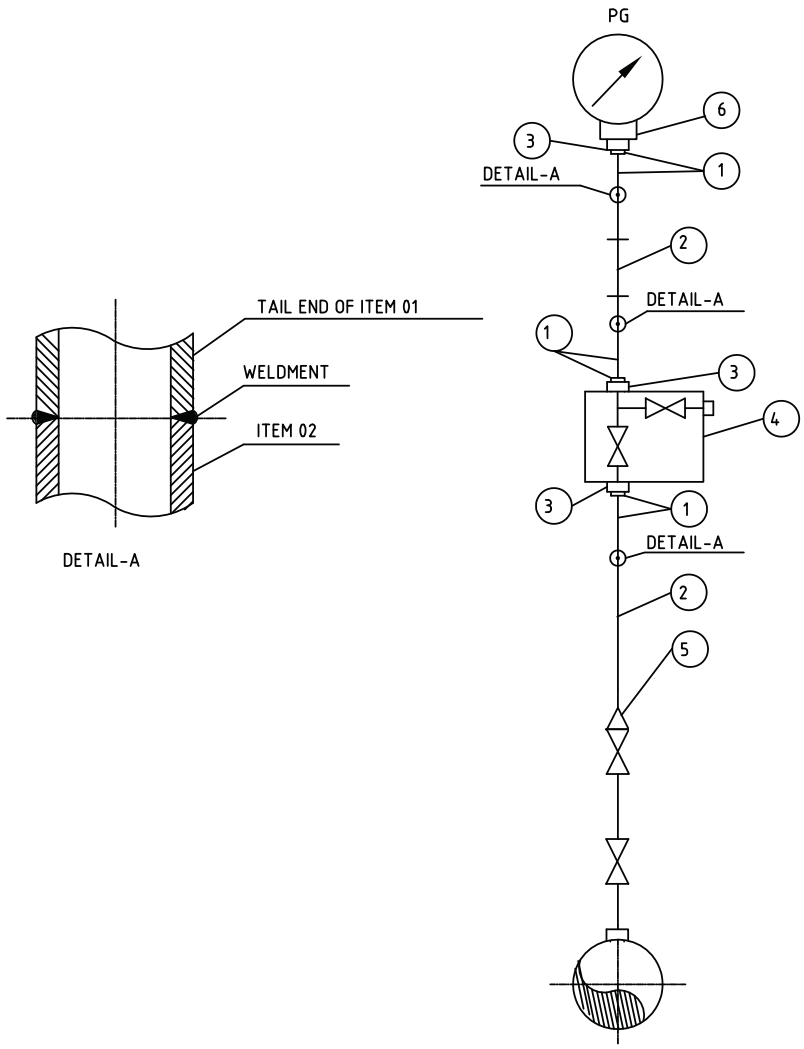
REV. NO. 00

PAGE : 15

ITEM NO.	ITEM DESCRIPTION	QTY/INST.
11	TWO VALVE MANIFOLD + VENT PLUG / PR.TESTING: 3000 PSI MATL. : SS316, PORT SIZE : 1/2" NPTF	01
10	TUBE FITTING/DFDC/, MATL. : SS316 SIZE : 1/2" NPTM x TO SUIT 1/2" OD SS TUBE.	03
09	TUBE MATL. : ASTM A213 TP 316 H SIZE : 1/2" OD x 1.13 mm THK.	A/R
08	DRAIN POT: 2" NB Sch 80 BODY: A106 Gr. C / CONN. 3/4" NB – SW	01
07	HALF COUPLING / 3/4" NB–SW /AS PER ANSI B16.11 MATL : ASTM A105 /CL. 3000	01
06	GLOBE VALVE / CL. 800 SIZE : 3/4" NB–SW BODY: ASTM A105	02
05	TEE TUBE UNION; MATL. : SS316 SIZE : OD OF 3/4" NB PIPE x SUIT TO 1/2" OD – TUBE RATING : 3000	01
04	FORGED EQUAL TEE/AS PER ANSI B16.11/RATING : CL 3000 SIZE : 3/4" NB–SW ; MATL. : ASTM A105	01
03	FORGED BULK HEAD UNION / AS PER ANSI B16.11 RATING : ANSI CL. 3000 SIZE : 3/4" NB – SW/MATL. : ASTM A105	01
02	FORGED COUPLING/AS PER ANSI B16.11 SIZE : 3/4" NB – SW / RATING : ANSI CL 3000 MATL. : ASTM A105	A/R
01	IMPULSE PIPE; SIZE : 3/4" NB – SCH 80 MATL. : ASTM A106 Gr. C	A/R



ITEM No.	ITEM DESCRIPTION	QUANTITY/INST. (Nos.)
1	NUT & TAIL FITTING + COPPER WASHERS MATL : ASTM A105 / SIZE: NUT : 3/4" BSPF TAIL : ID= 9 mm / OD= 19 mm	03
2	IMPULSE PIPE SIZE : 1/2" NB - SCH 160 MATL : ASTM A106 Gr.C	A/R
3	ADAPTER MATL:ASTM A105 SIZE : 1/2" NPTM x 3/4" BSPM	03
4	TWO VALVE VALVE MANIFOLD+VENT PLUG RATING : 6000 LBS/ MATL: SS304 PORT CONNECTION : 1/2" NPTF	01
5	FORGED REDUCER/ RATING CL. 6000LBS SIZE: OD of 1" NB x 1/2" NB-SW/AS PER ANSI B16.11 SMATL : ASTM A105	01
6 ##	SNUBBER MATL. ASTM A105 SIZE : 1/2" NPTM X 1/2" NPTF FLOW DIRECTION- 1/2" NPTF TO 1/2" NPTM	01

ONLY FOR SERVICES WITH PULSATING FLOW (DISCHARGE SERVICES)

NOTE :-
1. PRESSURE INDICATOR MOUNTED LOCAL AT SOURCE

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EN-DG-724-145-7002

REV. NO. 00

PAGE :

APPLICABLE C&I CABLE TYPES

S. No.	C&I Cable Type
G-TYPE	
1	2P X 0.5 sq.mm
2	4P X 0.5 sq.mm
3	8P X 0.5 sq.mm
4	12P X 0.5 sq.mm
F-TYPE	
1	4P X 0.5 sq.mm
2	8P X 0.5 sq.mm
3	12P X 0.5 sq.mm
4	20P X 0.5 sq.mm
CONTROL CABLE	
1	3C X 2.5 sq.mm

SECTION III

(DOCUMENTS TO BE SUBMITTED BY BIDDER)

COMPLIANCE CERTIFICATE

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

a) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification and there are no exclusions with regard to same.

b) There are no other deviations w.r.t. specification other than those furnished in the 'Schedule of Deviations'. Any other deviation, stated or implied, taken elsewhere in the offer stands withdrawn unless specifically brought out in the 'Schedule of Deviations'.

c) Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL/ Customer/Customer's Consultant approval and customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. Charges for 3rd party inspection (TUV/ equivalent) for imported components wherever required shall be included by bidder in the base price itself.

d) Any drawing/ document/ data-sheet/ calculation/ Quality plan/ Instrumentation etc. if submitted along with the offer shall be considered for reference only, same shall be subject to BHEL / Customer/ Customer's Consultant approval in the event of order.

e) The offered materials shall be either equivalent or superior to those specified in the specification.
For components where materials are not specified, same shall be suitable for intended duty, all materials shall be subject to approval in the event of order.

f) The commissioning spares shall be supplied on 'As Required Basis' & prices for same included in the base price itself.
Prices for special tools & tackles, if any, shall also be included in the base price.
Recommended spares shall be quoted separately with price indicated separately.

g) Charges for supervision during critical stages of erection, final installation checks before commissioning, commissioning of Travelling Band Screen and its accessories, Trial run and Site Testing shall be included by bidder in the base price itself.

h) All sub - vendors shall be subject to BHEL/ Customer/Customer's Consultant approval in the event of order.
The guarantees of Equipments shall stand valid till the satisfactory completion of site demonstration testing & trial run its acceptance by BHEL/ Customer/Customer's Consultant.

i) The offered Travelling Band Screens have been supplied by bidder in the past and are inline with Technical PQR indicated in NIT. Any deviation to this criteria shall be suitably highlighted in the deviation schedule.

j) The orientation of piping shall be finalised during detailed Engg.

k) Electrical/ C&I :

- All motor ratings have been considered in line with Section -I.
- Supply of electrical viz. LT power cables, instrumentation and control cables, cable glands, lugs, cable trays etc. shall be as per specification. Their erection shall be done by BHEL.
- The junction boxes for termination of field instruments are included in bidder's scope. The instrumentation cable and cabling from instruments/ actuators to junction boxes is also included in bidder's scope.
- Valve actuators and controls shall be provided as specified in Data Sheet-A and Project specific requirements as specified in Sub-Section IB & Section IC.
- Alarms/ annunciations/ instruments shall be finalised during detailed engineering in the event of order which shall be subject to BHEL/ Customer/Customer's Consultant approval and shall be without any commercial implications to BHEL.

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

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

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

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

BHEL	**LOAD DATA (ELECTRICAL)**	JOB NO.		ORIGINATING AGENCY		PEM (ELECTRICAL)
		PROJECT TITLE	2X660 MW MAITREE SUPER THERMAL POWER PROJECT	NAME		DATA FILLED UP ON
		SYSTEM / S	COLTCS/SCS/DF/TWS	SIGN.		DATA ENTERED ON
		DEPTT. / SECTION	ELECTRICAL	SHEET 1 OF 1	REV. 00	DE'S SIGN. & DATE

	TITLE: TECHNICAL SPECIFICATION FOR TRAVELLING BAND SCREEN SYSTEI		SPEC NO: PE-TS-421-172-N001
	TECHNICAL DATA SHEET- B		SECTION : III
			REV.NO: 00
S.no.	**Description**	**Units**	**Data/Parameters**
1	**General**		
1.1	Nos. of Traveling Band screening systems sets required	Nos.	
1.2	Nos. of Spray wash pumps common for all TBS	Nos.	
1.3	Liquid handled		
1.4	Type of Travelling Band Screen		
1.5	No. of speed levels for the TBS		
1.6	Hydraulic /Fluid coupling		
1.7	Manufacturer		
1.8	Country of Origin		
1.9	Drive Mechanism Safety Devices		
2	**Site Data**		
2.1	FGL of the Site	m	
2.2	Elevation of the TBS Operating Floor	m	
2.3	Invert level of the Intake canal at TBS Inlet	m	
2.4	Min. W.L. at upstream of TBS	m	
2.5	Max. W.L. at upstream of TBS	m	
2.6	Clearance between bars of coarse bar screens at upstream of TBS(Not in Bidder scope)	mm	
2.7	Maximum Chamber length & width for the TBS		
2.8	Design Mechanical temperature	Deg. Cel.	
2.9	Spray wash/Flushing water source		
2.10	Pressure available at Tap off from discharge of purchaser's pump	mwc	
2.11	Max. Limit on shut off head of purchasers pump”	mwc	
3	**Design Data**		
3.1	Flow rate per stream		
-	Design/Normal	cum/hr	
-	Maximum	cum/hr	
3.2	Total Effective area at Min. water level	m^2	
3.3	Total Effective area at Max. water level	m^2	
3.4	No. of Speed levels of TBS		
3.5	Screen Wire Mesh Size (Diameter)	mm	

	TITLE: TECHNICAL SPECIFICATION FOR TRAVELLING BAND SCREEN SYSTEI		SPEC NO: PE-TS-421-172-N001
	TECHNICAL DATA SHEET- B		SECTION : III
			REV.NO: 00
S.no.	**Description**	**Units**	**Data/Parameters**
3.6	Slow Rotating speed	rpm	
3.7	Fast rotating speed	rpm	
3.8	TBS Length	m	
3.9	TBS Width	m	
3.10	TBS Depth	m	
3.11	Protection Mechanism for Differential level > Design Differential		
3.12	Type of protection mechanism		
3.13	Differential Head across TBS at Min. W.L		
	At Design flow		
	At Max Flow		
3.14	Differential Head in Clean Condition	MWC	
3.15	Differential Headin Choked Condition(Start of slow speed backwash/flushing)	MWC	
3.16	Differential Head in Choked Condition(Start of fast speed backwash/flushing)	MWC	
3.17	Water velocity through TBS at Mn. W.L at design flow and clean condition	m/sec	
3.18	Design pressure of Spray Wash system		
3.19	Travelling Band Screen clear opeining	mm^2	
3.2	Maximum water velocity through screen at min. WL	m/sec	
3.21	Design differential head for Travelling Band screens	MWC	
3.22	Maximum head loss permitted across TBS (i.e. between inlet and outlet) in clean condition at Min WL	MWC	
3.23	Screen backwashing/flushing start "ON" Slow speed head loss across TBS	MWC	
3.24	Screen backwashing/flushing start at fast speed	MWC	
3.25	Corrosion Protection system		
3.26	Service Factor for Gear Box		
3.27	The velocities for Calculating the inside diameters shall be limited to		
4	**Spray Wash/Flushing system**		
4.1	Spray wash/flushing water terminal point pipe		
	a) Material		
	b) O.D.Xthickness	mmXmm	

	TITLE: TECHNICAL SPECIFICATION FOR TRAVELLING BAND SCREEN SYSTEI		SPEC NO: PE-TS-421-172-N001
	TECHNICAL DATA SHEET- B		SECTION : III
			REV.NO: 00
S.no.	**Description**	**Units**	**Data/Parameters**
4.2	Motor Rating of Spray Wash pump		
5	**Self Cleaning Strainer**		
5.1	Quantity		
5.2	Screen perforation size	mm	
5.3	Free flow area in the Screen basket		
6	**Submersible sump pump**		
6.1	Capacity	cum/hr	
6.2	Head	MWC	
7	**Debris Segregation and collection baskets**		
7.1	Quantity	Nos.	
7.2	Size(Preferable) - L x B x H	MxMxM	
7.3	Discharge mechanism for emptying the basket		
7.4	Type of arrangement for handling by Gantry crane provided		
7.5	Basket frame plate thickness	mm	
7.6	Wire Mesh size dia	mm	
7.7	Guide Ways		
7.7.1	Number	Nos.	
7.7.2	Type		
8	**Guide ways section**		
8.1	Frame work section size		
8.2	Whether provision for sacrificial anode provided for future		
8.3	Thickness of frame plates	mm	
8.4	Section for chain guide ways		
8.5	Plate thickness for chain guide ways	mm	
8.6	Fixing method of guide ways to be supplied		
9	**Splash Housing & refuse trough**		
9.1	Required Section of refuse trough (pl. provide dimensional sketch) along with required gradient		
10	**Head Shaft & Sprocket**		
10.1	Head shaft diameter	mm	
10.2	Foot shaft diameter	mm	

S.no.	Description	Units	Data/Parameters
10.3	Connection details of Head sprocket with Head shaft (Keyed/Shrink fit/ others pl. specify)		
10.4	Connection details of Foot sprocket with FOOT shaft (Keyed/Shrink fit/ others pl. specify)		
10.5	Nos. of teeth on Head sprocket	Nos.	
10.6	Nos. of teeth on Foot Sprocket	Nos.	
10.7	Type of Sprocket teeth, whether insert are being used or not , or two teeth construction		
10.8	Centre distance between head shaft & foot shaft	mm	
10.9	Type of suport &Bearing for the Head shaft		
10.10	Type of support &Bearing for the foot shaft		
10.11	Max. power demand at Head shaft at Design differential head		
11	**Control and Instrumentation**		
11.1	Control Panel		
11.2	Differential Level Switch		
11.3	Differential Level Transmitters		
11.4	Pressure Transmitters		
11.4.1	Spray wash individual suction line		
11.4.2	Spray wash Suction Header		
11.4.3	Spray wash Discharge Header		
11.4.4	Spray wash individual discharge line		
11.5	Pressure Gauges		
11.5.1	Spray wash individual suction line		
11.5.2	Spray wash pump suction header		
11.5.3	Spray wash pump discharge header		
11.5.4	Spray wash individual discharge line		
11.6	Differential Pressure Very High Switch		
11.7	Differential Pressure Transmitters		
11.8	Differential Pressure Gauge		
11.9	Limit Switches		
12	**Operation**		

	TITLE: TECHNICAL SPECIFICATION FOR TRAVELLING BAND SCREEN SYSTEI		SPEC NO: PE-TS-421-172-N001
	TECHNICAL DATA SHEET- B		SECTION : III
			REV.NO: 00
S.no.	**Description**	**Units**	**Data/Parameters**
12.1	Travelling Band Screening sysetm is designed for the following operation modes:		
12.1.1	Automatic start up initiated by High differential level		
12.1.2	Automatic start-up intiated by timer.		
12.1.3	Manual mode of operation		
12.1.4	Provision for manual operation of the Travelling band is made in case of control system failure.		
13	**TBS Drive motor**		
13.1	Make &Rating		
13.2	Max. Power output of motor	KW	
13.3	Speed	rpm	
13.4	Coupling Type		
14	**Reduction Gear Box**		
14.1	Make		
14.2	Gear ratio/Speed ratio		
14.3	Type		
14.4	Duty Factor		
14.5	Drive mechanism		
14.5	Type fo drive mecahnism to transmit power from Gear Box to Head Shaft		
15	**Carrying Roller Chain Mechanism**		
15.1	Type of chain		
15.2	No. of chains per TBS	Nos.	
15.3	Type		
15.4	Chain pitch	mm	
15.5	Chain side bar size	mm	
15.6	Chain roller diameter	mm	
15.7	Chain Pin diameter	mm	
15.11	Chain Bushing diameter	mm	
15.12	Method of chain pin lubrication		
15.13	How weaving action of chain is prevented?		
15.14	Type&nos. of arrangement for adjusting chain tension per TBS		
16	**Screening Elements**		

	TITLE: TECHNICAL SPECIFICATION FOR TRAVELLING BAND SCREEN SYSTEI		SPEC NO: PE-TS-421-172-N001
	TECHNICAL DATA SHEET- B		SECTION : III
			REV.NO: 00
S.no.	**Description**	**Units**	**Data/Parameters**
16.1	Type of screening elements		
16.2	No. of screening Element rows per TBS	Nos.	
16.3	No. of Screening Element per row	Nos.	
16.4	Total no. of screening elements per TBS	Nos.	
16.5	Dimensions of Screening elements (LXB)	mmXmm	
16.6	Clearance between successive baskets	mm	
16.7	Wire mesh size Dia	mm	
16.8	Clearance between rotating screening elements and static components	mm	
16.9	Type of sealing and its material		
16.10	How trash bypassing is avoided?(give sketch w.r.t to basket sketch)		
17	**Spray wash/Flushing system**		
17.1	Spray wash pumps		
17.2	No. of Spray wash pumps	Nos.	
17.3	Type & make of pump		
17.4	Design flow	cum/hr	
17.5	Design TDH of pump	MWC	
17.6	Design pump speed	rpm	
17.7	Design pump efficiency	%	
17.8	Type of impeller		
17.9	Whether Inserts/embedments/packers for Spray wash pumps/distributors and nozzles being supplied.		
18.0	**Spray Nozzles**		
18.1	Nos. provided per TBS	Nos.	
18.2	Pitching of nozzles	Min	
18.3	Size of the nozzle	mm	
18.4	Spray Nozzle Effective envelope	m2	
18.5	Max. Flow rate for each nozzle	cum/hr	
18.6	Spray Nozzle Effective envelope		
19.0	**Drive motor for Spray wash/Flushing pump**		
19.1	Type and make of motor		
19.2	Rating	KW	
19.3	Speed	rpm	

	TITLE: TECHNICAL SPECIFICATION FOR TRAVELLING BAND SCREEN SYSTEI		SPEC NO: PE-TS-421-172-N001
	TECHNICAL DATA SHEET- B		SECTION : III
			REV.NO: 00
S.no.	**Description**	**Units**	**Data/Parameters**
20.0	**Motorised valves- Spray Wash header**		
20.1	Nos. provided per TBS	Nos.	
20.2	Type & make of motor		
20.3	Motor rating	KW	
20.4	Whether supports (whever necessary) complete with foundation plates, bolts,nuts,inserts etc. are included in the offer.		
21.0	**Counter flanges:**		
21.1	Counter flanges complete with gaskets, bolts and nuts etc. for all terminal points		
22.0	**Tests**		
22.1	Whether all the tests and inspections to be carried out at the shop are mentioned in the Quality plan submitted by bidder?		
23.0	**Hydrostatic Test**		
23.1	Hydrostatic test pressure for Spray wash/ flushing system/Self Cleaning Strainer	Bar (g)	
23.2	Test duration	Min	
24.0	**Painting**		
24.1	Surface preparation		
24.2	Primer coating thickness		
24.3	Finish coating thickness		
25.0	**Weights:**		
25.1	Weight of the heaviest equipment/assembly to	Kgs	
	be handled including filled up debris segregation basket		
25.2	Recommended Gantry crane capacity	Kgs	
26.0	**Civil loadiing Data**		
26.1	Travelling Band Screen(per screen)		
26.2	Static load		
26.3	Dynamic load		
26.4	Spray wash/Back flushing pump (per pump)		
26.5	Static load		
26.6	Dyanamic load		
27.0	**Materials of Construction**		
27.1	Screen Wire mesh		
27.2	Clamping Plates/Clamps		

S.no.	Description	Units	Data/Parameters
27.3	Basket frame and wire damping bars		
27.4	Fasteners		
27.5	Head Shaft		
27.6	Foot Shaft (if applicable)		
27.7	Head/Foot Sprockets		
27.8	Carrying chain		
27.9	Rubber Seals		
27.10	**Carrying chain & rollers**		
27.10.1	Carrying Chain pins,&Bushing		
27.10.2	Drive Chain type		
27.10.3	Drive chain pin/Bushing		
27.10.4	Shaft bearing Bushing spherical roller		
27.10.5	Sprocket		
27.10.6	Torque tube		
27.10.7	Main supporting frame		
27.10.8	Screen chain side bars		
27.10.9	Drive Chain guard		
27.10.10	Baffle plate in boot section		
27.10.11	Guide ways / Anchor		
27.10.12	Splash housing and refuse chute		
27.10.13	Basket frame		
27.11	Pipe & Nozzles		
27.11.1	Spray nozzle		
27.11.2	Pipe work		

S.no.	Description	Units	Data/Parameters
27.11.2.1	Upto 50 NB		
27.11.2.2	above 50 NB		
27.12	**Valves**		
27.12.1	Valve 400 NB and above (Butterfly Valves only)		
27.12.1.1	Body & Disc		
27.12.1.2	Shaft		
27.12.1.3	Seal		
27.12.1.4	Sealing ,retatining segment& internals		
27.12.2	Valve 350 NB and Below (Gate/Globe Valves only)		
27.12.2.1	Body, Bonnet & Trim		
27.12.3	Check Valves		
27.12.3.1	Body & Bonnet		
27.12.3.2	Seating surface &stem		
27.12.3.3	Disc		
27.12.3.4	Hinge Pin		
27.13	**Spray Wash pump**		
27.13.1	Spray Wash pump Casing		
27.13.2	Spray Wash pump impeller		
27.13.3	Spray Wash pump Shaft		
27.13.4	Material of Gland Packing /Mechnical Seal (If applicable)		
27.14	**Debris Segregation and collection baskets**		
27.14.1	Frame		
27.14.2	Wire Mesh		
27.14.3	Flanges		
27.15	**Self Cleaning Strainer**		
27.15.1	Body		
27.15.2	Internals / Wetted Fastners		
27.16	All Non-Wetted Fastners		
27.17	All Wetted Fastners		

MOTOR DATASHEET-C

CLAUSE NO.	Bidder's Name ……..

DE-	LT MOTORS	
A.	**GENERAL**	
1.	Manufacturer & Country of origin. (Shall be as per approved QA make)	
2.	Equipment driven by motor	
3.	Motor type	
4.	Quantity	
B.	**DESIGN AND PERFORMANCE DATA**	
1.	Frame size	
2.	Type of duty	
3.	Type of enclosure /Method of cooling/ Degree of	
4.	Applicable standard to which motor generally	
5.	Efficiency class as per IS	
6.	(a)Whether motor is flame proof	Yes/No
	(b)If yes, the gas group to which it conforms as per	
7.	Type of mounting	
8.	Direction of rotation as viewed from DE END	
9.	Standard continuous rating at 40 deg.C. ambient temp. as per Indian Standard (KW)	
10.	Derated rating for specified normal condition i.e. 50 deg. C ambient temperature (KW)	
11.	Maximum continuous load demand of driven	
12.	Rated Voltage (volts)	
13.	Permissible variation of :	
	a. Voltage (Volts)	
	b. Frequency (Hz)	
	c. Combined voltage and frequency	
14.	Rated speed at rated voltage and	
15.	At rated Voltage and frequency:	
	a. Full load current	

CLAUSE NO.	Bidder's Name ……..

	b. No load current	
16.	Power Factor at	
	a. 100% load	
	b. NO load	
	c. Starting.	
17.	Efficiency at rated voltage and frequrecy,	
	a.100% load	
	b. 75% load	
	c. 50% load	
18.	Starting current (amps) at	
	a. 100 % voltage	
	b. 85% voltage	
	c. 80% voltage	
19.	Minimum permissible starting Voltage (Volts)	
20.	Starting time with minimum permissible voltage	
	a. Without driven equipment coupled	
	b. With driven equipment coupled	
21.	Safe stall time with 100% and 110% of rated	
	a. From hot condition	
	b. From cold condition	
22.	Torques :	
	a. Starting torque at min. permissible voltage(kg-	
	b. Pull up torque at rated voltage.	
	c. Pull out torque	
	d. Min accelerating torque (kg.m) available	
	e.Rated torque (kg.m)	
23.	Stator winding resistance per phase (ohms at 20	
24.	GD2 value of motors	

CLAUSE NO.	Bidder's Name ……..

25.	No of permissible successive starts when motor is in hot condition	
26.	Locked Rotor KVA Input	
27.	Locked Rotor KVA/KW	
28.	Vibration limit :Velocity (mm/s)	
29.	Noise level limit (dBA)	
C.	**CONSTRUCTIONAL FEATURES**	
1.	Stator winding insulation	
	a. Class & Type	
	b. Winding Insulation Process	
	c. Tropicalised (Yes/No)	
	d. Temperature rise over specified maximum ambient temperature of 50 deg C	
	e. Method of temperature measurement	
	f. Stator winding connection	
2.	Main Terminal Box	
	a. Type	
	b. Location(viewed from NDE side)	
	c. Entry of cables(bottom/side)	
	d. Recommended cable size(To be matched with cable size envisaged by owner)	
	e. Fault level (MVA),Fault level duration(sec)	
	f. Cable glands & lugs details (shall be suitable for	
3.	Type of DE/NDE Bearing	
4.	Motor Paint shade	
5.	Weight of	
	a. Motor stator (KG)	
	b. Motor Rotor (KG)	
	c. Total weight (KG)	

CLAUSE NO.	Bidder's Name ……..

D.	**List of accessories.**	
1.	Space Heaters (Applicable for 30 KW & above motor) (Nos./Power in watts/supply voltage)	
2.	Terminal Box for Space Heater (Yes/No)	
3.	Speed switch (Yes/No)	
4.	Insulation of bearing (Yes/No)	
5.	Noise reducer(Yes/No)	
6.	Grounding pads	
	i) No and size on motor body	
	ii) Nos on terminal Box	
7.	Vibration pads	
	i) Nos and size	
	ii) Location	
8.	Any other fitments	
E.	**List of curves.**	
1.	Torque speed characteristic of the motor	
2.	Thermal withstand characteristic	
3.	Starting. current Vs. Time	
4.	Starting. current Vs speed	
5.	P.F. and Effi. Vs Load	
F.	**Additional Data to be filled for each rating of DC Motor**	
1.	Rated armature voltage (Volt)	
2.	Rated field excitation (Amp)	
3.	Permissible % variation in voltage	
4.	Minimum Permissible Starting voltage (volt)	
5.	At rated voltage	
	i)Full load Armature current.(Amp)	

CLAUSE NO.	Bidder's Name ……..

	ii)Full load Field current (Amp)	
	iii)No load Armature current (Amp)	
6.	Full load Field current (Amp)	
7.	No load Aramature current (Amp)	
8.	Minimum permissible field current(Amp) to avoid	
	i) Maximum permissible voltage	
	ii) Rated voltage	
	iii) Minimum Permissible Voltage	
9.	Resistance (indicative Values) in ohm	
	i)Armature winding(Arm + IP + Series) at 25	
	ii) Field Winding at 25 deg. C	
10..	Inductance (indicative values)	
	i) Armature winding	
	ii) Field winding	
11	Value of trimmer resistance (ohm) to be connected in series with the shunt field to	
	i) 220 V DC	
	ii) 250 V DC	
	iii) 187 V DC	
12	Value of the external resistance (ohm)required to be connected in series with armature during starting only	
13	Technical data sheet for external resistance box	
14	GA drawing of motor	
15	Starting time calculation	
16	Starter resistance design calculation	
17	Electrical connection diagram of motor	