SECTION – D3

GENERAL TECHNICAL REQUIREMENTS FOR C&I

GENERAL REQUIREMENT

1) Bidder shall provide complete and independent control & instrumentation system with all accessories, auxiliaries and associated equipments for the safe, efficient and reliable operation of Ozone generation plant.

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

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

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

5) The customer specification attached as Specific Technical Requirement will supersede the Data sheets, if there is any mismatch.

GENERAL TECHNICAL REQUIREMENTS FOR INSTRUMENTS

FORM NO. PEM-6666-0

BHEL	**DATA SHEET FOR TEMPERATURE ELEMENT (WITH THERMOWELL)** Refer Specific Technical Requirement for details	SPECIFICATION NO.: VOLUME SECTION REV. NO. / DATE: SHEET 1 OF 2

TAG No. ……. Qty..... Data Sheet No.: **PES-145-03A-DS1-0**

Data Sheet A & B

DATA SHEET-A FOR TEMPERATURE ELEMENT (WITH THERMOWELL) (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
GENERAL	MANUFACTURER		
	MODEL NUMBER		
TECHNICAL	ELEMENT TYPE	☐ RTD (3 WIRE) ☐ T / C	
	T / C GROUNDED	☐ YES ☐ NO	
	ELEMENT THICKNESS (AWG)		
	LIMIT OF ERROR	Accuracy +- 0.5 % of SPAN	
	INSULATION RESISTANCE	MORE THAN 5M OHM AT 100V DC	
	TIME CONSTANT		
	MOUNTING THREAD SIZE	Process connection M33 X 2 thread or 150 RF Flanged	
	CONDUIT THREAD SIZE		
	EXTENSION WIRE TYPE		
	THERMOWELL	☐ YES ☐ NO	
	THERMOWELL LENGTH		
	LINE SIZE		
	PRESSURE RATING		
	TEMPERATURE RATING		
	FLUID MEDIUM		

NAME				NAME
SIGNATURE				SIGNATURE
DATE				DATE

FORM NO. PEM-6666-0

BHEL	**DATA SHEET FOR TEMPERATURE TRANSMITTER**	SPECIFICATION NO.:
		VOLUME
		SECTION
		REV. NO. / DATE:
		SHEET 1 OF 2

TAG No. ……. Qty..... Data Sheet No.: **PES-145-03A-DS1-0**

Data Sheet C

DATA SHEET-C FOR TEMPERATURE ELEMENT (WITH THERMOWELL)
(TO BE FILLED BY CONTRACTOR AFTER AWARD OF CONTRACT)

GENERAL	MANUFACTURER	
	MODEL NUMBER	
TECHNICAL	ELEMENT TYPE	
	T / C GROUNDED	
	ELEMENT THICKNESS (AWG)	
	LIMIT OF ERROR	
	INSULATION RESISTANCE	
	TIME CONSTANT	
	MOUNTING THREAD SIZE	
	CONDUIT THREAD SIZE	
	EXTENSION WIRE TYPE	
	THERMOWELL	
	THERMOWELL LENGTH	
	LINE SIZE	
	PRESSURE RATING	
	TEMPERATURE RATING	
	FLUID MEDIUM	

NAME				NAME
SIGNATURE				SIGNATURE
DATE				DATE

1.0 TECHNICAL REQUIREMENTS

1.1 General

i) The temperature sensor elements shall be duplex type either thermocouple (T/C) or resistance temperature detector (RTD). Unless otherwise specified, the type of sensors for different applications shall be as follows:

ii) Nickel Chromium Nickel T/C medium temp. range (250°C to 600°C)

iii) Platinum-Rhodium Platinum High temp. range (600°C and above). Type S/R/B.

iv) Platinum RTD Low temperature & high accuracy (-50°C to 250°C).

1.2 Process Parameters

The instrument shall be suitable for a Process Parameters given in the instrument data sheet.

1.3 Thermocouple Wire Size

The thermocouple wire size for a given temperature application shall be as per table - 3.1A of ASME PTC 19.3 - 1974.

1.4 Sensor Grounding

As per instrument data sheet.

1.5 Sensor Protective Sheath & Wire Insulation

The sensor protective sheath shall be 8mm OD 316 SS seamless tube using compacted magnesium oxide packing/porcelain for insulation.

1.6 Sensor Characteristics

Thermocouple calibration characteristics i.e. temperature vs. milli volt or resistance shall be as per the applicable Indian Standards (IS-2054 for thermocouple 'K' type, IS-2055 for Pt.Rd.Pt.), RTD type of sensor calibration i.e. temperature vs. resistance shall be as per applicable Indian Standard (IS-2848).

1.7 Sensor Accuracy Limits

T/C sensor limiting accuracy shall be as per table 3.2A of ASME PTC 19.3 - 1974. RTD sensor accuracy shall be as per table 9.1 of ASME PTC - 19.3 - 74.

1.8 Insulation Resistance

Insulation resistance of RTD leads w.r.t. body shall be more than 5 mega ohms at 100V DC.

1.9 End Connection

The sensor assemblies shall have screwed M33 x 2 end connection. Specific design requirements of pressure, temperature and end connection type for a given application are indicated in the instrument data sheet.

1.10 Terminal Head

The terminal head cover shall be screwed type design having gasket with small flexible chain attached between fixed portion and head cover.

1.10.1 Terminal Head Enclosure

The terminal head enclosure shall be dust, weather proof and water proof as per NEMA-4 classification unless specified otherwise.

1.10.2 Terminals

The terminal head shall have provision of screwed terminal of 1.5 mm2 size for external connection. The terminals shall be suitably marked '+ve' & '-ve' for thermocouple and 'Lo', 'Hi' and "C' for three wire RTD.

1.11 Cable Entry

Cable gland complete with neoprene gromet suitable for PVC cable with maximum diameter of 17.5mm shall be provided for cable entry. The actual size of cable shall be indicated during the contract stage. Separate cable entry and cable glands shall be provided for both the elements.

1.12 Thermowell and its material

Temperature element shall be supplied along with the thermowell. The thermowell shall be of tungstion carbide for mill air temperature and for rest of the applications of AISI 316SS shall be machined out of solid bar stock and designed to suit the process conditions. For detail of the thermowell, see enclosed drawing.

1.12.1 Internal Construction

Sensor assemblies shall preferably be metal sheathed with spring load on to the thermowell tip for better response. The sheathed sensor assembly shall be replaceable (in-situ) type without removal of thermowell.

1.12.2 Compensating cable should be used for connecting elements to secondary Instruments/Device unless there is specific requirement for cold junction compensation. Field mounted cold junction compensation box as per NEMA-4 shall be provided for all thermocouples. The CJC box shall have automatic temperature control at reference junction temperature of 60°C. Each CJC box shall be provided with duplex RTD for remote monitoring.

2.0 TESTING

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

2.2 The vendor shall conduct following tests as a minimum requirement and shall furnish test certificate thereof, for BHEL's approval before despatch of the same.

2.2.1 Physical dimension of the sensor assemblies as per approved drawing.

2.2.2 Electrical characterstic of sensor such as continuity of the thermocouple wires, and insulation resistance of the RTD leads w.r.t. body.

2.2.3 Temperature vs. Resistance/milli volt for the sensor assemblies shall be tested with reference to standard resistance thermometer by comparison method. This test may be carried out once for the T/C or RTD sensor wires for each batch production.

2.2.4 Each type of high pressure thermowell assembly with thread and connection shall be tested against hydrostatic test pressure of one & a half times the maximum working pressure for any leakage. However dimensional checks and thread confirmity with gauges shall be checked for each sensor assembly.

3.0 APPLICABLE DATA SHEET FORMS

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

- Data sheet A&B for Temperature Element (With Thermowell) : Data sheet no. PES-145-03A-DS1-0

- Data sheet C for Temperature Element (With Thermowell) : Data sheet no. PES-145-03A-DS2-0

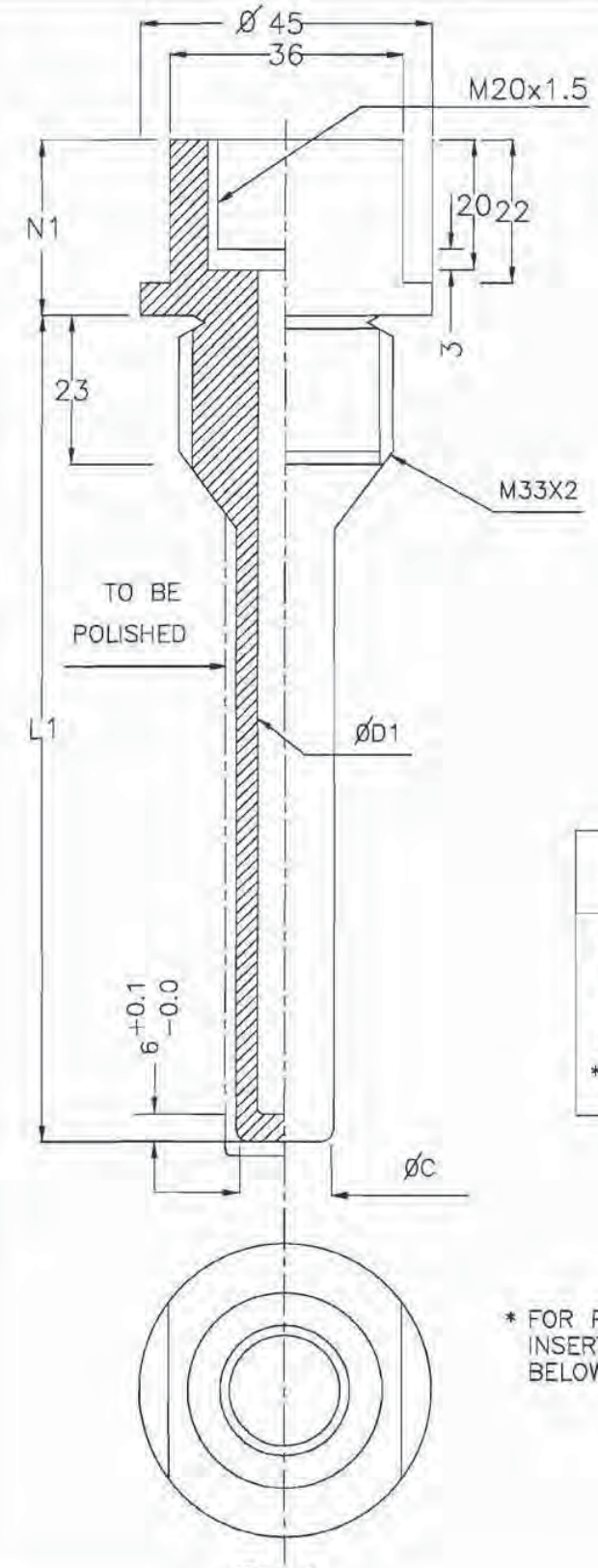
FORM NO. PEM - 6666-0

THERMOWELL MEDIUM PRESSURE (40 Kgf/Cm2)

VOLUME IIB

REV. NO. 01 | DATE

SHEET 4 OF 8



PIPE O.D.	INSERTION LENGTH (L1)
Ø 509 & ABOVE	325
Ø 506 TO 369	250
Ø 368 TO 274	175
*Ø 273 BELOW	150

* FOR PIPE O.Ds UP TO 159mm THE THERMOWELL INSERTION WILL BE STRAIGHT. FOR PIPE O.Ds BELOW 159mm, THE INSERTION SHALL BE SLANT.

Fig.1

FORM NO. - 6666-0

	SPECIFICATION FOR TEMPERATURE ELEMENT (WITH THERMOWELL)	VOLUME II B REV. NO. 01 SHEET 5 OF 8

THERMOWELL-MEDIUM PRESSURE
(40 KG/CM2)

ALL DIMENSIONS IN mm

Instrument stem dia D+0.0 -0.1	DIA D1 +0.2 0	DIA C	Insertion Length L1	Extention element length N1	Corres ponding element length(L)
6	6,5	12.5	150	27 75 100	171 219 244
			175	27 75 100	196 244 269
			250	27 75 100	271 319 344
			325	27 75 100	346 394 419
8	8.5	15	150	27 75 100	171 219 244
			175	27 75 100	196 244 269
			250	27 75 100	271 319 344
			325	27 75 100	346 394 419

FORM NO. - 6666-0

BHEL

SPECIFICATION FOR TEMPERATURE ELEMENT (WITH THERMOWELL)

VOLUME II B

REV. NO. 01

ALL DIMENSIONS IN mm

Instrument stem dia D+0.0 -0.1	DIA D1 +0.2 0	DIA C	Insertion Length L1	Extention element length N1	Corrcs ponding element length(L)
12	12.5	19	150	27	171
				75.	219
				100	244
			175	27	196
				75	244
				100	269
			250	27	271
				75	319
				100	344
			325	27	346
				75	394
				100	419
14	14.5	21	150	27	171
				75	219
				100	244
			175	27	196
				75	244
				100	269
			250	27	271
				75	319
				100	344
			325	27	346
				75	394
				100	419

NOTE: The corresponding element lenghts are given for information only. The elements lengths are worked out as per the formula :

$$L = L1 + N1 - 6$$

FORM NO. PEM - 6666-0

THERMOWELL-HIGH PRESSURE (250 Kgf/Cm2)

VOLUME IIB

REV. NO. 01 | I

SHEET 7 OF 8

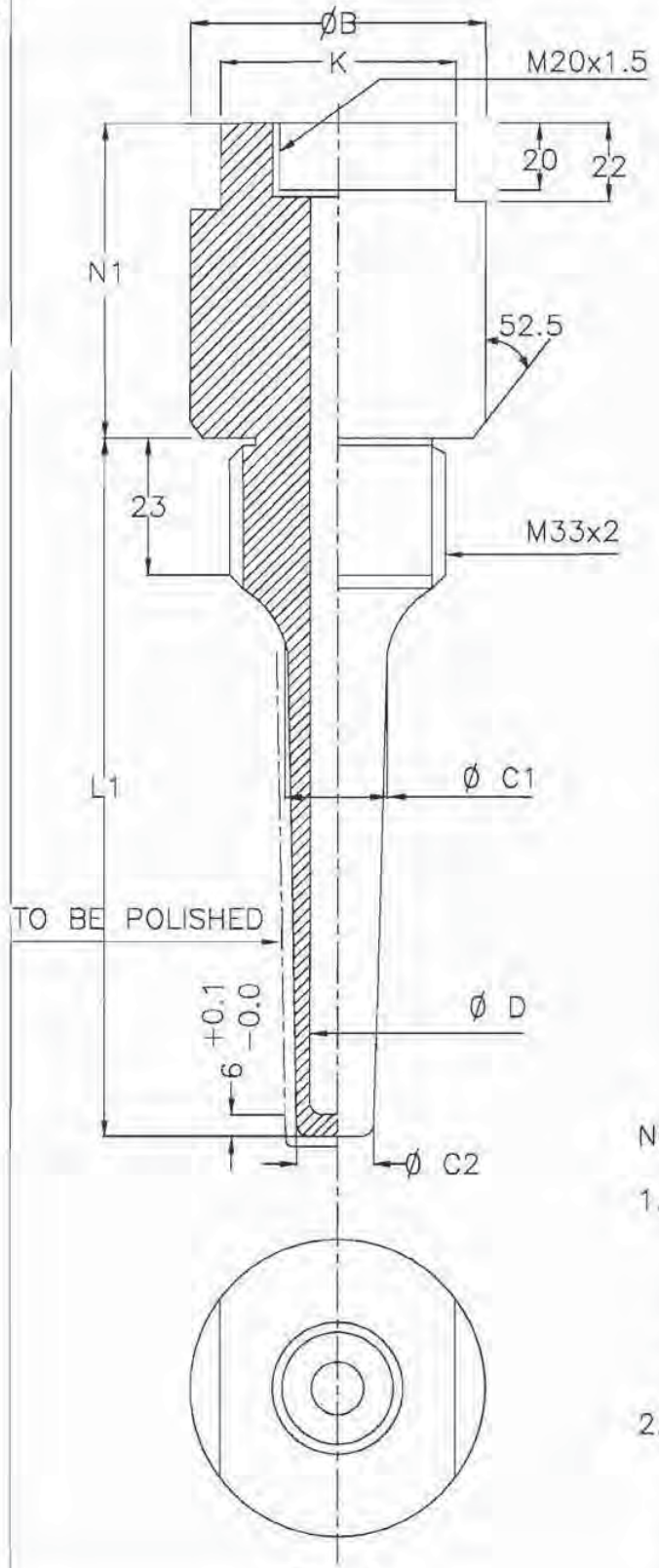


Fig. 2

PIPE O.D.	INSERTION LENGTH L1
Ø 509 & ABOVE	325
Ø 508 TO 368	250
Ø 367 TO 0274	175
Ø 273 BELOW	150

NOTE :-

1. THE CORRESPONDING ELEMENT ELEMENT LENGTHS ARE GIVEN FOR INFORMATION ONLY. THE ELEMENT LENGTHS ARE WORKOUT AS PER THE FORMULA L=L1+N1-6.

2. FOR PIPE OD'S UPTO 159mm, THE THERMOWELL INSERTION WILL BE STRAIGHT. FOR PIPE OD'S BELOW 159mm, THE INSERTION SHALL BE SLANT.

FORM NO. - 6666-0

SPECIFICATION FOR TEMPERATURE ELEMENT (WITH THERMOWELL)

VOLUME II B
REV. NO. 01
SHEET 8 OF 8

ALL DIMENSIONS IN mm

Instrument stem dia D (+0.0 -0.1)	DIA D1 (+0.2 0.0)	DIA C1	DIA C2	K	DIA B	Insertion Length L1	Extention Length N1	Corresponding Element Length (L)
6	6.5	19	12.5	36	45	150	27 75 100	171 219 244
						250	27 75 100	271 319 344
8	8.5	21.5	15	36	45	150	27 75 100	171 219 244
						250	27 75 100	271 319 344
12	12.5	25.5	19	36	45	150	27 75 100	171 219 244
						250	27 75 100	271 319 344
14	14.5	27.5	21	36	45	150	27 75 100	171 219 244
						250	27 75 100	271 319 344
16	16.5	29	23	46	55	150	27 75 100	171 219 244
						250	27 75 100	271 319 344

FORM NO. PEM-6666-0

CHECK LIST FOR
PRESSURE / DIFFERENTIAL PRESSURE GAUGE
(MECHANICAL AUXILIARY PACKAGES)

VOLUME
SECTION
SHEET 16 OF 16

SL NO	TESTS/CHECKS	QUANTM OF CHECK	REFERENCE DOC. ACCEPTANCE NORMS	AGENCY P	AGENCY W	AGENCY V	REMARKS
1.0	CHECK FOR		APPROVED TECHINCAL REQUIREMENT/ DATA SHEET				MFR TO CARRY OUT ROUTINE TEST ON 100%. WHEN MATL CORELATION ARE NOT AVAILABLE MFR'S COMPLIANCE TO BE PROVIDED
	1.1 DIAL SIZE	100%		M	C	C	
	1.2 MODEL NO/TAG NO	100%		M	C	C	
	1.3 RANGE/SCALE	100%		M	C	C	
	1.4 END CONNECTION	100%		M	C	C	
	1.5 SWITCH CONTACT RATING & NOS	100%		M	C	C	
2.0	CALIBRATION						
	2.1 ACCURACY	100%		M	C	B	
	2.2 REPEATABILITY (FOR SWITCH)	100%		M	C	B	
	2.3 SET POINT ADJUSTMENT FOR SWITCH	100%		M	C	C	
3.0	OVER PRESSURE & LEAK TEST	100%		M	C	C	
4.0	OPERATION OF PR. RELEIF DEVICE	ONE PER TYPE		M	C	C	
5.0	REVIEW OF T.C. FOR MATERIAL OF--						
	5.1 SENSOR	FOR LOT		-	-	B	
	5.2 MOVEMENT			-	-	B	
	5.3 PROCESS CONNECTION			-	-	B	
	5.4 HOUSING			-	-	B	
6.0	REVIEW OF T.C. FOR DEGREE OF PROTECTION	TYPE TEST		-	-	B	
7.0	REVIEW OF T.C. FOR CONTACT RATING OF SWITCH	ONE PER TYPE		-	-	B	
8.0	ACCESSORIES AS APPLICABLE	100%		M	C	C	

LEGEND:
M: MANUFACTURER/ SUB CONTRACTOR, C: CONTRACTOR/ NOMINATED INSP AGENCY, B: BHEL. P: PERFORM, W: WITNESS, V: VERIFICATION.

NOTE:
CONTRACTOR TO PROVIDE COMPLIANCE CERTIFICATE FOR TESTS/CHECKS VERIFIED BY CONTRACTOR AND SUBMIT THE SAME ALONGWITH TEST CERTIFICATES TO BE VERIFIED BY BHEL.

FORM NO. PEM-6666-0

BHEL	**DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE** Refer Specific Technical Requirement for details	SPECIFICATION NO.: VOLUME SECTION DATE: SHEET 1 OF 1

TAG No. ……. Qty..... Data Sheet No.: **PE-DC-999-145-I026**

Data Sheet A & B

		DATA SHEET-A FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE (TO BE FILLED BY PURCHASER)	DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
GENERAL	MANUFACTURER		
	MODEL NUMBER		
TECHNICAL	PRESSURE ELEMENT	▌BOURDON ☐ DIAPHRAGM ☐ BELLOW	
	MATERIAL	SENSING ELEMENT – AISI 316 SS MOVEMENT – AISI 304 SS Refer Specific Technical Requirement for details	
	ENCLOSURE	☐ IP-55 ▌IP-65 ☐ FUEL GAS HAZARDOUS APPL. EXPL. PROOF	
	DIAL	SIZE: ☐ 100MM ▌150MM COLOR: WHITE NUMERALS: BLACK SCALE: ▌LINEAR ☐ SQUARE ROOT	
	CASE	COLOUR : BLACK	
	ADJUSTMENT	▌EXT. MICROMETER SCREW ☐ INT. MICRO SCREW	
	MOUNTING	▌LOCAL ☐ PANEL OR RACK	
	OVER RANGE PROTECTION	▌150% OF MAX. PRESSURE ☐ 125% ABOVE 150 KG/CM2 FSD ☐ AS REQUIRED	
	BLOW OUT DISC	SUITABLE MATERIAL	
	SWITCHING FACILITY NO./TYPE OF CONTACTS COJNTACT RATINGS SETTING RANGE REPEATABLITY POWER SUPPLY	Refer Specific Technical Requirement for details	
PERFORMANCE	ACCURACY	± 0.5% OR BETTER OF FULL SCALE DEFLECTION	
CONNECTION	PROCESS	AS APLLICABLE	
	LOCATION	☐ BACK ☐ BOTTOM ▌AS REQUIRED	
ACCESSORIES	NAME PLATE / METAL TAG	SS	
	MOUNTING	☐ WALL ▌PIPE – U CLAMPS & BOLTS ☐ PANEL / RACK ☐ AS REQUIRED	
	OTHER	Refer Specific Technical Requirement for details	

NAME				NAME
SIGNATURE				SIGNATURE
DATE				DATE

FORM NO. PEM-6666-0

	DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE	SPECIFICATION NO.:
		VOLUME
		SECTION
		DATE:
		SHEET 1 OF 1

TAG No. ……. Qty..... Data Sheet No.: **PE-DC-999-145-I026**

Data Sheet C

DATA SHEET-C FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE
(TO BE FILLED BY CONTRACTOR AFTER AWARD OF CONTRACT)

GENERAL	MANUFACTURER	
	MODEL NUMBER	
TECHNICAL	PRESSURE ELEMENT	
	MATERIAL	
	ENCLOSURE	
	DIAL	
	CASE	
	ADJUSTMENT	
	MOUNTING	
	OVER RANGE PROTECTION	
	BLOW OUT DISC	
	SETTING RANGE	
PERFORMANCE	ACCURACY	
CONNECTION	PROCESS	
	LOCATION	
ACCESSORIES	NAME PLATE / METAL TAG	
	MOUNTING	
	OTHER	

NAME				NAME
SIGNATURE				SIGNATURE
DATE				DATE

FORM NO. PEM-6666-0

	DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER	SPECIFICATION NO.:
		VOLUME
		SECTION
		DATE:
		SHEET 1 OF 4

TAG No. ……. Qty..... Data Sheet No.: **PES-145-01-DS1-0**

Data Sheet A & B

		DATA SHEET-A FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER (TO BE FILLED BY PURCHASER)	DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
GENERAL	MANUFACTURER		
	MODEL NUMBER		
TECHNICAL	TYPE	☐ INDUCTANCE ☐ CAPACITANCE ☐ STRAIN GAUGE ☐	
	POWER SUPPLY	24V DC	
	TRANSMITTER MEASUREMENT	☐ PRESSURE ☐ DIFF. PRESSURE	
	OUTPUT SIGNAL	4-20MA	
	NO. OF WIRE	TWO	
	ACCURACY	± 0.5% OF SPAN	
	LINEARITY, HYSTERISIS, DEAD BAND AND REPEATABILITY	± 0.1% OF SPAN	
	STABILITY	± 0.25% OF SPAN OR BETTER FOR 6 MONTHS	
	SENSITIVITY	± 0.05% OF SPAN	
	MATERIAL		
	A) BODY	FORGED CARBON STEEL	
	B) ELEMENT	316 SS	
	C) SEAL	TEFLON	
	CONTINUOUSLY ADJUSTABLE SPAN AND ZERO ADJUSTMENT PROVIDED	☐ YES ☐ NO	
	MOUNTING	☐ WALL/PIPE STAND ☐ TRANSMITTER RACK	
	ENCLOSURE	☐ NEMA-4 ☐ NEMA-7	
	TURN DOWN RATIO	TO BE SPECIFIED BY BIDDER	
	INSULATION RESISTANCE	TO BE SPECIFIED BY BIDDER	
	ZERO SUPPRESSION RANGE	TO BE SPECIFIED BY BIDDER	
	ZERO ELEVATION RANGE	TO BE SPECIFIED BY BIDDER	
	INTEGRAL INDICATOR	☐ YES ☐ NO	

FORM NO. PEM-6666-0

BHEL	**DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER**	SPECIFICATION NO.: VOLUME SECTION DATE: SHEET 2 OF 4

TAG No. ……. Qty..... Data Sheet No.: **PES-145-01-DS1-0**

Data Sheet A & B

DATA SHEET-A FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
	TRANSMITTER SHALL BE ABLE TO DRIVE OUTPUT IMPEDANCE OF 500 OHMS.	YES	
	ZERO DRIFT	< 0.1%	
	SPAN DRIFT	< 0.1%	
	MANIFOLD		
	a) PRESSURE MEASUREMENT	3 WAY	
	B) DIFFERENTIAL PRESSURE MEASUREMENT	5 WAY	
	CABLE ENTRY DETAIL	SUITABLE FOR DIA OF 17.5 mm	

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

FORM NO. PEM-6666-0

BHEL	**DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER**	SPECIFICATION NO.:
		VOLUME
		SECTION
		DATE:
		SHEET 1 OF 2

TAG No. ……. Qty..... Data Sheet No.: **PES-145-01-DS2-0**

Data Sheet C

DATA SHEET-C FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER
(TO BE FILLED BY CONTRACTOR AFTER AWARD OF CONTRACT)

GENERAL	MANUFACTURER	
	MODEL NUMBER	
TECHNICAL	TYPE	
	POWER SUPPLY	
	TRANSMITTER MEASUREMENT	
	OUTPUT SIGNAL	
	NO. OF WIRE	
	ACCURACY	
	LINEARITY, HYSTERISIS, DEAD BAND AND REPEATABILITY	
	STABILITY	
	SENSITIVITY	
	MATERIAL	
	A) BODY	
	B) ELEMENT	
	C) SEAL	
	CONTINUOUSLY ADJUSTABLE SPAN AND ZERO ADJUSTMENT PROVIDED	
	MOUNTING	
	ENCLOSURE	
	TURN DOWN RATIO	
	INSULATION RESISTANCE	
	ZERO SUPPRESSION RANGE	
	ZERO ELEVATION RANGE	
	INTEGRAL INDICATOR	

FORM NO. PEM-6666-0

BHEL	**DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER**	SPECIFICATION NO.:
		VOLUME
		SECTION
		DATE:
		SHEET 2 OF 2

TAG No. ……. Qty..... Data Sheet No.: **PES-145-01-DS2-0**

Data Sheet C

DATA SHEET-C FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER
(TO BE FILLED BY CONTRACTOR AFTER AWARD OF CONTRACT)

TRANSMITTER SHALL BE ABLE TO DRIVE OUTPUT IMPEDANCE OF 500 OHMS.	
ZERO DRIFT	
SPAN DRIFT	
MANIFOLD	
b) PRESSURE MEASUREMENT	
B) DIFFERENTIAL PRESSURE MEASUREMENT	
CABLE ENTRY DETAIL	

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

FORM NO. PEM-6666-0

	DATA SHEET FOR TEMPERATURE GAUGE	SPECIFICATION NO.:
		VOLUME
		SECTION
		DATE:
		SHEET 1 OF 2

TAG No. ……. Qty..... Data Sheet No.: **PES-145-27-DS1-0**

Data Sheet A & B

DATA SHEET-A FOR TEMPERATURE GAUGE (TO BE FILLED BY PURCHASER)	DATA SHEET-B (TO BE FILLED-UP BY BIDDER)

GENERAL	MANUFACTURER		
	MODEL NUMBER		
TECHNICAL	TYPE - MERCURY FILLED	☐ RIGID STEM ☐ CAPILLARY	
	PRESSURE ELEMENT	BOURDON	
	MATERIAL		
	PRESSURE ELEMENT	☐ AISI 316 SS ☐ CR-MO STEEL	
	CASE	☐ DIE CAST AL	
	BULB & CAPILLARY	☐ AISI 316 SS	
	CAPILLARY ARMOUR	☐ SS 316 ☐ FLEXIBLE	
	MOVEMENT	☐ AISI 304 SS	
	THERMOWELL	☐ AISI 316 SS ☐ CR.MO. STEEL ☐ SCREWED TYPE ☐ WELDED TYPE	
	ENCLOSURE	☐ INDOOR MOUNTED IP-55 ☐ OUTDOOR MOUNTED IP-67 ☐ FUEL GAS HAZARDOUS APPL. EXPL. PROOF	
	DIAL	SIZE : ☐ 100MM ☐ 150MM ☐ 250MM COLOUR: ☐ WHITE CASE : ☐ BLACK NUMERALS: ☐ BLACK	
	MOUNTING & CONNECTION	☐ DIRECT MOUNTED ☐ PANEL OR RACK MOUNTED	
	COMPENSATION	CASE COMP.	
	ZERO ADJUSTER	PROVIDED	
	CAPILLARY LENGTH	5.0 METERS (FOR LOCAL MOUNTED) 15.0 METERS (FOR PANEL/RACK MOUNTING)	
PERFORMANCE	ACCURACY	± 1% OR BETTER OF FULL SCALE DEFLECTION	
CONNECTION	TEMPERATURE GAUGE CONNECTION	M20X1.5(M)	
	LOCATION	BACK	
	THERMOWELL	☐ YES ☐ FORGED BAR STACK TYPE	
	THERMOWELL CONNECTION	☐ M20X1.5 INTERNAL ☐ M33X2 EXTERNAL ☐ DESIGN CODE: ASME PTC	

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

FORM NO. PEM-6666-0

	DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER	SPECIFICATION NO.:
		VOLUME
		SECTION
		DATE:
		SHEET 1 OF 2

TAG No. ……. Qty..... Data Sheet No.: **PES-145-27-DS2-0**

Data Sheet C

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

GENERAL	MANUFACTURER	
	MODEL NUMBER	
TECHNICAL	TYPE - MERCURY FILLED	
	PRESSURE ELEMENT	
	MATERIAL	
	PRESSURE ELEMENT	
	CASE	
	BULB & CAPILLARY	
	CAPILLARY ARMOUR	
	MOVEMENT	
	THERMOWELL	
	ENCLOSURE	
	DIAL	
	MOUNTING & CONNECTION	
	COMPENSATION	
	ZERO ADJUSTER	
	CAPILLARY LENGTH	
PERFORMANCE	ACCURACY	
CONNECTION	TEMPERATURE GAUGE CONNECTION	
	LOCATION	
	THERMOWELL	
	THERMOWELL CONNECTION	

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

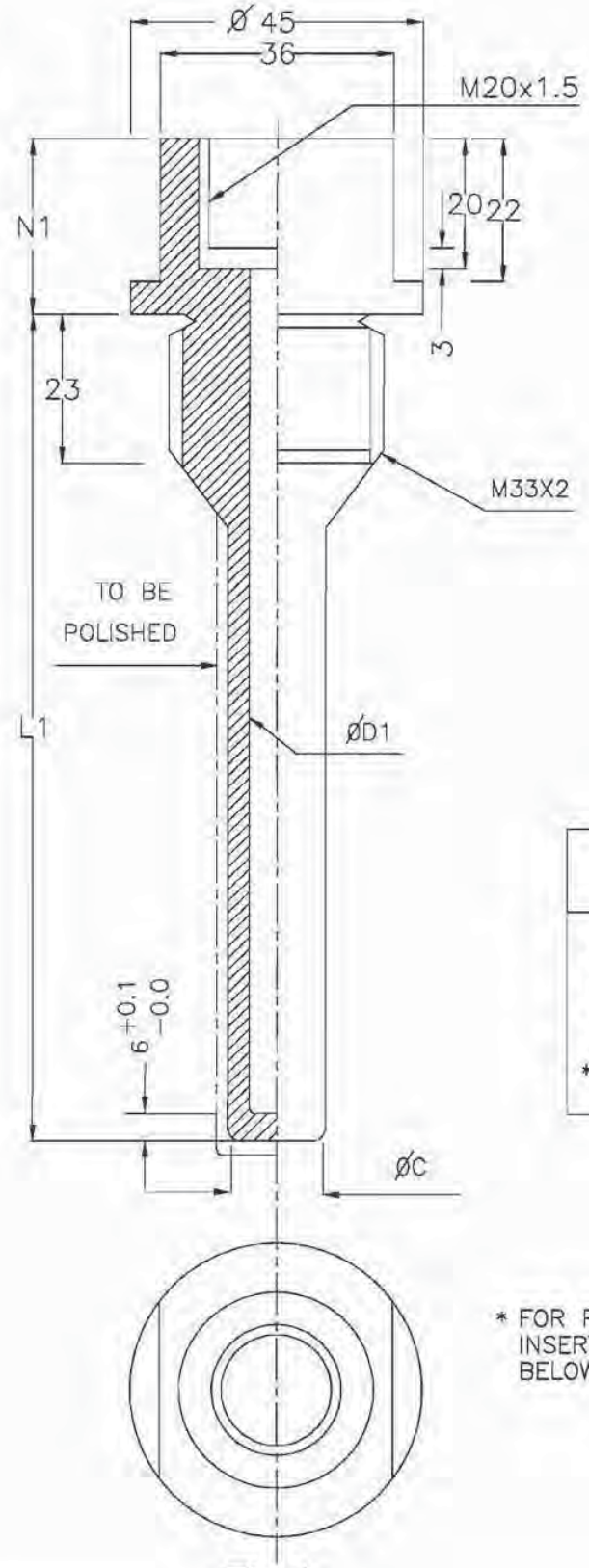
FORM NO. PEM – 6666–0

THERMOWELL MEDIUM PRESSURE (40 Kgf/Cm2)

VOLUME IIB

REV. NO. 01

SHEET 3 OF 7



PIPE O.D.	INSERTION LENGTH (L1)
Ø 509 & ABOVE	325
Ø 506 TO 369	250
Ø 368 TO 274	175
* Ø 273 BELOW	150

* FOR PIPE O.Ds UP TO 159mm THE THERMOWELL INSERTION WILL BE STRAIGHT. FOR PIPE O.Ds BELOW 159mm, THE INSERTION SHALL BE SLANT.

Fig.1

FORMAT NO. - 6666-0

BHEL

SPECIFICATION FOR TEMPERATURE GAUGE

VOLUME II B

REV. NO. 01

SHEET 4 OF 7

THERMOWELL-MEDIUM PRESSURE
(40 KG/CM2)

ALL DIMENSIONS IN mm

Instrument stem dia D+0.0 -0.1	DIA D1 +0.2 0	DIA C	Insertion Length L1	Extention element length N1	Corres ponding element length(L)
6	6,5	12.5	150	27	171
				75	219
				100	244
			175	27	196
				75	244
				100	269
			250	27	271
				75	319
				100	344
			325	27	346
				75	394
				100	419
8	8.5	15	150	27	171
				75	219
				100	244
			175	27	196
				75	244
				100	269
			250	27	271
				75	319
				100	344
			325	27	346
				75	394
				100	419

FORMAT NO. - 6666-0

BHEL

SPECIFICATION FOR TEMPERATURE GAUGE

VOLUME II B

REV. NO. 01

ALL DIMENSIONS IN mm

Instrument stem dia D+0.0 -0.1	DIA D1 +0.2 0	DIA C	Insertion Length L1	Extention element length N1	Corres ponding element length(L)
12	12.5	19	150	27	171
				75.	219
				100	244
			175	27	196
				75	244
				100	269
			250	27	271
				75	319
				100	344
			325	27	346
				75	394
				100	419
14	14.5	21	150	27	171
				75	219
				100	244
			175	27	196
				75	244
				100	269
			250	27	271
				75	319
				100	344
			325	27	346
				75	394
				100	419

NOTE: The corresponding element lenghts are given for information only. The elements lengths are worked out as per the formula :

$$L = L1 + N1 - 6$$

FORM NO. PEM - 6666-0

THERMOWELL–HIGH PRESSURE (250 Kgf/Cm2)

VOLUME IIB

REV. NO. 01

SHEET 6 OF 7

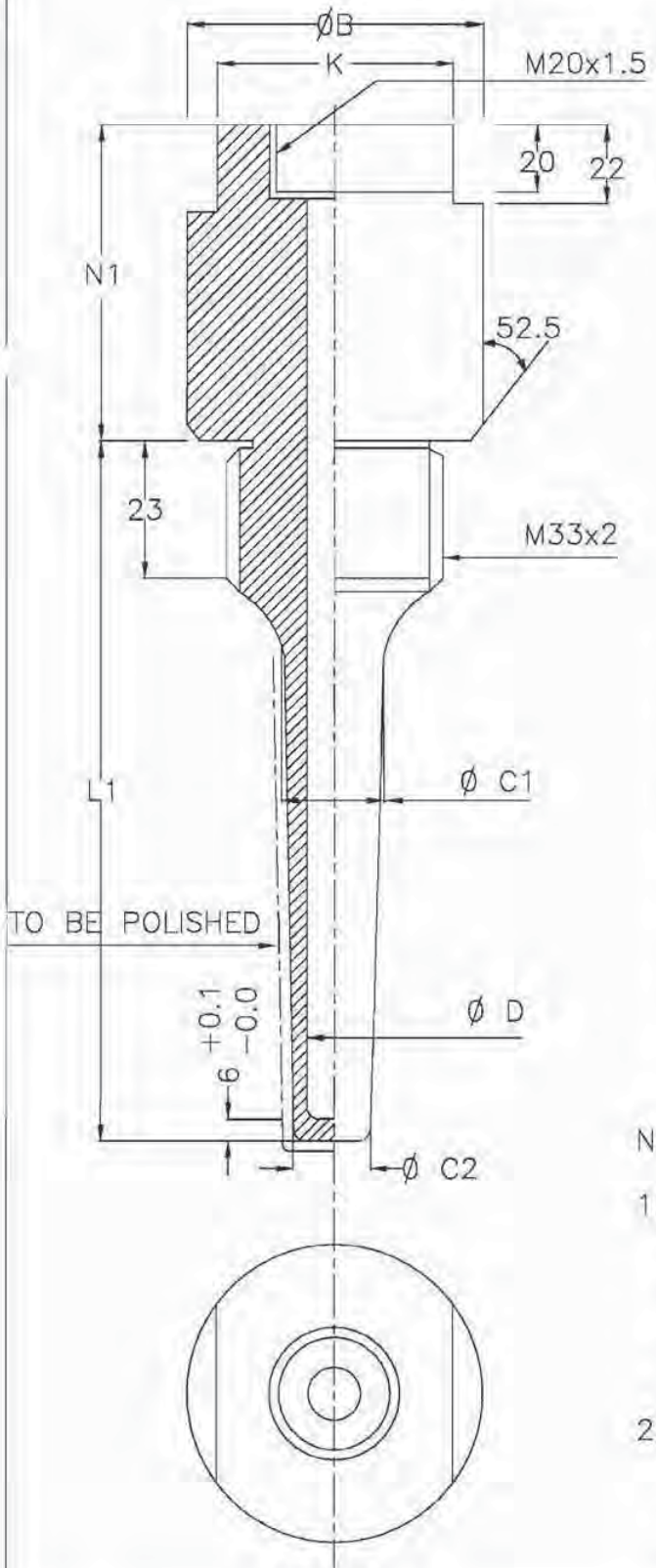


Fig. 2

PIPE O.D.	INSERTION LENGTH L1
Ø 509 & ABOVE	325
Ø 508 TO 368	250
Ø 367 TO 274	175
Ø 273 BELOW	150

NOTE :–

1. THE CORRESPONDING ELEMENT ELEMENT LENGTHS ARE GIVEN FOR INFORMATION ONLY. THE ELEMENT LENGTHS ARE WORKOUT AS PER THE FORMULA L=L1+N1–6.

2. FOR PIPE OD'S UPTO 159mm, THE THERMOWELL INSERTION WILL BE STRAIGHT. FOR PIPE OD'S BELOW 159mm, THE INSERTION SHALL BE SLANT.

FORMAT NO. - 6666-0

बी एच ई एल BHEL

SPECIFICATION FOR TEMPERATURE GAUGE

VOLUME II B

REV. NO. 01

SHEET 7 OF 7

ALL DIMENSIONS IN mm

Instrument stem dia D (+0.0 -0.1)	DIA D1 (+0.2 0.0)	DIA C1	DIA C2	K	DIA B	Insertion Length L1	Extention Length N1	Corresponding Element Length (L)
6	6.5	19	12.5	36	45	150	27 75 100	171 219 244
						250	27 75 100	271 319 344
8	8.5	21.5	15	36	45	150	27 75 100	171 219 244
						250	27 75 100	271 319 344
12	12.5	25.5	19	36	45	150	27 75 100	171 219 244
						250	27 75 100	271 319 344
14	14.5	27.5	21	36	45	150	27 75 100	171 219 244
						250	27 75 100	271 319 344
16	16.5	29	23	46	55	150	27 75 100	171 219 244
						250	27 75 100	271 319 344

GENERAL TECHNICAL REQUIREMENTS FOR LOCAL CONTROL PANEL

FORM NO. PEM-6666-0

BHEL	**DATA SHEET FOR LOCAL CONTROL PANEL**	VOLUME SECTION DATE: SHEET 1 OF 1

TAG No. ……. Qty.....

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)	
	ENCLOSURE SHEET THICKNESS	FRONT	■ 3.0 mm	
		OTHER	■ 3.0 mm	
		DOOR	■ 3.0 mm	
TECHNICAL	INPUT POWER SUPPLY		☐ 240V 50 Hz AC ☐ 220V DC ■ 415V 3 PHASE ☐	
	NO. OF FEEDERS		☐ ONE ■ TWO	
	CONTROL SUPPLY		☐ 110V AC ■ 220V AC ☐ 220V DC ☐ During detailed engg. (As per requirement)	
	ALARM ANNUNCIATOR WINDOW (EXCLUDING SPARES)		_____NOS. (AS REQUIRED)	
	PAINT TYPE		☐ EPOXY ENAMEL ■ EPOXY POWDER COATED	
	PANEL COLOUR (EXTERNAL)		■ LIGHT GREY (Shade 631 IS-5) (Project specific) ☐ OPALINE GREEN (Shade 275) ☐ During detailed engg.	
	FINISH		■ MATT ☐ GLOSSY ☐ SEMI GLOSSY	
	PANEL COLOUR (INTERNAL)		■ WHITE ☐ CREAM ☐ OFF WHITE	
	FINISH		☐ MATT ☐ GLOSSY ■ SEMI GLOSSY	
	CLASS OF PROTECTION		■ IP-65 ☐ IP-55	
	CONTROL HARDWARE		PLC BASED	
	FOUNDATION ARRANGEMENT		■ FOUNDATION BOLTS ☐ ANCHOR FASTENERS	
	WEIGHT OF PANEL (Kg.)			
	PANEL TYPE		☐ PRESSURISED ■ UNPRESSURISED As per Requirement	
	CABLE GLAND		☐ SINGLE COMPRESSION ■ DOUBLE COMPRESSION	
	AMMETER (TYPE OF INPUT)		☐ 1 Amp CT ☐ 4-20 mA	

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

FORM NO. PEM-6666-0

	DATA SHEET FOR LOCAL PANELS	SPECIFICATION NO.:
		VOLUME
		SECTION
		REV. NO. / DATE:
		SHEET 1 OF 1

TAG No. ……. Qty.....

Data Sheet C

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

GENERAL	MANUFACTURER		
	CONSTRUCTION		
	ENCLOSURE SHEET THICKNESS	FRONT	
		OTHER	
		DOOR	
TECHNICAL	INPUT POWER SUPPLY		
	NO. OF FEEDERS		
	CONTROL SUPPLY		
	ALARM ANNUNCIATOR WINDOW (EXCLUDING SPARES)		
	PAINT TYPE		
	PANEL COLOUR (EXTERNAL)		
	FINISH		
	PANEL COLOUR (INTERNAL)		
	FINISH		
	CLASS OF PROTECTION		
	CONTROL HARDWARE		
	FOUNDATION ARRANGEMENT		
	WEIGHT OF PANEL (Kg.)		
	PANEL TYPE		
	CABLE GLAND		
	AAMETER (TYPE OF INPUT)		

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

	SPECIFICATION FOR LOCAL PANELS	VOLUME II B 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 of Local Panels required for control and monitoring of the Auxiliary Plant & Equipment.

2.0 CODES AND STANDARDS

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

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

a)	IS-6005 : 1970	:	Code of practice for phosphating of iron and steel.
b)	IS-5 : 1978	:	Colours for ready mixed paints and enamels.
c)	IS-1248:1983	:	Direct Acting Indicating Instruments.
d)	IS-13947 (Part-III):1993	:	Rotary Cam Switches.
e)	IS-6875:1973	:	Auxiliary relays.
f)	IS-8828:1993	:	Circuit breaker for household and similar installations.
g)	IS-13947 (Part-I):1993	:	Low Voltage switchgear & control gear : Part-I (General Rules)
h)	NFPA-496:1974	:	Purged & Pressurised Enclosure for Electrical Equipment in Hazardous Locations.

3.0 TECHNICAL REQUIREMENTS

3.1 Panel Construction

3.1.1 The local panels shall house the secondary instruments, annunciation system, Single loop controller, Control switches / push buttons, indicating lamps, 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 stiffners 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
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 stiffners 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.

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

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

3.1.8 All steel surfaces shall be cleaned by sand / pellet blasting, treated for pickling, degreasing and phosphating etc. by seven tank method. The panel shall have a high quality finish and appearance. The panel shall be painted with two coats of primer followed by two coats of epoxy / synthetic enamel based final paint of color shade and finish as given in data sheet-A (No. PES-145-54A-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-145-54A-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-145-54A-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 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 (10) percent spare terminal.

3.1.14 The interior of each panel shall be suitably illuminated through fluorescent lamps 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.

3.2 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.
GREEN	Motor ON / Valve OPEN	BLACK	Lamp test

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 condition.
RED	Motor ON / Valve OPEN condition	WHITE	Normal / healthy condition

3.3.7 Ammeters

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

3.3.8 Miniature Circuit Breaker (MCB)

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

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

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

4.0 TESTING AND INSPECTION

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

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

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

4.3.1 Routine Tests

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

4.3.2 Type Tests

1. Enclosure Class Test

5.0 SPARES AND CONSUMABLES

5.1 Commissioning Spares and consumables

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

5.2. Mandatory Spares

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

5.3. Recommended Spares

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

6.0 DRAWINGS AND DOCUMENTS

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

1. Data Sheet no. PES-145-54A-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-145-54A-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-145-54A-DS1-0
- Data sheet C for Local Panels : Data sheet no. PES-145-54A-DS2-0

GENERAL TECHNICAL REQUIREMENTS FOR PLC

FORM NO. PEM-6666-0

	DATA SHEET FOR PLC SYSTEM **1 X 700 MW BELLARY**	SPECIFICATION NO.: VOLUME II B SHEET 1 OF 1

Data Sheet No.: **PES-145-36-DS1-0**

Data Sheet A & B

		DATA SHEET-A FOR PLC SYSTEM (TO BE FILLED BY PURCHASER)	DATA SHEET – B (TO BE FILLED BY BIDDER)
GENERAL	PROJECT	**1 X 700 MW BELLARY**	
	SERVICE	**OZONE GENERATION PLANT**	
	QUANTITY	■ UNITISED ☐ COMMON	
	LOCATION	■ INDOOR ☐ OUTDOOR	
PLC EQUIPMENT	MAKE / MODEL NO.	BIDDER TO INDICATE	
	PROCESSOR	REDUNDANT WITH HOT STANDBY	
	DATA BUS (HMI)	☐ COPPER WIRE ☐ FIBRE OPTIC	
	DATA BUS (I/O - CPU)	☐ COPPER WIRE ☐ FIBRE OPTIC	
	DATA BUS (REMOTE I/O - CPU)	☐ COPPER WIRE ☐ FIBRE OPTIC	
	FIELD CONTACTS INTERROGATION VOLTAGE	■ 24 V ☐ 48 V	
	LOCATION OF COUPLING RELAYS	■ MCC ☐ PLC PANEL	
	DESKTOP OWS QUANTITY	☐ ONE ☐ TWO ☐ **1 No. LCD**	
	DESKTOP MONITOR TYPE	☐ 19" ☐ 21" TFT/CRT MONITOR	
	PRINTER (A4) - QUANTITY	INKJET _____ LASER B/W _____ 1 No COLOR INKJET _____ COLOR LASER _____	
	PRINTER (A4) - MODEL	INKJET _____ LASER B/W _____ COLOR INKJET _____ COLOR LASER _____	
	PROGRAMMING / CONFIGURATION FACILITY	A) ☐ HAND HELD B) ENGINEERING SOFTWARE ☐ ONE OWS ☐ ALL OWS ☐ _____	
	SAFETY STANDARD	_____	
	COMPUTER FURNITURE	☐ YES ☐ NO	
PANEL	QUANTITY	BIDDER TO INDICATE	
	CLASS OF PROTECTION	■ **IP 65**	
	REMOTE I/O PANEL	☐ YES ■ NO	
	COLOUR	AS PER IS-5 SHADE _____	
	BACK-UP	■ YES ☐ NO	
	MIMIC	■ YES ☐ NO	
	CONTROL HARDWARE	■ PB ■ INDICATORS ☐ FACIAS _____ Nos. ☐ OTHERS	
COMMUNICATION TO OTHER SYSTEM	HARDWIRED	☐ YES ■ NO	
	PURPOSE	☐ CONTROL ■ MONITORING	
	MEDIUM	☐ UTP ■ FIBRE OPTIC ☐ OTHERS	
	TIME SYNCRONIZATION SIGNAL FORMAT	☐ PULSE ☐ RS-485 ■ IRIG-B	
	SOFTLINK	☐ MODBUS ☐ OPC	
	SERIAL LINK	COMMUNICATION PORT TYPE _____	
POWER SUPPLY INPUT FEEDER	PLC PANEL	BIDDER TO INDICATE LOAD DATA	
	REMOTE I/O PANEL	BIDDER TO INDICATE LOAD DATA	

FORM NO. PEM-6666-0

BHEL	**DATA SHEET FOR PLC SYSTEM**	SPECIFICATION NO.: VOLUME II B SHEET 1 OF 1

Data Sheet No.: **PES-145-36-DS2-0**

Data Sheet C

DATA SHEET – C
(TO BE FILLED BY BIDDER AFTER AWARD OF CONTRACT)

GENERAL*	PROJECT	
	SERVICE	
	QUANTITY	
	LOCATION	
PLC EQUIPMENT	MAKE / MODEL NO.	
	PROCESSOR	
	DATA BUS (HMI)	
	DATA BUS (I/O - CPU)	
	DATA BUS (REMOTE I/O - CPU)	
	FIELD CONTACTS INTERROGATION VOLTAGE	
	LOCATION OF COUPLING RELAYS	
	DESKTOP OWS QUANTITY	
	DESKTOP MONITOR TYPE	
	PRINTER (A4) - QUANTITY	
	PRINTER (A4) - MODEL	
	PROGRAMMING / CONFIGURATION FACILITY	
	SAFETY STANDARD	
	COMPUTER FURNITURE	
PANEL	QUANTITY	
	CLASS OF PROTECTION	
	REMOTE I/O PANEL	
	COLOUR	
	BACK-UP DESK	
	MIMIC	
	CONTROL HARDWARE	
COMMUNICATION TO OTHER SYSTEM	HARDWIRED	
	PURPOSE	
	MEDIUM	
	TIME SYNCRONIZATION SIGNAL FORMAT	
	SOFTLINK	
	SERIAL LINK	
POWER SUPPLY INPUT FEEDER	PLC PANEL	
	REMOTE I/O PANEL	

Form No. PEM-6666-0

	TITLE:	
BHEL	**SPECIFICATION FOR PROGRAMMABLE LOGIC CONTROLLER SYSTEM**	VOLUME **II-B** SHEET 1 OF 9

1. SCOPE

This specification covers the Design, Manufacture, Assembly, Inspection and Testing at manufacturer's works, proper packing and delivery to site, erection and commissioning of the PLC Control & Monitoring System comprising PLC Control panel/Remote I/O panel (housing Processors, I/O cards, power supply packs etc.), Operator workstations(OWS), Printers, Annunciation system, UPS, cables and all other equipments and accessories required for completeness of the system as mentioned in different sections of this specification.

2. GENERAL

2.1. The PLC shall perform protection logic, interlock and sequential control functions such as binary logic operation, set/reset operation, timers, counters, logic blocks, math functions, input quality checking engineering unit conversion, Boolean functions & PID control (Analog logic function).

2.2. The system shall be redundant in processor, power supply and communication interfaces unless otherwise specified. The system shall have self-diagnostic features. The control of all drives and equipment shall be effected through the keyboard/mouse / panel mounted push button / control switches as per Data sheets-A&B.

2.3. The system shall have facility for connecting to Main Plant's Distributed control system (DCS) using hardware / software interface for two-way transfer of signals.

2.4. The mimic shall be displayed on the OWS screen and may also be provided on the control desk/panel (as per Data sheets).

2.5. In case OWS is provided, HMI functions like Trends, Curves, Bar charts, Historical storage of Data, Logs and reports etc. shall be provided in addition to Plant-schematics. The necessary catalogue / literature elaborating the features of HMI shall be supplied along with the bid.

2.6. It shall be possible to use the same OWS as programming station.

2.7. The PLC system shall be sized to meet process/system requirements as per the approved P&IDs and Control write-up.

2.8. The PLC system shall be designed to ensure that no single device failure should result in failure of any other device.

2.9. Signal multiplication where required shall be done in PLC. Use of relays for multiplication of contacts (for control, monitoring and alarm) is not acceptable. The control/ monitoring components on the control panel/ desk shall be driven through I/O modules.

3. TECHNICAL REQUIREMENTS

Details of various PLC system components shall be inclusive of but not limited to the following:

3.1. CODES AND STANDARDS

3.1.1. The equipment covered under this specification shall meet the requirements of latest edition of all applicable codes and standards like ANSI, NEMA, IEEE, IEC, NEC & IS.

3.1.2. PLC shall conform to IEC: 1131

3.1.3. The offered PLC shall comply with safety standards as per Data sheet-A&B.

3.2. CONTROL PANEL

3.2.1. PLC control panel shall be freestanding type with provision for mimic display, push-button stations, control switches, indicating lamps, metering instruments like Indicators, ammeters etc. and facia windows for critical alarms.

3.2.2. 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 2.0 mm for load bearing sections (mounted with instruments) and Not less than 1.6 mm for others
Gland plate thickness: 3.0mm
Base channel: ISMC 100 with anti-vibration mounting & foundation bolts.

3.2.3. Each panel shall be identified by a name plate, which shall be of non-rusting metal or three ply lamicold, with engraved lettering.

3.2.4. 25 x 6 mm Copper ground bus to be provided for each panel.

3.2.5. 240V AC single phase, thermostatically controlled space heaters shall be provided. Each free standing panel shall have a door switch operated fluorescent lamp and a 240V AC plug point.

3.2.6. Painting treatment shall be as per IS: 6005. Two coats of lead oxide primer shall be followed by powder coating. Paint shade shall be as specified in the “Data sheet for PLC system”-Data Sheet-A&B.

3.2.7. The annunciation system shall be facia window type, driven by the PLC. Audible alarm, Acknowledge, Reset and lamp test facility shall be provided as per ISA sequence – S18.1, M.

3.3. PROCESSORS

3.3.1. The microprocessors shall be 32 bit, and Hot redundant.

3.3.2. Hot redundancy: PLC shall be provided with two processors (Main processing unit and memories) one for normal operation and one as hot standby. In case of failure of working processor, there shall be an appropriate alarm and simultaneously the hot standby processor shall take over the complete operation automatically. This transfer from main processor to standby processor shall be bump less and shall not cause any disturbance whatsoever. In the event of both processors failing, the system shall revert to fail safe mode. It shall be possible to keep any of the processor as master and other as standby.

3.3.3. An authorized forcing facility shall be provided for changing the status of inputs and outputs, timers and flags to facilitate fault finding and other testing requirements.

3.3.4. The standby processor shall be updated automatically in line with the changes made in the working processor.

3.3.5. In the event of any replacement of the processor, synchronization of the replaced processor shall be automatic upon live insertion.

3.3.6. The cycle time for input scanning, execution of logics, overheads and output scan shall not exceed 120 m sec.

3.3.7. The processor & memory shall be loaded up to 50% at normal conditions and maximum up to 60% under worst loading conditions.

3.3.8. The memories shall be field expandable.

3.4. INPUT / OUTPUT Modules

3.4.1. Input/output card assignments shall be modular i.e. no single card shall be assigned with more than one drive of a particular sub-system. The maximum number of channels per I/O module shall be as follows.

- Analog Input Module: 16
- Analog Output Module: 16
- Binary Input Module: 32
- Binary Output Module: 32
- Analog Input/output combined: 16
- Binary Input/output combined: 32

3.4.2. On line I/O replacement: All I/O cards shall have quick disconnect terminations allowing for card replacement without disconnection of external wiring and without switching off the power supply.

3.4.3. 10% spare capacity shall be ensured in each card channel assignment. Overall minimum 20% spare channels shall be provided.

3.4.4. Output command to MCC/Switchgear shall be through coupling relays, whose mounting location shall be as per “Data sheet A & B for PLC System”. In case coupling relays are located in PLC Panel, the same shall be in PLC vendor’s scope of supply.

3.4.5. Status feedback from MCC shall be in the form of potential free contact.

3.5. DATA BUS/ I/O BUS

3.5.1. The Data bus connecting PLC and HMI work stations shall be TCP/IP on Ethernet.

3.5.2. The Data bus and I/O bus communication medium shall be twisted pair shield copper conductor for indoor locations and those areas not subjected to induced signals. Repeaters/signal amplifiers shall not be used. Copper conductor cable used shall be Category-5 or better. The communication medium shall be Fibre optic cable in the event any portion of communication cable run is in outdoor or where distances are beyond 500 meters.

3.6. OPERATOR WORK STATION (OWS)

3.6.1. The OWS and Keyboard shall be desktop mounted and shall be used for controlling, monitoring and programming function.

3.6.2. Colour CRT(s) with keyboard and mouse shall be as per Data Sheet-A&B. CRT shall have graphic display facility.

3.6.3. The OWS shall be with Windows based operating system having necessary Engineering/Configuring software.

3.7. PRINTER

Printers shall be provided as per Data Sheet-A&B.

3.8. COMMUNICATION WITH PLANT DCS

3.8.1. The PLC system shall be provided with hardwired/serial interface for communication with plant DCS.

3.8.2. Serial communication to / from DCS where provided shall be engineered to ensure that signal communication time from / to DCS shall not exceed 1 seconds for control / feedback.

3.8.3. Serial communication to DCS shall be OPC (Data access 2.0), Ethernet based TCP/IP Protocol. Alternatively the serial communication shall be MODBUS protocol on RS 485 network.

3.8.4. Data transmitted from PLC to DCS shall include all information necessary for the DCS graphic displays to monitor and control the process equipment and PLC. Such data may include pertinent analog and digital status information, interlock, alarms and maintenance conditions. Data transmitted from DCS to the PLC shall include necessary signals to provide operator control interface from DCS for the process/ equipment being controlled by PLC.

3.8.5. Bidder to include 'Light interface units, converters, Ethernet switch, accessories at PLC end for connectivity to other system. The bidder's terminal point shall be Ethernet port in case of copper medium connection to DCS or LIU in case of Fiber optic medium for connectivity with plant DCS. In case distance between PLC & DCS is greater than 1.8 Km, single mode of optical fiber cable with compatible accessories shall be used. For distance less than 1.8 Km multimode optical fiber ports shall be used.

3.9. POWER SUPPLY Scheme

3.9.1. PLC Panel and I/O Cabinets: PLC system shall be provided with 2x100% UPS fed from Two Nos. redundant 415V, 3-ph feeders, as per the scheme PE-SD-999-145-001, sh-08 of 08. Each UPS shall have 30 minutes back up. Input feeder failure shall be monitored in the PLC system. Necessary redundant power pack and transformers shall be provided (in the PLC panel) to derive the power supply for control desk, PLC panel and input / output cabinets etc

3.9.2. Remote I/O panels: Similar power supply arrangement as for PLC panels shall be provided if it is not possible to extend the power cable form UPS of PLC panels.

3.9.3. Each OWS and associated HMI peripherals shall be provided with a feeder from either one of the UPS

4. DRAWING/DOCUMENT AND DATA TO BE FURNISHED AFTER AWARD OF THE CONTRACT:

4.1. For Approval:

- PLC system configuration drawing along with functional write-up.
- Input/Output signal list.
- BOM of PLC
- List of PLC controlled devices
- Control panel/control desk GA drawings.
- Control desk/panel component layout drawing.
- Control panel/control desk Foundation detail and cutout drawings
- Power distribution scheme.

- Block logic diagrams.
- Annunciation list.
- PLC control room layout drawing.
- List of soft signal exchange with Plant DCS.
- List of mandatory spares
- Quality plan
- Data Sheet-C
- CRT display
- Power supply scheme for PLC system, HMI & peripherals, Remote I/O etc.

4.2. For Information:

- Cable schedule and cable interconnection drawing(in BHEL approved format)
  - Between Field and PLC
  - Between Field and MCC
  - Between MCC and PLC
- Electronic earthing requirements.
- Panel Heat dissipation data
- Product/component catalogues.
- Operation & Maintenance Manual on CDs.
- Softcopy of Final/As-built drawings on CDs.
- Calculation for Processor, Memory & Data bus loading

The above list is the minimum requirements. Additional documents/calculations required shall be finalized during contract stage.

5. DRAWINGS AND DOCUMENTS TO BE SUBMITTED ALONG WITH THE BID

- Proposed PLC system configuration drawing with write-up
- Product catalogues and specifications for PLC as well as HMI application.
- Proposed power supply schemes for PLC system, peripherals, and Remote I/O panels.

6. TESTING AND INSPECTION

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

6.2. BHEL's standard Quality Plan for PLC 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.

6.3. The complete PLC system, including all instrument and devices shall be subjected to standard factory tests (i.e. Type Tests and Routine Tests) as per relevant IS, NEMA, IEEE, IEC.

6.4. Factory Acceptance Test-FAT (Functional Tests) shall be performed prior to shipment and Owner/Purchaser shall be notified 15 days before the schedules dates of the test.

6.5. The certificates for following type tests, as per IEC Standard, shall be submitted: -

- Surge protection test as per IEC-225-4
- Dry heat test as per IEC-68-2-2
- Damp Heat test as per IEC-68-2-3

- Vibration Heat test as per IEC-68-2-6
- Electrostatic discharge test as per IEC-801-2 or equivalent
- Radio frequency Immunity test as per IEC-801-6 or equivalent
- Electromagnetic Immunity test as per IEC-801-3 or equivalent

7. SPARES AND CONSUMABLES

7.1. 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.

7.2. 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.

7.3. 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.

7.4. Special Tools & Tackles

The bidder shall supply all Special Tools & Tackles 'as required' during Start-up and further maintenance of the system, as part of the main equipment supply.

7.5. Spares, Service support

Bidder shall provide availability of spares and service support for minimum 10 years after guarantee period.

8. MARKING AND PACKING

8.1. Marking:

A stainless steel name-plate shall be permanently fixed on each equipment giving its Tag/serial Number and salient technical specification.

8.2. Packing:

All equipment/materials shall be suitably packed and protected for the entire period of dispatch, storage and erection against impact, abrasion, corrosion, 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.

9. PERFORMANCE AND GUARANTEE

The PLC system shall be guaranteed to meet the performance requirement as specified and also for trouble-free continuous operation for 12 months from the date of commissioning or 18 months from the date of delivery at site whichever is later unless specified otherwise in Vol-IIB Section - B or Section - C.

10. APPLICABLE DATA SHEET FORMS

This document shall be read with the following data sheet forms :

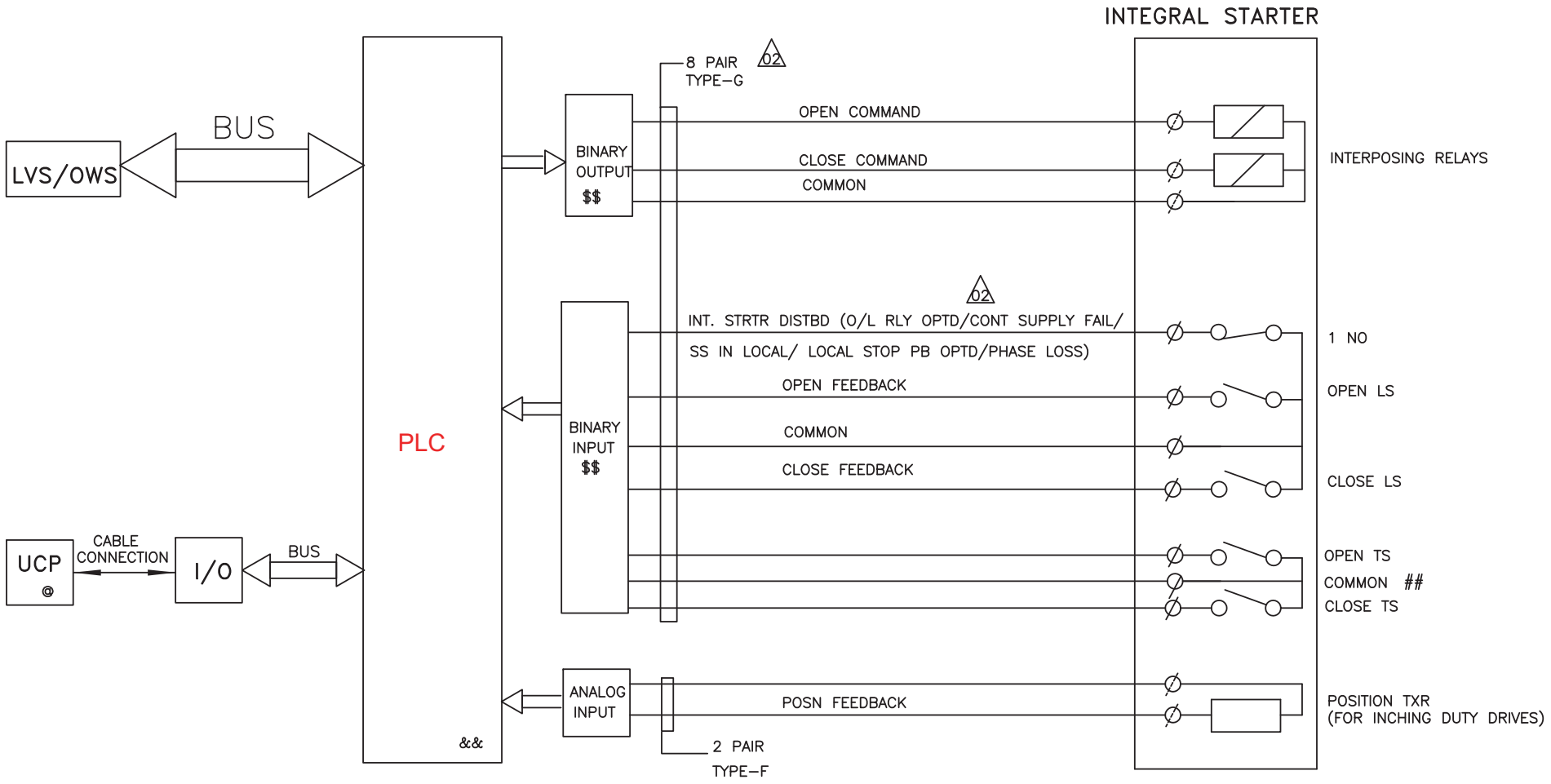
- Data Sheet A & B for PLC system - PE-DC-999-145-I036-1
- Data Sheet C for PLC system - PE-DC-999-145-I036-2

11. Bidder shall provide at least 20% wired spare capacity of I/O modules over and above system requirement.

.

12. Bidder shall include 10% or 1 No. (whichever is higher) each type of module, which shall include controller card, communication card, I/O card, Power supply card/ unit, relays, push button, lamps etc.

PLC INTERFACE FOR BIDIRECTIONAL DRIVE

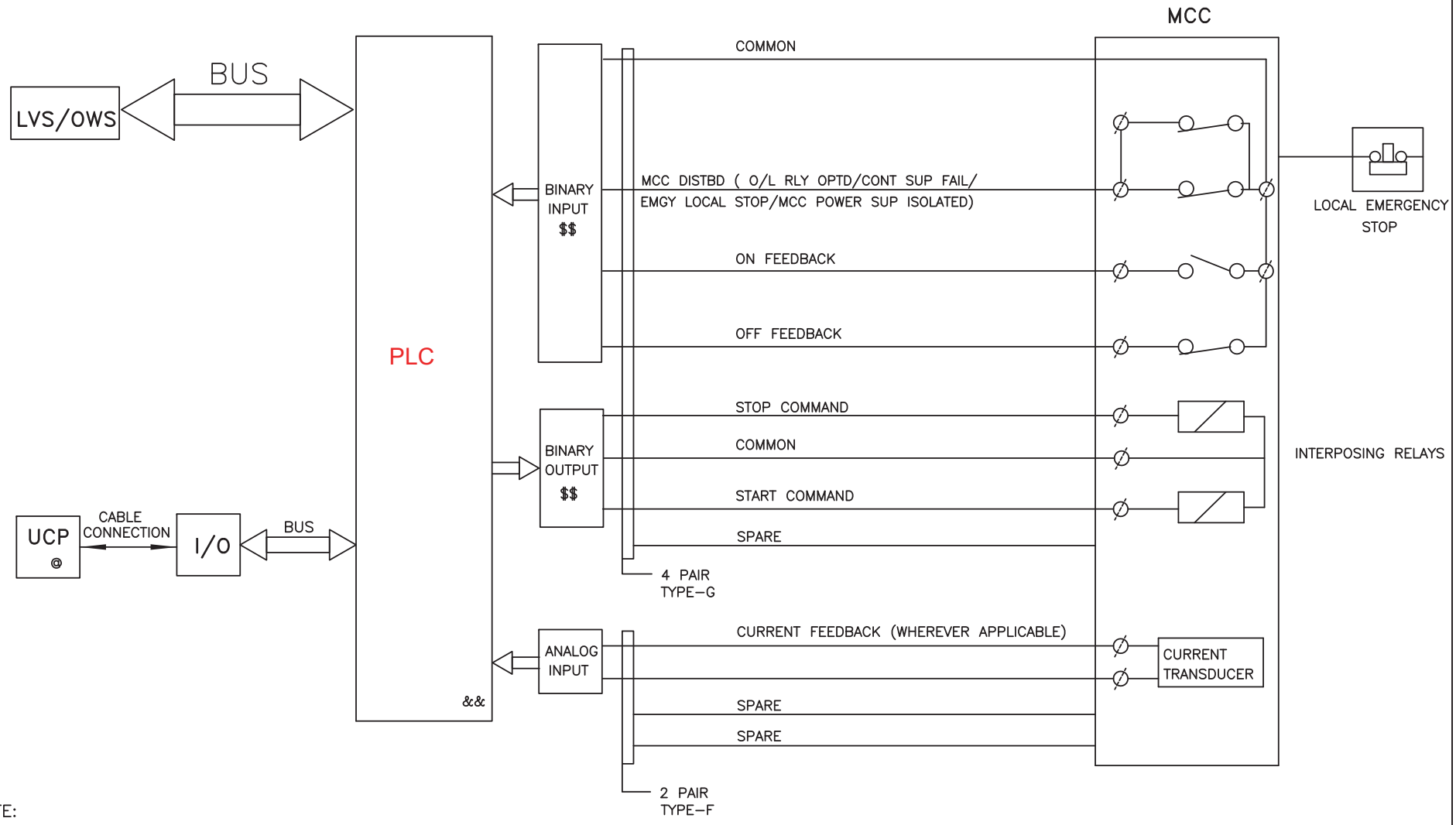


NOTE:

1. TYPE–G : OVERALL SCREENED TWISTED PAIR CABLE (0.5 sq mm)
2. 'TYPE–F INDIVIDUAL & OVERALL SCREENED TWISTED PAIR CABLE (0.5 sq mm)
3. '$$' REDUNDANT INPUTS/ OUTPUTS FOR CRITICAL SERVICES..
4. '&&' REDUNDANT PROCESSOR .
5. @ REFER CL. NO. 1.0(C).
6. ## FOR IMPORTANT DRIVES, AS INDICATED IN DRIVE LIST.

BHEL	KARNATAKA POWER CORPORATION LIMITED BELLARY THERMAL POWER STATION STAGE – III (1 x 700MW)	DRG NO.	PE-DM-367-145-I002
		DATE	25.11.2011
	PLC INTERFACE FOR BIDIRECTIONAL DRIVE	REV. NO.	02
		SH. 8 OF 13	SHS

PLC INTERFACE FOR UNIDIRECTIONAL LT DRIVE



NOTE:

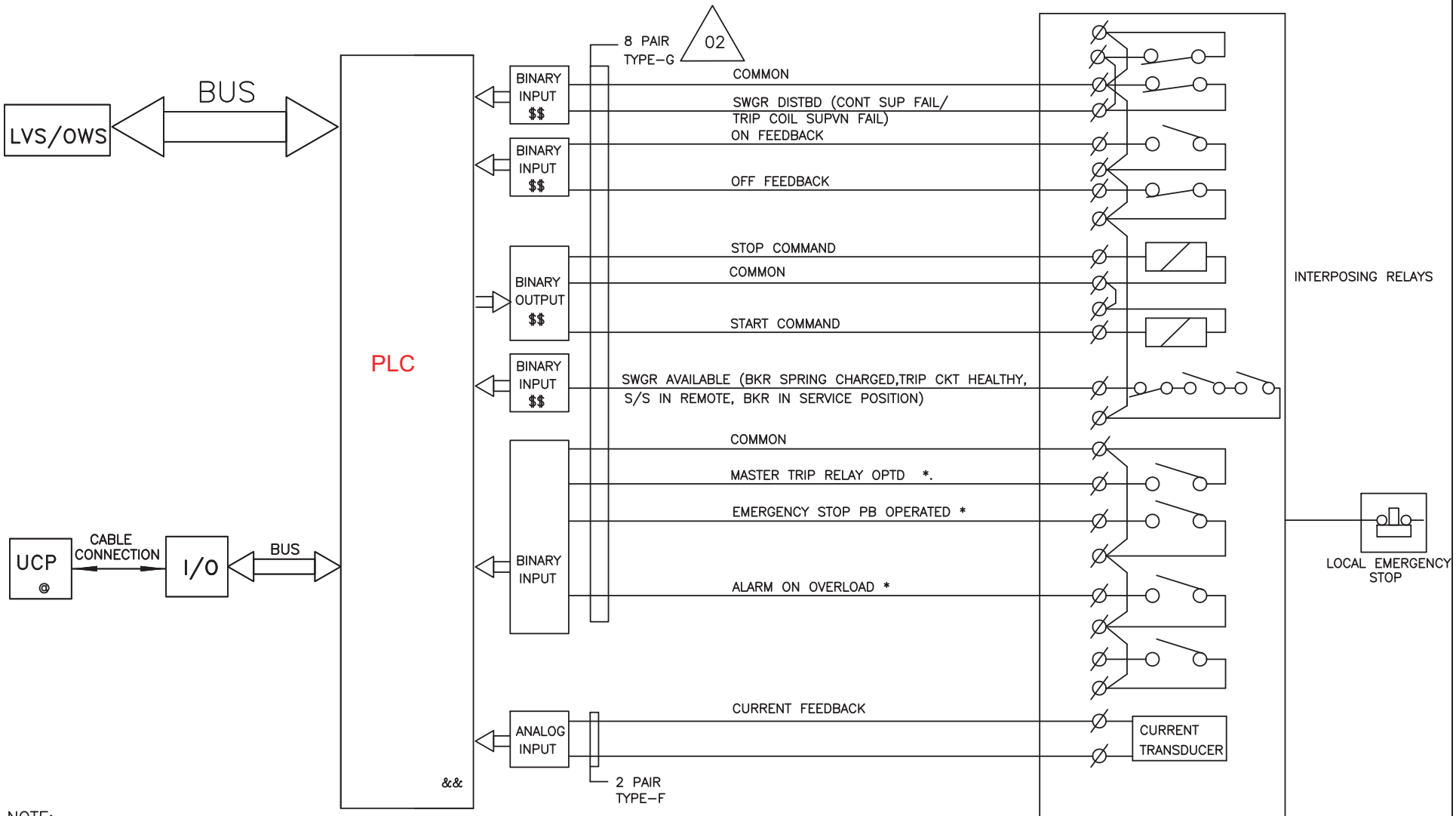
1. TYPE-G : OVERALL SCREENED TWISTED PAIR CABLE (0.5 sq mm)
2. 'TYPE-F INDIVIDUAL & OVERALL SCREENED TWISTED PAIR CABLE (0.5 sq mm)
3. '$$' REDUNDANT INPUTS/ OUTPUTS FOR CRITICAL SERVICES .
4. '&&' REDUNDANT PROCESSOR .
5. @ REFER CL. NO. 2.0(b).

BHEL	KARNATAKA POWER CORPORATION LIMITED BELLARY THERMAL POWER STATION STAGE - III (1 x 700MW)	DRG NO.	PE-DM-367-145-I002
		DATE	25.11.2011
	PLC INTERFACE FOR UNIDIRECTIONAL LT DRIVE	REV. NO.	02
		SH. 9	OF 13 SHS

PLC

INTERFACE FOR UNIDIRECTIONAL HT DRIVE

HT SWGR

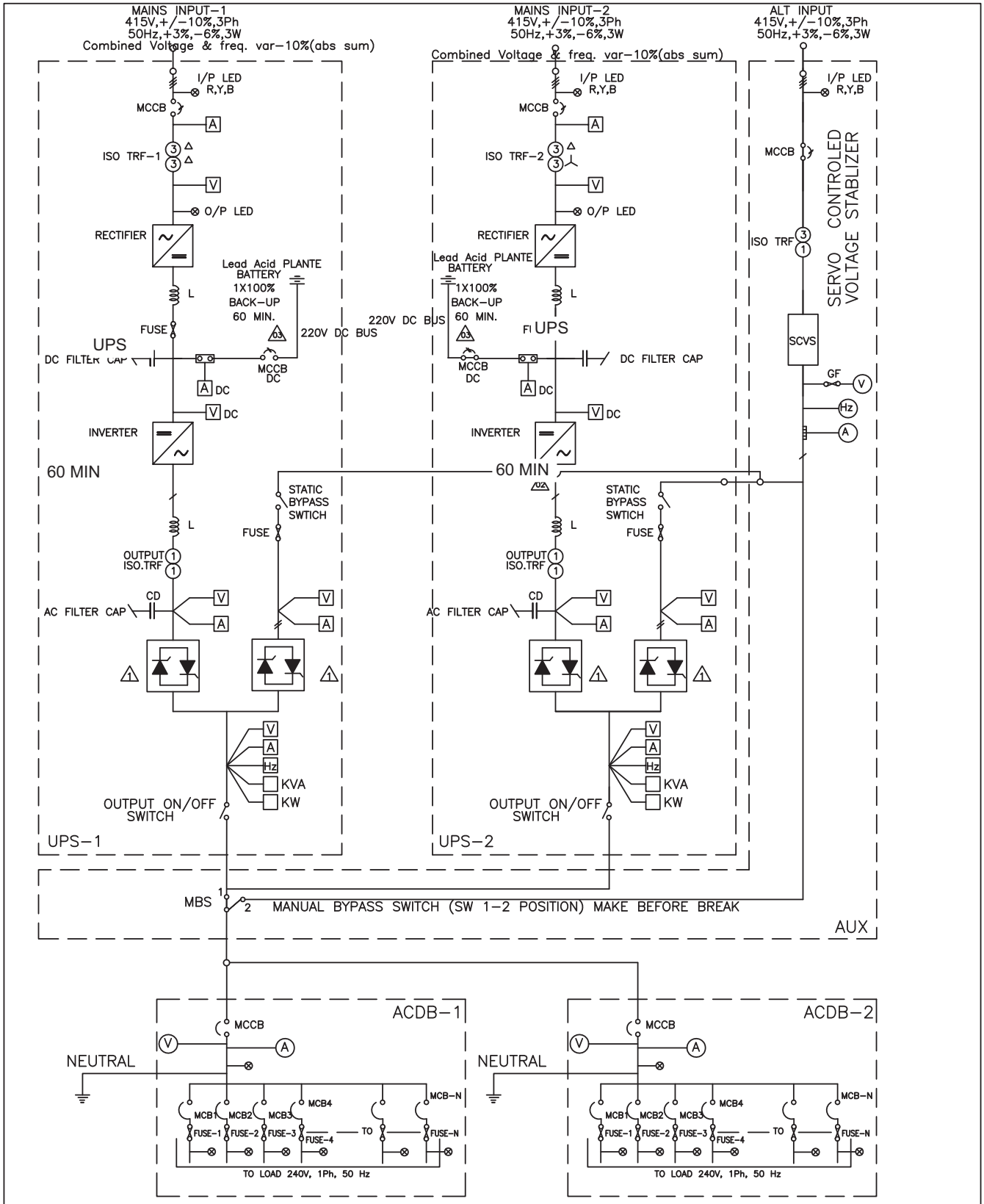


NOTE:

1. TYPE–G : OVERALL SCREENED TWISTED PAIR CABLE (0.5 sq mm)
2. 'TYPE–F INDIVIDUAL & OVERALL SCREENED TWISTED PAIR CABLE (0.5 sq mm)
3. '$$' REDUNDANT INPUT/OUTPUT FOR CRITICAL SERVICES.
4. ** REFER CLAUSE 5.0
5. '&&' REDUNDANT PROCESSOR
6. '*' FOR ANNUNCIATION
7. @ REFER CL.NO 4.0(C).

BHEL	KARNATAKA POWER CORPORATION LIMITED BELLARY THERMAL POWER STATION STAGE – III (1 x 700MW)	DRG NO.	PE-DM-367-145-I002
	PLC S INTERFACE FOR UNIDIRECTIONAL HT DRIVE	DATE	25.11.2011
		REV. NO.	02
		SH. 12	OF 13 SHS

SINGLE LINE DIAGRAM OF UPS



NOTES:

1. ACDB-1&2 NEUTRAL TO BE GROUNDED TO A DEDICATED GROUND.
2. ALL OUTPUT FEEDERS OF ACDB SHALL BE PROVIDED WITH AN LED AFTER THE FUSE FOR FEEDER ON INDICATION WITH FEEDER DESCRIPTION.
3. REDUNDANT FEEDERS SHALL BE LOCATED IN DIFFERENT ACDBs.
4. FOR FURTHER DETAILS REFER TECHNICAL SPECIFICATION SECTION D2.25 VOL IV SHT 233-246

DRG PE-DG-367-145-I004
REV 03
SHEET 2 OF 2

Cheklist for Serial Communication between maxDNA Systems and Foreign Device :BHEL

A Device Specific :

SN	Parameters	Options available	Remarks if any
1	Model No.& Make of Device		
2	Communications Link Options	☐ Multidrop ☐ Peer to Peer ☐ N/w topology attached	
3	Protocol Mode (Device is a)	☐ Master ☐ Slave ☐ Master/Slave	
4	Protocol	☐ RTU ☐ ASCII ☐ Other ----------	
5	Master	☐ System maxDNA ☐ Other ----------	
6	Dist.bet.maxDNA System & Device*	☐ ---------- Feet ☐ ---------- Meters	

B Electrical Spcific :

1	Interface Type	☐ RS232 ☐ RS422 ☐ RS485	
2	Wiring at Device end	☐ 2 Wire ☐ 4 Wire	
3	Transmission Channel	☐ Half Duplex ☐ Full Duplex	
4	Baud Rates (bps)	☐ 1200 ☐ 2400 ☐ 4800 ☐ 9600 ☐ 19200	
5	Databits	☐ 8 ☐ 7	
6	Stopbits	☐ 1 ☐ 2	
7	Parity	☐ None ☐ Odd ☐ Even	
8	H/w & Software Handshake	☐ Yes ☐ No	
9	Response Timeout time (Sec)	☐ ---------- ☐ Configurable timeout	
10	Data Formats Supported	☐ Boolean ☐ Real ☐ Char ☐ Sn.Int ☐ UnSn.Int	
11	Transmission mode	☐ Asynchronous ☐ Synchronous	

C Application Specific : *

1	Primary Function*	☐ Data Acquisition ☐ Data Acquisition & Control	
		☐ Download parameter sets	
2	Analog Points to read	--------Nos. ☐ Details attached ☐ Details not attached	
3	Analog Points to write	--------Nos. ☐ Details attached ☐ Details not attached	
4	Digital Points to read	--------Nos. ☐ Details attached ☐ Details not attached	
5	Digital Points to write	--------Nos. ☐ Details attached ☐ Details not attached	
6	Memory / Flag Points to read	--------Nos. ☐ Details attached ☐ Details not attached	
7	Memory / Flag Points to write	--------Nos. ☐ Details attached ☐ Details not attached	

D Hardware Specific :

1	Cable type	☐ Boolean cable ☐ Twisted pair cable	
2	Cable Details Enclosed	☐ Yes ☐ No	
3	Any specific Converter required	☐ Yes ☐ No ☐ Details enclosed	

E Device Documents :

1	Manufacturer's Documents*	☐ Tech., Spec. ☐ Operating Manual	

***Notes:**

A6 To identify converter requirement and cable length.

C The sr.no.1 to 7 are reqd.to be furnished for interface impl. :such as Tagname,Description,point type, modbus(Register) address,EU,range & device (dlave) address

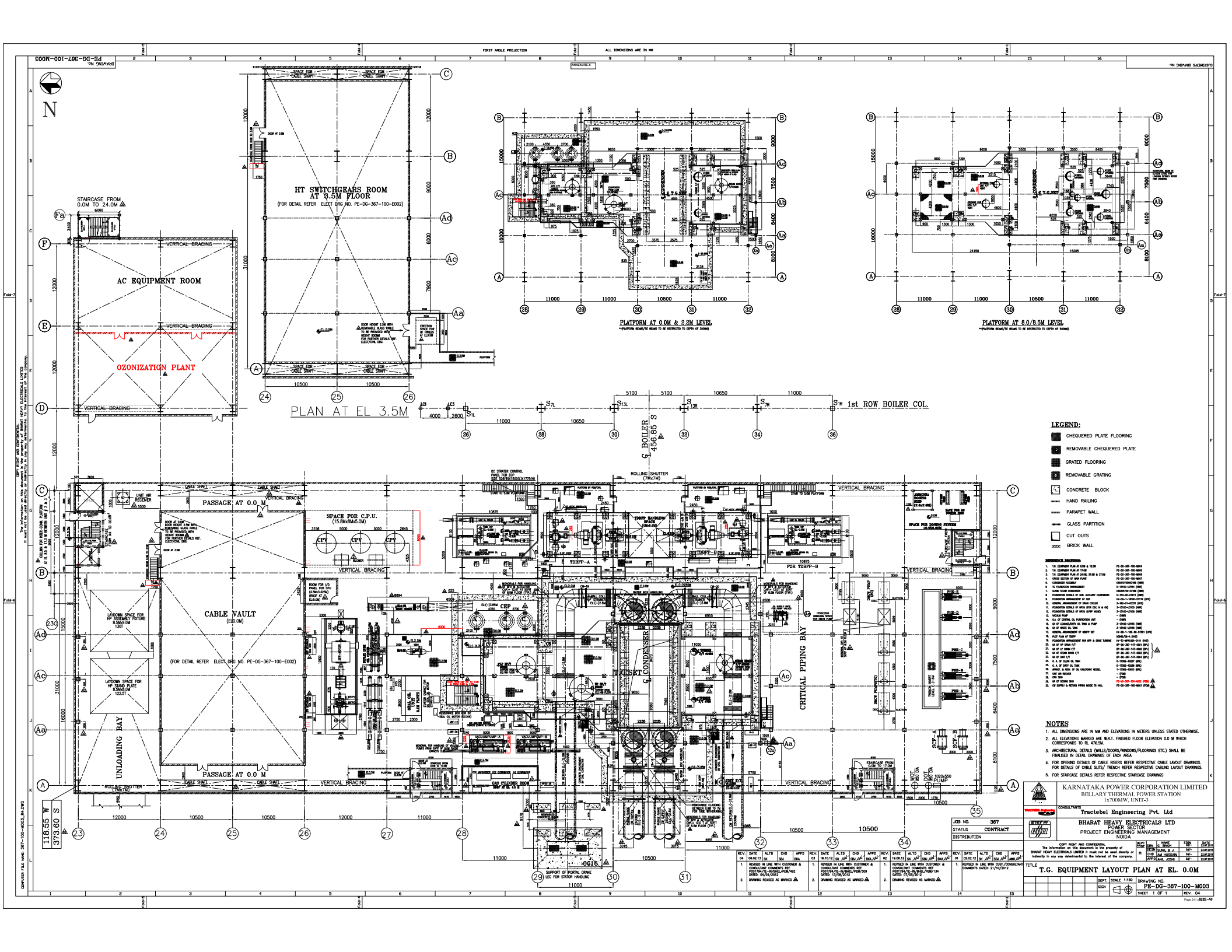
C1 What is the primary purpose of the communications link?

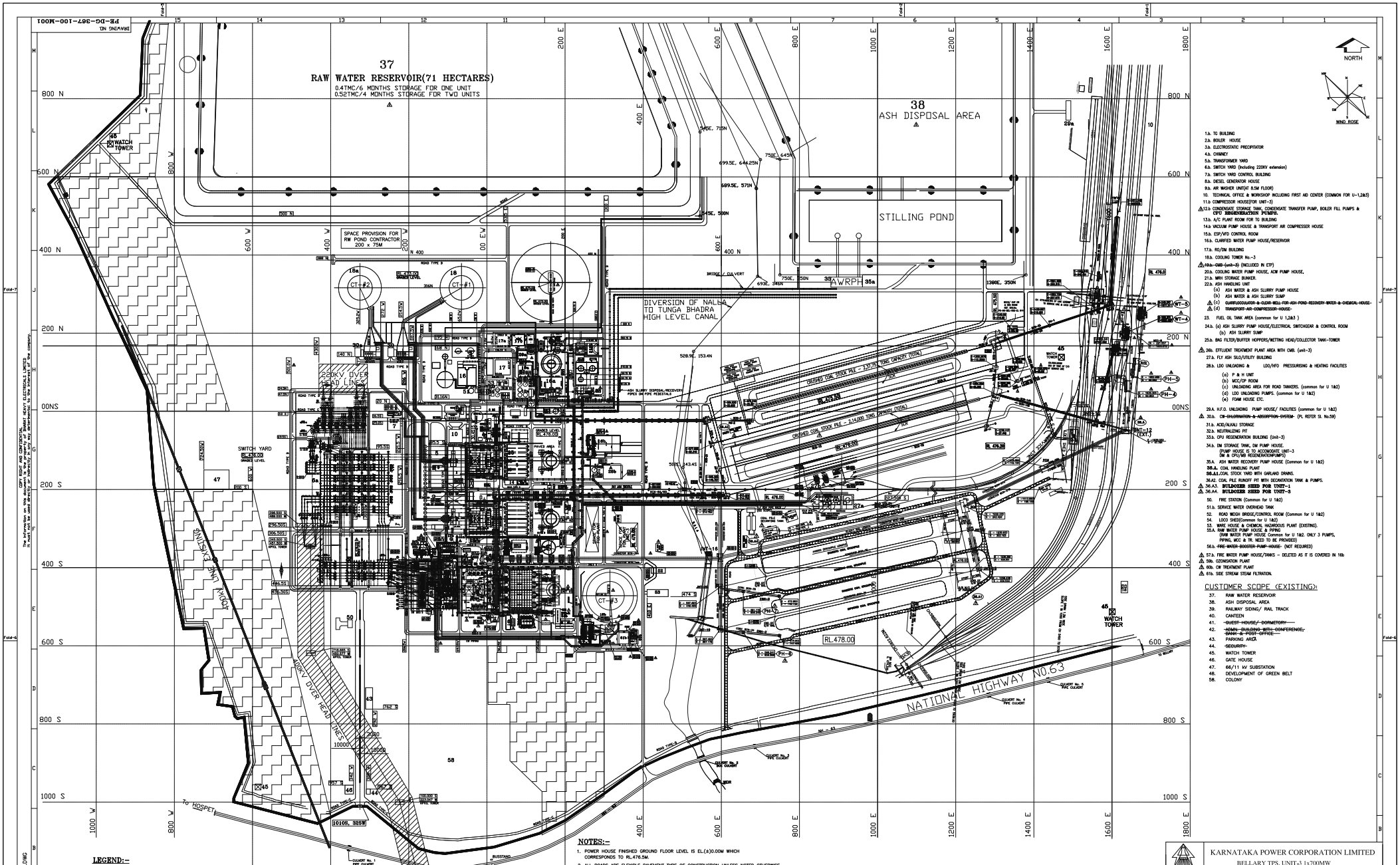
E1 Reqd. Contents : This document must provide an overview of the device including its intended use(a general technical,communication & electrical details)

Format for exchange of signals with DDCMIS							
Serial No	**Tag name**	**Tag Description**	**Modbus address**	**Point Type**	**ENGG. UNIT**	**Range**	**Function Code**

Note:

1	Tag Name and Descriptions are of that of Slave devices
2	Modbus Address is register address in Slave Device
3	Engg unit is unit of measurement Ex Pressure - bar, Temp Deg C etc
4	Point type is Analog or packed binary
5	Range applicable for analog value and is instrument range
6	Function code is Modbus function code used to update data from slave to master Ex Function Code for Read Input Register etc
7	Kindly Indicate Start and end register address for each function type and each block of data


PLAN AT EL 3.5M
HT SWITCHGEARS ROOM AT 3.5M FLOOR
(FOR DETAIL REFER ELECT DRG NO. PE-DG-367-100-E002)
AC EQUIPMENT ROOM
OZONIZATION PLANT
CABLE VAULT (EL0.0M)
UNLOADING BAY
CRITICAL PIPING BAY
T.G SET
G. CONDENSER
G. BOILER
PASSAGE AT 0.0 M
SPACE FOR C.P.U.
CEP
GAS CYLINDER ROOM
PLATFORM AT 0.0M & 2.2M LEVEL
PLATFORM AT 8.0/8.5M LEVEL
1st ROW BOILER COL.
LEGEND:
CHEQUERED PLATE FLOORING
REMOVABLE CHEQUERED PLATE
GRATED FLOORING
REMOVABLE GRATING
CONCRETE BLOCK
HAND RAILING
PARAPET WALL
GLASS PARTITION
CUT OUTS
BRICK WALL
NOTES
1. ALL DIMENSIONS ARE IN MM AND ELEVATIONS IN METERS UNLESS STATED OTHERWISE.
2. ALL ELEVATIONS MARKED ARE W.R.T. FINISHED FLOOR ELEVATION 0.0 M WHICH CORRESPONDS TO RL 476.0M.
3. ARCHITECTURAL DETAILS (WALLS/DOORS/WINDOWS/FLOORINGS ETC.) SHALL BE FINALISED IN DETAIL DRAWINGS OF EACH AREA.
4. FOR OPENING DETAILS OF CABLE RISERS REFER RESPECTIVE CABLE LAYOUT DRAWINGS. FOR DETAILS OF CABLE SLITS/ TRENCH REFER RESPECTIVE CABLING LAYOUT DRAWINGS.
5. FOR STAIRCASE DETAILS REFER RESPECTIVE STAIRCASE DRAWINGS
KARNATAKA POWER CORPORATION LIMITED
BELLARY THERMAL POWER STATION
1x700MW, UNIT-3
Tractebel Engineering Pvt. Ltd
BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NOIDA
JOB NO. 367
STATUS CONTRACT
DISTRIBUTION
T.G. EQUIPMENT LAYOUT PLAN AT EL. 0.0M
DRAWING NO. PE-DG-367-100-M003
SHEET 1 OF 1
REV. 04



NORTH

WIND ROSE

1a. TG BUILDING
2a. BOILER HOUSE
3a. ELECTROSTATIC PRECIPITATOR
4a. CHIMNEY
5a. TRANSFORMER YARD
6a. SWITCH YARD (Including 220KV extension)
7a. SWITCH YARD CONTROL BUILDING
8a. DIESEL GENERATOR HOUSE
9a. AIR WASHER UNIT(AT 8.5M FLOOR)
10. TECHNICAL OFFICE & WORKSHOP INCLUDING FIRST AID CENTER (COMMON FOR U-1,2&3)
11a. COMPRESSOR HOUSE(FOR UNIT-3)
△12a. CONDENSATE STORAGE TANK, CONDENSATE TRANSFER PUMP, BOILER FILL PUMPS & CPU REGENERATION PUMPS.
13a. A/C PLANT ROOM FOR TG BUILDING
14a. VACUUM PUMP HOUSE & TRANSPORT AIR COMPRESSER HOUSE
15a. ESP/MFD CONTROL ROOM
16a. CLARIFIED WATER PUMP HOUSE/RESERVOIR
17a. RO/DM BUILDING
18a. COOLING TOWER No.-3
~~△19a. CMB (unit-3)~~ (INCLUDED IN ETP)
20a. COOLING WATER PUMP HOUSE, ACW PUMP HOUSE.
21a. MRH STORAGE BUNKER.
22a. ASH HANDLING UNIT
(a) ASH WATER & ASH SLURRY PUMP HOUSE
(b) ASH WATER & ASH SLURRY SUMP.
△(c) ~~CLARIFLOCCULATOR & CLEAR WELL FOR ASH POND RECOVERY WATER & CHEMICAL HOUSE.~~
△(d) ~~TRANSPORT AIR COMPRESSOR HOUSE.~~
23. FUEL OIL TANK AREA (common for U 1,2&3)
24a. (a) ASH SLURRY PUMP HOUSE/ELECTRICAL SWITCHGEAR & CONTROL ROOM
(b) ASH SLURRY SUMP
25a. BAG FILTER/BUFFER HOPPERS/WETTING HEAD/COLLECTOR TANK-TOWER
△26a. EFFLUENT TREATMENT PLANT AREA WITH CMB. (unit-3)
27a. FLY ASH SILO/UTILITY BUILDING
28a. LDO UNLOADING & LDO/HFO PRESSURISING & HEATING FACILITIES
(a) P & H UNIT
(b) MCC/CP ROOM
(c) UNLOADING AREA FOR ROAD TANKERS. (common for U 1&2)
(d) LDO UNLOADING PUMPS. (common for U 1&2)
(e) FOAM HOUSE ETC.
29A. H.F.O. UNLOADING PUMP HOUSE/ FACILITIES (common for U 1&2)
△30a. ~~CW CHLORINATION & ABSORPTION SYSTEM~~ (PL REFER Sl. No.59)
31a. ACID/ALKALI STORAGE
32a. NEUTRALIZING PIT
33a. CPU REGENERATION BUILDING (Unit-3)
34a. DM STORAGE TANK, DM PUMP HOUSE.
(PUMP HOUSE IS TO ACCOMODATE UNIT-3 DM & CPU/WB REGENERATION PUMPS)
35A. ASH WATER RECOVERY PUMP HOUSE (Common for U 1&2)
36A. COAL HANDLING PLANT
36A.a1.COAL STOCK YARD WITH GARLAND DRAINS.
36A.a2. COAL PILE RUNOFF PIT WITH DECANTATION TANK & PUMPS.
△36A.a3. **BULDOZER SHED FOR UNIT-1**
△36A.a4. **BULDOZER SHED FOR UNIT-3**
50. FIRE STATION (Common for U 1&2)
51a. SERVICE WATER OVERHEAD TANK
52. ROAD WEIGH BRIDGE/CONTROL ROOM (Common for U 1&2)
54. LOCO SHED(Common for U 1&2)
53. WARE HOUSE & CHEMICAL HAZARDOUS PLANT (EXISTING).
55A.A RAW WATER PUMP HOUSE & PIPING.
(RAW WATER PUMP HOUSE Common for U 1&2. ONLY 3 PUMPS, PIPING, MCC & TR. NEED TO BE PROVIDED)
56.b. ~~FIRE WATER BOOSTER PUMP HOUSE~~ (NOT REQUIRED)
△57.b. FIRE WATER PUMP HOUSE/TANKS – DELETED AS IT IS COVERED IN 16b
△59b. OZONISATION PLANT
△60b. CW TREATMENT PLANT
△61b. SIDE STREAM STEAM FILTRATION.

CUSTOMER SCOPE (EXISTING):

37. RAW WATER RESERVOIR
38. ASH DISPOSAL AREA
39. RAILWAY SIDING/ RAIL TRACK
40. CANTEEN
41. ~~GUEST HOUSE/ DORMITORY~~
42. ~~ADMN. BUILDING WITH CONFERENCE, BANK & POST OFFICE~~
43. PARKING AREA
44. ~~SECURITY~~
45. WATCH TOWER
46. GATE HOUSE
47. 66/11 kV SUBSTATION
48. DEVELOPMENT OF GREEN BELT
58. COLONY

LEGEND:-

- RAILWAY TRACK
- FUTURE
- BOUNDARY
- FENCING
- EFFLUENT DRAIN
- STORM WATER DRAIN
- ROAD
- GREEN BELT AREA
- ROADS IN COAL HANDLING AREAGREEN BELT AREA

NOTES:-

1. POWER HOUSE FINISHED GROUND FLOOR LEVEL IS EL.(±)0.00M WHICH CORRESPONDS TO RL.476.5M.
2. ALL ROADS ARE FLEXIBLE PAVEMENT TYPE OF CONSTRUCTION UNLESS NOTED OTHERWISE.
   WIDTH OF ROAD ARE AS FOLLOWS:
   a) TYPE AA—— 23m WIDE WITH TWO CARRIAGEWAYS OF 10m WIDE WITH 3m REFUGE
   b) TYPE B —— 17m WIDE WITH TWO CARRIAGEWAYS OF 7m WIDE WITH 3m REFUGE
   c) TYPE B —— 7m WIDE
   c) TYPE C —— 4m WIDE
   d) TYPE D —— 5m WIDE CONCRETE ROAD WITH RAILS
   e) TYPE E —— 5m WIDE CONCRETE ROAD
   f) TYPE F —— 7m WIDE CONCRETE ROAD
   g) TYPE G —— 7m WIDE CONCRETE ROAD WITH RAIL
3. FINISHED TOP OF ROADS SHALL BE 250mm ABOVE THE SURROUNDING GRADE LEVEL IN MAIN PLANT GRADED AREA.
4. ALL ROADS INDICATED ON THIS DWG ARE SUGGESTIVE ONLY AND ARE IN CUSTOMERS SCOPE
5. PIPE/CABLE RACKS ARE INDICATIVE ONLY & FINAL DETAIL SHALL BE AS PER SEPERATE DETAILED DWG.

REV.	DATE	ALTD	CHD	APPD
5	30.05.2013	LUS/SBJ	AMH	AJ
4	15.12.2012	LUS	AMH	AJ
3	22.06.2012	SUHEL	AMH	AJ
2	07.03.2012	GS	SBJ/AMH	AJ
1	01.07.2011	GS	SBJ/	AJ/

JOB NO. 367
STATUS CONTRACT
DISTRIBUTION

KARNATAKA POWER CORPORATION LIMITED
BELLARY TPS, UNIT-3 1x700MW
CONSULTANT
TRACTEBEL ENGINEERING PVT. LTD
BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NEW DELHI

DEPT. CODE	NAME	SIGN	DATE
DRN	SBJ		06.05.2011
DES'N	AMH/SBJ		02.05.2011
CHD	AM /HUSSAIN		06.05.2011
APPD	ANIL JOSHI		02.05.2011

TITLE
PLOT PLAN

DEPT. SCALE 1:9000 DRAWING NO. PE-DG-367-100-M001
SIGN
DATE
SHEET 1 OF 1 REV. 5

FORMAT SIZE: A0

DRAWING NO PE-DG-367-100-M001

ELECTRONIC FILE NAME: 367_100_M001_R5.DWG

LIST OF SCHEDULES

SUGGESTIVE PRICE FORMAT FOR OZONE GENERATION PLANT: 1X700 MW BELLARY THERMAL POWER STATION UNIT NO. 3, STAGE-3

Sl. No.	DESCRIPTION OF EQUIPMENT / ITEM	TOTAL PRICE FOR "FOR" SITE
(1)	(2)	(3)
1.0	Total lump sum firm price on FOR site basis for design, engineering, manufacturing, painting, inspection & testing, supply, delivery, installation, packing and forwarding of equipments to site, loading, unloading, storage and handling at site, in site transportation, complete with all accessories including start up and commissioning spares, site testing, erection, testing & commissioning, trial run, performance guarantee test and handing over to customer inclusive of all prevailing taxes, duties and other levies as required of **OZONE GENERATION PLANT** and as defined in the technical specification (**PE-TS-367-174-14000A-A001 REV 01**) for **1X700 MW BELLARY THERMAL POWER STATION UNIT NO. 3, STAGE-3**	
	NOTES:	
a	Bidder to note that total price indicated above at 1.0 shall be considered for evaluation and hence, should be complete in all respect for the full scope defined and considering all terms and conditions agreed.	
b	In case, price indicated above does not match with item wise break-up given at 2.0, the highest price so calculated shall be considered for evaluation but in case of order, the same shall be placed at the lowest price.	
2.0	**BREAK-UP OF PRICES GIVEN IN 1.0 ABOVE**	
2.1	Total lump sum firm price for **EQUIPMENT (SUPPLY)** for design, engineering, manufacturing, painting, inspection & testing, supply, delivery, installation, packing and forwarding of equipments to site, complete with all accessories including start up and commissioning spares, inclusive of all taxes & duties for the complete scope of supply of **OZONE GENERATION PLANT** and as defined in the technical specification (**PE-TS-367-174-14000A-A001 REV 01**) for **1X700 MW BELLARY THERMAL POWER STATION UNIT NO. 3, STAGE-3**.	
2.2	Total lump sum firm price for all services including unloading, handling & transportation at site , insite transportation, Erection & Commissioning, trial run, performance guarantee test, preparation & submission of "As Built" drawings, etc, required for completion of **OZONE GENERATION PLANT and** as defined in the technical specification **(PE-TS-367-174-14000A-A001 REV 00)** for **1X700 MW BELLARY THERMAL POWER STATION UNIT NO. 3, STAGE-3**.	
2.3	PG test and handing over the plant to customer.	
3.0	Recommended spares for three (3) years normal operation (optional item)	
4.0	Break-up (%) of prices given at Sl No-2.1 above (To be used during contract execution for payment)	
4.1	Lumpsum firm price for supply of Ozonators with accessories inclusive of all taxes, duties and other levies as applicable.	35% of sl no 2.1 above.
4.2	Lumpsum firm price for supply of Compressor with accessories inclusive of all taxes, duties and other levies as applicable.	15% of sl no 2.1 above.
4.3	Lumpsum firm price for supply of Oxygen Generation plant (air receiver, air dryer, oxygen generator, oxygen receiver) with accessories inclusive of all taxes, duties and other levies as applicable.	20% of sl no 2.1 above.
4.4	Lumpsum firm price for supply of Tanks, Pumps, Valves, piping and chillers with accessories inclusive of all taxes, duties and other levies as applicable.	13% of sl no 2.1 above.
4.5	Lumpsum firm price for supply of PLC and instruments with accessories inclusive of all taxes, duties and other levies as applicable.	15% of sl no 2.1 above.
4.6	Lumpsum firm price for supply of Miscellaneous scope with accessories inclusive of all taxes, duties and other levies as applicable.	2% of sl no 2.1 above.

COMPLIANCE CUM CONFIRMATION SCHEDULE

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

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

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

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

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

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

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

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

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

i.) Performance Guarantees shall stand valid till the satisfactory completion of performance testing and its acceptance by purchaser/customer

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

DEVIATION SHEET (COST OF WITHDRAWL)

PROJECT:-1X700 MW BELLARY THERMAL POWER STATION UNIT NO. 3, STAGE-3

PACKAGE:- OZONE GENERATION PLANT

TENDER ENQUIRY REFERENCE:-

NAME OF BIDDER:-

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

PARTICULARS OF BIDDERS/ AUTHORISED REPRESENTATIVE

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

NOTES:

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

	TITLE *** SCHEDULE OF DECLARATIONS**	**BHEL DOCUMENTS NO.: PE-TS-367-174-14000A-A001** VOL III SHEET…….. OF……

*** Bidder shall include this schedule both in technical and Price offers**

DECLARATION

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

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

Biders Company Name …….

Authorised representative's
Signature ……..

Name …….

Bider's Name

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

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