INDEX

SL. NO.	PUMP DESCRIPTION	PUMPS MODELS	MOTOR RATING	DATA SHEET NO
1	CONDENSATE TANSFER PUMPS	K5523- 150X125	55 KW / 4 PL	5297 - 30 / PS

					NTPC DOC. NO. 9915-371-110-PEM-QVE-Q-160	
					CUSTOMER	THDC INDIA LIMITED
					PROJECT	**2X660 MW Khurja SUPER THERMAL POWER PROJECT (TG & Associated Packages)**
					CONSULTANT	NTPC LTD.
JOB NO.		**475**			MAIN CONTRACTOR	BHARAT HEAVY ELECTRICALS LTD.
STATUS		**CONTRACT**				PS-PEM NOIDA
REV	DATE	ALTD	CHKD	APPD		FLOWMORE LIMITED
00	02.12.2021	Madh	Priyank	PS		**QP- MOTORS (HORIZONTAL)**
					BHEL	DOCUMENT NO: PE-V7-475-100-N005
					SIGN	
					DATE	REV – 00

ENDORSEMENT SHEET FOR QP

REFERENCE / *STANDARD* / FIELD QUALITY PLAN (RQP ~~/ SQP/RFQP/SFQP~~)

TO BE FILLED IN BY SUPPLIER AT TIME OF SUBMISSION		To be filled in by NTPC
PROJECT NAME	2 x 660 MW THDC khurja STPP	*REVIEW & ENDORSEMENT BY NTPC* **PROJECT SPECIFIC QP NUMBER ALLOTTED** **QP NO.:** 9915-371-110-PEM-QVE-Q-160 **REV. NO.:** 00 **DATE:** 03.12.2021 ** The **RQP/~~SQP/RFQP/SFQP~~** once endorsed for a particular contract shall remain valid even though the original QP may have expired or revised, unless / otherwise mutually agreed with the supplier. ①
CONTRACT NO.:	9915	
MAIN SUPPLIER	**BHARAT HEAVY ELECTRICAL LIMITED**	
MANUFACTURER WORKS & ADDRESS	**CG POWER AND INDUSTRIAL SOLUTION LIMITED, A – 6/2 MIDC INDUSTRIAL AREA AHMEDNAGAR - 414111**	
ITEM /EQUIPMENT / SYSTEM/ SUB-SYSTEM DETAILS i.e. MODEL TYPE / SIZE /RATING etc.	**MOTOR FOR CONDENSATE TRANSFER PUMP – 55 KW / 4 PL HORIZONTAL (2 NOS.)**	
APPROVED QP NO.: RQP/~~SQP/RFQP/SFQP~~	**000-999-QVE-P-44 REV-04 DTD 20 – 06 - 2012**	
Confirmation by Main Supplier (TICK WHICHEVER APPLICABLE)		*(TICK APPLICABLE)*
√*I. That the item/ component is identical to that considered for QP approval.* **OR.**		**The QP is endorsed for this project without any change** ✓
II. That there are minor changes in the item/ component with respect to that considered for QP approval, however the same do not affect the contents of QP. **OR**		
III. That there are minor changes in the item/ component with respect to that considered for QP approval, however the same affect the QP slightly, as indicated below / in attached sheet.		**The QP is endorsed for this project with changes as indicated.**
		DISTRIBUTION OF ENDORSEMENT OF **A) RQP/SQP:** *1. MAIN SUPPLIER (WITH A COPY OF QP)* *2. MANUFACTURER* *3. RIO* *4. CQA-SPL* *5. CQA-O/C* **B) RFQP/SFQP:** *1. MAIN SUPPLIER (with a copy of QP)* *2. MANUFACTURER* *3. NTPC FQA (with a copy of QP)* *4. NTPC Erection (with a copy of QP)* *5. CQA-SPL* *6. CQA-O/C*

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ENDORSEMENT SHEET FOR QP

REFERENCE / *STANDARD* / <u>FIELD</u> QUALITY PLAN (RQP ~~/ SQP/RFQP/SFQP~~)

TO BE FILLED IN BY SUPPLIER AT TIME OF SUBMISSION		To be filled in by NTPC
SIGN.: (Main Supplier) *DATE: 02.12.2021*	*SIGN.: (Manufacturer)* *DATE: 02.12.2021*	**NTPC (Reviewed /Approved by/ Date & Seal)**

MANUFACTURER'S NAME & ADDRESS	REFERENCE QUALITY PLAN			To be filled in by NTPC
CROMPTON GREAVES LTD LT MOTORS DIVISION A-6/2, MIDC AHMEDNAGAR – 414111 MAHARASHTRA	Item /equipment : LT INDUCTION MOTORS (50KW TO 200 KW) sub-system :	QP No.: NTPC-RQP 1 Rev. No.:'4' Date:- PAGE : Page 1 of 5	SIGN OF MANUFACTURER MiQ	QP No.: 0000-999-QVE-P-044 Rev. No.: 4 Date :-20-6-12 Valid upto:19-06-15	Reviewed by: V SHRIVASTAV RAJIV GARG P K BASU	Approved By: AK GARG

Sr. No.	ITEM	Characteristics	Class	Type of Check	Quantum of check M	Quantum of check C/N	Reference Documents	Acceptance Norms	Format of Record	Agency D*	Agency M	Agency C	Agency N	Remarks
1	2	3	4	5	6		7	8	9	10				11
A. INCOMING INSPECTION: RAW MATERIAL / COMPONENT														
1	COPPER WIRE dual coated enameled round copper wire	1.Dimension	MA	Measurement	1 Sample / lot	1 Sample/lot	MSA-091-02-R0	MSA-091-02R0	Inspn. Record		P	V	--	
		2.Elongation	MA	Mechanical	-do-	-do-	-do-	-do-	-do-		P	V	--	
		3.Mandrel Winding Test	MA	Visual	-do-	-do-	-do-	-do-	-do-		P	V	--	
		4.Peel Test	MA	Test	-do-	-do-	-do-	-do-	-do-		P	V	--	
		5.BD Voltage Test	CR	Electrical	-do-	-do-	-do-	-do-	-do-		P	V	V	
		6.Cut Through Test	MA	Electrical	-do-	-do-	-do-	-do-	-do-		P	V	--	
		7.Heat Shock Test	MA	Test	-do-	-do-	-do-	-do-	-do-		P	V	--	
		8.Resistance	MA	Electrical	-do-	-do-	-do-	-do-	-do-		P	V	--	
		9.Springiness	MA	Mechanical	-do-	-do-	-do-	-do-	-do-		P	V	--	
		10.Abrasion Test	MA	Performance	-do-	-do-	-do-	-do-	-do-		P	V	--	
		11.Continuity Test	MI	Electrical	-do-	-do-	-do-	-do-	-do-		P	V	--	
		12.Tan Delta bending Point test	MA	Thermal	Each supplier once a month	-do-	-do-	-do-	-do-		V	V	V	
2	STEEL SHAFT Straightened steel bar in black finish	1.Dimension – OD	MA	Measurement	1 Sample/lot/heat	-do-	MSA-072-01R0	MSA-072-01R0	Supp. TC	√	V	V	--	
		2.Hardness	MA	Measurement	1 Sample/lot/heat	-do-	-do-	-do-	-do-	√	V	V	--	
		3.Chemical comp.	MI	Chemical	1 Sample/lot/heat	-do-	-do-	-do-	-do-	√	V	V	V	
		4.Tensile strength	MA	Mechanical	1 Sample/lot/heat	-do-	-do-	-do-	-do-	√	V	V	V	
		5.Yield strength	MA	Mechanical	1 Sample/lot/heat	-do-	-do-	-do-	-do-	√	V	V	--	
		6.% Elongation	MA	Mechanical	1 Sample/lot/heat	-do-	-do-	-do-	-do-	√	V	V	--	
		7.Ultrasonic test	MA	Mechanical	100%	-do-	-do-	-do-	-do-	√	V	V	V	
		8.Metallographic test	MA	Chemical	1 Sample/lot/heat	-do-	-do-	-do-	-do-	√	V	V	V	
		9 Normalizing	MA	Mechanical	100%	-do-	-do-	-do-	-do-	√	V	V	V	
3	AL INGOTS EC GRADE PURITY 99.5%	Chem. Comp.	MA		1 Sample/Lot	--	IS4026:1992	IS4026:1992	Supp. TC		V	--	--	

LEGENDS:* RECORDS IDENTIFIED WITH " TICK" ✓ SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION **
M: MANUFACTURER/ SUB-SUPPLIER C: MAIN SUPPLIER, N : NTPC, P: PERFORM, W : WITNESS, V: VERIFICATION.
AS APPROPRIATE CHP: NTPC SHALL BE INDICATED IN COLUMN 'N' AS 'W'

Note:# *NTPC Inspection Engineer to check, approval date/ revision no. of reference documents at the time of Inspection*

	MANUFACTURER'S NAME & ADDRESS	REFERENCE QUALITY PLAN				To be filled in by NTPC	
Small solutions Strong relationships	CROMPTON GREAVES LTD LT MOTORS DIVISION A-6/2, MIDC AHMEDNAGAR – 414111 MAHARASHTRA	Item /equipment : LT INDUCTION MOTORS (50KW TO 200 KW) sub-system :	QP No.: NTPC-RQP 1 Rev. No.:'4' Date:- PAGE : Page 2 of 5	SIGN OF MANUFACTURER MiQ	QP No.: 0000-999-QVE-P-044 Rev. No.: 4 Date :-20-6-12 Valid upto:19-06-15	Reviewed by: V SHRIVASTAV RAJIV GARG P K BASU	Approved By: Approved AK GARG

Sr. No.	ITEM	Characteristics	Class	Type of Check	Quantum of check M	Quantum of check C/N	Reference Documents	Acceptance Norms	Format of Record	Agency D*	Agency M	Agency C	Agency N	Remarks
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A. INCOMING INSPECTION: RAW MATERIAL / COMPONENT														
4	CI CASTING (Body, End Shields, T.Box, Bearing Covers)	1.Surface defects	MA	Visual	100%	100%	MSA-02-01	No defect	Inspn. Rec		P	V	--	
		2.Dimn. Conformity	MA	Measurement	1 Sample / heat	--	Comp. Drg.	Comp. Drg.	-do-		P	--	--	
		3.Hardness	MA	Mechanical	1 Sample / lot	1 Sample / lot	IS 210:1993	IS 210:1993	Supp. TC		V	V	--	
		4.Tensile strength	MA	Verification	-do-	-do-	-do-	-do-	-do-		V	V	--	
		5.Chemical comp.	MA	Verification	-do-	-do-	-do-	-do-	-do-		V	V	--	
5	ALUMINUM FAN	1.Dimension	MA	Measurement	1Sample/size/lot	--	Fan Drg.	Fan Drg.	Inspn Rec.		P	--	--	
		2.Protective paint	MA	Visual	-do-	--	-do-	-do-	-do-		P	--	--	
6	VARNISH & THINNER	1.Viscosity	MA	Ford cup	1 Sample/ lot	--	MFGR's	MFGR's	Inspn. Rec.		v	--	--	
		2.Shelf life	MA	Verification	-do-	--	Catalogue	Catalogue	Label		v	--	--	
7	Bearing	ID / OD / WIDTH	MA	Measurement	1 Sample / lot	--	MFGR's Catalogue	MFGR's Catalogue	Inspn. Rec.	√	V	--	--	Surveillance verification By NTPC
8	BRAZING ALLOYS	Chemical comp.	MA	Chemical	1 Sample / lot	--	MSA-203-01R0	MSA-203-01R0	-do-		V	--	--	
9	TERMINAL BLOCK (DMC)	1.Dimension	MA	Measurement	1 Sample / lot	--	As per drg	As per drg	Supp. TC		P	--	--	
		2.Chem. Comp.	MA	Chemical	-do-	1 Sample / lot	-do-	-do-	-do-		V	--	--	
		3.Comparative Tracking Index	MA	Electrical	-do-	--	MSA-086-01	MSA-086-01			V	V	--	
10	PAINT	Viscosity at 32 Deg C	MA	Measurement	-do-		MFGR's Catalogue	MFGR's Catalogue	Inspn. Record		P	--	--	
11	SPACE HEATER	1.IR value & HV	MA	Electrical	100%	1sample/Rating/lot	MSA-023-01R0	MSA-023-02R0	Inspn Report		P	--	-	
		2.Resistance	MA	-do-	100%	-do-	-do-	-do-	-do-		P	--	-	
12	STAMPINGS	1.Thickness	MA	Measurement	1 Sample / lot	-do-	Stamping.drg.	Comp. drg.	Supp.TC		V	V	V	
		2.Waviness	MA	Visual	-do-	-do-	MSA-060-01R0	MSA-060-01R0	-do-		V	V	V	
		3.Burr height	MA	Measurement	-do-	-do-	-do-	<50 micron.	-do-		V	V	V	
		4.Coating Thickness	MA	Mechanical	-do-	-do-	-do-	MSA-060-01	-do-		V	V	V	
		5.Permeability	MA	Electrical	-do-	-do-	-do-	-do-	-do-		V	V	V	
		6.Specific core loss	MA	Electrical	-do-	-do-	-do-	-do-	-do-		V	V	V	
		7.IR	MA	Electrical	-do-	-do-	-do-	-do-	-do-		V	V	V-	

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	MANUFACTURER'S NAME & ADDRESS	REFERENCE QUALITY PLAN				To be filled in by NTPC		
Smart solutions. Strong relationships.	CROMPTON GREAVES LTD LT MOTORS DIVISION A-6/2, MIDC AHMEDNAGAR – 414111 MAHARASHTRA	Item /equipment : LT INDUCTION MOTORS (50KW TO 200 KW) sub-system :	QP No.: NTPC-RQP 1 Rev. No.:'4' Date:- PAGE : Page 3 of 5	SIGN OF MANUFACTURER MIQ	QP No.: 0000-999-QVE-P-044 Rev. No.: 4 Date :-20-6-12 Valid upto:19-06-15	Reviewed by: V SHRIVASTAV RAJIV GARG P K BASU	Approved By: AK GARG	

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1	2	3	4	5	6		7	8	9		10			11
13	STATOR CORE PACK	1.Dimn. Conformity (core length. & Dia.)	MA	Measurement	1 Sample / lot	–	MSA-060-02R0	MSA-060-02R0	Inspn. Report		P	–	–	
		2.Alignment of slot	MA	Visual	-do-	–	-do-	-do-	-do-		P	–	–	
		3.Deburring and cleanliness	MA	Visual	-do-	–	-do-	-do-	-do-		P	–	–	
14	SLOT INSULATION (Class 'F')	1.Tensile Strength	MA	Mechanical	1 Sample/lot	–	MSA-088-09R0	MSA-088-09R0	Supp.TC		V	–	–	
		2.Elongation at break	MA	-do-	-do-	–	-do-	-do-	-do-		V	–	–	
		3.BDV as recd. & after ageing	CR	Electrical	-do-	1 Sample / lot	-do-	-do-	-do-		V	V	–	
		4.IR Value	MA	Electrical	-do-	–	-do-	-do-	-do-		V	–	–	
15	VARNISH FG SLEEVE (Class 'F')	1.Dimn. - Bore dia Thickness	MA	Measurement	1 Sample/lot	–	MSA-088-07R0	MSA-088-07R0	Supp.TC		P	–	–	
		2.BDV as recd. &after ageing	CR	Electrical	-do-		-do-	-do-	-do-		P	–	–	
		3.IRValue	MA	-do-	-do-		-do-	-do-	-do-		P	–	–	
		4. Glass content conformity	MA	Chemical	1 Sample/lot	–	MSA-088-07R0	MSA-088-07R0	Supp. TC		V	–	–	
		5. Varnish compatibility	MA	Chemical	-do-	–	-do-	-do-	-do-		V	–	–	
		6. Bending before and after aging	MA	Mechanical	-do-	–	-do-	-do-	-do-		V	–	–	
		7. Voltage proof test in air at room temp & at 150C	MA	Electrical	-do-	–	-do-	-do-	-do-		V	–	–	
		8. Stability of coating	MA	Chemical	-do-	–	-do-	-do-	-do-		V	–	–	
		9. Self extinguishing	MA	Chemical	-do-	–	-do-	-do-	-do-		V	–	–	
16	GASKET	1.Shore hardness	MA	Mechanical	1 Sample/lot	–	MSA 162-01R0	MSA 162-01R0	Inspn Record		P	–	–	
		2.Ageing test	MA	Thermal	-do-	–	-do-	-do-	Supp.TC		V	–	–	
		3.Flame test	MA	Chemical	-do-	1 Sample / lot	-do-	-do-	-do-		V	V	V	
		4.Neoprene conformity	MA	Chemical	-do-	-do-	-do-	-do-	-do-		V	V	V	
		5.Dimn.	MA	Mechanical	1 Sample /lot	–	Gasket Drg	Gasket Drg	Inspn Record		P	–	–	

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Smart solutions. Strong relationships.	CROMPTON GREAVES LTD LT MOTORS DIVISION A-6/2, MIDC AHMEDNAGAR – 414111 MAHARASHTRA	Item /equipment : LT INDUCTION MOTORS (50KW TO 200 KW) sub-system :	QP No.: NTPC-RQP 1 Rev. No.:'4' Date:- PAGE : Page 4 of 5	SIGN OF MANUFACTURER MiQ	QP No.: 0000-999-QVE-P-044 Rev. No.: 4 Date :-20-6-12 *Valid upto:19-06-15*	Reviewed by: V SHRIVASTAV RAJIV GARG P K BASU	Approved By: AK GARG

Sr. No.	ITEM	Characteristics	Class	Type of Check	Quantum Of check		Reference Documents	Acceptance Norms	Format of Record	Agency				Remarks
					M	C/N				D*	M	C	N	
1	2	3	4	5	6		7	8	9	10				11
B	IN PROCESS INSPN. :													
1	MACHINED CASTINGS (BODY, END SHIELDS, T.BOX, BEARING Covers	1.Dimn.	CR	Measurement	100%		Comp.Drg.	Comp.Drg.	Inspn Record		P	--	--	No blow -holes on machined surface of castings & no welding on casting permitted
		2 Concentricity/ Perpendicularity of machined surface	MA	Mechanical	10%		-do-	-do-	-do-		P	--	--	
		3.Blow holes	MA	Visual	100%	--	No blow hole	No blowhole	-do-		P	--	--	
		4 Pressure testing [4] (For Flameproof Motors only)	MA	Mechanical	100%	100%	MSA-02-02R0	MSA-02-02R0	Inspn Record		P	V	V	
2	COIL FORMING	1 Conductor dia	MA	Measurement	100%	--	Winding MO	Winding MO.	-do-		P	--	--	
		2. No. of turns	MA	Visual	100%		-do-	-do-	-do-		P			
3	WOUND STATOR	1.Resistance	MA	Electrical	100%	--	-do-	-do-	-do-		P	--	--	
		2.HV Test	MA	-do-	-do-	--	-do-	-do-	-do-		P	--	--	
		3.Interturn (Surge Test)	MA	-do-	-do-	--	-do-	-do-	-do-		P	--	--	
		4.Polarity	MA	-do-	-do-	--	-do-	-do-	-do-		P	--	--	
		5. Impregnation : VPI	MA	Mechanical	100%	1/RATING/LOT	SP05	SP05	Inspn. Record		P	V	V	
		6.Workmanship (joints, Slot Wedges, tightness & connections)	MA	Visual	100%	--	-do-	-do-	-do-		P	--	--	
4	MACHINED SHAFT	1.Dimn Conformity	CR	Mechanical	100%	--	Shaft Drg.	Shaft Drg.	Inspn. Record		P		--	
		2.Concentricity of Shaft	MA	-do-	-do-	--	-do-	-do-	-do-		P	--	--	
		3.M/cing finish, radius, chamfer	MA	Visual	-do-	--	-do-	-do-	-do-		P	--	--	
5	DIE CAST ROTOR	1. Core length	MA	Measurement	100%	--	M.O.	M.O.	Inspn. Record		P		--	
		2.Free from blow-holes, cracks	MA	Visual	100%	--	-do-	-do-	-do-		p	--	--	
6	MACHINED ROTOR	1.Dimn. - OD	CR	Measurement	100%	1 Sample / lot	-do-	-do-	Inspn. Record		P	--	--	
		2.Concentricity w.r.t. Bearing seat	MA	Mechanical	10%	-do-	-do-	-do-	-do-		P	--	--	
7	ROTOR	Dynamic balancing of Rotors at rated speed [4]	MA	Mechanical	100%	100 %	A18 R0 & TS A16 R1	ISO: 1940 Grade- G 2.5	Inspn. Record	√	P	V	V	
8	FAN	Fan Balancing	MA	Mechanical	100%	100%	TS-A19-R0	ISO: 1940 Grade -G2.5	Inspn.Record	√	P	V	V	
9	ASSEMBLED MOTOR	Name Plate data, T. box location,	MA	Visual	100%	1 Sample / lot	TS: A20R5	TS: A20 R5	Inspn. Record		P	V	V	
		Flame path joint Gap for Flame proof motors [4]	MA	Mechanical	100%	100%	IS2148	IS2148	Inspn. Record		P	V	V	

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		VERIFICATION OF TYPE TEST CLEARANCE FROM NTPC ENGG												
C.	FINAL INSPECTION:	1. Marking on the Name Plate	MA	Visual	100%	100%	IS:325/ NTPC Specn/	IS:325/ NTPC Specn/	TC	√	P	W	W	
	ROUTINE TEST	2. a) Paint Shade	MA	Mechanical	-do-	-do-	Appd D/S,&Drg	Appd D/S,&Drg	TC	√	P	W	W	
		b) Paint Thickness (On casting surface)	MA	Mechanical	1 sample /Lot	1 sample /Lot	-do-	Min 100 microns	TC	√	P	W	W	
		c) Scratch Test	MA	Mechanical	-do-	-do-	-do-	No Peel-off						
		3.Location of T.Box.	MA	Visual	100%	100%	Appd D/S	Appd D/S	TC	√	P	W	W	
		4.IR test before & after HV on Main wdg. & Sp.Heater.	MA	Electrical	-do-	-do-	IS-325	IS-325	TC	√	P	W	W	
		5.HV on Main Wdg. & Space Heaters	MA	-do-	-do-	-do-	-do-	-do-	TC	√	P	W	W	
		6.Measurement of Wdg. Res.	MA	-do-	-do-	-do-	-do-	CGL-TS-35	TC	√	P	W	W	
		7.No Load Test	MA	-do-	-do-	-do-	-do-	Appd D/S,&Drg	TC	√	P	W	W	
		8.Locked Rotor Test at reduced voltage	MA	-do-	-do-	-do-	-do-	CGL-TS-35	TC	√	P	W	W	
		9.Reduced voltage running in both directions (1/^3 Un)	MA	-do-	-do-	-do-	-do-	IS325	TC	√	P	W	W	
		10.Overspeed test (120% of rated speed) for 2 min.	MA	Mechanical	-do-	-do-	-do-	-do-	TC	√	P	W	W	
		11. Vibration Test at rated speed & voltage	MA	Mechanical	-do-	-do-	IS12075	IS12075	TC	√	P	W	W	
		12.Degree of Protection By insertion of 1 mm thick wire	MA	Mechanical	-do-	-do-	-do-	IS:325/IS:4029	TC	√	P	W	W	
		13.Mounting & overall dimension	MA	Measurement	-do-	1Sample/rating/Lot	-do-	As per D/S & Drg	TC	√	P	W	W	
D.	DISPATCH INSPECT-IONS	Case Marking.	MA	Visual	100%	--	Manufacturing Order	Manufacturing Order	Manufacturing Order		P	--	--	

LEGENDS:* RECORDS IDENTIFIED WITH * TICK* ✓ SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION ** M: MANUFACTURER/ SUB-SUPPLIER C: MAIN SUPPLIER N : NTPC, P: PERFORM, W : WITNESS, V: VERIFICATION. AS APPROPRIATE CHP: NTPC SHALL BE INDICATED IN COLUMN 'N' AS 'W'

Note:# NTPC Inspection Engineer to check, approval date/ revision no. of reference documents at the time of inspection

SUB-SECTION–E-42

MOTORS

MOTOR

TESTS/CHECKS / TEMS/COMPONENTS	Visual	Dimensional	Make/Type/Rating /General Physical Inspection	Mech/Chem. Properties	NDT /DP/MPI/UT	Metallography	Electrical Characteristics	Welding/Brazing(WPS/PQR)	Heat Treatment	Magnetic Characteristics	Hydraulic/Leak/Pressure Test	Thermal Characteristics	Run out	Dynamic Balancing	Routine & Acceptance tests as per IS-4722 /IS- 9283/IS 2148/IEC60034\IEC 60079-I/ IS-12615	Vibration	Over speed	Tan delta, shaft voltage & polarization index test	Paint shade, thickness & adhesion
Plates for stator frame, end shield, spider etc.	Y	Y	Y	Y	Y				Y										
Shaft	Y	Y	Y	Y	Y	Y			Y										
Magnetic Material	Y	Y	Y	Y			Y			Y		Y							
Rotor Copper/Aluminium	Y	Y	Y	Y			Y		Y										
Stator copper	Y	Y	Y	Y			Y		Y			Y							
SC Ring	Y	Y	Y	Y	Y		Y	Y	Y										
Insulating Material	Y		Y	Y			Y					Y							
Tubes, for Cooler	Y	Y	Y	Y	Y				Y		Y								
Sleeve Bearing	Y	Y	Y	Y	Y				Y		Y								
Stator/Rotor, Exciter Coils	Y	Y	Y				Y	Y											
Castings, stator frame, terminal box and bearing housing etc.	Y	Y	Y	Y	Y			Y											
Fabrication & machining of stator, rotor, terminal box	Y	Y			Y			Y	Y										
Wound stator	Y	Y					Y	Y											
Wound Exciter	Y	Y					Y	Y											
Rotor complete	Y	Y					Y						Y	Y					
Exciter, Stator, Rotor, Terminal Box assembly	Y	Y					Y												
Accessories, RTD, BTD, CT, Space heater, antifriction bearing, gaskets etc.	Y	Y	Y																

Complete Motor	Y	Y	Y												Y	Y	Y	Y1	Y

Note:

1. The manufacture is to furnish a detailed Quality Plan indicating the practices & Procedure followed along with relevant supporting documents during QP finalization. However, following methodology to be followed for Inspection Categorization:

Note for LT Motor:

i) Motor rating up to 50 KW: Inspection CAT- III : Acceptance of Motor up to 50 KW is based on COC of the Manufacturer and Main Contractor confirming as follows:

"It is hereby confirmed that the above mentioned motor /motors was/ were manufactured taking care of NTPC specific requirements regarding ambient temp., voltage frequency variation, hot starts, pull out torque, starting KVA/KW, temperature rise, distance between center of stud gland plate and tested in accordance with approved drawing /data sheets."

ii) Motor rating above 50 KW & less than 75 KW: Inspection CAT- II as per NTPC approved MQP: Acceptance of Motor rating above 50 KW & less than 75 KW is based on NTPC review of Routine Test inspection report as per IS:12615 - 2018 (including latest revision) duly witnessed by main contractor along with COC of the Manufacturer and Main Contractor confirming as follows:

"It is hereby confirmed that the above mentioned motor /motors was/ were manufactured taking care of NTPC specific requirements regarding ambient temp., voltage frequency variation, hot starts, pull out torque, starting KVA/KW, temperature rise, distance between center of stud gland plate, space heater and tested in accordance with approved drawing /data sheets."

iii) Motor rating 75 KW & above: Inspection CAT-I: As per NTPC approved MQP.

2. Additional routine tests for Flame proof motors shall be applicable as per relevant standard
3. Makes of major bought out items for HT motors will be subject to NTPC approval.
4. Y1 = for HT Motor / Machines only.
5. For LT Motors, stator core stack length & grade, no load loss and winding resistance w.r.t. type tested motor for IE2/IE3 shall be checked/verified in addition to

Compliance of relevant standard IS:12615/IEC requirement. In case actual results are not within the tolerance limit as declared by manufacturer during QP submission,

the motor shall be subjected to efficiency test.

CABLING, EARTHING, LIGHTNING PROTECTION

ATTRIBUTES / CHARACTERISTICS / ITEMS/COMPONENTS / SUB SYSTEMS	Dimension	Paint shade, paint thickness, adhesion	Pre-treatment of sheet	IP protection	Proof load*	Surface finish	Deflection test*	HV & IR	Galvanise Test (If Applicable)	Functional	Bought out items/Bill of material	Routine tests as per relevant standard & specification	Acceptance tests as per relevant standard & specification	Constructional feature as per NTPC Specification
Wall Mounted-Lighting Panel (IS-513, IS:5, IS:2629, 2633, 6745)	Y	Y	Y	Y		Y		Y		Y	Y	Y	Y	Y
Switch box/junction box/ Receptacles Panel (IS-513, IS:5, IS:2629, 2633, 6745)	Y	Y	Y	Y		Y		Y	Y	Y	Y	Y	Y	Y
Cable glands(BS-6121)	Y													Y
Cable lug	Y													Y
Lighting wire (IS-694)	Y											Y		
Flexible conduits	Y											Y		Y
Conduits (Galvanise & Epoxy) IS-9537 & IS-2629, 2633, 6745	Y		Y						Y			Y		Y
RCC Hume Pipe (IS-458)												Y		
Cable termination & straight through joint (IS 13573)	Y											Y		Y
Cable Trays, bends, tees, crosses, Flexible supports system & accessories IS-513, 2629,2633,6745	Y		Y		Y	Y	Y		Y			Y	Y	Y
Trefoil clamp	Y													Y
GI flats for earthing & lighting protection (IS 2062, 2629, 6745,2633)	Y		Y						Y			Y		Y
GI wire (IS-280)	Y											Y		
Fire Sealing System (BS –476)												Y	Y	Y

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

2.* Deflection Test on cable trays and Proof Load test on cable trays support system will be as per details given in the NTPC technical specification & approved MQP. The above acceptance tests shall be done only on one sample from each size of offered lot. This test is not applicable on bends, tees & crosses.

3. Make of all items will be subject to NTPC approval.

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

ANNEXURE-III

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

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

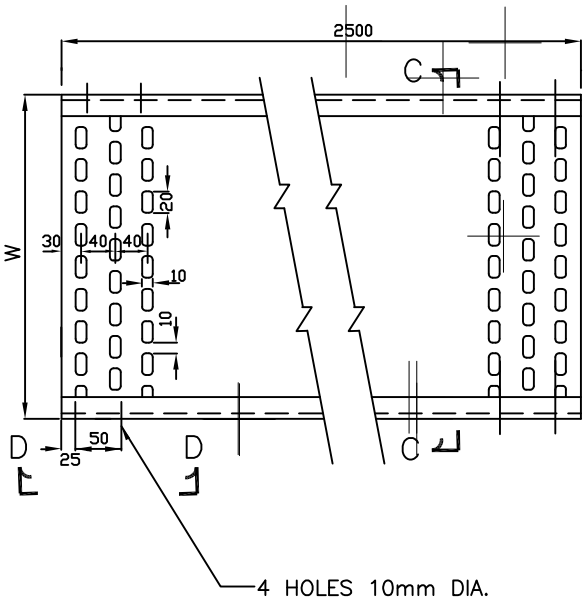
: ** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTER CONTROLLED)

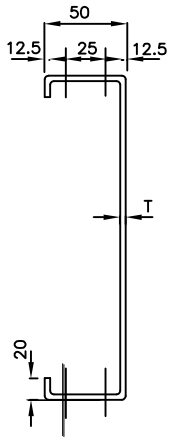
LOAD DATA (ELECTRICAL)	JOB NO.		ORIGINATING AGENCY		PEM (ELECTRICAL)	
	PROJECT TITLE		NAME		DATA FILLED UP ON	
	SYSTEM		SIGN.		DATA ENTERED ON	
	DEPTT. / SECTION	MAUX	SHEET 1 OF 1	REV. 00	DE'S SIGN. & DATE	

CABLE SCHEDULE FORMAT

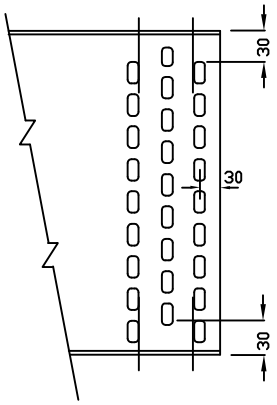
ANNEXURE III

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

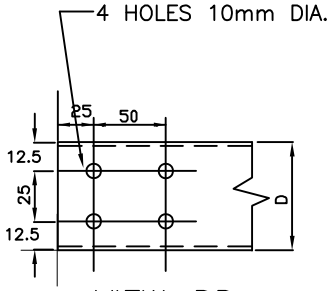




SECTION–CC
(100/50 TRAYS)



ARRANGEMENT OF
PERFORATIONS



VIEW–DD
(100,50W TRAYS)

TRAY WIDTH W (mm)	100	50
TRAY DEPTH D (mm)	50	50
T (mm)	2	2

PERFORATED TYPE TRAY

भेल BHEL	TYPICAL DETAILS OF CABLE TRAYS AND ACCESSORIES	DWG. NO.

SECTION – I

SPECIFIC TECHNICAL REQUIREMENTS

SUB-SECTION IC – Specific Technical Requirement (C&I)

CONTROL AND INSTRUMENTATION FOR MILL REJECT SYSTEM

C&I SPECIFIC TECHNICAL REQUIREMENTS

Specific Technical Requirements (C&I):

1. Complete C&I system for Mill Reject System is in bidder's scope of supply. Items not specifically mentioned however required for the completeness of the system shall be supplied by bidder without any commercial implication.

2. Mill Reject System shall be operated from DDCMIS (BHEL's scope). Profibus based controls and conventional controls (hardwired 4-20mA/DI/DO) are envisaged for this package.

3. **All motorized valves shall be supplied with Non-intrusive Profibus based Electric Actuator (with integral starter)** for MRS package along with necessary interface units for linking to corresponding Control System as applicable. The interface of these actuators with DCS shall be with PROFIBUS DP interface. All actuator settings including torque, limit shall be possible without opening the actuator cover and LCD indication shall be available integral to actuator body. Open/Close command termination logic suitably built inside the actuator Details shall be referring in the specification.

4. All ON, OFF, INCHING type electric actuators shall be PROFIBUS DP compatible. PROFIBUS DP protocol based actuators shall have two (redundant) PROFIBUS DP ports for connecting the redundant PROFIBUS DP cables. That is if one PROFIBUS DP cable is cut or not working/not available, then complete actuator functionality shall be available through the second redundant cable without any manual intervention.

5. All the Electronic Transmitter for Pressure, Temperature, Differential Pressure and DP based Flow /Level measurements shall be genuine, verifiable PROFIBUS PA protocol compatible instruments. The transmitters shall be connected to DDCMIS through PROFIBUS PA protocol complying to IEC 61158 directly from transmitter. This is subject to customer approval and BHEL decision shall be final.

6. The PROFIBUS protocol design shall be further validated by BHEL and approved by NTPC during detailed engineering and any variation/ changes required based on DDCMIS system requirements and actual field installation, operational philosophy etc. shall be considered by bidder without any implications.

7. Profibus DP based IMC in LV SWGR/MCC (BHEL's scope) shall be provided.

8. Bidder to provide **Comprehensive Annual Maintenance Services (AMS)** for three (03) years after warranty period for the Profibus instruments of MRS system.

9. 415V AC/ 230V UPS Power supply shall be provided by BHEL at a single point, further distribution to various instruments/equipment of the system shall be in bidder scope. Bidder to include necessary power distribution board/change over switch in his scope. Any power supply other than the above, if required by any instrument/equipment has to be derived by the bidder from the above supply & all necessary hardware for the same shall be in bidder scope. Bidder to submit the power requirement along with the bid.

10. Bidder shall provide the following:-
    Configuration/ diagnostic tool for all Profibus based instruments – 2 Nos of each make.
    Bidder shall also provide all required software (lifetime licensed) and hardware (cables/connectors, Tablet/ Laptop etc.) along with these tools.

11. All transmitters (except PROFIBUS PA compatible transmitters) shall be smart type and shall have 4-20mA DC signal with superimposed digital communication (HART) as per this specification.

12. Redundancy of sensors shall be provided by bidder
    (i) Triple redundancy for all analog and binary inputs required for protection of system/drives.
    (ii) For all other control functions dual redundancy of the sensors shall be provided by the bidders.

13. RF Type level switches shall be provided for interlock & monitoring purpose

14. Guided wave radar type Level transmitters shall be provided at each MRS silo for level measurement.

15. All Temperature sensors shall be Duplex type and temperature transmitter shall be provided for all temperature measurement applications. Bidder to provide temperature transmitter along with compensating cable, JB/Rack & other erection hardware.

16. All the transmitters supplied by Bidder shall be LIE/LIR mounted. The LIE/LIRs shall be in Bidder's scope of supply.

17. For instruments which are not located inside covered building, suitable canopy/ protective arrangement shall be provided which shall be approved during detail engineering.

18. All field instruments enclosure shall be IP65 local panel/cabinet enclosure shall be IP 55, unless otherwise specified.

19. Double root valves shall be provided for all pressure tapping where the pressure exceeds 40 Kg./sq.cm.

20. All the instruments PG/DPG/DPT/PT etc. (as applicable) having contact with corrosive media shall be provided with chemical/diaphragm seal.

21. Epoxy coated painting shall be provided for all C&I Equipment & Instruments.

22. All the wetted parts of the instruments including the accessories like root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifolds and all the other accessories required for mounting/erection of these local instruments as well as valves shall be of SS-316 material, suitable pressure class and same shall be in bidder's scope.

23. At least 20% spare unused terminals shall be provided everywhere including local junction boxes, instrument racks/enclosures, termination/marshalling cabinets, etc

24. All instruments and control elements shall be terminated on JB/LCP in field and both instrument and JB/LCP are in bidder scope. Number of Junction Boxes shall be sufficient and positioned in the field to minimize local cabling (max 12-15 mtrs) and trunk cable.

25. JB provided on the valves for manually operated valves Limit switches wherever specified.

26. The solenoid operated valves/dampers/Gates shall have a limit switch for open/close feedback. The control voltage of Solenoid Valve shall be 24V DC only.

27. Limit switches shall be silver plated with high conductivity and non-corrosive type Contact rating shall be sufficient to meet the requirement of DDCMIS subject to a minimum of 60 V, 6 VA rating. Protection class shall be IP 55.

28. The contacts of equipment mounted instruments sensors, switches etc. for external connection including spare contacts shall be wired out to suitably located junction boxes by bidder.

29. Bidder to provide one number local control panel for each pyrite hoppers. This local panel will act as interface between the DCS and the field devices for commands & feedbacks. Any other Local control panel, apart from the above mentioned requirement, shall also be in the bidder's scope of supply.

30. Provision for separate Terminal block/wiring diagram for power and control blocks of control panel to be ensured.

31. 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.

32. All panels, cabinets shall be provided with a continuous bare copper ground bus. The ground bus shall be bolted to the panel structure on bottom on both sides. The bolts shall face inside of panels. The system ground shall be isolated from the panel ground with suitable isolators. All internal component grounds or common shall be connected to the system ground, which shall be fabricated of copper flat (size 25mm x 6mm min., length as applicable).

33. VFD panels for drives (as applicable) shall be in Bidders scope in line with specification requirement.

34. VFD Drive shall be provided with bypass contactor for motors with standard features like indication, manual and Auto set point facility, control power source, capable of changing supply frequency from 50% to 125%, bypass harmonies suppression, etc.

35. The design, manufacture, inspection, testing, site calibration and installation of all C&I equipment and systems covered under this specification shall conform to the latest editions of applicable codes and standards.

36. Bidder to provide erection hardware including junction boxes, canopies, structural steel as required.

37. All instruments should be supplied with valid calibration and test certificates provided by OEM.

38. Instrument installation and accessories required for the same shall be in Bidder's scope. However, any instrument installation not covered in the specification, same shall be subject to customer and BHEL approval during detailed engineering. All instruments required for the package shall be supplied, mounted on the gauge board racks, along with accessories like impulse pipe, fittings & valve manifolds etc.

39. All the instruments/equipment's/electrical items shall be provided & designed with maximum star rating as available in line with energy conservation policies notified by BEE, GOI at the time of supply.

40. All field instruments shall be weatherproof, drip tight, dust tight and splash proof suitable for use under outdoor ambient conditions prevalent in the subject plant. All field-mounted instruments shall be mounted in suitable locations where maximum accessibility for maintenance is achieved.

All the field instruments shall also be provided with SS tag nameplate and double compression type Nickel-plated brass cable gland. Gaskets, Fasteners, Counter and mating flange (SS316 material), nuts & bolts etc. shall also be included, wherever required with the field instruments.

41. Bidder to perform tests of C&I items/instruments/systems as per Quality plans/type test attached in the specification. However, if any test not specified in the quality plan but specified in specification Tests for I&C equipment included elsewhere in specification will have to perform by Bidder without any cost implication. The make/model of various instruments/items/systems shall be subject to approval of owner/purchaser during detailed engineering stage. No commercial and delivery implication in this regard shall be acceptable. In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with.

42. Bidder shall ensure that various C&I instruments /equipment like electronic transmitters / transducers, Temperature elements and other instruments/ local devices etc. that are being furnished by the Bidder, are of the same make, series and family of hardware to the extent possible so as to ensure smooth and optimal maintenance.

43. All measuring instruments/equipment and subsystems offered by the Bidder shall be from reputed experienced manufacturers ((from BHEL/customer approved vendor list) of specified type and range of equipment, whose guaranteed and trouble free operation has been proven. Further, all instruments shall be of proven reliability, accuracy, and repeatability requiring a minimum of maintenance and shall comply with the acceptable international standards. Further, Bidder to meet the **provenness criteria** for all the supplied C&I items mentioned elsewhere in the specification

44. All the equipments shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at Site till the time of erection. While packing all the materials, the limitation from the point of view of the sizes of railway wagons available in India should be taken account of. The Bidder shall be responsible for any loss or damage during transportation, handling and storage due to improper packing. BHEL/NTPC shall have right to insist for completion of works in shops before despatch of materials for transportation.

45. Bidder's presence is required for 3 Man days (Excluding travel time) at EDN Bangalore during FAT of DDCMIS for certifying correctness & completeness of implementation of Control logic. Intimation to attained FAT shall be informed in 2 days advance. All the expenses like boarding, lodging and travel, Air fare etc. shall be in bidder's scope.

46. Bidder's presence is required for 15 Man days (in three visits) at site during commissioning of DDCMIS for assistance related to process correctness. Three visit shall be made with total 15 Man days (Excluding travel time) in which one visit shall be of 5 Man days each. All the expenses like boarding, lodging and travel, Air fare etc. shall be in bidder's scope.

47. Bidder's C&I representative shall be present at BHEL-PEM for 3 man-days, for preparation of Control scheme of Mill Reject System. All the expenses like boarding, lodging and travel, Air fare etc. shall be in bidder's scope.

48. Bidder shall furnish Instrument Schedule, Control Scheme, I/O list, Drive list, Cable Schedule, Cable interconnection, Instrument/SOV Installation diagram, Instrument datasheets, JB grouping, SOV grouping, Annunciation list, List of Instruments/devices for Profibus/HART, configuration diagram for Profibus based actuators/instruments in BHEL approved format. Also, editable database format like MS Excel, MS Access etc. of these documents shall also be provided by Bidder.

49. Bidder to note that Instrumentation Cable shall be as per Electrical Cable scope matrix attached elsewhere in the Specification.

50. The Contractor shall provide complete Instrumentation for control, monitoring and operation of entire Mill Reject System. The requirements given are to be read in conjunction with detailed Technical specification enclosed in the specification. Further in case of any discrepancy in the requirement within the same section noted by the bidder in the specification, the same will be brought to the notice of BHEL in the form of pre- bid clarification. In absence of any pre-bid clarification, the more stringent requirement as per interpretation of customer shall prevail without any commercial implication.

ACTUATORS

ELECTRICAL ACTUATORS

1.00.00 **General Requirements**

Actuators shall be designed for valve operation to ensure proper function in accordance with specifications given below and complying to EN15714-2 or equivalent. All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions.

4.00.00 REQUIREMENT FOR NON-INTRUSIVE PROFIBUS ACTUATOR

4.01.00 **Type**

1. The actuators shall have integral starters with built in SPP (Single Phasing Preventer). 415 V, 3 phase 3 wire power supply shall be given to the actuator from switch board as applicable through a switch fuse unit. Control voltage of the motor starter shall be 110 V AC / 24 V DC, derived suitably from 415V power supply.
2. The actuators shall be Non- Intrusive electric actuator. All actuator settings including torque, limit shall be possible without opening the actuator cover and LCD indication shall be available integral to actuator body

4.02.00 **Rating**

1. Supply Voltage & frequency: 415V +/- 10%, 3 Phase, 3 Wire & 50HZ +/- 5%.
2. Sizing:
   Open/Close at rated speed against designed differential pressure at 90% of rated voltage.
   For ON/OFF type: Three successive open-close operations or 15 minutes, whichever is higher.
   For inching type: 150 starts per hour or required cycles, whichever is higher

4.03.00 **Construction**

1. Enclosure: Totally enclosed weatherproof, minimum IP-68 degree of protection.
2. Manual Wheel: Shall disengage automatically during motor operation.

4.04.00 **Motor**

Type: Squirrel cage induction motor suitable for Direct On-Line (DOL) starting
Enclosure: Totally enclosed, self-ventilated
Insulation: Class F. Temperature rise 70 Deg C. over 50 Deg C ambient.
Bearings: Double shielded, grease lubricated antifriction

		Earth Terminals: Two Protection: Single Phasing Protection, Over-heating protection through Thermostat (as applicable) and wrong phase sequence protection shall be provided over and above other protection features standard to bidder's design. Suitable means shall be provided to diagnose the type of fault locally.
4.05.00	**Position / Torque Transmitter**	The Position/ Limit measurement shall be done using absolute encoders which will give information of position/ limit in both the directions. Electronic measurement of torque shall be provided.
4.06.00	**Local Operation**	It shall be possible to operate the actuator locally also. Lockable local/remote selection shall be provided on the actuator.
4.07.00	**LCD Display**	A local LCD display shall be provided to give information regarding actuator alarms, status and valve position indications as a minimum in local.
4.08.00	**Wiring**	Suitable voltage grade copper wire.
4.09.00	**Terminal Block**	For power cables, the grade of TBs shall be minimum 650V.
4.10.00	**Accessories**	All required accessories for calibration / settings/ configuration of various parameters of actuator shall be provided.
4.11.00	**SIL Certification**	All actuators shall be certified for SIL 2 or better.

contd. on next page

REQUIREMENT FOR NON-INTRUSIVE PROFIBUS ACTUATOR

4.12.00	**Interfaces**	For ON-OFF and INCHING type actuators interface with the control system shall be through fieldbus network. a) Open/ close commands, open/ close feedback status, disturbance signal etc. shall be available to the Control System through the fieldbus network along with diagnostics. The detailed diagnostics including the actuator operating data shall be available to the DDCMIS through the fieldbus network. b) All actuators shall be Profibus compatible. However the exact protocol shall be based on finalized protocol of If Profibus DP protocol is envisaged then actuator shall have two (redundant) Profibus DP ports for connecting the redundant Profibus DP cables. That is if one profibus cable is cut or not working/ not available, then complete actuator functionality shall be available through the second redundant cable without any manual intervention. Also, for Profibus DP cable connection, suitable connector integral to the actuator, or external devices/ accessories (mounted inside minimum IP65 protection class enclosure) shall be provided so that the actuator can be isolated online from the profibus network without disturbing the Profibus communication of other actuators of the segment. c) Open/close command termination logic shall be suitably built inside actuator. d) For all actuators GSD and DTM files are to be provided which shall be configured/ tested with DCS for proper interfacing and diagnostics.
4.13.00	**Terminal Box**	Suitable terminals/ connectors, integral to actuator, for terminating fieldbus cables and power cables shall be provided. Necessary glands for power cables and armored fieldbus cables shall be provided.
4.14.00	**Training**	Contractor shall provide training on Non-Intrusive Fieldbus Electric Actuator along with detail training on Foundation Fieldbus/ Profibus interface used in actuator for Employer's personnel. The duration of the training shall be as elaborated in Part-C, Section-VI of technical specifications.

	DATASHEET FOR MOTORISED VALVE ACTUATOR (2X660MW Talcher STPP)	SPECIFICATION NO.:		
		VOLUME	II B	
		SECTION	D	
		REV. NO.	00	DATE:06/03/2020
		SHEET	1 OF	4

Data Sheet A & B

		DATA SHEET-A (TO BE FILLED BY PURCHASER)	DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
GENERAL*	* PROJECT	2X660 MW TALCHER STPP	
	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 -20 to70 DEG C AND RELATIVE HUMIDITY OF 0-95%IN HOT HUMID AND TROPICAL ATMOSPHERE AND HIGHLY POLLUTED AT PLACES OF COAL DUST AND FLY DUST	
	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, WEATHER PROOF,DUST TIGHT SUITABLE FOR OUTDOOR USE WITHOUT CANOPY, NEMA6/IP:68	
	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** as per IEC60034-1	
HANDWHEEL as per standard EN 12570:2000	* 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) (REFER NOTE NO. 6 & 7)	BIDDER TO SPECIFY	
	@ MOTOR TYPE	SQUIRREL CAGE INDUCTION MOTOR, STARTING CURRENT LIMITED TO SIX TIMES THE RATED CURRENT-INCLUSIVE OF I.S. TOLERANCE	
	ACTUATOR APPLICABLE WIRING DIAGRAM (TO BE DECIDED DURING DETAILED ENGINEERING)	BIDDER TO FURNISH WIRING DIAGRAM	
	COLOUR SHADE	☐ BLUE (RAL 5012) ☐ SIEMENS GRAYRAL 7030/32 ■TO BE DECIDED DURING DETAILED ENGINEERING	
	PAINT TYPE	☐ ENAMEL ☐ EPOXY CONFIRMING TO CORROSION CATEGORY C5-I ■ TO BE DECIDED DURING DETAILED ENGINEERING	
	SHAFT RPM	BIDDER TO SPECIFY	
	OLR SET VALUE	BIDDER TO SPECIFY	
	@ STARTING / FULL LOAD CURRENT	BIDDER TO SPECIFY	
	NO. OF REV FOR FULL TRAVEL	BIDDER TO SPECIFY	

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 ■ IP 68 ■ FLAME PROOF TO BE DECIDED DURING DETAILED ENGINEERING	
	@MOTOR BEARING WITH 2 EARTH TERMINALS	DOUBLE SHIELDED, GREASE LUBRICATED ANTI FRICTION	
	@ INSULATION CLASS	CLASS F. TEMPERATURE RISE 70 Deg C. OVER 50 Deg C AMBIENT	
	@ WINDING TEMP PROTECTION	■ THERMOSTAT (3 Nos.,1 IN EACH PHASE)	
	SINGLE PHASE / WRONG PHASE SEQUENCE PROTECTION	REQUIRED (THERMISTOR PTC)	
INTEGRAL STARTER	INTEGRAL STARTER	■ REQUIRED ☐ NOT REQUIRED	
	TYPE OF SWITCHING DEVICE	■ CONTACTORS ■ CONTACTORS(REVERSING TYPE) ■ THYRISTORS	
	TYPE	☐ CONVENTIONAL ■ NON-INTRUSIVE PROFIBUS	
	IF NON-INTRUSIVE PROFIBUS (REFER BELOW POINT a – g)		
	a) INTERFACE WITH CONTROL SYSTEM	■ PROFIBUS ☐ HARDWIRED	
	b) FIELDBUS PROTOCOL	■ PROFIBUS DP ☐ PROFIBUS PA ☐ FOUNDATION FIELDBUS	
	c) REDUNDANT PORTS(IN CASE,PROFIBUS DP PROTOCOL)	■ REQUIRED ☐ NOT REQUIRED	
	d)TORQUE/LIMIT MEASUREMENT TRANSMITTER(REFER NOTE NO.9)	■ REQUIRED ☐ NOT REQUIRED	
	e)POSITION MEASUREMENT TRANSMITTER(REFER NOTE NO.9)	■ REQUIRED ☐ NOT REQUIRED	
	f)LCD DISPLAY INTEGRAL TO ACTUATOR BODY(REFER NOTE NO.10)	■ REQUIRED ☐ NOT REQUIRED	
	g) SIL CERTIFICATION(SIL 2 OR BETTER)	■ REQUIRED ☐ 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(LOCKABLE)	■REQUIRED ☐ NOT REQUIRED	
	STATUS CONTACTS FOR MONITORING	■ REQUIRED ☐ NOT REQUIRED	
	INTEGRAL STARTER DISTURBED SIGNAL (TO BE DECIDED DURING DETAILED ENGINEERING)	REQUIRED MOTOR THERMOSTSTTRIP O/L RELAY OPTD, CONT./POWER SUPPLY FAILED,S/S IN LOCAL/REMOTE/OFF MODE,TORQUE SWITCH OPEN/CLOSE CUT OFF/STOP PB OPTD,VALVE JAMMED ETC)	
	ACTION ON LOSS OF EXTERNAL ELECTRIC POWER	■ STAYPUT ■ FAIL SAFE TO BE DECIDED DURING DETAILED ENGINEERING	
INTERPOSING RELAY/OPTO COUPLER (Applicable for integral Starter) DATASHEET & WIRING DIAGRAM OF	TYPE OF ISOLATING DEVICE	■ INTERPOSING RELAY ■ OPTO COUPLER TO BE DECIDED DURING DETAILED ENGINEERING	
	QUANTITY	■ 2 NOs. ■3 NOs. TO BE DECIDED DURING DETAILED ENGINEERING	
	DRIVING VOLTAGE	■ 20.5 – 24V DC ☐ _____V DC	
	DRIVING CURRENT	■ 125mA MAX ☐ _____mA MAX	

	DATASHEET FOR MOTORISED VALVE ACTUATOR (2X660MW Talcher STPP)	SPECIFICATION NO.:		
		VOLUME	II B	
		SECTION	D	
		REV. NO.	00	DATE:06/03/2020
		SHEET	3 OF 4	

Data Sheet A & B

		DATA SHEET-A (TO BE FILLED BY PURCHASER)	DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
ISOLATION DEVICE TO BE PROVIDED(NOT APPLICABLE FOR NON-INTRUSIVE PROFIBUS ACTUATOR)	LOAD RESISTANCE	■ > 192 ohms - <25 k ohms □ > _____ohms - < _____ohms	
TORQUE SWITCH(NOT APPLICABLE FOR NON-INTRUSIVE PROFIBUS ACTUATOR)	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 FOR NON-INTRUSIVE PROFIBUS ACTUATOR)	MFR & MODEL NO.	BIDDER TO SPECIFY	
	OPEN : INT : CLOSE	□1 No ■2 Nos. / 2 Nos. (ADJ.) / □1 No. ■2Nos.	
	CONTACT TYPE	2 NO + 2 NC	
	RATING (AC / DC)	5A 240V AC AND 0.5A 220V	
	ACCURACY	2% OF SET VALUE	

POSITION TRANSMITTER (ALSO REFER NOTE NO.9)	POSITION TRANSMITTER	■ REQUIRED □ NOT REQUIRED	
	MFR & MODEL NO.	BIDDER TO SPECIFY	
	TYPE	■ ELECTRONIC (2 WIRE) R/I CONVERTER ■ ELECTRONIC (2 WIRE) CONTACTLESS TO BE DECIDED DURING DETAILED ENGINEERING	
	SUPPLY	■ 24V DC □	
	OUTPUT	■ 4-20mA	
	ACCURACY	± 1% FS	
SPACE HEATER	@SPACE HEATER	REQUIRED	
	@ POWER SUPPLY (NON NTEGRAL)	240V 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 @■ TO BE DECIDED DURING DETAILED ENGINEERING	
	@ EARTHING TERMINAL	REQUIRED	
	PLUG & SOCKET	■ REQUIRED ■ NOT REQUIRED (TO BE DECIDED DURING DETAILED ENGINEERING)	
	NO. OF PINS REQUIRED	■ 9 PINS ■ 13 PINS (TO BE DECIDED DURING DETAILEDENGINEERING)	
	NOS. OF PLUG & SOCKET	□ 1 Nos. for ON/OFF □ 2 NOS.(for inching duty)	
CABLE GLANDS	@ POWER CABLE GLAND	QUANTITY & SIZE TO BE DECIDED DURING DETAILED ENGINEERING	
	@ SPACE HEATER CABLE GLAND		
	CONTROL CABLE GLANDS-1		

	DATASHEET FOR MOTORISED VALVE ACTUATOR (2X660MW Talcher STPP)	SPECIFICATION NO.:		
		VOLUME	II B	
		SECTION	D	
		REV. NO.	00	DATE:06/03/2020
		SHEET	4 OF	4

Data Sheet A & B

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

	CONTROL CABLE GLANDS-2		
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 NATIONAL AND INTERNATIONAL STANDARD. AS A MINIMUM, THE FOLLOWING STANDARDS SHALL BE COMPLIED WITH:
   IS-9334, IS-2147, IS-2148, IS-325, IS-2959, IS-4691, IS-4722, IEC 60947-5-1 AND EN 15714-3 :2010 OR LATEST VERSION.
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 BE SUITABLE FOR DIRECT ON LINE STARTING.
7. THE MOTOR SHALL BE CAPABLE OF STARTING AT 85 PERCENT OF RATED VOLTAGE RUNNING AT 80 PERCENT OF RATED VOLTAGE AT RATED TORQUE AND 85 PERCENT RATED VOLTAGE AT 33 PERCENT EXCESS RATED TORQUE FOR A PERIOD OF 5 MINUTES EACH
8. IN ADDITION TO ABOVE REQUIREMENTS FOR LIMIT/TORQUE SWITCH, MECHANICAL END STOP WITH ACCURACY OF 2% SHALL BE SUPPLIED.
9. THE POSITION/LIMIT MEASUREMENT SHALL BE DONE USING ABSOLUTE ENCODERS WHICH WILL GIVE INFORMATION OF POSITION/LIMIT IN BOTH THE DIRECTIONS.ELECTRONIC MEASUREMENT OF TORQUE SHALL BE PROVIDED
10. A LOCAL LCD DISPLAY SHALL BE PROVIDED TO GIVE INFORMATION REGARDING ACTUATOR ALARMS, STATUS AND VALVE POSITION INDICATION AS A MINIMUM IN LOCAL.
11. IT SHOULD BE POSSIBLE TO OPERATE THE ACTUATOR LOCALLY. LOCKABLE LOCAL/REMOTE SELECTION SHALL BE PROVIDED ON THE ACTUATOR.
12. LOCAL POSITION INDICATOR SHALL BE PROVIDED FOR 0 TO 100 % TRAVEL.
13. CONTROL WIRING SHALL BE SUITABLE VOLTAGE GRADE COPPER WIRE OF 1.5 SQ. MM.
14. ENDURANCE: RATED TORQUE RANGE SHOULD BE BASED ON ISO 5211, ISO5210.
15. TAG PLATE SHALL BE CONFIRMING TO STANDARD BS-15714.
16. THE ACTUATORS SHALL BE DESIGNED TO BE SELF-LOCKING UPON LOSS OF POWER. MOTOR SHALL BE DESIGNED TO CLOSE IN 30 SECS. FROM FULL OPEN POSITION AND SHALL HAVE ADEQUATE CAPACITY TO OPEN AND CLOSE UNDER FULL UNBALANCED DESIGN PRESSURE.
17. AUTOMATIC PHASE CORRECTION FACILITY AND POTENTIAL FREE CONTACT FOR ANNUNCIATION OF POWER FAILURE SHALL BE PROVIDED.
18. LIMIT SWITCHES SHALL BE SILVER PLATED WITH HIGH CONDUCTIVITY AND NON-CORROSIVE TYPE. CONTACT RATING SHALL BE SUFFICIENT TO MEET THE REQUIREMENT OF CONTROL SYSTEM SUBJECT TO A MINIMUM OF 60 V, 6 VA RATING. PROTECTION CLASS SHALL BE IP67.
19. SUITABLE TERMINALS/CONNECTORS.INTEGRAL TO ACTUATORS ,FOR TERMINATING FIELDBUS(PROFIBUS-DP) CABLES AND POWER CABLES SHALL BE PROVIDED.NECESSARY GLANDS FOR POWER CABLES AND ARMORED FIELDBUS CABLES SHALL BE PROVIDED.
20. THE MOTOR SHALL OPERATE SATISFACTORILY UNDER THE +/- 10% SUPPLY VOLTAGE VARIATION AT RATED FREQUENCY, -5% TO +5% VARIATION IN FREQUENCY AT RATED SUPPLY VOLTAGE, SIMULTANEOUS VARIATION IN VOLTAGE & FREQUENCY THE SUM OF ABSOLUTE PERCENTAGE NOT EXCEEDING 10%.
21. ACTUATOR SHALL ATTAIN FULL SPEED OPERATIONS BEFORE VALVE LOAD IS ENCOUNTERED AND IMPART AN UNSEATING BLOW TO START THE VALVE IN MOTION (HAMMER BLOW EFFECT).
22. OPEN/CLOSE AT RATED SPEED AGAINST DESIGNED DIFFERENTIAL PRESSURE AT 90% OF RATED VOLTAGE.

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

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

FIELD & MEASURING INSTRUMENTS

1.00.00	**MEASURING INSTRUMENTS (PRIMARY AND SECONDARY)**
1.01.00	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. Refer Sub-section Basic Design Criteria. Further, all instruments shall be of proven reliability, accuracy, and repeatability requiring a minimum of maintenance and shall comply with the acceptable international standards and shall be subject to Employer's approval.
1.02.00	Every panel-mounted instrument requiring power supply shall be provided with 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.
1.03.00	All transmitters, sensors, switches and gauges for parameters like pressure, temperature, level, flow etc. as required for the safe and efficient operation and maintenance as well as for operator and management information (including all computation) of equipment in the system under the scope of specification shall be provided on as required basis with in quoted lump sum price. The Contractor shall furnish all Instrumentation / Control equipment & accessories under this specification as per technical specification, ranges, makes & model as approved by the Employer during detailed engineering.
1.04.00	The necessary root valves, impulse piping, drain cocks, 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, on as required basis. The contacts of equipment mounted instruments, sensors, switches etc. for external connection including spare contacts shall be wired out in flexible/rigid conduits, independently to suitably located common junction boxes. 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./sq.cm.
1.05.00	All instruments envisaged for sea water applications, shall be provided with wetted parts made of Monel/ Hastelloy C or any other material (if provenness experience of the proposed material for such applications is established by contractor). For Chlorine application: Instruments shall be provided with wetted parts (e.g. diaphragm seal, etc.) made of Hastelloy C. Also, filled liquid shall be Fluorolube oil/ Inert Hydrocarbon / CTFE etc., for these applications. For applications of FECL3 solution: Instruments shall be provided with wetted parts (e.g. diaphragm seal, etc.) made of Tantalum.
1.06.00	For coastal areas, all instruments shall be provided with durable epoxy/ polyurethane coating for housings and all exposed surfaces of the instruments.
1.07.00	The instruments which are proposed to be used for PG test as indicated in the tender P&IDs shall meet the minimum requirements specified in ASME PTC or subsequent clauses in this chapter whichever is better.

2.00.00 SPECIFICATION FOR ELECTRONIC TRANSMITTERS

2.01.00 SPECIFICATION FOR ELECTRONIC TRANSMITTER FOR PRESSURE, DIFF PRESS AND DP BASED FLOW / LEVEL MEASUREMENTS

Microprocessor based 2 wire loop powered electronic transmitter with /Profibus PA complying to IEC 61158.) output signal shall be provided.

Range	Accuracy (For calibrated Range)	Turndown (For span)	Stability (% of Calibrated range)
<=400mmwc	0.1%	20:1	+/-0.2% for 1 year
>400mmwc	0.060%	50:1	+/-0.25 % for 10 year
>250 kg/cm2	0.065%	10:1	+/- 0.15 % for 5 years

Above parameters/features of offered models shall be strictly as defined in standard published catalogue of the manufacturer only.

Transmitter shall have weather proof IP-67 metallic housing with durable corrosion resistant coating, integral digital display with self-indicating diagnostics, Plug and socket type electrical connection for HART and ½ "NPT (F) for Profibus type Transmitter, calibration using HART/Fieldbus calibrator, 2/3/5 Valve non integral manifold and rack with canopy. For HART transmitter SIL 2 certification is required.

For primary air and flue gas applications, DPT shall be provided for pressure measurement below range of 2000 mmwc.

For corrosive, viscous, solid bearing, slurry type process fluids, suitable diaphragm seal shall be provided. Parts below seal shall be removable for cleaning. Entire volume shall be completely filled with inert liquid suitable for instruments. LVDT type transmitter is not acceptable.

2.02.00 GUIDED WAVE RADAR TYPE LEVEL TRANSMITTER

Type	Microprocessor based 2 wire type (loop powered), HART protocol compatible Guided wave radar transmitter.
Principle	TDR (Time domain reflectometry)
Probe Type & Material	(i) Coaxial probe of SS316/316L. If required, probe shall be suitable for overfill prevention. (ii) Rod probe, cable probe of SS316/SS316L can be used for applications wherever coaxial probe is not suitable.
Output signal	4-20 mA DC along with superimposed digital signal (based on HART protocol), suitable for over fill prevention.
Accuracy	+/- 0.5% of calibrated span or minimum 5mm.
Power supply	24 VDC +/- 10%.
Housing	Weather proof as per IP-65, metallic housing with durable corrosion resistance coating.
Adjustment/ calibration	Using hand held HART calibrator/ centralized PC based system (as applicable).
Zero & span	Continuous, temper proof, remote as well as manual adjustability from instrument. It should be possible to calibrate the instrument

adjustment	without any level in the tank/sump etc.
Display	Integral digital display.
Load Impedance	500 ohms (minimum).
Electromagnetic compatibility	Shall meet EN 61326-1 (1997) and AmdtA1, class A equipment/EN 50081-2 & EN 5008 1-2 & EN 50082-2
Mounting	(i) External cage shall be provided where ever side mounting is required. External cage and other mounting accessories to be provided by the contractor. (ii) Where ever top mounting is required, all mounting accessories, stilling well (as required) etc., shall be provided by the contractor. (iii) All weather canopy shall be provided for protection from direct sunlight and direct rain for open locations.

Note: Four wire type transmitters can also be provided for applications where 2- wire transmitter has some technical limitations, subject to employer's approval during detailed engineering stage. However, in such cases isolated 4-20 mA DC (analog) output shall be provided. Power supply required for such transmitters shall be 240V AC / 24V DC.

2.03.00 Ultrasonic Type level Transmitter

S.No.	Features	Essential/Minimum requirement
1.	Type of Transmitter	Non-contact Microprocessor based 2 wire type (loop powered), HART protocol compatible Ultrasonic transmitter.
2.	Output signal	4-20 mA DC (Analog) along with superimposed digital signal (based on HART protocol).
3.	Accuracy	+/- 0.5% of calibrated span or minimum 5mm.
4.	Power supply	24 V DC +/- 10%.
5.	Temperature compensation	To be provided within transducer.
6.	Housing	Weather proof as per IP-65, metallic housing with durable corrosion resistance coating.
7.	Adjustment/calibration/ maintenance	Using hand held HART calibrator/ centralized PC based system (as applicable).
8.	Zero and Span adjustment	Continuous, tamper proof, remote as well as manual adjustability from instrument. It should be possible to calibrate the instrument without any level in the tank/sump etc.
9.	Sensor Material	Corrosion resistant material to suit individual application requirement.
10.	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.

11.	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.
12.	Display	Integral digital display
13.	Diagnostics	Loss of echo alarm etc.
14.	Load Impedance	500 ohms (minimum).
15.	Electrical Connection	Plug and socket
16.	Accessories	• All weather canopy shall be provided for protection from direct sunlight and direct rain for open locations. • All mounting accessories required for erection and commissioning shall be provided. • For hazardous area, explosion proof enclosure as described in NEC article 500

Note:

1) Contractor can also provide Radar type transmitter as per above specification in place of ultrasonic transmitter subject to approval by Employer during detailed Engineering. Sonic frequency based transmitters can also be provided under "ultrasonic transmitters" category for fly ash silo level.

2) Four wire type transmitters can also be provided for applications where 2- wire transmitter has some technical limitations, subject to employer's approval during detailed engineering stage. However, in such cases isolated 4-20 mA DC (analog) output shall be provided. Power supply required for such transmitters shall be 240V AC / 24V DC.

3) For applications where transmitter location is not accessible, the transmitter shall have separate sensor unit and electronic unit for such applications. It shall be possible to mount the electronic unit at accessible location.

2.04.00 HART Hand Held calibrator

Hand held calibrator shall be provided for adjustment/calibration/maintenance of the HART compatible transmitters. The hand held calibrator shall be suitable for all types of transmitters supplied in the package. If one type of hand held type calibrator is not suitable for communicating with all types of transmitters then separate hand held calibrator will be provided for that specific type of transmitter.

3.02.00 **Resistance Temperature Detector (RTD)**

Sr. No.	Features		Essential/Minimum Requirements
1	Type of RTD.	:	Four wire, Pt-100 (100 Ohms resistance at zero degree Centigrade).
2	No. of element	:	Duplex
3	Housing/Head	:	IP-65/Diecast Aluminium. Head of TE to be provided with sufficient space and arrangement to mount head mounted temperature transmitter (as applicable). Plug in connectors are to be

			provided for external signal cable connection. TE terminal head shall be spring loaded for positive contacts with the thermo well
4	Insulation and sheathing of RTD	:	Mineral (magnesium oxide) insulation and SS316 sheath,
5	Calibration and accuracy	:	As per As per IEC-751/ DIN-43760 Class-A for RTD
6	Accessories	:	Thermo well and associated fittings
7	Standard	:	IEC-751/ DIN-43760 for RTD and ASME PTC-19.3 for Thermo-well.

NOTES :

1) The specifications for RTDs of winding/ bearings of motor/pump, can be as per their manufacturer standards. The manufacturer shall submit the adequate supporting documents for establishing their standard practice. However the type of RTD shall be Pt100.

2) The specifications of temp elements for air conditioning & ventilation system / process can be as per system manufacturer's standards. The manufacturer shall submit the adequate supporting documents for establishing their standard practice.

3.04.00 **Thermo well** (for all process temp. elements)

(a) Shall be one piece solid bored type of 316 SS of step-less tapered design. (As per ASME PTC 19.3, 1974)

(b) For Mill classifier outlet long life solid sintered tungsten carbide material of high abrasion resistance shall be provided.

(c) For Air & Flue gas 316 SS protecting tube with welded cap. (However contractor shall provide better material for Flue gas service if required based on the specified boiler design parameters).

(d) For furnace zone, impervious ceramic protecting tube of suitable material along with Incoloy supporting tubes and adjustable flanges.

3.05.00 **Not Used**

3.06.00 **TEMPERATURE TRANSMITTER**

Minimum technical requirements shall be as follows:
Single input/Dual input temperature transmitter shall be 2-wire loop powered directly from 4-20mA input cards of DDCMIS. Transmitter shall be fully compatible with thermocouples and RTDs being provided. It shall be capable to handle Pt-100 RTD, Thermocouple –K, R & S types (selectable through HART/Fieldbus terminal/calibrator).Temperature compensation for T/C shall be performed in the transmitter itself.

In case of failure (open or burn-out) of RTD/thermocouple, transmitter shall provide low temperature output. Transmitter shall be HART/Fieldbus (Profibus PA/Foundation Fieldbus complying to IEC 61158)compatible, have EMC compatibility as per EN 61326, weather proof IP-67 metallic housing with durable corrosion resistant coating, plug and socket type electrical connection for HART and 1/2" NPT(F) connection for Fielbus , integral digital display with self-indicating diagnostics, operating ambient temperature of 85 deg C without display & 70 deg C with display, suitable for 2 inch pipe mounting in enclosure/rack . Composite Accuracy shall be as follows :. RTD =<0.25% of 0-250 deg C span, T/C -K type =<0.2 % of 0-600 deg C span, CJC accuracy (for T/C) shall be ≤ 1 deg C

Notes :

1. Dual input temperature transmitter shall have bump less changeover facility to second sensor in case first sensor fails. This changeover is to be alarmed in control system.
2. Composite accuracy is to be calculated as summation of all applicable accuracies of temperature transmitter for converting sensor input to output (e.g., A/D accuracy, basic accuracy, digital accuracy, etc.) and temperature effect on these accuracies at ambient temperature of 50 deg C, based on the figure/ formula given in the standard product catalogue for span as specified above for various types of temperature elements specified.
3. Above mentioned parameters/features of offered models shall be strictly as defined in standard published catalogue of the manufacturer only.
4. Dual input temperature transmitters can also be accepted in place of single input TT.

3.07.00 **Din rail temperature transmitter** 4-20mA HART based suitable for mounting on DIN-rails in JBs. The specifications of the JBs shall be same as indicated in Subsection INST CABLE with additional DIN-rails and IP 65 Protection class. This temperature transmitter shall be the ones which are especially designed for DIN-rail mounting with IP 20 protection class. These shall have terminals for input/output provided on front side when mounted on DIN-rail. Head mounted temperature transmitter with clamps to make it suitable for DIN-rail mounting shall not be acceptable under this category. Accuracy of Din rail should be :. RTD =<0.4% of 0-250 deg C span, T/C -K type =<0.4 % of 0-600 deg C span, CJC accuracy (for T/C) shall be < 1 deg C. Oher specifications shall be as mentioned in clause 3.06.00. Exact applications shall be as defined in PART-A of specifications.

3.08.00 **Multi Input Temperature transmitter (Temperature Multiplexer)**

For only information related temperature inputs fieldbus based Multi input temperature transmitters can be provided. Transmitters shall be capable of withstanding ambient temperature upto 85 deg C. Maximum number of inputs per such temperature transmitter shall be eight. One (1) no. input shall be kept as spare wired upto TBs of field mounted panel in each multi input TT. These shall be installed in field mounted panels with minimum IP 55 protection class. Exact applications shall be as defined in PART-A of specifications.

4.00.00 **ELECTRICAL METERING INSTRUMENTS**

Electrical metering instruments shall be furnished in accordance with the following general specifications. Application standard for electrical metering instruments shall be as per IS: 1248- 2003 (Revised). The size of each instrument shall be as approved by Employer during detailed engg. All metering instruments shall be flush panel mounting type.

4.01.00 (a) Frequency meters for Synchronization purposes: Accuracy: ± 1.5% of full scale.

(b) Synchroscope: Accuracy class: 0.5 or better.

(c) Voltmeters: Accuracy: ± 2.0% of full scale or better.

4.02.00 Synchronizing Relays

Synchronizing check relay with necessary ancillary equipment shall be provided which shall permit breakers to close after checking the requirements of synchronizing of incoming and running supply. The phase angle setting shall not exceed 10 Degree and this angle shall be adjustable and shall take the account the circuit breaker closing period. This relay shall have a response time of less than 200 milliseconds when the two system conditions are met within preset limits and with the timer disconnected. The relay shall have a frequency difference setting not exceeding 0.45% at rated value and at the minimum time setting. The relay shall have a continuously adjustable time setting range of 0.5-3 secs. Additionally, a guard relay shall be provided to prevent the closing attempt by means of synchronizing check relay when control switch is kept in closed position long before the two systems are in synchronism. The Control Voltage shall be 220V DC and PT input Voltage shall be 110 V AC.

4.03.00 Auxiliary PTs for Measurement & Synchronization

Applicable Standard	IS : 3156
Rated Voltage	110V
Insulation Level	660V grade
Frequency	50 Hz
Mounting	Panel Mounting
Test Voltage (Power frequency)	2.5 KV for 1 min.
Operating temperature	(-) 40 Deg C to (+) 85 Deg C
Primary Voltage	63.5 V to 115V
Secondary Voltage	63.5 V to 115V
Class of accuracy	1
Burden	25 VA
Class of Insulation	E or better

13.00.00 SPECIFICATION FOR FLOW ELEMENTS

13.01.00 Orifice Plate

Features	Essential/Minimum Requirements
Type	Concentric as per ASME PTC-19.5 (Part-II), ISA RP-3.2, 1960 or BS-1042, ISO 5167
Material	316 SS
Thickness	3 mm for main pipe diameter up to 300 mm and6 mm for main pipe dia above300 mm.
Tappings	Flanged weld neck or D & D/2 with 3 pairs of tapping (as applicable). Root valves to be provided in all the tappings. However for flow elements in CPU, DM & PT plant- 2 Pairs of Tappings shall be provided as minimum.
Beta Ratio	0.34 to 0.7

13.04.00 **NOT USED**

14.00.00 **NOT USED**

15.00.00 **PROCESS ACTUATED SWITCHES**

FEATURES	ESSENTIAL / MINIMUM REQUIREMENTS		
	Pressure/ Draft Switches/ DP Switches	Temperature switches	Level switches
Sensing Element	Piston actuated for high pressure and diaphragm or bellows for low pr./ vacuum	Vapor pressure sensing, liquid filled bellow type with SS bulb and capillary (5 m minimum, to suit application)	Capacitance types, float type, conductivity type, RF type, Ultrasonic type as per suitability to the application. .
Material	316 SS	Bulb 316 SS/ capillary 304 SS	316 SS
End connection	½ inch NPT (F)	½ inch NPT (F)	Manufacturer standard
Over range/ proof pressure	150% of maximum operating pr.	-	150% of maximum operating pr.
Repeatability	+/- 0.5% of full range		
No. of contacts	2 No.+2NC. SPDT snap action dry contact		
Rating of contacts	60 V DC, 6 VA (or more if required by DDCMIS)		
Elect. Connection	Plug in socket.		
Set point adjustment	Provided over full range.		

Dead band adjustment	Adjustable/ fixed as per requirement of application.		
Enclosure	Weather and dust proof as per IP-55, metallic housing.		
Accessories	Siphon, snubber, chemical seal, pulsation dampeners as required by process	Thermo well of 316 SS and packing glands	All mounting accessories
Mounting	Suitable for enclosure/ rack mounting or direct mounting	Suitable for rack mounting or direct mounting	-
Power Supply (wherever required)	As per Contractor's Standard practice.		

Notes :-

1) 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.

2) Pressure/ Diff pressure switches for very low press/ DP measurements can have sensor material other than SS316 in case of any technical limitation and the offered product is standard product of the manufacture for very low pressure applications.

3) Repeatability can be upto +/-1% of full range in case of switches with diaphragm seals or very low pressure/DP range.

4) The specifications of switches for air conditioning & ventilation system / process can be as per system manufacturer's standards. The manufacturer shall submit the adequate supporting documents for establishing their standard practice.

5) For ESP Level Switches following requirements are to be met:
   i) ESP Level Switches calibration shall not be affected by changes in ambient temperature.
   ii) Active build up compensation to be provided to sense and auto correct the effect of ash deposition on level probe.
   iii) Self- -diagnostic features like health status, maintenance requirement, instrument failure, false alarm etc. to be provided.

   The manufacturer shall submit adequate supporting documents, catalogues for establishing the above features.

6) Vibration Rod type switches to be provided for first two fields of ESP.

16.00.00 **NOT USED**

17.00.00 **SOLENOID VALVES**

Solenoid valves shall fulfil the following requirements:

a. Type 2/3/4 way SS 316/Forged Brass (depending on the application subject to Employer's approval during detailed Engg.)

b. Power supply : 24 V DC ± 10%.

c. Plug and socket electrical connection.

d. Insulation : Class 'H'

e. IP Class : IP65

19.05.00 **Electronic Flow-Meter**

The electronic flow meter shall include flow sensor and flow indicator cum integrator / totaliser and shall include all required accessories for satisfactory operation. The flow meter shall be based on full bore electromagnetic principle and shall be electronic type of proven design, make and model acceptable to the owner.

The Bidder shall submit all necessary technical literature and details of selection criteria of the instrument offered to substantiate the model selected. The Bidder shall also furnish list of similar installation along with feed back on satisfactory performance of the instruments.

The flow meter shall meet or exceed the following requirement :

(a)	Output	:	4-20 mA DC Isolated output
(b)	Accuracy	:	± 0.5% of calibrated span or better *
(c)	Repeatability	:	± 0.2% of calibrated span or better
(d)	Power Supply	:	240V AC ± 10%, 50 HZ ± 5%/ 24 V DC, to be arranged by the contractor.
(f)	Protection class	:	IP-55
(e)	Flow tube		SS304
(f)	liner		Hard Rubber

The flow meter shall provide local indication for instantaneous flow. It should also be possible to get local display for daily and monthly discharge. The flow meter shall indicate totaliser/ integrator to get the daily and monthly discharge as stated above.

21.00.00 **Limit switches**

For offsite plant (except PT, DM, Chlorination, chemical treatment, Liquid effluent treatment) application Limit switches shall be silver plated with high conductivity and non corrosive type. Contact rating shall be sufficient to meet the requirement of DDCMIS subject to a minimum of 60 V, 6 VA rating. Protection class shall be IP 55.

For main plant application limit switches are to be provided as per contractor standard and proven practice.

For PT, DM, Chlorination system , chemical treatment, Liquid effluent treatment plant , limit switches of manual valves and solenoid operated on-off valves shall be of inductive proximity type and shall be mounted inside the enclosure: pl. refer the minimum specification requirement below .

Operating voltage Range	10-40 V DC
Sensing system	Inductive Proximity type , 2 Wire
Sensor Contact Type	NO
Reverse polarity and short circuit protection	Yes
IP Class-Sensor	IP67
IP Class-Enclosure(Switch box)	IP67
Cable entry-Enclosure(Switch box)	2no-1/2" NPT
Casing material-Sensor	Brass /SS
Enclosure(Switch box) Housing material	FRP or SS
Operating Ambient temp(sensors)	-5 to 70 deg C
Max allowed Voltage Drop across sensor	5 V
Standard applicable	EN 60947-5-2 or equivalent.

AMS for Profibus Instruments

9.00.00

10.00.00 **ANNUAL MAINTENANCE SERVICES**

10.01.00 The requirements specified below are applicable for warranty (defect liability period) and 3 years AMS period.

10.01.01 The Contractor's scope shall also include providing Post Warranty Maintenance for 3 years after completion of warranty period of the offered profibus systems and all associated components as per specification. The AMS shall include tools and tackle as required; travel, boarding & lodging of service engineer. In the event of any malfunction of the system hardware/system software, experienced service engineer shall be made available at site within 48 hours on the receipt of such information from Employer.

Employer personnel will work on system day-to-day basis and wherever possible, Employer shall inform the type of failure of hardware/ software to Contractor based on diagnostic available with the system. However Contractor shall be fully responsible to attend and rectify the root cause and the failure within 48 hrs. Contractor may utilize the spares available with Employer, if necessary and available with Employer at site, which are part of mandatory spares supplied with system as per this specification. However, the consumed spares shall be replenished to Employer within 2 months' time.

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10.02.00 **The services under Post Warranty Maintenance Agreement, shall broadly comprise of the following:**

10.02.01 Periodic Maintenance Site visits, minimum four (4) times in a year (total days expected 16 in a year), schedule of visits to be discussed and finalized jointly between Contractor and client after placement of order/ delivery. It shall include inspection of general healthiness of the system, study and advice on daily maintenance, inspection of Hardware & Software, if any problem is reported, running of test programs, on-line servicing and solving reported problems. System shall be checked online.

10.02.02 Software Maintenance/ Support Contractor shall maintain the existing operating & application software for any debugging requirements to have consistent performance of the system.

10.02.03 Emergency Service In the event of any malfunction of the profibus system hardware/system software during this period, Service Engineer must report at site within 48 hrs. of report of failure. The system must be brought back within 48 hours after reporting at site.

10.03.00 Contractor shall note that while carrying out the Annual Maintenance Contract activities, Employer's engineers shall associate with the Contractor. On-job training of these associated engineers shall be covered under this scope. This shall include all items being supplied by Contractor, including any bought out items but not limited to the following:

Labour, at no additional cost, to repair any system devices , to provide tests, and adjustment to system devices.

SPECIFICATIONS FOR PR. GAUGE, D.P. GAUGE, TEMP. GAUGE AND LEVEL GAUGE.

Sl. No	FEATURES	ESSENTIAL/MINIMUM REQUIREMENTS		
		Pr. Gauge/ DP Gauge/ Draught gauges	Temperature Gauge	Level Gauge
1	Sensing Element and material	Bourdon for high pressure, Diaphragm/Bellow for low pr. Of 316 SS	Mercury in steel for below 450°C and inert gas actuated for above 450°C of SS bulb and capillary.	Tempered * toughened Borosilicate gauge glass steel armoured reflex or transparent type.
2	Body material	SS 316	SS 316	Forged carbon steel/304 SS
3	Dial size	150mm	150 mm	Tubular covering entire range
4	End connection	1/2 inch NPT (M)	3/4" 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° arc graduated in metric units	Linear, 270° arc graduated in °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 be1.5 to the max. Design pr. at 38°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 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	

Notes:-

*Bicolour type level gauges will be provided for applications involving steam and water except for condensate and feed water services.

Length of gauge glass shall not be more than 1400 mm. If the vessel is higher, multiple gauge glasses with 50 mm overlapping shall be provided.

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.

6.00.00 **FIELD MOUNTED LOCAL JUNCTION BOXES (AS PER STANDARD AND PROVEN**

Practice of vendor

(i)	No. of ways	12/24/36/48/64/72/96/128 with 20% spares terminals.
(ii)	Material and Thickness	4mm thick Fiberglass Reinforced Polyester (FRP).
(iii)	Type of terminal blocks	Rail mounted cage-clamp type suitable for conductor size upto 2.5 mm^2. A M6 earthing stud shall be provided.
(iv)	Protection Class	IP: 55 min. for indoor & IP-65 min for outdoor applications.
(v)	Grounding	To be provided.
(vi)	Color	RAL 7035

11.00.00 **CONDUITS AND CABLE TRAYS TO BE PROVIDED AS PER STANDARD AND PROVEN PRACTISE OF CONTRACTOR.**

PROVENESS CRITERIA

5.00.00 **INSTRUMENTS (PRIMARY & SECONDARY)**

(i)	Type of Instrument	
(ii)	Make / Model	
(iii)	Name of Power Station (Location & Address)	
(iv)	Unit Size (MW)	
(v)	Commissioning date	
	Whether above instruments have atleast one (1) year satisfactory operation in one (1) power station having unit rating of 200 MW or above.	Yes/No
(vi)	Client's certificate attached	Yes/No

PROCESS CONNECTION AND PIPING

PROCESS CONNECTION AND PIPING

1.00.00 **PROCESS CONNECTION PIPING**

Process connection & piping including all impulse piping, sample piping, pneumatic piping/tubing, valves, valve manifolds, fittings and all other accessories required for proper installation & completeness of impulse piping system, sampling piping system and air supply system shall be provided by the Contractor on as required basis.

The rating of material of impulse pipes, tubes, fittings, valves and their installation thereof shall conform to the latest edition of standards as per following table:

Impulse Pipes, Tubes (Material, Rating)	ANSI B31.1, ANSI B31.1a, ANSI/ISA 77.70
Valves (Material, Pr. Class, Size)	ASTM A182/ASTM A105 as per ASME 16.34
Fittings (Size, Rating, Material)	ANSI B31.1, ANSI B31.1a, ASME B16.11-2009
Installation Schemes	BS 6739-2009, ANSI/ISA 77.70

Instrument air filters cum regulator set with mounting accessories shall be provided for pneumatic device requiring air supply.

1.01.00 All transmitters and switches (except for fuel oil applications) shall be suitably grouped together and mounted inside
(i) Local Instruments Enclosures (LIE) in case of Open Areas of the Plant like Boiler Area, Coal Handling, Chimney Area, FGD area, CW Pump House, DM Plant, PT Plant, Ash Handling Plant etc.
(ii) Local Instrument Racks (LIR) in case of covered areas like Turbine Area, Generator Area etc.
(iii) Local Indicators/Gauges shall also be suitably grouped in Local Instrument Racks

In case grouping is not possible and these are to be installed individually, canopy with suitable mounting arrangement shall be provided.

All electric actuators, pneumatic control valves, Junction Boxes, Solenoid boxes and Local control panels which are not installed inside building, suitable canopy shall be provided and design of canopy shall be approved by Employer during detailed engineering.

1.02.00 Local Instrument Enclosures (LIEs) and Local Instrument Racks (LIRs) complete with all fittings, mountings & accessories, drains and Utility Lighting, Cable & Grounding cable etc. shall be provided by the Contractor on as required basis. The Degree of Protection of LIE and JB of LIE/LIR shall be IP-55. The instrument racks shall be constructed from 1.6 mm sheet plate and shall be free standing type constructed of suitable 3 mm thick channel frame of steel and shall be provided with a canopy to protect the equipment mounted in racks from falling objects, water etc. The canopy shall not be less than 3 mm thick steel and extended beyond the ends of the rack.

1.03.00 All temperature transmitters shall be suitably grouped together and mounted inside (i) Enclosures in case of open areas of the plant like Boiler Area, Coal Handling,

Chimney Area, FGD area, CW Pump House, DM Plant, PT Plant, Ash Handling Plant etc. and (ii) Racks in case of covered areas like Turbine Area, Generator Area etc. on as required basis. In case grouping is not possible and temperature transmitter is to be installed individually, canopy with suitable mounting arrangement shall be provided.

1.04.00 For skid mounted instruments and instruments integral to equipments, process connection and piping can be in line with bidder's standard and proven practice.

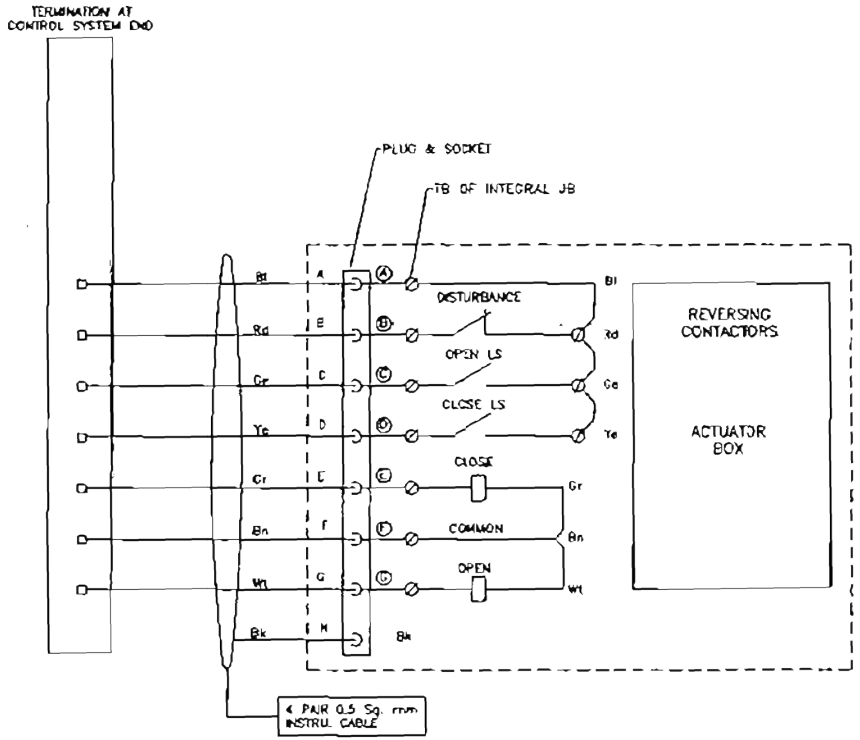
1.05.00 Contractor shall furnish "Certificate of Compliance" of erection of PCP as per NTPC approved documents.

1.06.00 PAINTING COLOR SCHEME FOR IMPULSE PIPING

S. No.	Area / Equipment	Impulse Pipe Ground Color		Identification Tag/Band		
		Color	RAL	Color	ISC No.	RAL
1)	Air	Grey	9002	Sky Blue	101	
2)	Water	Grey	9002	Sea Green	217	
3)	Steam	Aluminum		Signal Red	537	3001
4)	Air Steam Mixture	Aluminum		Sky Blue	101	
5)	Gas	Grey	9002	Canary Yellow	309	
6)	Oils	Grey	9002	Light Brown	410	
7)	Pulverized Fuel	Grey	9002	Silver Grey	628	
8)	Fire Installations	Fire Red	536 (ISC) 3001 (RAL)	White		9010
9)	HP Dosing	Grey	9002	Dark Admiralty Grey	632	
10)	LP Dosing / acid / alkali Piping	Grey	9002	Signal Red	537	
11)	Ash Piping	Grey	9002	French Blue	166	

Note: Ground color indicated against each piping shall be followed in case piping is not insulated /cladded.

DRIVE & INSTRUMENT CABLE INTERCONNECTION AND TERMINATION PHILOSOPHY



FOR TENDER PURPOSE ONLY

एन टी पी सी लिमिटेड
NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT: TYPICAL THERMAL POWER PROJECT

TITLE: INTERFACING OF ACTUATORS

REV.NO	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
A	FIRST ISSUE										28.04.06

CLEARED BY

SIZE	SCALE	DRG. NO.	REV. NO.
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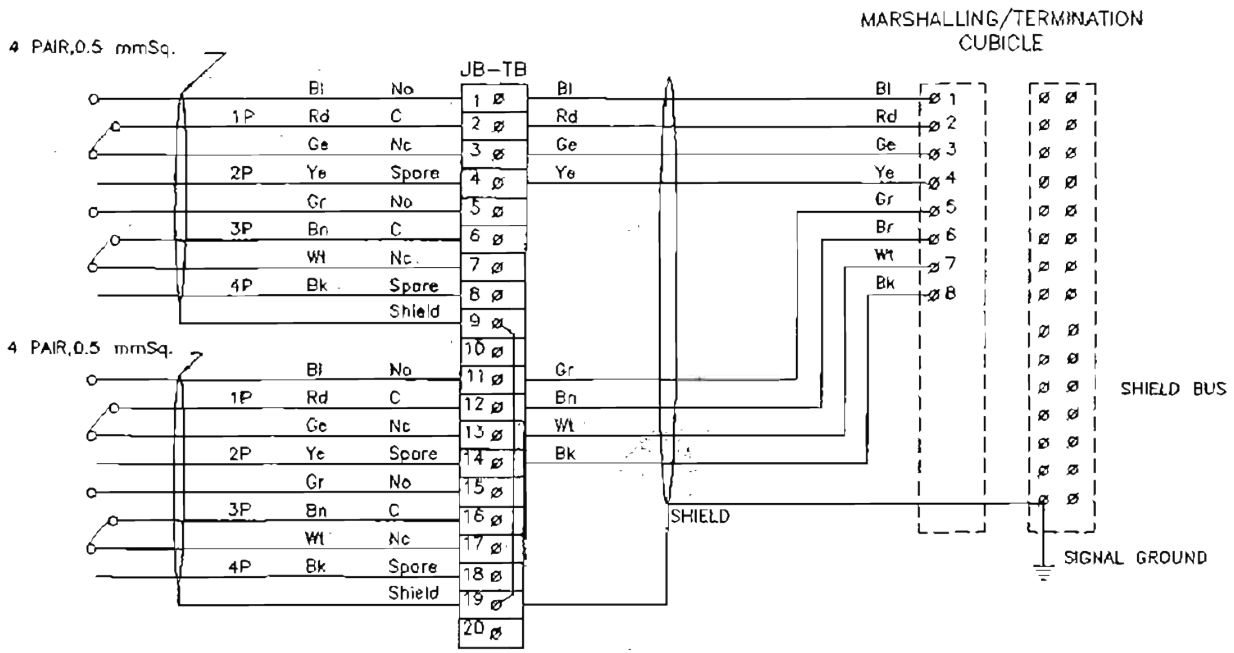

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NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT: TYPICAL THERMAL POWER PROJECT

TITLE: INTERFACING OF FIELD INSTRUMENTS/ SWGR SWITCH (COC) TERMINATION DETAILS

REV.NO	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
A	FIRST ISSUE										29.04.08

CLEARED BY

SIZE	SCALE	DRG. NO.	REV. NO.
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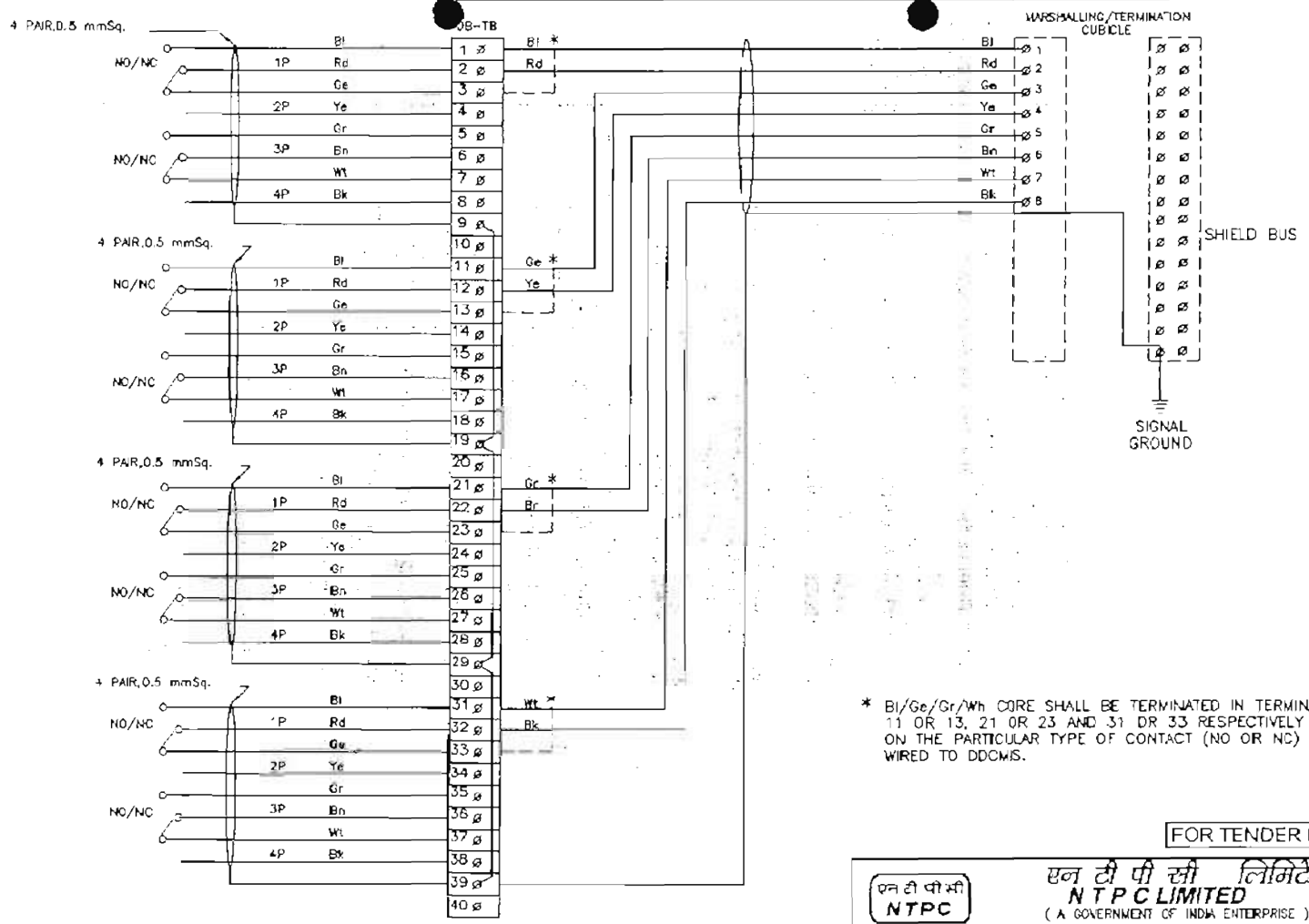

* Bl/Ge/Gr/Wh CORE SHALL BE TERMINATED IN TERMINAL 1 OR 3, 11 OR 13, 21 OR 23 AND 31 OR 33 RESPECTIVELY DEPENDING ON THE PARTICULAR TYPE OF CONTACT (NO OR NC) IS TO BE WIRED TO DDCMIS.

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NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT: TYPICAL THERMAL POWER PROJECT

TITLE: INTERFACING OF FIELD INSTRUMENTS
SWITCH TERMINATION DETAILS
NO/NC

REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
A	FIRST ISSUE										29.04.06

CLEARED BY

SIZE	SCALE	DRG. NO.	REV. NO.
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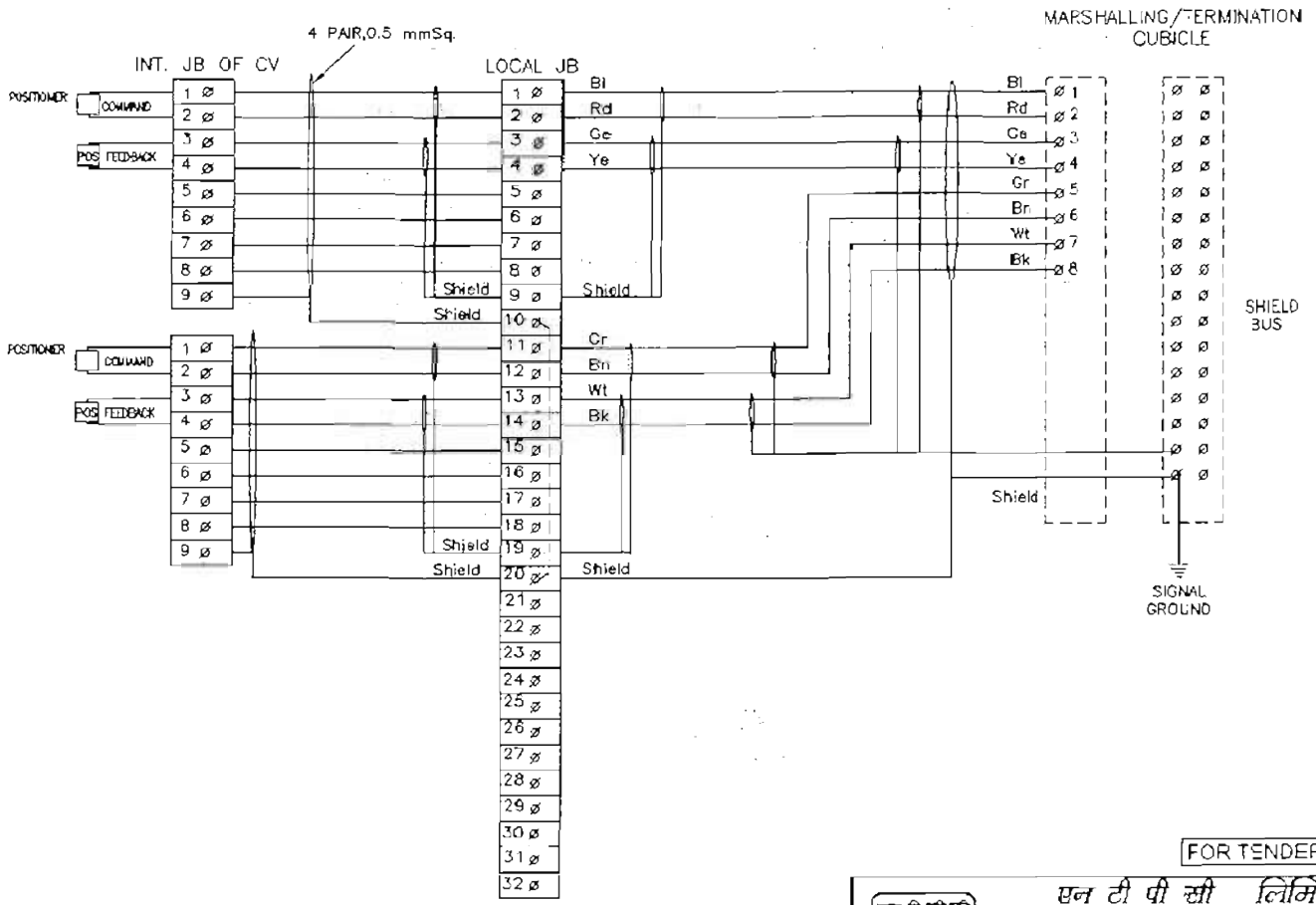

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NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT: TYPICAL THERMAL POWER PROJECT

TITLE: INTERFACING OF FIELD INSTRUMENTS CONTROL VALVE

REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
A	FIRST ISSUE										29.04.06

CLEARED BY

SIZE	SCALE	DRG. NO.	REV. NO.
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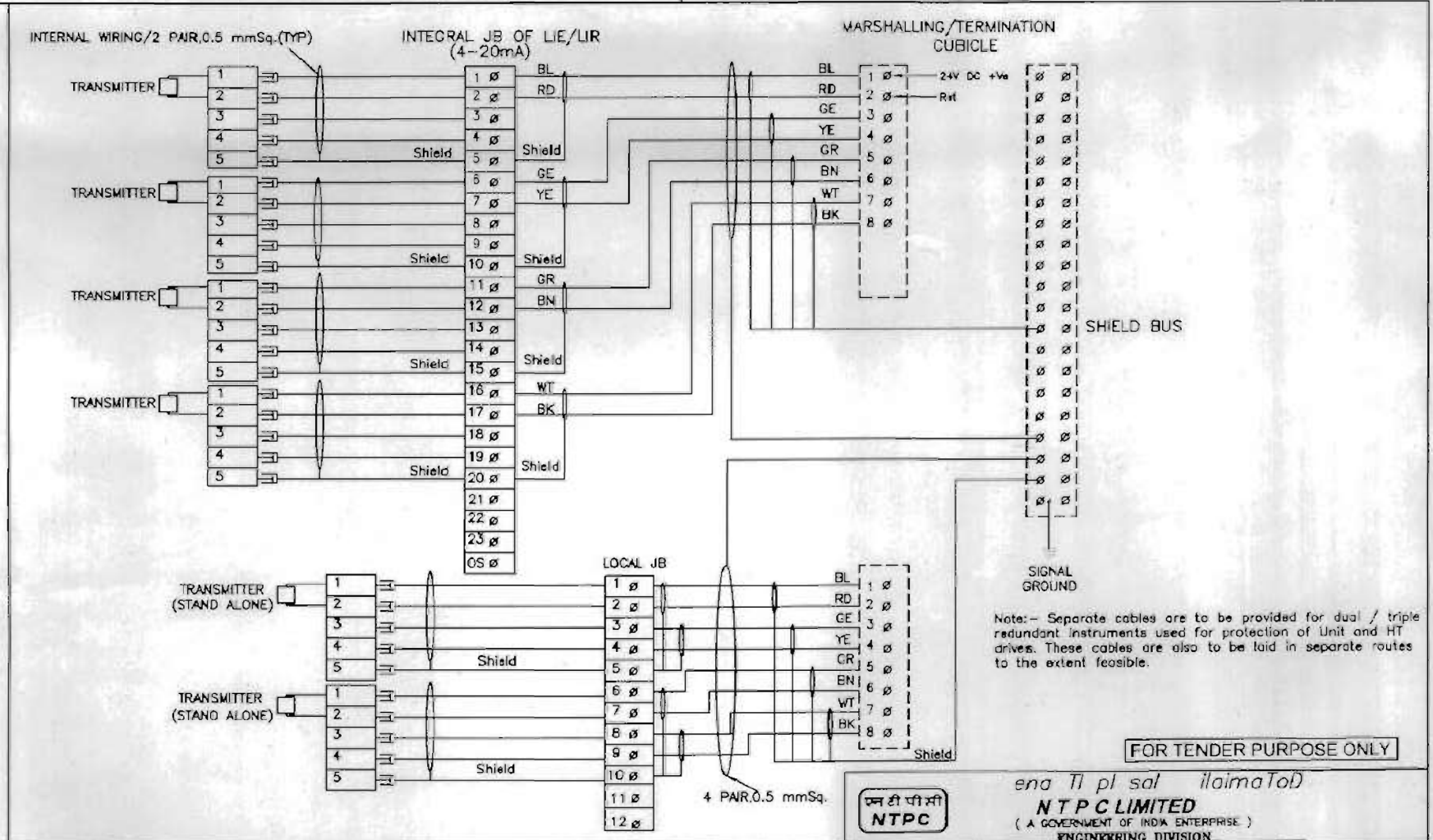

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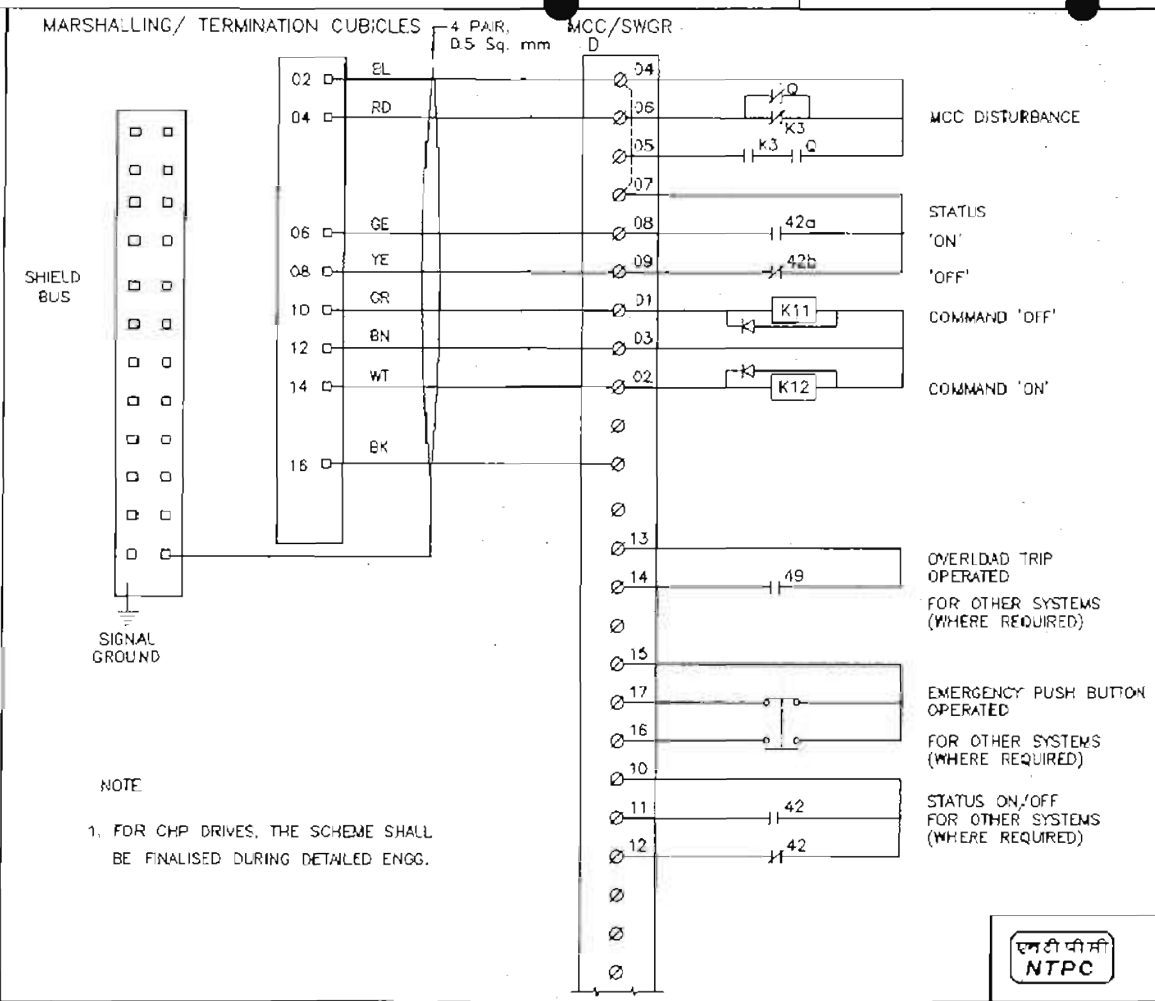
REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
C	NOTE REGARDING CABLE IS ADDED.										10.12.13
B	INTERNAL WIRING FOR LIE/LIR MOUNTED SHOWN WIRING OF STAND ALONE TXTR SHOWN										10.12.06
A	FIRST ISSUE										12.1.05

CLEARED BY

PROJECT: TYPICAL THERMAL POWER PROJECT

TITLE: INTERFACING OF FIELD INSTRUMENTS 4-20mA

SIZE	SCALE	DRG. NO.	REV. NO.
A3	NTS	0000-999-POI-A-065 SH 04 OF 14	C



NOTE

1. FOR CHP DRIVES, THE SCHEME SHALL BE FINALISED DURING DETAILED ENGG.

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N T P C LIMITED
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ENGINEERING DIVISION

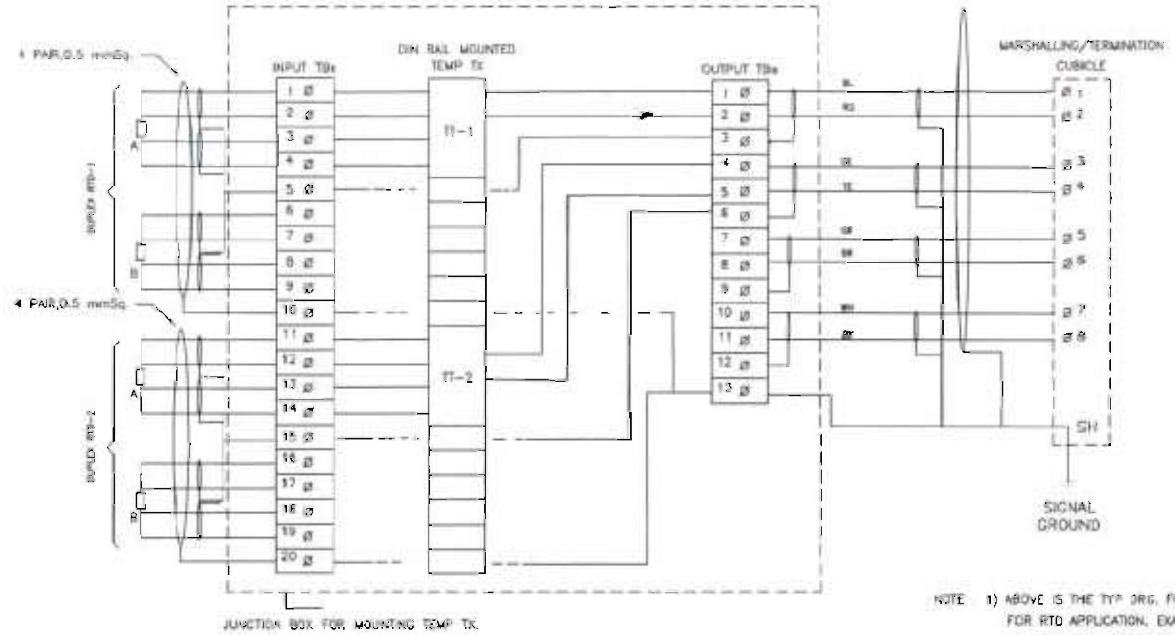
REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD	M	E	C	C&I	ARCH.	APPD	DATE
A	FIRST ISSUE										29.04.08

CLEARED BY

PROJECT: TYPICAL THERMAL POWER PROJECT

TITLE: INTERFACING OF FIELD INSTRUMENTS
INTERFACE OF DDCMIS WITH MCC/SWGR/ACTUATOR
(LT MOTORS)

SIZE	SCALE	DRG. NO.	REV. NO.
A3	NTS	0000-999-POI-A-065 SH 05 OF 14	A



NOTE 1) ABOVE IS THE TYP DRG. FOR DIN RAIL MOUNTED TEMP TRANSMITTERS FOR RTD APPLICATION, EXACT TYPE OF TEMP TRANSMITTER SHALL BE AS PER PART-A OF SPECIFICATION.

2) THE EXACT GROUPING OF TEMP Txs SHALL BE FINALISED DURING DETAILED ENGG. STAGE.

FOR TENDER PURPOSE ONLY

NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT: TYPICAL THERMAL POWER PROJECT

TITLE: INTERFACING OF FIELD INSTRUMENTS
TYPICAL RTD CONNECTION WITH TEMP TRANSMITTERS INJBs

REV NO	DESCRIPTION	DRAWN	DESIGN	CHKD	M	E	C	C&I	ARCH.	APPD	DATE
A	FIRST ISSUE										29.04.01

CLEARED BY

SIZE	SCALE	DRG. NO.	REV. NO
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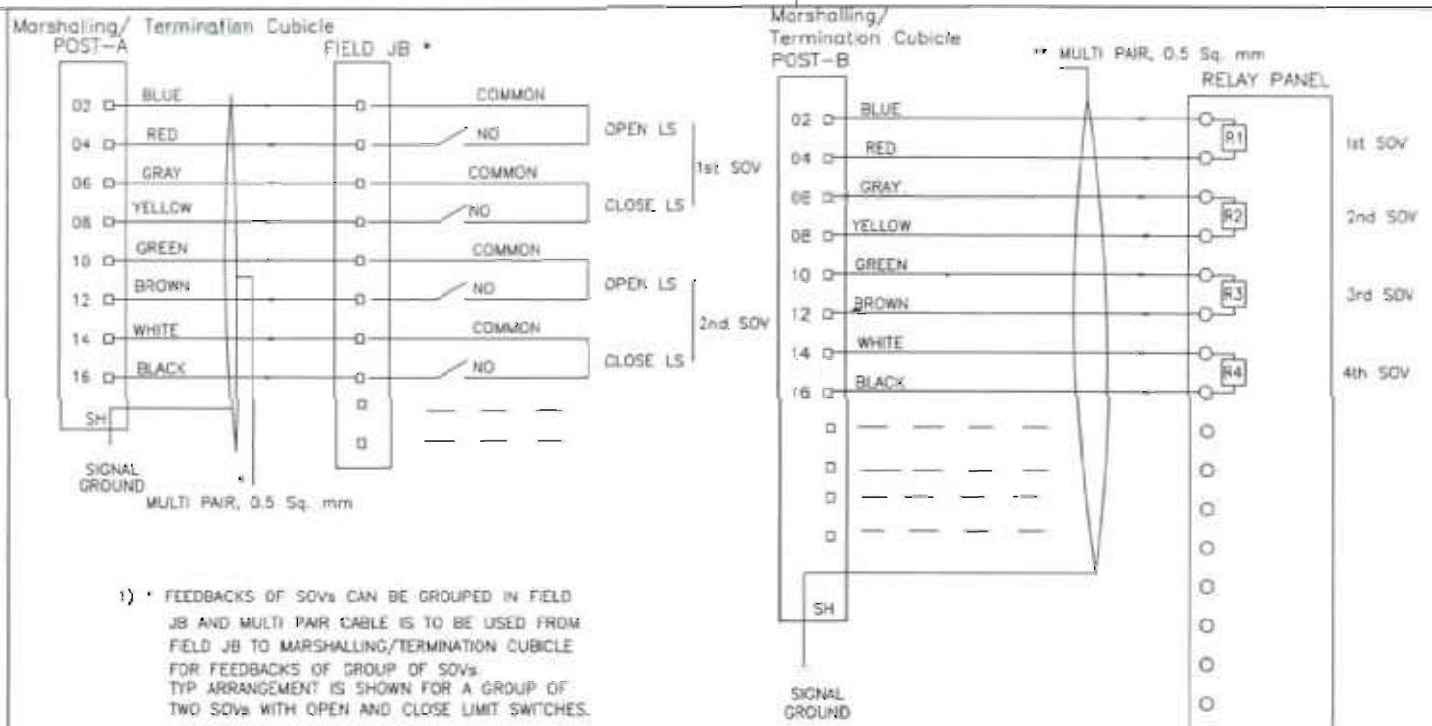


1) * FEEDBACKS OF SOVs CAN BE GROUPED IN FIELD JB AND MULTI PAIR CABLE IS TO BE USED FROM FIELD JB TO MARSHALLING/TERMINATION CUBICLE FOR FEEDBACKS OF GROUP OF SOVs. TYP ARRANGEMENT IS SHOWN FOR A GROUP OF TWO SOVs WITH OPEN AND CLOSE LIMIT SWITCHES.

2) NO. OF LIMIT SWITCHES/NO. OF CONTACT IN LIMIT SWITCHES SHALL BE PROVIDED FOR EACH VALVE AS PER SPEC. REQUIREMENT/ PHILOSOPHY FOR RESPECTIVE SYSTEM.

3) ** MULTIPAIR CABLE IS TO BE USED FOR CONNECTION OF COMMAND OUTPUTS FROM MARSHALLING/TERMINATION CUBICLE TO RELAY PANEL FOR A GROUP OF SOVs.

REV NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
B	FIRST ISSUE										30.10.02

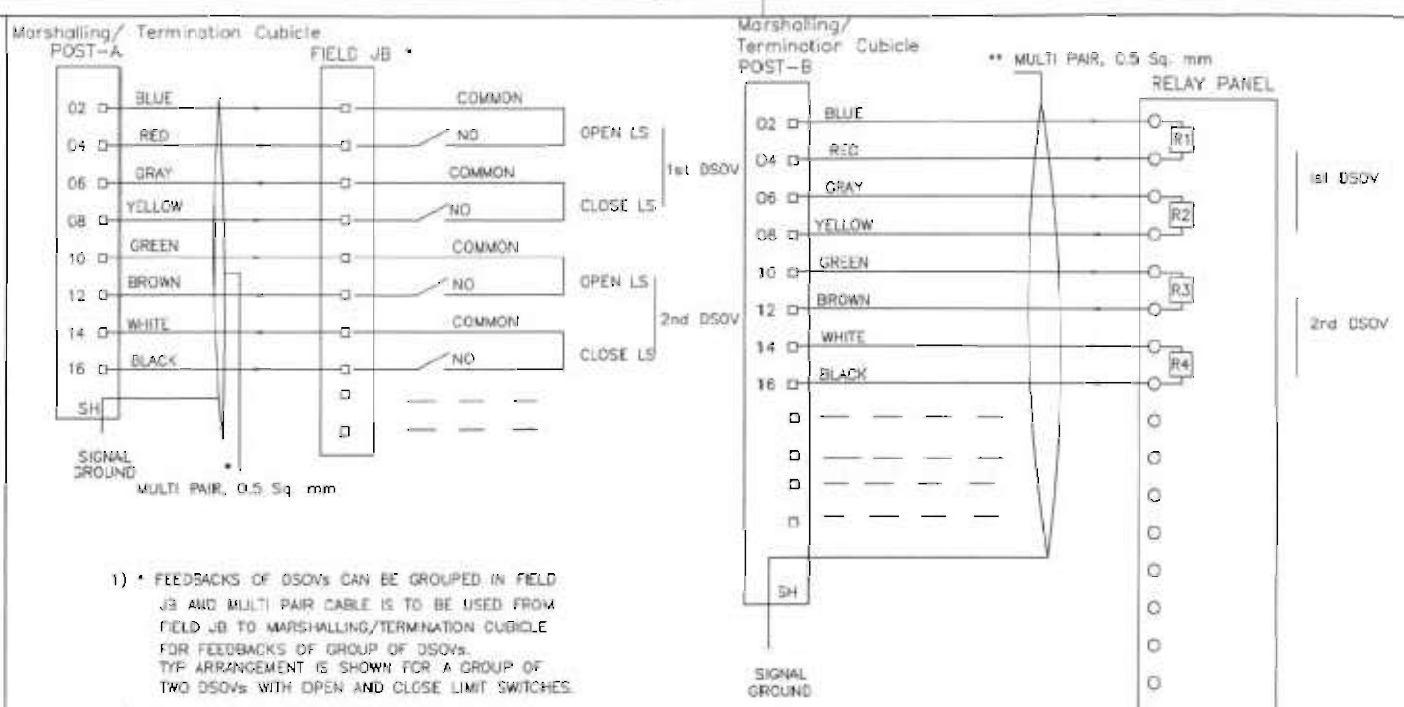
CLEARED BY

एन टी पी सी NTPC
नेशनल थर्मल पावर कार्पोरेशन लिमिटेड
National Thermal Power Corporation Ltd.
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT: TYPICAL THERMAL POWER PROJECT

TITLE: INTERFACING OF FIELD INSTRUMENTS
INTERFACE OF DDCMIS WITH MCC/SWGR/ACTUATOR
(SINGLE COIL SOLENOID)

SIZE	SCALE	DRG. NO.	REV. NO.
A3	NTS	0000-999-FOI-A-065 SH 08 OF 14	C



1) * FEEDBACKS OF DSOVs CAN BE GROUPED IN FIELD JB AND MULTI PAIR CABLE IS TO BE USED FROM FIELD JB TO MARSHALLING/TERMINATION CUBICLE FOR FEEDBACKS OF GROUP OF DSOVs. TYP ARRANGEMENT IS SHOWN FOR A GROUP OF TWO DSOVs WITH OPEN AND CLOSE LIMIT SWITCHES.

2) NO. OF LIMIT SWITCHES/NO. OF CONTACT N LIMIT SWITCHES SHALL BE PROVIDED FOR EACH VALVE AS PER SPEC. REQUIREMENT/ PHILOSOPHY FOR RESPECTIVE SYSTEM.

3) ** MULTIPAIR CABLE IS TO BE USED FOR CONNECTION OF COMMAND OUTPUTS FROM MARSHALLING/TERMINATION CUBICLE TO RELAY PANEL FOR A GROUP OF DSOVs.

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National Thermal Power Corporation Ltd.
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT: TYPICAL THERMAL POWER PROJECT

TITLE: INTERFACING OF FIELD INSTRUMENTS
INTERFACE OF DDCMIS WITH MCC/SWGR/ACTUATOR
(DOUBLE COIL SOLENOID)

REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
B	FIRST ISSUE										30.10.00

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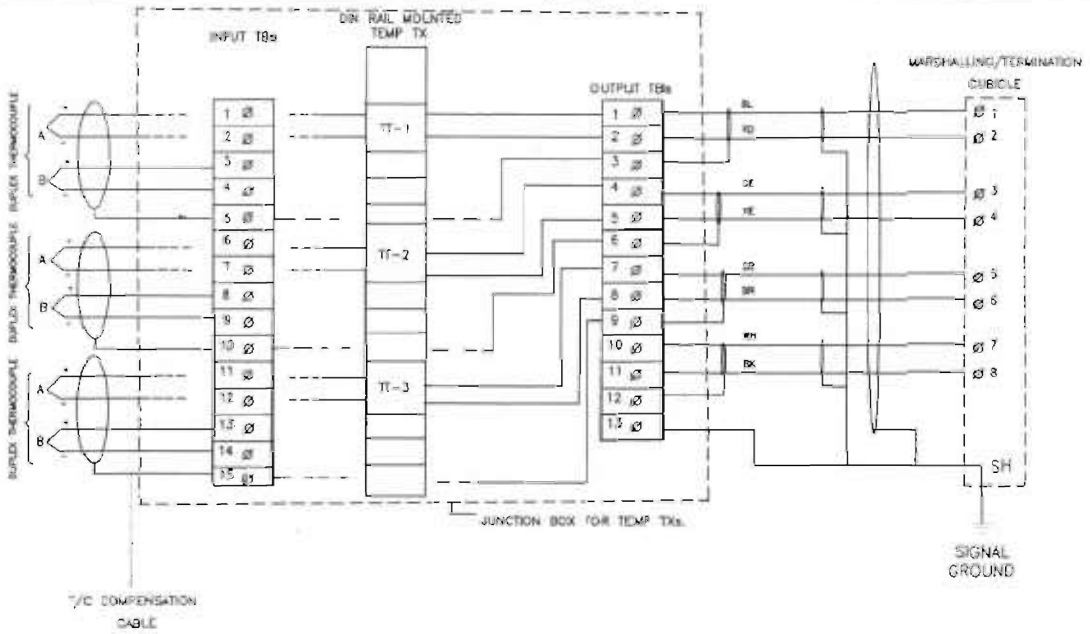
SIZE	SCALE	DRG. NO.	REV. NO.
A3	NTS	0000-999-POI-A-065 SH 09 OF 14	C



NOTE: 1) ABOVE IS THE TYP DRG FOR DIN RAIL MOUNTED TEMP TRANSMITTER FOR T/C APPLICATION. EXACT TYPE OF TEMP TRANSMITTERS SHALL BE AS PER PART-A OF SPECIFICATION.

2) THE EXACT GROUPING OF TEMP TXs SHALL BE FINALISED DURING DETAILED ENGG. STAGE.

3) AFTER BLANDING OF T/C CABLES ON JB, THE CABLE PAIR OF FIRST ELEMENT WILL BE DIRECTLY CONNECTED TO TI AND FOR CABLE PAIR OF SECOND ELEMENT LOOP SHALL BE KEPT, BEFORE TERMINATION AT INPUT TBs FOR FUTURE USE.

FOR TENDER PURPOSE ONLY

NTPC

N T P C LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT: TYPICAL THERMAL POWER PROJECT

TITLE: INTERFACING OF FIELD INSTRUMENTS
TYPICAL T/C CONNECTION WITH TEMP TXs IN JBs

REV.NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
A	FIRST ISSUE										29.04.05

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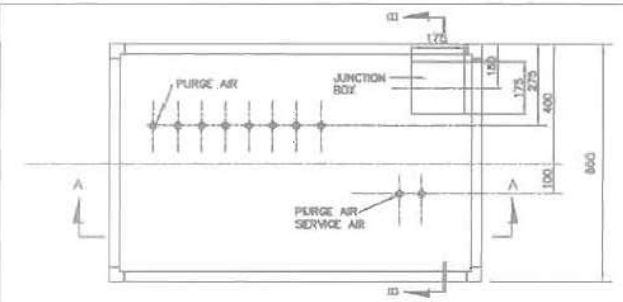
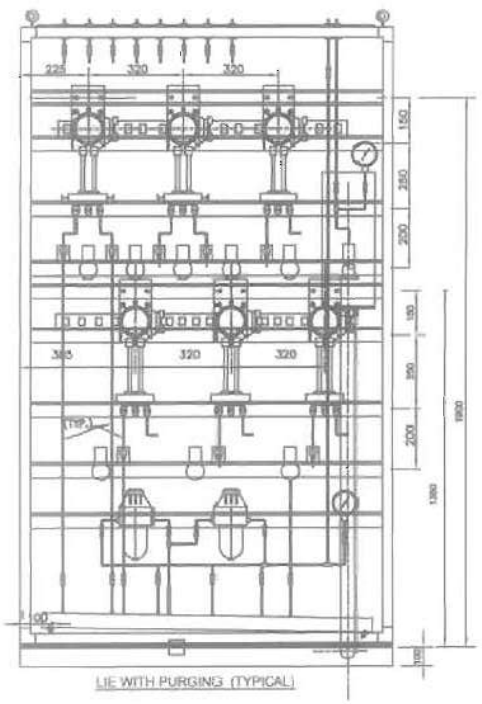
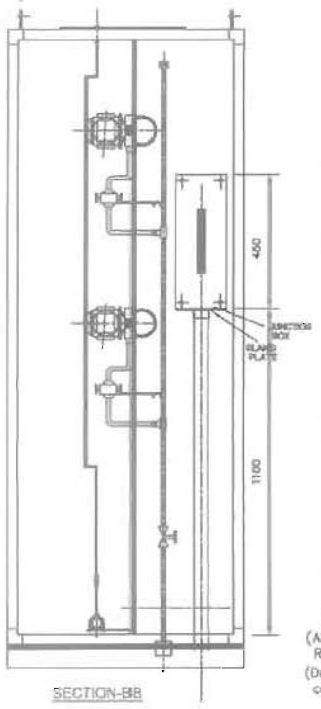
SIZE	SCALE	DRG. NO.	REV. NO.
A3	NTS	0000-999-POI-A-065 SH 11 OF 14	C

LIE/LIR AND INSTRUMENT INSTALLATION DIAGRAM





LIE WITH PURGING (TYPICAL)



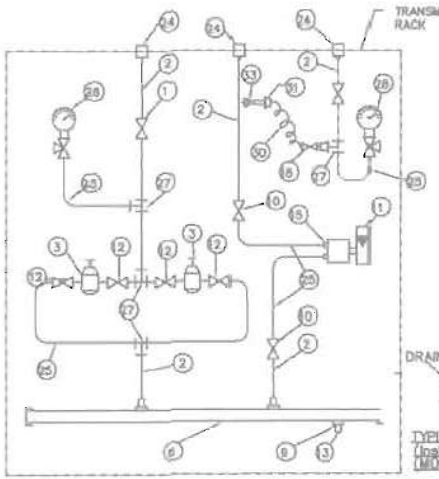
SECTION-BB

LIST OF MATERIALS

ITEM NO.	DESCRIPTION
1.	ISOLATION VALVE(gate/globe). SS.
2.	SEAMLESS SS PIPE.
3.	AIR FILTER REGULATOR.
6.	INST. AIR HEADER SS.
10.	COMP. NEEDLE VALVE SS.
11.	AIR PURGE SET.
12.	COMP VALVE SS.
13.	PLUG SS.
15.	TUBE SS CONNECTOR.
16.	TUBE COMP. EQUAL TEE UNION.
24.	BULKHEAD-SS SUITABLE FOR GI PIPE CONNECTION
25.	SEAMLESS TUBE SS.
27.	BRANCH TEE SS.
28.	PR. GAUGE.
30.	NYLON FLEX. HOSE BRAIDED WITH SS WIRE.
31.	HOSE BARBED CONN. SS.
33.	QUICK DISCONNECT SS (PURGE AIR CONNECTION TO INSTRUMENT SOURCE END).

LIST OF MATERIALS

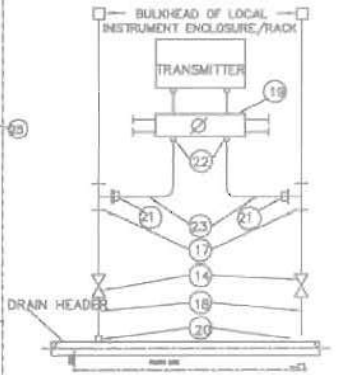
ITEM NO.	DESCRIPTION
14.	SW GLOBE VALVE.
17.	SW EQUAL TEE
18.	S.S. NIPPLE
19.	5 VALVE MANIFOLD
20.	SW HALF COUPLET CS
21.	PIPE x TUBE UNION
22.	SUITABLE ADAPTER
23.	SS TUBE



TYPICAL PURGE AIR CONNECTION INSIDE THE INST. ENCLOSURE

(APPLICABLE FOR MILL, AIR & FLUE GAS SERVICE INSTRUMENTS REQUIRING PURGE AIR)

(Drain Header of each LIE/LIR shall be connected to nearest plant drain)



TYPICAL ARRANGEMENT OF DP TRANSMITTER (Inside LIE/LIR) (MOUNTED BELOW INSTRUMENT SOURCE POINT)

FOR TENDER PURPOSE ONLY

NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT: TYPICAL THERMAL POWER PROJECT (TURNKEY EPC PACKAGE)

TITLE: TYPICAL GA OF LOCAL INSTRUMENT ENCLOSURE, PURGING SCHEME, DP TRANSMITTER

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	GM	ARCH.	APPD	DATE
A	FIRST ISSUE										08.09.11

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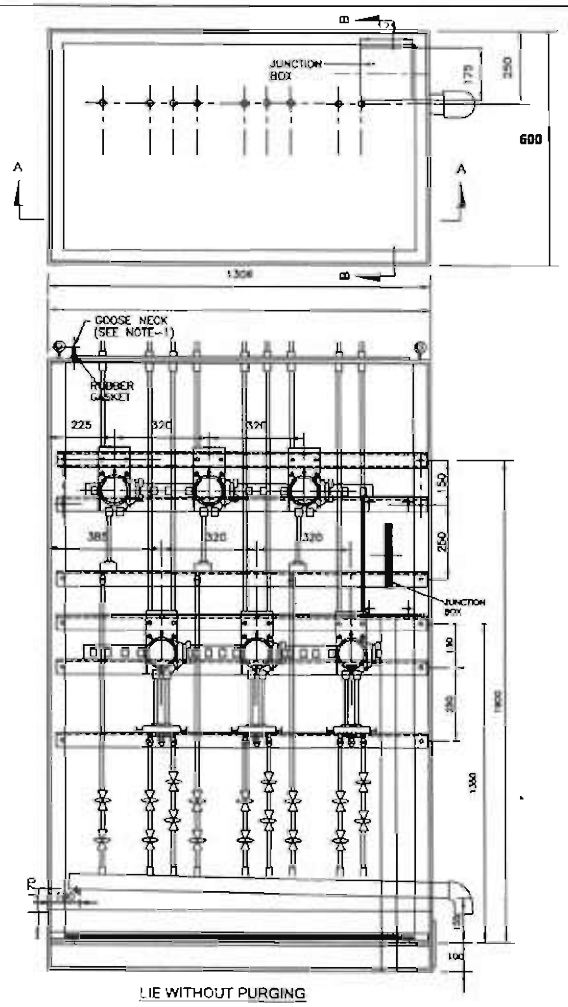
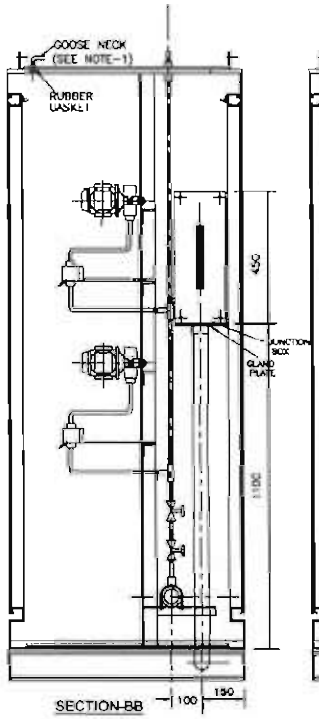
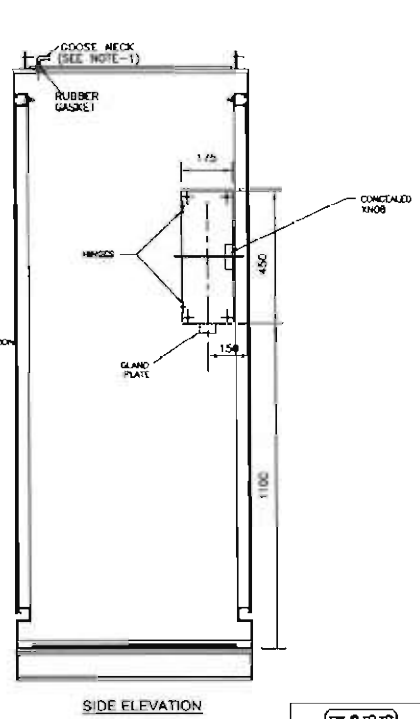
SIZE	SCALE	DRG. NO.	REV. NO.
A2	N.T.S.	0000-999-POI-A-036	A



LIE WITHOUT PURGING



SECTION-BB



SIDE ELEVATION

NOTES:-

1. TO BE PROVIDED FOR LIEs USED IN STEAM & WATER APPLICATION.
2. MATERIAL OF JBs FOR LIEs SHALL BE SAME AS THAT OF LIE.

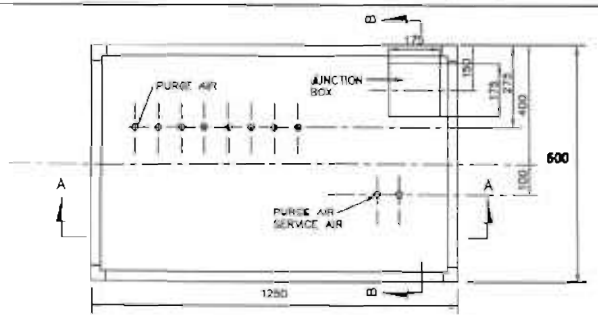
FOR TENDER PURPOSE ONLY

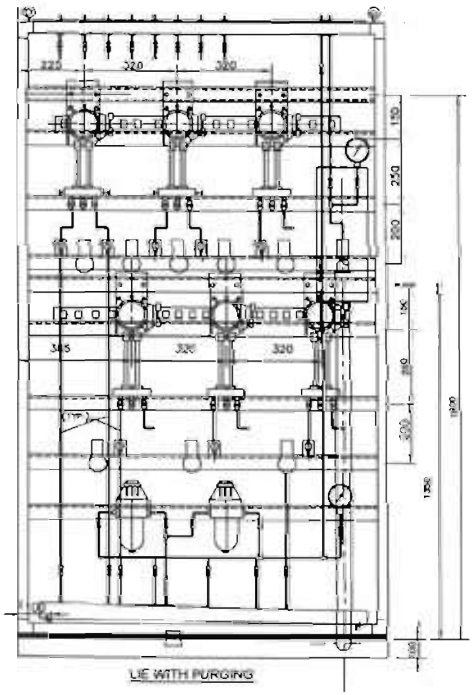
NTPC — N T P C LIMITED (A GOVERNMENT OF INDIA ENTERPRISE) ENGINEERING DIVISION

PROJECT: TYPICAL THERMAL POWER PROJECT

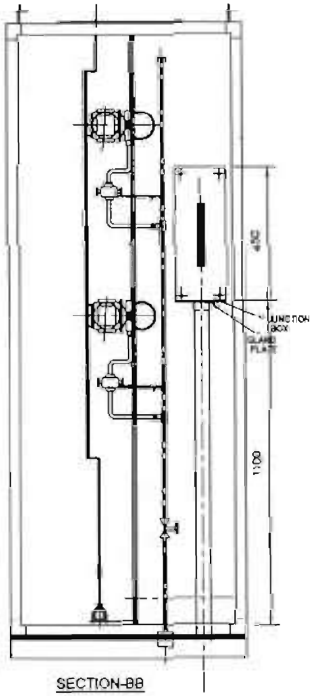
TITLE: TYPICAL GA OF LOCAL INSTRUMENT ENCLOSURE / RACK

REV. NO	DESCRIPTION	SIZE	SCALE	DRG. NO.	REV. NO.
A	FIRST ISSUE	A2	N.T.S.	0000-999-POI-A-064 SHEET 01 OF 03	B





LIE WITH PURGING



SECTION-BB

NOTES.-

1. MATERIAL OF JBs FOR LIEs SHALL BE SAME AS THAT OF LIE.

FOR TENDER PURPOSE ONLY

NTPC LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)

PROJECT: TYPICAL THERMAL POWER PROJECT

TITLE: TYPICAL GA OF LOCAL INSTRUMENT ENCLOSURE / RACK

SIZE	SCALE	DRG. NO.	REV. NO.
A2	N.T.S.	0000-999-POI-A-064 SH- 02 OF 03	B

REV.NO	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	REMKS/ DATE
A	FIRST ISSUE							T.G.			

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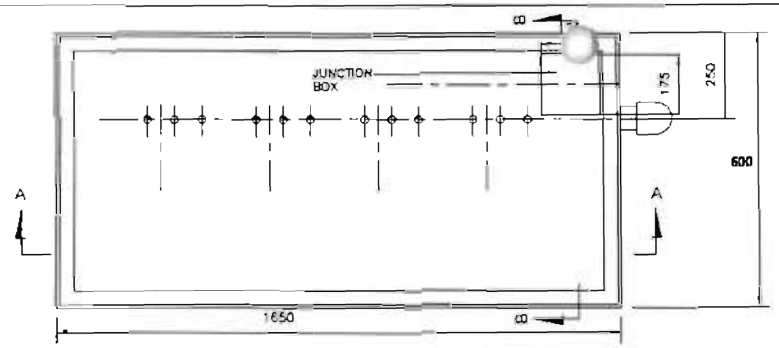
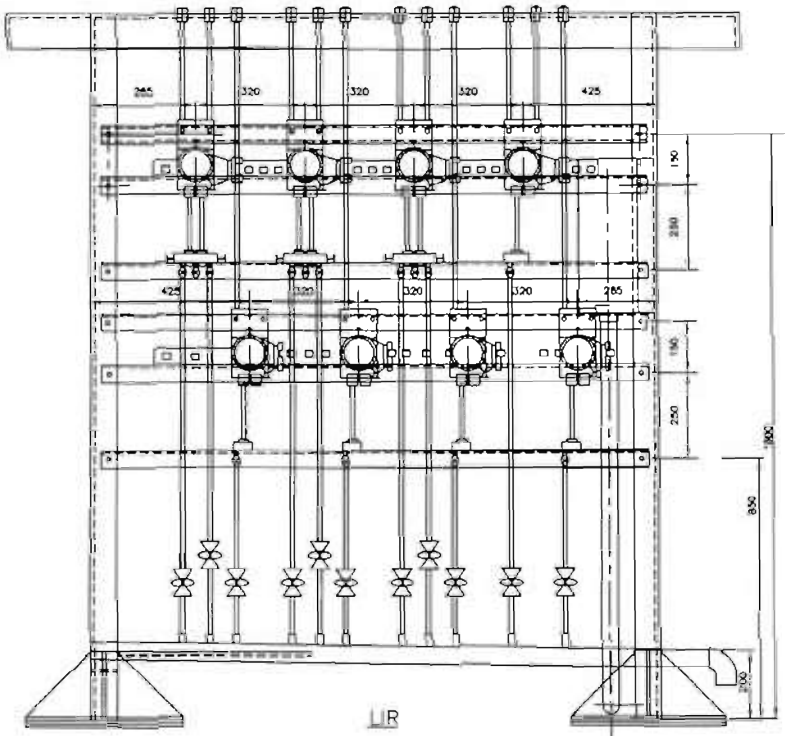
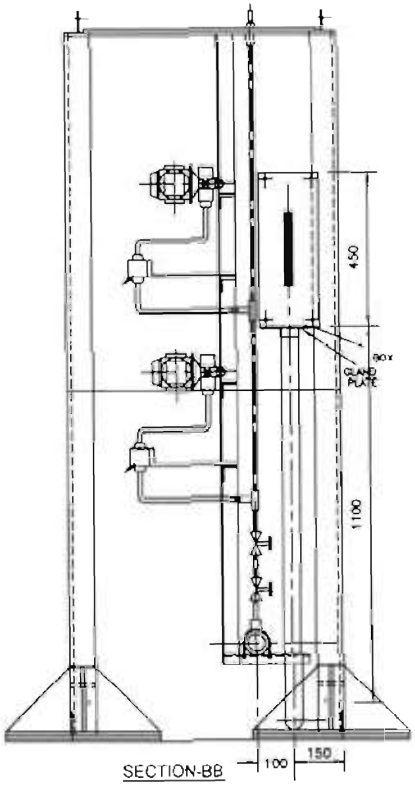




LIR



SECTION-BB

NOTE:-

1. MATERIAL OF JBs FOR LIRs SHALL BE SAME AS THAT OF LIR.

SECTION-AA
LIR WITHOUT PURGING

FOR TENDER PURPOSE ONLY

NTPC

N T P C LIMITED
(A GOVERNMENT OF INDIA ENTERPRISE)
ENGINEERING DIVISION

PROJECT: TYPICAL THERMAL POWER PROJECT

TITLE: TYPICAL GA OF LOCAL INSTRUMENT ENCLOSURE / RACK

REV. NO.	DESCRIPTION	DRAWN	DESIGN	CHKD.	M	E	C	C&I	ARCH.	APPD	DATE
A	FIRST ISSUE										21.06.12

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SIZE	SCALE	DRG. NO.	REV. NO.
A3	N.T.S.	0000-999-POI-A-064 SH- 03 OF 03	A