

ANNEXURE - 2

5 x 800 MW YADADRI THERMAL POWER STATION, NALGONDA- INERT GAS EXTINGUISHING SYSTEM - BIDDER DWGS/DOCS SCHEDULE												
1	LIST OF SUPERCIDED DRAWINGS / DOCUMENTS				S	TO INDEX PAGE		NO COMMENTS				1
2	LIST OF ACTIVE DRAWINGS / DOCUMENTS				A	TODAY'S DATE		COMMENTS AS MARKED CLEARED FOR MANUFACTURE				2
3	LIST OF DRAWINGS/DOCUMENTS UNDER PREPARATION				UP	31-Mar-21		NOT APPROVED & COMMENTS AS MARKED				3
4	LIST OF BHEL APPROVED DRAWINGS				ADS			RETAINED FOR INFORMATION				4
									A		1	
1	Drawings & Documents Pending with BIDDER								A	P-BIDDER	2	
2	Drawings & Documents Pending with BHEL								A	P-BHEL	3	
3	Drawings & Documents Approved by BHEL								A	ADS	4	
4	Supercided Drawings.								A	S		
S. NO	DRAWING/ DOCUMENTS	DWG. NO.	APPR (A/I)	SCHEDULE OF SUBMISSION	REV	SENT BY BIDDER (SOFT COPY)	HARD COPY RECEIVED FROM BIDDER	COMMENTS SEND TO BIDDER	STS	PEND	BHEL APP STATUS	REMARKS
	A) MECHANICAL											
A.01	P&I Diagram for IGES for each control room		A	14 days from P.O Placement	0				UP	P-BIDDER		
A.01	Design Philosphy & Write-up		A	14 days from P.O Placement	0				UP	P-BIDDER		
A.03	Layout of IGES for each control room		A	30 days from P.O Placement	0				UP	P-BIDDER		
A.04	Isometric View of IGES Piping system for each control room		A	30 days from P.O Placement	0				UP	P-BIDDER		
A.05	Clean Agent Room		A	30 days from P.O Placement	0				UP	P-BIDDER		
A.06	Clamping Arrangement		A	30 days from P.O Placement	0				UP	P-BIDDER		
A.07	Cylinder Manifold		A	30 days from P.O Placement	0				UP	P-BIDDER		
A.08	DV Pilot Manifold		A	30 days from P.O Placement	0				UP	P-BIDDER		
A.09	Control Logic		A	30 days from P.O Placement	0				UP	P-BIDDER		
A.10	Pressure Relief Vents G.A & location layout		A	30 days from P.O Placement	0				UP	P-BIDDER		
	B) ELECTRICAL											
B.01	EPB Inhibitor Unit		A	14 days from placement of P.O	0				UP	P-BIDDER		
B.02	Gas Release Panel		A	14 days from placement of P.O	0				UP	P-BIDDER		

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2	Drawings & Documents Pending with BHEL								A	P-BHEL	3			
3	Drawings & Documents Approved by BHEL								A	ADS	4			
4	Supercided Drawings.								A	S				
S. NO	DRAWING/ DOCUMENTS		DWG. NO.	APPR (A/I)	SCHEDULE OF SUBMISSION	REV	SENT BY BIDDER (SOFT COPY)	HARD COPY RECEIVED FROM BIDDER	COMMENTS SEND TO BIDDER	STS	PEND	BHEL APP STATUS	REMARKS	
B.03	Circuit Diagrams			A	14 days from placement of P.O	0				UP	P-BIDDER			
B.04	G.A of Junction Box			A	14 days from placement of P.O	0				UP	P-BIDDER			
B.05	Cable Schedule			A	14 days from placement of P.O	0				UP	P-BIDDER			
	C) QUALITY													
C.01	Quality Assurance Plan			A	14 days from placement of P.O	0				UP	P-BIDDER			
	D) PROCEDURE													
D.01	System Write-Up			I	14 days from placement of P.O	0				UP	P-BIDDER			
D.02	Bill of Materials			A	30 days from placement of P.O	0				UP	P-BIDDER			
D.03	Testing & Commisioning Procedure			A	14 days from placement of P.O	0				UP	P-BIDDER			
D.04	Pre-Commissioning Procedure			I	14 days from placement of P.O	0				UP	P-BIDDER			
D.05	Job Procedure / Installation Procedure			I	14 days from placement of P.O	0				UP	P-BIDDER			
	E) OTHERS													
E.01	Flow calculations			I	30 days from placement of P.O	0				UP	P-BIDDER			
	F) APPROVALS													

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2	Drawings & Documents Pending with BHEL								A	P-BIDDER	2	
3	Drawings & Documents Approved by BHEL								A	P-BHEL	3	
4	Supercided Drawings.								A	ADS	4	
									A	S		
S. NO	DRAWING/ DOCUMENTS	DWG. NO.	APPR (A/I)	SCHEDULE OF SUBMISSION	REV	SENT BY BIDDER (SOFT COPY)	HARD COPY RECEIVED FROM BIDDER	COMMENTS SEND TO BIDDER	STS	PEND	BHEL APP STATUS	REMARKS
F.01	LPCB Approvals of IGES Components		I	14 days from placement of P.O	0				UP	P-BIDDER		
G) DATA SHEETS												
G.01	Inert Gas Cylinder		A	14 days from placement of P.O	0				UP	P-BIDDER		
G.02	Pneumatic IGES Valve		A	14 days from placement of P.O	0				UP	P-BIDDER		
G.03	Release Unit With Solenoid		A	14 days from placement of P.O	0				UP	P-BIDDER		
G.04	Contact Guage Unit		A	14 days from placement of P.O	0				UP	P-BIDDER		
G.05	Discharge Hose		A	14 days from placement of P.O	0				UP	P-BIDDER		
G.06	Check Valve		A	14 days from placement of P.O	0				UP	P-BIDDER		
G.07	Leak / Bleeder Unit		A	14 days from placement of P.O	0				UP	P-BIDDER		
G.08	Hi- Flex Hose		A	14 days from placement of P.O	0				UP	P-BIDDER		
G.09	Pressure Relief Device		A	14 days from placement of P.O	0				UP	P-BIDDER		
G.10	Non Return Valve for Pilot Line		A	14 days from placement of P.O	0				UP	P-BIDDER		
G.11	Nozzle Assembly		A	14 days from placement of P.O	0				UP	P-BIDDER		
G.12	Pressure Regulator		A	14 days from placement of P.O	0				UP	P-BIDDER		

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3	Drawings & Documents Approved by BHEL								A	P-BHEL	3	
4	Supercided Drawings.								A	ADS	4	
									A	S		
S. NO	DRAWING/ DOCUMENTS	DWG. NO.	APPR (A/I)	SCHEDULE OF SUBMISSION	REV	SENT BY BIDDER (SOFT COPY)	HARD COPY RECEIVED FROM BIDDER	COMMENTS SEND TO BIDDER	STS	PEND	BHEL APP STATUS	REMARKS
G.13	Ball Valve WITH Pneumatic Actuator		A	14 days from placement of P.O	0				UP	P-BIDDER		
G.14	Pressure Guage		A	14 days from placement of P.O	0				UP	P-BIDDER		
G.15	Restrictor		A	14 days from placement of P.O	0				UP	P-BIDDER		
G.16	Solenoid Valves		A	14 days from placement of P.O	0				UP	P-BIDDER		
G.17	Warning Signs		A	14 days from placement of P.O	0				UP	P-BIDDER		
G.18	Pressure Operated Switch		A	14 days from placement of P.O	0				UP	P-BIDDER		
G.19	Pipes & Fittings		A	14 days from placement of P.O	0				UP	P-BIDDER		
G.20	Cables		A	14 days from placement of P.O	0				UP	P-BIDDER		
H) CALCULATIONS & OTHER GENERAL ITEMS												
H.01	Battery Sizing Calculations		I	30 days from P.O Placement	0				UP	P-BIDDER		
H.02	Electrical Load List		I	14 days from P.O Placement	0				UP	P-BIDDER		
H.03	List of Bought out Items		I	14 days from P.O Placement	0				UP	P-BIDDER		
H.04	Storage Procedures		I	14 days from placement of P.O	0				UP	P-BIDDER		
H.05	List of Tag Numbers		I	14 days from placement of P.O	0				UP	P-BIDDER		

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									A		1	
1	Drawings & Documents Pending with BIDDER								A	P-BIDDER	2	
2	Drawings & Documents Pending with BHEL								A	P-BHEL	3	
3	Drawings & Documents Approved by BHEL								A	ADS	4	
4	Supercided Drawings.								A	S		
S. NO	DRAWING/ DOCUMENTS	DWG. NO.	APPR (A/I)	SCHEDULE OF SUBMISSION	REV	SENT BY BIDDER (SOFT COPY)	HARD COPY RECEIVED FROM BIDDER	COMMENTS SEND TO BIDDER	STS	PEND	BHEL APP STATUS	REMARKS
H.06	O & M Manuals / Procedure		I	30 days from P.O Placement	0				UP	P-BIDDER		
H.07	Field Quality Plan		I	30 days from P.O Placement	0				UP	P-BIDDER		
	6) INTERFACE DRAWINGS											
G.01	Interface between Fire Alarm Panel & Gas Release Panel		I	14 days from P.O Placement	0				UP	P-BIDDER		

ANNEXURE-3


VENDOR'S NAME & ADDRESS:			MANUFACTURING QUALITY PLAN						QP. NO.:				
			CUSTOMER: BHEL, HYDERABAD – 32.			BHEL P.O.NO.:			REV NO:		DATE:		
			PROJECT:			P.O.DATE:							
PRODUCT:			BHEL SPEC:			REV:			PAGE 1 OF 1				
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY			REMARKS
										P	W	V	
1.0	RAW MATERIALS & BOUGHT OUT ITEMS												
2.0	INPROCESS INSPECTION												
3.0	FINAL INSPECTION & TESTING												
4.0	PRESERVATION & PACKING												

VENDOR TO NOTE: THIS FORMAT IS IN MICROSOFT WORD. HEADER & FOOTER SHALL BE AVAILABLE IN EACH PAGE OF QP. QP SHALL BE IN LANDSCAPE & A4 SIZE ONLY. FONT SIZE SHALL BE MIN 10. VENDOR SHALL SIGN & STAMP IN EACH PAGE OF QP. LOI REF. & DATE ARE NOT ACCEPTABLE. P.O.NO. & DATE SHALL BE INDICATED. QP NO. SHOULD BE UNIQUE AND SHALL NOT REPEAT. ALL THE TESTS / CHECKS INDICATED IN THE BHEL SPEC. SHALL BE INDICATED IN THE QP.


LEGEND: P: PERFORM, W: WITNESS, V: VERIFICATION. INDICATE 1 FOR BHEL CQS (OR BHEL NOMINATED INSPECTION AGENCY) & 2 FOR VENDOR/SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.	PREPARED BY	APPROVED BY	APPROVED BY
	VENDOR'S SIGNATURE & STAMP	BHEL QA SIGNATURE & STAMP	CUSTOMER'S SIGNATURE & STAMP

		TYPICAL MANUFACTURING QUALITY PLAN							MQP. NO.:				
									REV NO:		DATE:		
		PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032					PRODUCT: SOLENOID VALVE			PAGE 1 OF 2			
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY			REMARKS
										P	W	V	
1.0	RAW MATERIALS & BOUGHT OUT ITEMS												
	Body, Bonnet, Female outlet	Chemical, Physical	Major	Analysis Test	One/Lot	Approved BHEL Spec./Drawing/datasheet	Approved BHEL Spec./Drawing/datasheet	Lab. /Supp. Certificate	√	2	2	1	
	Spindle	Chemical, Physical	Major	Analysis Test	One/Lot	Approved BHEL Spec./Drawing/datasheet	Approved BHEL Spec./Drawing/datasheet	Lab. /Supp. Certificate	√	2	2	1	
	Spring	Chemical	Major	Analysis Test	One/Lot	Approved BHEL Spec./Drawing/datasheet	Approved BHEL Spec./Drawing/datasheet	Lab. /Supp. Certificate	√	2	2	1	
	Outer Washer, Seat Washer	Hardness	Minor	Measurement	10%	Approved BHEL Spec./Drawing/datasheet	Approved BHEL Spec./Drawing/datasheet	Lab. /Supp. Certificate	√	2	2	1	
2.0	INPROCESS INSPECTION												
	Water tightness Seat Test	Leakage	Major	Hydro Test	100%	Approved BHEL Spec./Drawing/datasheet	Approved BHEL Spec./Drawing/datasheet	IIR	√	2	2	1	
	Hydrostatic Pressure Test	Leakage	Major	Hydro Test	100%	Approved BHEL Spec./Drawing/datasheet	Approved BHEL Spec./Drawing/datasheet	IIR	√	2	2	1	
	Operation Test	Open-close	Major	Functional	100%	Approved BHEL Spec./Drawing/datasheet	Approved BHEL Spec./Drawing/datasheet	IIR	√	2	2	1	
	Flow Test	Flow	Major	Flow	One/Lot	Approved BHEL Spec./Drawing/datasheet	Approved BHEL Spec./Drawing/datasheet	IIR	√	2	2	1	
3.0	FINAL INSPECTION & TESTING												
		VISUAL & DIMENSION CHECK	Major	Visual	10%	Approved BHEL Spec./Drawing/datasheet	Approved BHEL Spec./Drawing/datasheet	IR	√	2	1	-	


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		TYPICAL MANUFACTURING QUALITY PLAN							MQP. NO.:				
		PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032				PRODUCT:SOLENOID VALVE			REV NO:		DATE:		
									PAGE 2 OF 2				
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY			REMARKS
										P	W	V	
		HV TEST	Major	Hydro Test	10%	Approved BHEL Spec./Drawing/datasheet	Approved BHEL Spec./Drawing/datasheet	IR	√	2	1	-	
		SEAT LEAKAGE TEST	Major	Leakage	10%	Approved BHEL Spec./Drawing/datasheet	Approved BHEL Spec./Drawing/datasheet	IR	√	2	1	-	
		IR TEST	Major	Electrical	One/Lot	Approved BHEL Spec./Drawing/datasheet	Approved BHEL Spec./Drawing/datasheet	IR	√	2	1	-	
		PNEUMATIC TEST	Major	Pneumatic	10%	Approved BHEL Spec./Drawing/datasheet	Approved BHEL Spec./Drawing/datasheet	IR	√	2	1		
		OPERATIONAL TEST INCLUDING VERIFICATION OF PICKUP AND DROP VOLTAGE	Major	Operational test	10%	Approved BHEL Spec./Drawing/datasheet	Approved BHEL Spec./Drawing/datasheet	IR	√	2	1		
		BOM CHECK	Major	Verification	100%	Approved BHEL Spec./Drawing/datasheet	Approved BHEL Spec./Drawing/datasheet	IR	√	2	1		
4.0	PRESERVATION & PACKING												
	Identification	Marking & Stamping	Major	Verification & Stamping	100%	Approved BHEL Spec./Drawing/datasheet	Approved BHEL Spec./Drawing/datasheet	IR	√	2	2	1	
	Painting	Final finish & Paint DFT	Major	Visual & Measurement	100%	Approved BHEL Spec./Drawing/datasheet	Approved BHEL Spec./Drawing/datasheet	Painting Report	√	2	1	-	
	Packing	Soundness of packing	Major	Verification	100%	Approved BHEL Spec./Drawing/datasheet	Approved BHEL Spec./Drawing/datasheet	IR	√	2	2	1	

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		TYPICAL MANUFACTURING QUALITY PLAN							MQP. NO.:				
									REV NO:		DATE:		
		PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032					PRODUCT: PRESSURE SWITCH			PAGE 1 OF 2			
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY			REMARKS
										P	W	V	
1.0	RAW MATERIALS & BOUGHT OUT ITEMS												
	RAW MATERIAL	Chemical, Physical	Major	Analysis Test	One/Lot	Approved BHEL Spec./Drawing/datasheet	Approved BHEL Spec./Drawing/datasheet	Lab. /Supp. Certificate	√	2	2	1	
2.0	INPROCESS INSPECTION												
		RAW MATERIAL	Major	Visual	100%	Approved BHEL Spec./Drawing/datasheet	Approved BHEL Spec./Drawing/datasheet	IIR	√	2	2	1	
		PROCESS CONNECTION	Major	Visual	100%	Approved BHEL Spec./Drawing/datasheet	Approved BHEL Spec./Drawing/datasheet	IIR	√	2	2	1	
		CABLE ENTRY	Major	Visual	100%	Approved BHEL Spec./Drawing/datasheet	Approved BHEL Spec./Drawing/datasheet	IIR	√	2	2	1	
		MOUNTING	Major	Visual	One/Lot	Approved BHEL Spec./Drawing/datasheet	Approved BHEL Spec./Drawing/datasheet	IIR	√	2	2	1	
		WORKMANSHIP(Cleanliness, Neatness of wiring)	Major	Visual		Approved BHEL Spec./Drawing/datasheet	Approved BHEL Spec./Drawing/datasheet	IIR	√	2	2	1	
3.0	FINAL INSPECTION & TESTING												
		DIMENSION,VISUAL	Major	Visual	10%	Approved BHEL Spec./Drawing/datasheet	Approved BHEL Spec./Drawing/datasheet	IR	√	2	1	-	
		PERFORMANCE TEST INCLUDING SET POINT CALIBRATION,REPEATABILITY,SWITCH DIFFERENTIAL & OVER RANGE I.R TEST ON ASSEMBLY	Major	Functional	10%	Approved BHEL Spec./Drawing/datasheet	Approved BHEL Spec./Drawing/datasheet	IR	√	2	1	-	


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									REV NO:		DATE:		
		PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032					PRODUCT: PRESSURE SWITCH			PAGE 2 OF 2			
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY			REMARKS
										P	W	V	
		IBR certificate	Major	Functional	10%	Approved BHEL Spec./Drawing/datasheet	Approved BHEL Spec./Drawing/datasheet	IR	√	2		1	*if applicable
		Certificate of statutory approval authority like CCOE/PESO	Major	Functional	One/Lot	Approved BHEL Spec./Drawing/datasheet	Approved BHEL Spec./Drawing/datasheet	IR	√	2		1	
		I.P certificate review	Major	Functional	One/Lot	Approved BHEL Spec./Drawing/datasheet	Approved BHEL Spec./Drawing/datasheet	IR	√	2		1	
4.0	PRESERVATION & PACKING												
	Identification	Marking & Stamping	Major	Verification & Stamping	100%	Approved BHEL Spec./Drawing/datasheet	Approved BHEL Spec./Drawing/datasheet	IR	√	2	2	1	
	Packing	Soundness of packing	Major	Verification	100%	Approved BHEL Spec./Drawing/datasheet	Approved BHEL Spec./Drawing/datasheet	IR	√	2	2	1	

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		TYPICAL MANUFACTURING QUALITY PLAN							MQP. NO.:				
		PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032			PRODUCT: Forged, Seamless & Welded Fittings			REV NO:		DATE:			
		PAGE 1 OF 2											
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY			REMARKS
										P	W	V	
1.0	RAW MATERIALS & BOUGHT OUT ITEMS												
	Billets, Rounds, Pipes, Coil, Plate s, etc.	Chemical, Physical	Major	Analysis Test	One/Lot	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	Lab. /Supp. Certificate	√	2	2	1	
2.0	INPROCESS INSPECTION												
	Cleaning & Finishing	Blast Cleaning	Major	Cleaning	100%	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IIR	√	2	2	1	
	Finishing	Galvanizing	Major	Chemical	100%	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IIR	√	2	2	1	
3.0	FINAL INSPECTION & TESTING												
		NDT	Major	NDT	10%	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IR	√	2	1	-	
		Size, Thickness, Dimension	Major	Visual	10%	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IR	√	2	1	-	
		Surface Quality, Marking, Color coding, etc	Major	Visual	10%	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IR	√	2	1	-	
		PMI(Final inspected Fittings)	Major	PMI	One/Lot	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IR	√	2	1	-	
4.0	PRESERVATION & PACKING												
	Identification	Marking & Stamping	Major	Verification & Stamping	100%	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	IR	√	2	2	1	
	Painting	Final finish & Paint DFT	Major	Visual & Measurement	100%	Approved BHEL Spec./Drawing/ datasheet	Approved BHEL Spec./Drawing/ datasheet	Painting Report	√	2	1	-	

LEGEND: P: PERFORM, W: WITNESS, V: TEST CERTIFICATE REVIEW. INDICATE 1 FOR BHEL / BHEL NOMINATED INSPECTION AGENCY/END USER/END USER'S REPRESENTATIVE & 2 FOR VENDOR/SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.

		TYPICAL MANUFACTURING QUALITY PLAN						MQP. NO.:					
								REV NO:		DATE:			
		PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032				PRODUCT: Forged, Seamless & Welded Fittings				PAGE 2 OF 2			
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY			REMARKS
										P	W	V	
	Packing	Soundness of packing	Major	Verification	100%	Approved BHEL Spec./Drawing/datasheet	Approved BHEL Spec./Drawing/datasheet	IR	√	2	2	1	

LEGEND: P: PERFORM, W: WITNESS, V: TEST CERTIFICAT REVIEW. INDICATE 1 FOR BHEL / BHEL NOMINATED INSPECTION AGENCY/END USER/END USER'S REPRESENTATIVE & 2 FOR VENDOR/SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.

ANNEXURE-7

TD-106-2	Rev. No. 5 Form No.		PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, HYDERABAD –32.	PESD/HYD-776
				Rev No.: 00
				Page 1 of 1

<p style="text-align: center;">COPYRIGHT AND CONFIDENTIAL</p> <p>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED .</p> <p>It must not be used directly or indirectly in any way detrimental to the interest of the company.</p>		<p style="text-align: center;"><u>PRE-BID QUERRIES FROM SPECIFICATION</u></p> <p>If the proposal submitted has got any Queries from the technical stipulations in the bidding document, the Bidder shall tabulate below the full particulars of such Queries and shall sign below. Additional sheets may be enclosed, if necessary. Queries are to be furnished with mention of specific clause numbers. Technical and commercial Queries to scope of supply and services shall be indicated separately.</p> <table border="1" data-bbox="292 714 1469 1396"> <thead> <tr> <th data-bbox="292 714 527 787">SL.No.</th><th data-bbox="527 714 852 787">Clause No.</th><th data-bbox="852 714 1226 787">Description as per specification</th><th data-bbox="1226 714 1469 787">Queries by Bidder</th></tr> </thead> <tbody> <tr> <td colspan="4" data-bbox="292 787 527 1396" style="height: 250px;"></td></tr> </tbody> </table> <p>We confirm that all the Pre-Bid Queries to the Technical Specification, Job Specification and enclosures including reference documents attached are listed in this Annexure only. No other Pre-Bid Queries even if mentioned elsewhere shall be considered for any technical/ commercial evaluation or for ordering.</p> <p>Bidder's Signature.....</p> <p>Date:.....</p>	SL.No.	Clause No.	Description as per specification	Queries by Bidder				
SL.No.	Clause No.	Description as per specification	Queries by Bidder							

ANNEXURE - 8

Package Name : Inert Gas Extinguishing system

Project : 5 x 800 MW YADADRI THERMAL POWER STATION, NALGONDA

INPUT DRAWING LIST

SL NO.	Title of the Drawing (to be filled by Bidder)	INPUT DRG. NO. (to be filled by BHEL)	Rev. no.	DATE OF FURNISHING BY BHEL	Reference E Mail (to be filled by BHEL)	Drawing Type (to be filled by BHEL)	Remarks
1	Power House Arch Plan at El. 0.0 M (Unit-1&2)	PE-DG-417-611-C060	02	Furnished along with tender specification	Furnished along with tender specification	-N.A-	Annexure - 10 of Tender specifications
2	Power House Arch Plan at El. 0.0 M (Unit-3&4)	PE-DG-417-611-C061	01	Furnished along with tender specification	Furnished along with tender specification	-N.A-	Annexure - 10 of Tender specifications
3	Power House Arch Plan at El. 0.0 M (Unit-5)	PE-DG-417-611-C062	01	Furnished along with tender specification	Furnished along with tender specification	-N.A-	Annexure - 10 of Tender specifications
4	CCR/CER/UPS ROOM LAYOUT	PE-DG-417-145-I401	02	Furnished along with tender specification	Furnished along with tender specification	-N.A-	Annexure - 10 of Tender specifications
5	Power House Arch Plan at El. 17.0 M (Unit-1&2)	PE-DG-417-611-C071	01	Furnished along with tender specification	Furnished along with tender specification	-N.A-	Annexure - 10 of Tender specifications
6	Power House Arch Plan at El. 17.0 M (Unit-3&4)	PE-DG-417-611-C072	01	Furnished along with tender specification	Furnished along with tender specification	-N.A-	Annexure - 10 of Tender specifications
7	Power House Arch Plan at El. 17.0 M (Unit-5)	PE-DG-417-611-C073	01	Furnished along with tender specification	Furnished along with tender specification	-N.A-	Annexure - 10 of Tender specifications
8	Power House Arch Plan at El. 24, 27.5, 32.5M (Unit-1 & 2)	PE-DG-417-611-C074	01	Furnished along with tender specification	Furnished along with tender specification	-N.A-	Annexure - 10 of Tender specifications
9	Power House Arch Plan at El. 17.0 M (Unit-3,4 & 5)	PE-DG-417-611-C075	01	Furnished along with tender specification	Furnished along with tender specification	-N.A-	Annexure - 10 of Tender specifications

ANNEXURE - 9						
LIST OF DEVIATIONS						
Project: IGES SYSTEM FOR 5 x 800 MW YADADRI THERMAL STATION, NALGONDA						
Sl. No.	Part No./ Volume	Page no.	Clause No.	Subject	Deviation/Clarification	Reason for Deviation
1						
2						
3						
4						
5						
6						

NOTES:

1. Deviations, if any, shall be clearly brought out only in this format. Deviations mentioned / taken elsewhere or in any other format will be ignored.
2. Additional sheets in the same format can be attached by the vendor, if necessary.
3. Nature of Deviations shall only be of Design / Manufacturing constraints and non-availability of items / components / makes in market.
4. No price implications shall be entertained for deviations withdrawn during the technical scrutiny. If any deviations are accepted by BHEL during technical scrutiny then also there will be no price implication. Hence, in no case there will be consideration of Price implications.
5. Reasons for the deviations shall be specified in the Remarks column.
6. If there are no deviations from the specifications, bidder still has to submit the signed copy of this format by writing "NO Deviations" on this format.
7. If the "Deviation Schedule" is not submitted along with the offer, the bidder's offer is likely to be rejected without any further interaction with the bidder. Only the accepted deviations in conjunction with the original tender shall constitute the contract document for the award of job to the bidder

ANNEXURE - 11**CHECK LIST FOR OFFER SUBMISSION**

SL No	Description	Bidder's Confirmation
1	Bidder to confirm to the scope of supply and scope of services as per BHEL spec: PY51718, Rev-00	
2	Bidder to submit the No Deviation letter w.r.t. BHEL spec: PY51718, Rev-00 along with offer.	
3	Bidder to quote as per BHEL price format only. Bidder to attached unpriced bid format along with Annexure-A by indicating "QUOTED" against each item in the technical offer.	
4	For addition/reduction of quantity, unit rate quoted in the present offer shall be considered during ordering and shall be valid up to execution of the contract to the extent of (-)20% to (+) 10% of order Value.	
5	Inert Gas Extinguishing System for all the above mentioned locations shall be of the SAME MAKE. Different make for each Inert Gas Extinguishing Sytem is NOT ACCEPTABLE.	
6	In case of deviation, vendor to confirm that these are technically not feasible deviations and same are submitted in BHEL format. In case technically feasible deviations are proposed by the bidder and subsequently withdrawn, no commercial implications can be claimed by the bidder	
7	It shall be bidder's responsibility to get all his queries and deviations addressed by the purchaser during the pre-bid stage itself. No queries / deviations shall be accepted by purchaser from the bidder after the closure of pre-bid.	
8	Bidder to agree that Bill of materials / list of equipment furnished in the offer is only for information; Vendor shall supply all the material to meet the performance, sizing & technical requirement as per specification & its Annexures, scope matrix etc.	
9	Confirm that the quote includes training, commissioning spares, special tool & tackles, mounting hardware/ accessories, terminations, etc. as required for commissioning activities.	
10	All the equipments / items supplied by bidder are having valid statutory approval certificates and same will be produced at any stage of contract execution to BHEL. The same were eligible to take local statutory regulatory body approval during commissioning of the system	

BIDDER'S SIGNATURE:

NAME:

DATE:

COMPANY SEAL:

ANNEXURE-12 FOR SUB-VENDOR LIST

<u>ANNEXURE - I</u>		
S.No.	Item Description	Vendor
1	SEALED MAINTENANCE FREE BATTERY	AMARA RAJA POWER SYSTEMS LTD
		EXIDE INDUSTRIES LIMITED
		HBL POWER SYSTEMS LTD
		HOPPECKE BATTERIEN GMBH & CO KG
2	LEAD ACID STORAGE BATTERY	EXIDE INDUSTRIES LIMITED
		HBL POWER SYSTEMS LTD
		HOPPECKE BATTERIEN GMBH & CO KG
3	NICKEL-CADMIUM BATTERY	HBL POWER SYSTEMS LTD
		HOPPECKE BATTERIEN GMBH & CO KG
		AMCO SAFT INDIA LTD.
4	Battery chargers	AMARA RAJA POWER SYSTEMS LTD
		HBL POWER SYSTEMS LTD
		KERALA STATE ELECTRONICS
		DUBAS ENGINEERING PVT LTD.
		CHHABI ELECTRICALS P LTD.
5	Control cables	STATCON POWER CONTROLS LTD.
		UNIVERSAL CABLES LTD
		THERMO CABLES LIMITED
		KEC INTERNATIONAL LIMITED
		NICCO CORPORATION LTD HYD
		CORDS CABLE INDUSTRIES LTD.
		CMI LIMITED
		KEI INDUSTRIES LIMITED
		DELTON CABLES LIMITED
		PARAMOUNT COMMUNICATIONS LTD
		SPECIAL CABLES PVT. LTD.
		SRIRAM CABLES PVT. LTD.
		GEMSCAB INDUSTRIES LTD.
		POLYCAB WIRES PVT.LTD
		SUYOG ELECTRICALS LTD
6	Cable Trays	ELKAY TELELINKS LIMITED
		RAVIN CABLES LTD
		ASSOCIATED CABLES PVT LTD.
		PATNY SYSTEMS PVT. LTD
		JAMNA METAL COMPANY
		PARMAR METALS PVT. LTD
		METALEMMS BOMBAY PVT. LTD.
		VINFAB ENGINEERS INDIA PRIVATE
7	CABLE GLANDS (WEATHER PROOF/EX.PROOF)	PREMIER POWER PRODUCTS
		INDIA ELECTRICALS SYNDICATE
		UNITED AGRO ENGINEERING PVT. LTD.
		FLEXPRO ELECTRICALS PVT. LTD.,
		FCG POWER INDUSTRIES
		PROMPT ENGINEERING WORKS, MUMBAI
8	JUNCTION BOXES (WEATHER PROOF)	FLAMEPROOF EQUIPMENTS PVT.LTD.
		FCG FLAMEPROOF CONTROL GEARS
		ELECTROMAC INDUSTRIES
		PANAM CONTROLS,
		FLEXPRO ELECTRICALS PVT. LTD.,
		EX-PROTECTA
9	PRESSURE GAUGES	FLAMEPROOF EQUIPMENTS PVT.LTD.
		FCG FLAMEPROOF CONTROL GEARS
		PYROTECH ELECTRONICS PVT. LTD.
		FORBES MARSHALL (HYD) PVT LIMITED,
		PRECISION MASS PRODUCTS
		H.GURU INSTRUMENTS(S.I)PVT.LTD
		WALCHANDNAGAR INDUSTRIES LIMITED
		SCIENTIFIC DEVICES (BOMBAY) PVT. LT
		BAUMER TECHNOLOGIES
10	PRESSURE AND DIFFERENTIAL PRESSURE SWITCHES	GAUGES BOURDON INDIA
		GENERAL INSTRUMENTS CONSORTIUM
		A.N. INSTRUMENTS PVT. LTD.,
		PROTECH CONTROL INSTRUMENTS
		INDFOS INDUSTRIES LIMITED,
		TRAFAG CONTROLS INDIA PVT LTD
		BAUMER TECHNOLOGIES
		HIRLEKAR PRECISION ENGG. PVT. LTD.
		KAUSTUBHA UDYOG
		GAUGES BOURDON INDIA
		SWITZER PROCESS INSTRUMENTS
		PRESHZINGER ENGINEERING

S.No.	Item Description	Vendor
11	FLANGES	THE PUNJAB STEEL WORKS,
		METAL FORGINGS P. LTD.
		TUBE PRODUCTS INCORPORATE
		C.D. INDUSTRIES,
		CHW FORGE PRIVATE LIMITED
		KISAAN STEELS (PVT) LTD.,
		KUNJ FORGINGS PVT. LTD.

S.No.	Item Description	Vendor
12	BUTT WELDED PIPE FITTINGS	U I PIPE FITTINGS PVT. LTD.
		WEIFANG HUODA PIPE FITTINGS
		TUBE PRODUCTS INCORPORATE
		GUJARAT INFRAPIES PVT.LTD.,
		SAWAN ENGINEERS PVT. LTD.
		PETRO CHEM INDUSTRIES
		TRUE FORGE PVT.LTD.,
		DEE DEVELOPMENT ENGINEERS LTD.,
		TRUE FAB ENGINEER (P) LTD.
		P.K. TUBES & FITTINGS PVT. LTD.
		K. S. PIPE FITTINGS PVT. LTD.
		TUBE TURN (INDIA) P. LTD.
		POONAM ENTERPRISE
13	BOLTING MATERIAL	ATLAS FASTENERS
		MULTI FASTNERS PVT. LTD.
		BOLTMASTER (INDIA)PVT.LTD.
		PRESIDENT ENGINEERING WORKS
		MEGA ENGINEERING PVT. LTD.
		PIONEER NUTS AND BOLTS PVT.LTD
		MORNING STAR INDUSTRIES,
		UDEHRA FASTENERS LIMITED
		SREE PAVITHRA INDUSTRIES,
14	CARBON STEEL (SEAMLESS) TUBES / PIPES OD UPTO AND INCLUDING 114.3 MM	JR SEAMLESS PRIVATE LIMITED
		WUXI SPECIAL STEEL MATERIAL CO LTD
		SHANDONG LIAOCHENG ZGL
		YANGZHOU LONTRIN STEEL TUBE
		JIANGSU CHENGDE STEEL TUBE
		ZHEJIANG GROSS SEAMLESS
		PATELS AIRFLOW LIMITED
		EVERGREEN SEAMLESS PIPES & TUBES
		MAHARASHTRA SEAMLESS LTD.,
		JINDAL SAW LIMITED,
		HEAVY METAL & TUBES LIMITED,
		ISMT LIMITED.,
		MOKSHI INDUSTRIES PVT. LTD.
		AMARDEEP STEEL CENTRE
		POONAM ENTERPRISE
		NAGARDAS KANJI SHAH
		SCORODITE STAINLESS
15	CARBON STEEL (SEAMLESS) TUBES / PIPES OD ABOVE 114.3 MM AND BELOW 219.1 MM	TUBOS REUNIDOS,S.A,
		LAL BABA SEAMLESS TUBES PVT. LTD.
		WUXI SPECIAL STEEL MATERIAL CO LTD
		SHANDONG LIAOCHENG ZGL
		YANGZHOU LONTRIN STEEL TUBE
		JIANGSU CHENGDE STEEL TUBE
		ZHEJIANG GROSS SEAMLESS
		EVERGREEN SEAMLESS PIPES & TUBES
		MAHARASHTRA SEAMLESS LTD.,
		JINDAL SAW LIMITED,
		HEAVY METAL & TUBES LIMITED,
		ISMT LIMITED.,
		MOKSHI INDUSTRIES PVT. LTD.
16	CARBON STEEL (SEAMLESS) TUBE / PIPES OD FROM 219.1 MM UPTO AND INCLUDING 273.1 MM	AMARDEEP STEEL CENTRE
		POONAM ENTERPRISE
		NAGARDAS KANJI SHAH
		SCORODITE STAINLESS
		TUBOS REUNIDOS,S.A,
		JINDAL SAW LIMITED,
		ISMT LIMITED.,
		MOKSHI INDUSTRIES PVT. LTD.
		EVERGREEN SEAMLESS PIPES & TUBES
		ZHEJIANG GROSS SEAMLESS
		JIANGSU CHENGDE STEEL TUBE
		YANGZHOU CHENGDE STEEL PIPE

S.No.	Item Description	Vendor
		PRODUCTOS TUBULARES S.A.,

S.No.	Item Description	Vendor
17	CARBON STEEL (SEAMLESS) TUBES / PIPES OD ABOVE 273.1 MM UPTO AND INCLUDING 355.6 MM	WUXI SPECIAL STEEL MATERIAL CO LTD
		SHANDONG LIAOCHENG ZGL
		YANGZHOU LONTRIN STEEL TUBE
		YANGZHOU CHENGDE STEEL PIPE
		JIANGSU CHENGDE STEEL TUBE
		ZHEJIANG GROSS SEAMLESS
		KAVIISH FOCUS PIPES PVT. LTD
		EVERGREEN SEAMLESS PIPES & TUBES
		MAHARASHTRA SEAMLESS LTD.,
		MOKSHI INDUSTRIES PVT. LTD.
		AMARDEEP STEEL CENTRE
		POONAM ENTERPRISE
		PRODUCTOS TUBULARES S.A.,
18	CARBON STEEL (SEAMLESS) TUBE /PIPES OD ABOVE 355.6 MM	WUXI SPECIAL STEEL MATERIAL CO LTD
		YANGZHOU LONTRIN STEEL TUBE
		YANGZHOU CHENGDE STEEL PIPE
		JIANGSU CHENGDE STEEL TUBE
		ZHEJIANG GROSS SEAMLESS
		KAVIISH FOCUS PIPES PVT. LTD
		EVERGREEN SEAMLESS PIPES & TUBES
		MOKSHI INDUSTRIES PVT. LTD.
		AMARDEEP STEEL CENTRE
		POONAM ENTERPRISE
		PRODUCTOS TUBULARES S.A.,
19	SOCKET WELDED / SCREWED WELDED PIPE FITTINGS	S.S.PIPE FITTINGS & FORGINGS
		UNIQUE ENGINEERING ENTPS. P. LTD.
		PRESHZINGER ENGINEERING
		FLASH FORGE PVT LTD
		CARLO DYNATECH INDUSTRIES,
		U I PIPE FITTINGS PVT. LTD.
		TRUE FORGE PVT.LTD.,
		P.K. TUBES & FITTINGS PVT. LTD.
		K. S. PIPE FITTINGS PVT. LTD.
		SKY FORGE PRIVATE LIMITED
		PRECISION ENGINEERING INDS.,
		FITTECH INDUSTRIES PVT. LTD.
		LEADER VALVES LIMITED
		M.S. FITTINGS MANUFACTURING CO. PVT

1	Bidder to note that all IGES equipment such as cylinders, contact gauges, pressure regulators, Gas release Panel etc. shall be UL/FM/LPCB/VdS approved.
2	Cylinders shall also have PESO , Nagpur approval certificate.
3	Any other item which is not indicated above and is required for completion of the system shall be as per BHEL PMD.
4	Bidder shall take prior approval of BHEL w.r.to vendors for procurement of items which are not envisaged in the above list.

ANNEXURE-13

BOQ FOR INERT GAS EXTINGUISHING SYSTEM										
Sl.No.	Drawing Title	Unit	P&ID of IGES	Piping Layout of IGES	Isometric View of IGES	GA of Inergen cylinder storage room & supporting arrangement	GA of Cylinder Manifold	Pressure Vent Location Location Layout	Electrical Cabling Layout	TOTAL BOQ
	Vendor Documet No.									
	Drawing Approval status (By BHEL)									
	Remarks									
1.0	Inergen CYLINDER -300 BAR, CAPACITY. 140 LTRS.	Nos.								
2.0	LABEL FOR140 LTRS CYLINDER	Nos.								0
3.0	PNEUMATIC VALVE (INCLUDED IN CYLN. ASSEMBLY)	Nos.								0
4.0	CHECK VALVE 3/4"NPT X 1/2"BSP	Nos.								0
5.0	CONTACT GAUGE UNIT	Nos.								0
6.0	DISCHARGE HOSE 1/2" X 400 LG.	Nos.								0
7.0	NON RETURN VALVE 1/4 inch	Nos.								0
8.0	1/4 INCH CROSS FOR ACTUATION LINE	Nos.								0
9.0	HI-FLEX. HOSE FOR PILOT 1/4" X 365 Length.	Nos.								0
10.0	HI FLEX HOSE 1/4" X 500MM	Nos.								0
11.0	HI FLEX HOSE 1/4" X 400MM (1X90°)	Nos.								0
12.0	HI FLEX HOSE 1/4" X 700MM (1X90°)									0
13.0	PRESSURE GAUGE 1/2 NPT-300 Bar	Nos.								0
14.0	PRESSURE RELIEF DEVICE 300 BAR, BSP	Nos.								0
15.0	RELEASE UNIT 300 BAR(Automatic & Manual Release)	Nos.								0
16.0	1/4 Inch TEE PIECE FOR ACTUATOR LINE	Nos.								0
17.0	BALL VALVE, 1 1/2 INCH (DIVERter VALVE) FE - NPT	Nos.								0
18.0	HANDLE FOR 1 1/2 INCH BALL VALVE	Nos.								0
19.0	BALL VALVE, 1 INCH (DIVERter VALVE) FE - NPT	Nos.								0
20.0	HANDLE FOR 1 INCH BALL VALVE	Nos.								0

[illegible]

Sl.No.	Drawing Title	Unit	P&ID of IGES	Piping Layout of IGES	Isometric View of IGES	GA of Inergen cylinder storage room & supporting arrangement	GA of Cylinder Manifold	Pressure Vent Location Location Layout	Electrical Cabling Layout	TOTAL BOQ
	Vendor Documet No.									
	Drawing Approval status (By BHEL)									
	100 NB	Mtrs.								0
40.2	END CAP-100 NB	Nos.								0
40.3	CS FLANGES-100 NB	Nos.								0
40.4	Full COUPLINGS-3/4 NPT	Nos.								0
40.5	Gaskets	Nos.								0
40.6	M 36 x 275 mm long stud &nuts for 100 NB Flange 2500#									0
41.0	Piping from Manifold to Pilot manifold									
41.1	CS ASTM A 106 GR B SCH.XXS									
	100 NB	Mtrs.								0
42.0	Fittings Details at Cylinder Room									
42.1	Elbows-100 NB	Nos.								0
42.2	Equal Tee-100 NB	Nos.								0
42.3	END CAP-100 NB	Nos.								0
42.4	CS FLANGES-100 NB	Nos.								0
42.5	Gaskets	Nos.								0
42.6	M 36 x 275 mm long stud &nuts for 100 NB	Nos.								0
42.7	Full COUPLINGS-3/4 NPT	Nos.								0
42.8	U-Bolts-100 NB	Nos.								0
43.0	Cylinder supporting Strecturals									
43.1	ISMC-150 x 75 x 6	Mtrs.								0
43.2	Angle-75x75x6	Mtrs.								0
43.3	Square Plate- 250x150x10	Nos.								0
43.4	Base Square Plate-300x75x6	Nos.								0
43.5	Anchor fastener -M10x75	Nos.								0
43.6	Stiffner-Square Plate-200x200x6	Nos.								0
43.7	Bolts &nuts	Nos.								0
43.8	U-CLAMP-100 NB	Nos.								0
43.9	Angle-(Cylinder Bracket)-ISA-75x75x6									0
44.0	DRV Manifold supporting Strecturals									
44.1	ISMC-100x40x6	Mtrs.								0
44.2	Angle-	Mtrs.								0
44.3	Square Plate	Nos.								
44.4	Base Square Plate-	Nos.								0

Sl.No.	Drawing Title	Unit	P&ID of IGES	Piping Layout of IGES	Isometric View of IGES	GA of Inergen cylinder storage room & supporting arrangement	GA of Cylinder Manifold	Pressure Vent Location Location Layout	Electrical Cabling Layout	TOTAL BOQ
	Vendor Documet No.									
	Drawing Approval status (By BHEL)									
44.5	Anchor fastener	Nos.								0
44.6	Stiffner-Square Plate	Nos.								0
44.7	U-Bolts-100 NB	Nos.								0
45.0	Floor Structural Support									
45.1	ISA-75x75x6									0
45.2	Square Plate-150x150x6	Nos.								0
45.3	Anchor Fastener-M10x75	Nos.								0
46.0	Distripution Piping(Downstream piping from Restrictor)									
46.1	CS ASTM A 106 GR B SCH.40									
46.1.1	100NB	Mtrs.								0
46.1.2	80NB	Mtrs.								0
46.1.3	65NB	Mtrs.								0
46.1.4	50NB	Mtrs.								0
46.1.5	40NB	Mtrs.								0
46.2	CS Fittings for Piping at TG Building 17 Mtr									
46.2.1	Equal Tee									
46.2.1.1	100 NB ,B/W	Nos.								0
46.2.1.2	80 NB ,B/W	Nos.								0
46.2.1.3	65 NB B/W	Nos.								0
46.2.1.4	40 NB ,S/W	Nos.								0
46.2.2	Unequal Tee									
46.2.2.1	100X100X80NB, B/W	Nos.								0
46.2.2.2	100X100X40NB, B/W	Nos.								0
46.2.2.3	80X80X50NB, B/W	Nos.								0
46.2.2.4	80X80X40NB, B/W	Nos.								0
46.2.2.5	65x 65 x 40 NB,S/W	Nos.								0
46.2.2.6	50 x 50 x 40 NB,S/W	Nos.								0
46.2.3	Elbow-90° Elbow									
46.2.3.1	100NB B/W	Nos.								0
46.2.3.2	80NB B/W	Nos.								0
46.2.3.3	65NB S/W	Nos.								0
46.2.3.4	40NB S/W	Nos.								0

Sl.No.	Drawing Title	Unit	P&ID of IGES	Piping Layout of IGES	Isometric View of IGES	GA of Inergen cylinder storage room & supporting arrangement	GA of Cylinder Manifold	Pressure Vent Location Location Layout	Electrical Cabling Layout	TOTAL BOQ
	Vendor Documet No.									
	Drawing Approval status (By BHEL)									
46.2.4	REDUCING ELBOW									
46.2.4.1	100X80NB B/W	Nos.								0
46.2.5	Concentric Reducer									
46.2.5.1	100X80NB B/W	Nos.								0
46.2.5.2	80x65NB B/W	Nos.								0
46.2.5.3	80x50NB B/W	Nos.								0
46.2.5.4	65X50NB S/W	Nos.								0
46.2.5.5	65X40NB S/W	Nos.								0
46.2.5.6	50X40NB S/W	Nos.								0
47.0	<u>Piping Supports for Downstream Piping(S-1 to S-7- 94 Nos)</u>									
47.1	ISMC 100 x 50 x 5	Mtrs.								0
47.2	ISA 50 x 50 x5	Mtrs.								0
47.3	Square Plate-200 x 100 x 6 mm thick	Nos.								0
47.4	Anchor Fasteners	Nos.								0
47.5	M12 x 115 mm long	Nos.								0
47.6	M10 x 75 mm long	Nos.								0
47.7	U Bolts ,Double nuts with Washers									
47.7.1	M12 x 100 NB	Nos.								0
47.7.2	M10 x 80 NB	Nos.								0
47.7.3	M8 x 65 NB	Nos.								0
47.7.4	M8 x 50 NB	Nos.								0
47.7.5	M8 x 40 NB	Nos.								0
48.0	Full Coupling-1 1/2" (40 NB) for Nozzle fixing	Nos.								0

VOLUME : V-B

SECTION-IV

**TECHNICAL SPECIFICATION
FOR
CABLES**

CONTENT

CLAUSE NO.	DESCRIPTION
1.00.00	SCOPE OF SUPPLY
2.00.00	CODES & STANDARDS
3.00.00	DESIGN CRITERIA
4.00.00	SPECIFIC REQUIREMENTS
5.00.00	TESTS
6.00.00	DRAWINGS DATA & MANUALS

ATTACHMENTS

ANNEXURE-A	RATINGS AND REQUIREMENTS - H.V POWER CABLES (11KV & 3.3 KV)
ANNEXURE-B	RATINGS AND REQUIREMENTS - L.V POWER CABLES
ANNEXURE-C	RATINGS AND REQUIREMENTS - CONTROL CABLES
ANNEXURE-D	RATINGS AND REQUIREMENTS - 1.1KV FS POWER & CONTROL CABLE
ANNEXURE-E	RATINGS AND REQUIREMENTS - FLEXIBLE TRAILING CABLES
ANNEXURE-F	CABLE SIZES

SECTION-IV

TECHNICAL SPECIFICATION FOR CABLES

1.00.00 SCOPE OF SUPPLY

1.01.00 Power and Control Cables shall cover the requirement of entire Plant including the switchyard.

Other cables including special cables, if any, which may be necessary as per proven engineering practice for satisfactory and trouble free operation of the entire cable system of the plant shall also be within the scope of supply. These shall include all such cables for electrical integral with mechanical equipment systems and subsystems.

1.02.00 Cable shall be furnished in accordance with this specification and the following annexures :

- | | | | |
|----|----------------------------|---|--------------|
| a) | 11kV & 3.3 kV Power cables | : | Annexure - A |
| b) | 1100V Power Cables | : | Annexure – B |
| c) | Control Cables | : | Annexure – C |
| d) | Fire Survival Cables | : | Annexure – D |
| e) | Flexible Trailing cable | : | Annexure – E |

1.03.00 All relevant drawings, data and instruction manuals

2.00.00 CODES & STANDARDS

2.01.00 All cable and materials shall be designed, manufactured and tested in accordance with the latest applicable Indian Standards (IS) and IEC except where modified and/or supplemented by this specification.

2.02.00 Cable and material conforming to any other standard which ensures equal or better quality, may be accepted. In such case, copies of the English version of the standard adopted shall be submitted along with the bid.

2.03.00 The electrical installation shall meet the requirements of Indian Electricity Rules as amended upto date and relevant IS Code of Practice. In addition, other rules and regulations applicable to the work shall be followed.

3.00.00 DESIGN CRITERIA

3.01.00 Cables will be generally laid on ladder type trays or drawn through rigid PVC/GI /HDPE pipe/conduits. Cable tunnels shall be avoided as far as possible, except at locations where overhead trays are not possible, with prior approval of the Owner.

- 3.02.00 For continuous operation at specified rating, maximum conductor temperature shall be limited to the permissible value as per relevant standard and/or this specification which one is more stringent.
- 3.03.00 The insulation and sheath materials shall be resistant to oil, acid and alkali and shall be tough enough to withstand mechanical stresses during handling.
- 3.04.00 Armouring shall be single round wire of galvanized steel for multicore cables and aluminum for single core cable for power and control cables. For fire survival control cable, the armouring over inner sheath shall consist of single layer of wire / round galvanised steel wire as per IS 3975 amended upto date. For Fire survival power cable, Single core cables to be used in A.C. system, the armouring over inner sheath shall consist of single layer of round copper wire, for multi-core cables to be used in A.C. system and single core cables in D.C. System, the armouring over inner sheath shall consist of single layer of round galvanised steel wire.
- 3.05.00 The outer sheath shall have flame retardant low smoke halogen evolution (FRLSH) characteristics or fire survival characteristics as applicable and shall meet the requirements of additional tests specified for the purpose.
- 3.06.00 Core identification for multicore cable shall be provided by colour coding.
- 3.07.00 HT cables shall be manufactured by triple extrusion dry cured (CCV) process using pressurized nitrogen.

4.00.00 **SPECIFIC REQUIREMENTS**

4.01.00 **General Description**

All Cables shall be furnished in strict compliance with ratings and requirements and sizes as given in Annexures to this Specification.

4.02.00 **Drum Length and Tolerance**

The cables shall be supplied in non-returnable packing steel drum for 11 kV & 3.3 kV power cables, wooden drums for 1100V power and control cables, each containing minimum 500 meters length of larger sizes of cable unless specifically asked for. For smaller sizes of cables, each drum shall contain 1000 meters length of cable. Allowable tolerance on individual drum length is $\pm 5\%$.

4.03.00 **Non-Standard Length**

Non-standard lengths upto 5% of the total ordered quantity may be accepted. However the Contractor will be required to obtain approval before packing the Cables on drums. Non-standard lengths shall not be less than 100 metres in any case.

4.04.00 **Cable identification**

Cable identification shall be provided by embossing on every meter on the outer sheath the following :

- a) TSGENCO
- b) Manufacturer's name or trade mark
- c) Voltage grade
- d) Year of manufacture
- e) Type of insulation, e.g. XLPE/PVC/HR85/IE2 etc.
- f) No. of core and size of cables.
- g) Type of improved fire performance, e.g. FR/FRLSH/FS
- h) IS number

4.05.00 Packing

4.05.01 Cables shall be supplied in non returnable drums. The drums shall be of heavy construction. All wooden parts shall be manufactured from seasoned wood. All ferrous parts used shall be treated with suitable rust preventive finish or coating to avoid rusting during transit or storage. Wooden cable drum shall be treated by immersing in copper-nitrate solution.

4.05.02 Cable shall be wound and packed on drums in such a manner that it will be properly sealed and firmly secured to the drum. The ends of each length shall be sealed before shipment.

4.05.03 The cable drums should carry the following details in printed form:

- a) TSGENCO
- b) Manufacturer's name or trade make
- c) Type of cable & voltage grade
- d) Year of manufacture
- e) Type of insulation e.g. XLPE/HRPVC/IE2
- f) No. of core and size of cables
- g) Cable code e.g. FRLSH/FS
- h) Length of cable on drum
- i) No. of length on drum, if more than one
- j) Direction of rotation, by arrow
- k) Approx. gross mass.

- l) IS/IEC number and ISI mark

4.06.00 **Joints and Terminations**

Materials of construction for a joint/termination shall perfectly match with the dielectric chemical and physical characteristics of the associated cables. The material and design concepts shall incorporate a high degree of operating compatibility between the cable and joints. The protective outer covering (jacket) used on the joints/terminations shall have the same qualities as that of the cable outer sheath in terms of ambient/operating temperature withstand capability and resistance to hazardous environments and corrosive elements. Straight through joints and terminations for HT cables shall be heat shrinkable type.

4.07.00 **Selection Criteria**

- 4.07.01 a) HT and LT power cables shall be selected on the basis of current carrying capacity, short circuit rating and permissible voltage drop.
- b) While sizing power cables, following aspects shall be reckoned:
- i) Ground/Ambient Air temperature
 - ii) Depth of Laying.
 - iii) Power Cables touching each other.
- c) Cables, for circuit breaker controlled feeders, shall withstand the short circuit current for the fault clearing time 0.16 Sec. for outgoing feeder, 0.5 Sec. for Tie feeder and 1.0 Sec. for Incomer.
- d) HT cables shall be sized based on the following considerations:
- Rated current of the equipment and ground/ambient temperature.
 - Touching/spacing of cable.
 - Laying on multi-tier racks, trench
 - Depth of laying.
 - The voltage drop of the cable , during motor starting condition , shall be limited to 15% and during full load running condition shall be limited to 3 % rated voltage. For BFP motor, the voltage drop during motor starting condition shall be limited to 20% and for Mill motor shall be limited to 10%. Other outgoing feeder / transformer feeder shall be limited to 3% rated voltage.
 - Short circuits withstand capability
- e) For fuse/MCCB/Breaker protected circuits the conductor size shall depend upon full load current subject to voltage drop limited to 3% during running of all feeders and 15% during starting for motor feeders. In addition, transformer regulation shall also be considered for loads fed from 415V PMCC. Incase of other out going line feeder voltage drop shall be limited to 3%.

- f) For loads fed from local panels, the total running voltage drop in cable from 415V PMCC to local panel and from local panel to individual motor shall be limited to 3% at full load motor current while the same during starting shall be limited to 15%.
- g) As per national electric code (NEC) current rating capacity of motor feeder/cables should be 125% of full load current.
- h) For welding receptacle, 3% running drop shall only be considered.
- The minimum sizes of L.T cable to be chosen are as below:
- AL - 16 mm² (3 core) & 16mm² (2 core) Cu - 2.5 mm²
- 4.07.02 Apart from above, consideration shall also be given to limit the cable to some standard sizes instead of using too many types.
- 4.07.03 The standard cable sizes, amp capacities, derating factors. as given in IS/IEC will be generally followed.
- 4.07.04 a) For breaker protected circuits minimum size of the cable shall be as follows:
- | | | |
|--------------------|---|-------------------|
| 1100V Power Cable | : | 240 Sq mm XLPE AL |
| 3300V Power Cable | : | 185 Sq mm XLPE AL |
| 11000V Power Cable | : | 240 Sq mm XLPE AL |
- b) For motor circuits the selection of size will be made ensuring that the cable shall withstand a short circuit fault directly following a second hot start.
- 4.07.05 For fuse/MCCB protected circuit, the conductor size will depend on full load current subject to voltage drop not exceeding 3%. For practical purposes, the minimum size chosen is as below :
- | | | |
|--------------|---|------------|
| a) Aluminium | : | 6 Sq mm. |
| b) Copper | : | 2.5 Sq mm. |
- 4.07.06 All control cables shall be 2.5 Sq mm copper cable.
- 4.07.07 Multicore control cables will generally have spare conductor (s) in accordance with the following chart :

Conductors required	Cables
1 or 2	1-3/C
3 or 4	1-5/C
5 or 6	1-7/C
7 or 8	1-9/C

	9 or 10	1-12/C
	Above 10	Two or more of above cables
4.07.08	Separate cables for each type of following services/functions as applicable shall be used for each feeder. Same multicore cable using different services shall not be acceptable.	
	a) Power.	
	b) Control, interlock and indication.	
	c) Metering and measuring.	
	d) Alarm and annunciation.	
	e) C.T. Cables.	
	f) V.T. Cables.	
4.08.00	Cable Identification	
	Cable identification shall be provided by embossing on the outer sheath the following :	
	a) Manufacturer's name or trade mark	
	b) Manufacturer's name or trade mark	
	c) Voltage grade	
	d) Year of manufacture	
	e) Type of insulation, e.g. XLPE, HRPVC & IE2 etc.	
	f) No. of core & size of cables	
	g) Type of outer sheath e.g. FRLSH, FS etc.	
4.09.00	Selected sizes of power and control cables are given in Annexure-G.	
4.10.00	Fire Survival Cables shall be used for important auxiliaries / area as recommended in Standard Technical Specification by CEA for the following services. The fire survival time of these cables shall not be less than 3 hours at 750 deg. C.	
	i. DC emergency lube oil pump	
	ii. DC hydrogen seal pump	
	iii. Turbine lube oil pump/barring gear	
	iv. DC emergency lighting for main building and service building	
	v. DC cables for battery to charger & DC distribution boards	

- vi. Jacking oil pump
- vii. Emergency turbine trip in control room
- viii. Boiler Turbine : Generator inter trip which include the interconnection between
 - Boiler master fuel trip and turbine trip relays
 - Generator trip relays & turbine trip relays
 - Generator trip relays & generator breaker
 - Generator trip relays & field breaker
 - Generator trip relays & unit auxiliary transformer breaker
 - Incomer cables for DG board, emergency board, DC lighting board etc.

5.00.00 **TESTS**

5.01.00 **Shop Tests**

The Cables shall be subject to shop tests in accordance relevant IS/IEC standards to prove the design and general qualities of the Cables as below:

- 5.01.01 Routine tests on each drum of cables.
- 5.01.02 Acceptance Tests on 1 drum out of every 10 drums chosen at random for acceptance of the lot for every size.
- 5.01.03 Type test on each type and size of cable, inclusive of measurement of armour DC resistance of power cables on one drum out of every 10 drums of cable.

5.02.00 **Additional Tests**

Following additional acceptance tests shall also be performed on each type of cables having outer sheath with improved fire performance (category C1, Type FR/ Category C2, Type FRLSH)

- 5.02.01 Oxygen index test (both C1 & C2)

The Oxygen index shall not be less than 29.
- 5.02.02 Temperature Index Test (both C1 & C2)

The measured value of temperature index shall be 21 at a temperature of 250°C for FRLS cables and 350°C for FS cables
- 5.02.03 Flame Retardance test on single cable and on bunched cables (both C1 & C2)

After the test, there should be no visible damages on the test specimen within 300mm from its upper end.

After burning has ceased, the cables should be wiped clean and the charred or affected portion should not have reached a height exceeding 2.5 meter above the bottom edge of the burner, measured at the front and rear of the cable assembly. 3 Hours fire rating test shall be carried out for FS cable as per IEC-331

5.02.04 Halogen acid gas evolution test (for Category C2)

The level of HCL evolved shall not exceed 20 per cent by weight. HCL evolved shall not be exceed 2% for FS cable.

5.02.05 Smoke density test (for Category C2)

The cables shall meet the requirements of light transmission of minimum 40% after the test. Minimum transmission shall be 80% for FS cable.

5.02.06 Test for specific optical density of smoke

The cables shall meet the requirements of IS/IEC.

5.02.07 Test for rodent & termite repulsion property

The test shall be carried out to note the presence of rodent and termite repelling chemical in PVC compound. Normal procedure is that a few chippings of the PVC compound are slowly ignited in a porcelain dish or crucible in a muffle furnace at about 600°C. The resulting ignited ash is boiled with a little ammonium acetate solution (10%). A drop of aqueous sodium sulphide solution is placed on a thick filter paper and it is allowed to soak. The spot is touched with a drop of above extract. A black spot indicates the presence of anti-termite & rodent compound.

Flammability test shall be carried on finished cables as per following standards-

- a) Swedish Chimney test – SS: 424-14-75
- b) IEEE std.383 – 1974 latest
- c) IEC std. 332-1, 332-3 and IEC 331

6.00.00 **DRAWINGS, DATA & MANUALS**

6.01.00 Drawings, Data and Manuals shall be submitted with the bid and for approval/reference and subsequent distribution after the issue of Letter of Intent in quantities and procedures as specified in General condition of contract and/or

6.02.00 **To be submitted with the Bid**

- a) Manufacturer's catalogues giving cable construction details and characteristics.

- b) Cable current ratings for different types of installation, inclusive of derating factors for ambient temperature, grouping etc.
- c) Write-up on Manufacturer's recommended method of splicing, jointing, termination etc. of the cables.
- d) Type test reports on 11 KV & 3.3 KV Power, LT FRLSH Power & control, FS power and control cables.
- e) Filled-up proposal particulars.

6.03.00 To be submitted for Owner/Purchaser's Approval and Distribution

All relevant drawings and data pertaining to the equipment like GTP, QAP, etc. shall be submitted by the Bidder for the approval of Owner/Owner's consultant. Also refer clause no. 1.19.02(u) of Section-I of Volume – V-A: Technical Specifications for Electrical Equipment & Accessories.

ANNEXURE-A

**RATINGS AND REQUIREMENTS
HV POWER CABLES (11 KV & 3.3 KV)**

- | | | | |
|-----|--|---|--|
| 1.0 | 11000/11000V & 3300/3300V grade 90°C continuous rating under normal condition and 250°C rating under short circuit condition heavy duty XLPE power cable suitable for use in 11000V/3300V non-effectively earthed system conforming to following requirement and in line with IS-7098, IS-8130, IS-5831 & IS-3975, manufactured by Triple Extrusion Dry Cure (CCV) process using pressurized Nitrogen. | | |
| 1.1 | Conductor | : | Stranded and compacted aluminium conductor of grade H2 & class 2 for all sizes, generally conforming to IS: 8130. |
| 1.2 | Conductor Screen | : | Extruded semi-conducting compound. |
| 1.3 | Insulation | : | Extruded cross linked polyethylene (XLPE) conforming to IS: 7098 (Part-2) |
| 1.4 | Insulation Screen | : | Extruded semi-conducting compound with a layer of non-magnetic metallic tape. For single core armoured cables, the armouring shall constitute the metallic part of screening. The semi-conducting tape shall be easily strippable. |
| 1.5 | Core Identification | : | By coloured strips applied on (For three core cables) cores. |
| 1.6 | Inner Sheath | : | Extruded HRPVC/FRLS compound conforming to type ST2 of IS: 5831 for three core cables. Single core cables shall have inner sheath. Filler material shall also be of type ST2 PVC. |
| 1.7 | Armour | : | Galvanised single round steel wire armour for twin and multicore cables.

Non-magnetic hard drawn aluminum single round wire conforming to H4 of IS-8130 latest for single core cables |
| 1.8 | Overall Sheath | : | Extruded FRLSH HRPVC compound conforming to type ST2 of IS: 5831. |
| 1.9 | Drum | : | Steel Drum |

ANNEXURE-B

**RATINGS AND REQUIREMENTS
LV POWER CABLES [1.1KV (XLPE TYPE)]**

- 1.0 1100 V grade, 90°C continuous rating under normal condition and 250°C under short circuit condition rating, XLPE heavy duty, power cable conforming to following requirement and in line with IS 7098 Part-I. IS 8130 & IS 5831 and IS 3975.
- 1.1 Conductor : Stranded and compacted plain aluminium of grade H2 and class 2 stranded, high conductivity annealed plain copper for cable sizes upto 2.5 mm² conforming to IS:8130.
- 1.2 Insulation : Extruded cross-linked polyethylene (XLPE) conforming to IS: 7098 (Part-1)
- 1.3 Core Identification : By color coding
- 1.4 Inner Sheath : Extruded HRPVC FRLS compound conforming to type ST2 of IS: 5831 for multicore cable. Single core cables shall have no inner sheath. Filler shall be of same material as of inner sheath i.e. ST2
- 1.5 Armour : Galvanized single round steel wire armour for twin and multicore cables.

Non-magnetic hard drawn aluminum single round wire conforming to H4 of IS-8130 latest for single core cables
- 1.6 Overall Sheath : Extruded FRLSH HRPVC compound conforming to type ST2 of IS: 5831.
- 1.7 Drum : Conforming to IS-10418 (Wooden drum)

ANNEXURE-C

**RATINGS AND REQUIREMENTS
CONTROL CABLES**

- 1.0 1100 V grade 85°C continuous rating under normal condition and 160°C under short circuit condition rating HRPVC Control cable (YWY) conforming to following requirement and in line with IS:1554, IS:8130, IS:5831 and IS:3975.
- 1.1 Conductor : Stranded, non-compacted & circular, high conductivity annealed plain copper, generally conforming to IS: 8130.
- 1.2 Insulation : Extruded HRPVC type-C compound conforming to IS: 5831. The minimum volume resistivity of insulation shall be 3.5×10^{14} ohm-cm at 27°C and 3.5×10^{11} OHM-CM at 85°C.
- 1.3 Core Identification : By color coding and numbering at interval of 100mm or less
- 1.4 Inner sheath : Extruded HRPVC compound conforming to type ST2 FRLS of IS: 5831 for multicore cables. Single core cables shall have no inner sheath. Filler shall be of same material as of inner sheath i.e. ST2.
- 1.5 Armour : Galvanised single round steel wire for twin and multicore cables.
- 1.6 Overall sheath : Extruded FRLSH HRPVC compound conforming to type ST2 of IS: 5831.
- 1.7 Drum : Conforming to IS: 10418 (Wooden drum)

ANNEXURE-D

**RATINGS AND REQUIREMENTS
(1.1KV GRADE COPPER CONDUCTOR FS POWER CABLES)**

1100 V, copper conductor, heat resisting insulation, extruded inner sheath of low smoke and very low halogen content fire resisting material, single layer of copper wire armour for single core/ single layer of round galvanised steel wire for multicore, outer sheath of low smoke and very low halogen content fire resistant material, suitable for minimum temperature of 750 deg.C for 3 hours. The cables shall be in compliance with IEC-60331, Part 11.

**RATINGS AND REQUIREMENTS
(1.1KV GRADE COPPER CONDUCTOR FS CONTROL CABLES)**

1100 V, copper conductor, heat resisting insulation, extruded inner sheath of low smoke and very low halogen content fire resisting material, single layer of copper wire armour for single core/ single layer of round galvanised steel wire for multicore, outer sheath of low smoke and very low halogen content fire resistant material, suitable for minimum temperature of 750 deg.C for 3 hours. The cables shall be in compliance with IEC-60331, Part 11.

ANNEXURE-E

**RATINGS AND REQUIREMENTS
FLEXIBLE TRAILING CABLES**

i) 3300 V Unearthed Grade

Flexible trailing cable, annealed plain copper conductor, Class-5 of IS-8130, insulated with EPR, conductor and insulation shielded with EPR, cores screened with ATC wire braiding, cores laid up, HD CSP inner sheathed, proof cotton taped and FRLS HD CSP sheathed overall, conforming to IS:9968. Alternatively PCP sheathing may be acceptable.

ii) 1100 V Grade

1100 V Grade trailing cable shall be plain copper of Class-5 of IS-8130, heat resistant elastomeric compound based on EPR insulation, inner sheath of heat resistant elastomeric compound PCP sheath, nylon cord reinforcement and heat resistant, oil resistant and flame retardant heavy duty elastomeric compound FRLS CSP outer sheath.

ANNEXURE-F

CABLE SIZES

Following sizes are given as a general guideline. Standard sizes as per IEC/IS shall be adopted.

Sl. No.	Cable Size	Conductor	Insulation
1.0	H. T. CABLES (11kV)		
1.1	1 core 1000 sq.mm	AL	XLPE (FRLS)
1.1	1 core 630 Sq.mm	AL	XLPE (FRLS)
1.2	3 core 400 Sq.mm	AL	XLPE (FRLS)
1.3	3 core 240 Sq.mm	AL	XLPE (FRLS)
1.4	1 core 70 Sq.mm	AL	XLPE (FRLS)
1.0	H. T. CABLES (3.3kV)		
1.1	1 core 630 Sq.mm	AL	XLPE (FRLS)
1.2	3 core 300 Sq.mm	AL	XLPE (FRLS)
1.3	3 core 240 Sq.mm	AL	XLPE (FRLS)
1.4	3 core 185 Sq.mm	AL	XLPE (FRLS)
1.5	1 core 70 Sq.mm	AL	XLPE (FRLS)
2.0	L. T. POWER CABLES		
2.1	3 core 2.5 Sq.mm	CU	XLPE (FRLS)
2.2	2 core 16 Sq.mm	AL	XLPE (FRLS)
2.3	3 core 16 Sq.mm	AL	XLPE (FRLS)
2.4	4 core 16 Sq.mm	AL	XLPE (FRLS)
2.5	2 core 35 Sq.mm	AL	XLPE (FRLS)
2.6	3 core 35 Sq.mm	AL	XLPE (FRLS)
2.7	4 core 35 Sq.mm	AL	XLPE (FRLS)
2.8	3 core 70 Sq.mm	AL	XLPE (FRLS)

Sl. No.	Cable Size	Conductor	Insulation
2.9	3.1/2 core 70 Sq.mm	AL	XLPE (FRLS)
2.10	3 core 95 Sq.mm	AL	XLPE (FRLS)
2.11	3.1/2 core 95 Sq.mm	AL	XLPE (FRLS)
2.12	3 core 185 Sq.mm	AL	XLPE (FRLS)
2.13	3.1/2 core 185 Sq.mm	AL	XLPE (FRLS)
2.14	3 core 240 Sq.mm	AL	XLPE (FRLS)
2.15	3.1/2 core 240 Sq.mm	AL	XLPE (FRLS)
2.16	3 core 300 Sq.mm	AL	XLPE (FRLS)
2.17	3.1/2 core 300 Sq.mm	AL	XLPE (FRLS)
2.18	1 core 630 Sq.mm	AL	XLPE (FRLS)
3.0	CONTROL CABLE		
3.1	2 core 2.5 Sq.mm	CU	HRPVC (FRLS)
3.2	3 core 2.5 Sq.mm	CU	HRPVC (FRLS)
3.3	5 core 2.5 Sq.mm	CU	HRPVC (FRLS)
3.4	7 core 2.5 Sq.mm	CU	HRPVC (FRLS)
3.5	9 core 2.5 Sq.mm	CU	HRPVC (FRLS)
3.6	12 core 2.5 Sq.mm	CU	HRPVC (FRLS)
3.7	20 core 2.5 Sq.mm	CU	HRPVC (FRLS)
4.0	FS POWER CABLES		
4.1	3 core 2.5 Sq.mm	CU	EPR
4.2	2 core 16 Sq.mm	CU	EPR
4.3	3 core 16 Sq.mm	CU	EPR
4.4	4 core 16 Sq.mm	CU	EPR
4.5	2 core 35 Sq.mm	CU	EPR

Sl. No.	Cable Size	Conductor	Insulation
4.6	3 core 35 Sq.mm	CU	EPR
4.7	4 core 35 Sq.mm	CU	EPR
4.8	3 core 95 Sq.mm	CU	EPR
4.9	3.1/2 core 95 Sq.mm	CU	EPR
5.0	FS CONTROL CABLE		
5.1	2 core 2.5 Sq.mm	CU	EPR
5.2	3 core 2.5 Sq.mm	CU	EPR
5.3	5 core 2.5 Sq.mm	CU	EPR
5.4	7 core 2.5 Sq.mm	CU	EPR
5.5	9 core 2.5 Sq.mm	CU	EPR
5.6	12 core 2.5 Sq.mm	CU	EPR

VOLUME : III-C

SECTION-XIII

TECHNICAL SPECIFICATION

FOR

PROTECTIVE LINING AND PAINTING

SECTION-XIII
TECHNICAL SPECIFICATION
FOR
PROTECTIVE LINING AND PAINTING
C O N T E N T S

<u>CLAUSE NO</u>	<u>DESCRIPTION</u>	<u>PAGE NO.</u>
1.00.00	INTENT OF SPECIFICATION	1
2.00.00	CODES & STANDARDS	1
3.00.00	GENERAL REQUIREMENTS	2
4.00.00	EQUIPMENT, MATERIAL AND SERVICES TO BE FURNISHED BY THE BIDDER	4
5.00.00	COATING PROCEDURE AND APPLICATION	7
6.00.00	TEST REQUIREMENTS	8
7.00.00	INFORMATION / DATA REQUIRED	12

SECTION-XIII

TECHNICAL SPECIFICATION

FOR

PROTECTIVE LINING AND PAINTING

1.00.00 INTENT OF SPECIFICATION

1.01.00 This specification addresses the requirements of all labour, material, and appliances necessary with reference to preparations for lining / painting, application as well as finishing of all lining / painting for all mechanical and electrical equipment, piping and valves, structures etc. included under the scope of this Package.

1.02.00 The Bidder shall furnish and apply all lining, primers including wash primers if required, under-coats, finish coats and colour bands as described hereinafter or necessary to complete the work in all respects.

2.00.00 CODES & STANDARDS

2.01.00 The Bidder shall follow relevant Indian and International Standards wherever applicable in cleaning of surface, selection of lining material / paints and their application. The entire work shall conform to the following standards / specifications (latest revision or as specified).

- a) SSPC SP 10 / NACE 2 / : Near White Blast Cleaning
- b) SSPC PA 2 : Measurement of dry film Coating Thickness with magnetic gauges.
- c) ASTM D 4541 : Method for pull off strength using portable Adhesion Tester.
- d) NACE RP 0274 – 2004 : High-Voltage Electrical Inspection of Pipeline Coatings
- e) NACE SP 0188 – 2006 : Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates

- f) NACE RP 0169 – 2002 : Control of External Corrosion on Underground or Submerged Metallic Piping Systems
- g) AWWA C 210 – 2007 : Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines
- h) IS 3589:2001 Annexure B : Steel Pipes for Water and Sewage Specification.
- i) AWWA C222-2000 : Polyurethane Coating for the Interior and Exterior of Steel Water Pipe and Fittings.
- j) IS 13213 : 2000 : Polyurethane Full Gloss Enamel (Two pack)

3.00.00 GENERAL REQUIREMENTS

- 3.01.00** The steel surface preparation prior to actual commencement of coating shall conform to SSPC SP 10 / NACE 2 / Sa2½ (near white metal) with sand blasting.
- 3.02.00** The contractor shall submit a detailed written description in the form of a manual covering coating equipment, procedures, materials inspection test, and repair etc. to Owner/Consultant for approval.
- 3.03.00** The contractor shall also provide copies of test reports from NABL approved laboratory (like National Test House, Kolkata) in support of the paint/primer materials to be used shall conform to the specification requirement.
- 3.04.00** The contractor shall also provide certificates from paint/primer manufacturer mentioning the batch numbers, date of manufacture and shelf life etc. of the materials to be used. In addition to that Manufacturing Quality Plan (MQP) and Field Quality Plan (FQP) shall also be submitted prior to commencement of supply of material and field application.
- 3.05.00** Paint/coating application work at site shall be done either by paint manufacturer or by their authorized applicator. The authorized applicator shall have proper training & certification from manufacturer. Applicator shall possess all the necessary specialized equipment and manpower experienced in similar job.

- 3.06.00 Applied coating shall be tested for dry film thickness, holiday (electrical inspection for continuity) and adhesion as per relevant standard such as SSPC PA 2, NACE RP 0274 and ASTM D 4541.
- 3.07.00 If necessary, the material may be heated and applied by airless spray / plural component spray system.
- 3.08.00 Manufacturer's specific recommendation, if any, shall be followed during application of lining / paints.
- 3.09.00 In areas where there is danger of spotting automobiles or other finally finished equipment or building by wind borne particles from paint spraying, a Purchaser approved method shall be adopted.
- 3.10.00 The colour scheme of the entire Plant, covered under this specification shall be approved by the Purchaser in advance before application.
- 3.11.00 All indoor and outdoor piping, insulated as well as uninsulated will have approved colour bands painted on the pipes at conspicuous places throughout the system, as approved by Purchaser.
- 3.12.00 Inside surfaces of vessels / tanks shall be protected by anticorrosive paints or rubber lining as required / specified elsewhere in the specification. External surfaces of all vessels / tanks shall be protected by anti corrosive painting.
- 3.13.00 For vessels / tanks requiring lining and epoxy painting all inside surface shall be blast cleaned using non-siliceous abrasive after usual wire brushing.
- 3.14.00 Natural rubber lining shall be provided on the inside of vessels / tanks as required / specified elsewhere in the specification, in three layers resulting in a total thickness not less than 4.5 mm.
- 3.15.00 Surface hardness of rubber lining shall be 65 +/- 5 deg. A (shore).
- 3.16.00 After the lining is completed, the vessels / tanks shall not be subjected to any prolonged exposure to direct sunlight in course of its transportation, erection etc. They shall not be stored in direct sunlight. No further lining or burning shall be carried out on the vessel, after application of the lining.

3.17.00 All lining projecting outside of the vessel shall be protected adequately from mechanical damages during shipment, handling storage etc.

3.18.00 Suitable warnings, indicating the special care that must be taken with respect to these lined vessels shall be stenciled on their outside surface with the letters at least 12 mm high.

3.19.00 All insulated piping shall have aluminium sheet jacketing.

4.00.00 EQUIPMENT, MATERIAL AND SERVICES TO BE FURNISHED BY THE BIDDER

4.01.00 After erection at site, the outside surfaces of all equipment having a shop coat shall be given further priming coat and finished coats of paint as detailed in following clauses. However, if the painting system is such that the shop coat and primer coat to be applied at site are not compatible, then shop coat has to be removed from the surface of equipment before application of primer coat with prior blasting.

All factory finished paints shall be touched up at site as required.

All uninsulated piping shall be finished with final paintings after use of proper wash primer and primer. Aluminium sheet jacketed piping need not be painted. Colour bands of Purchaser's approved shade shall however be applied on jacketed piping near walls or partitions, at all junctions, near valves and all other places as instructed by the Purchaser. All structures shall be painted with approved paint.

4.02.00 Surface Preparation

4.02.01 Unless mentioned otherwise, all rust and mill scale shall be removed by blasting to Sa 2-1/2 Swiss Standard before applying the primer.

4.02.02 Special care shall be taken to remove grease and oil by means of suitable solvents like Trichloroethylene or Carbon Tetrachloride.

4.02.03 The minimum degree of surface preparations for all equipment, piping, fittings, valves, structures etc. shall be "Near White" according to Steel Structure, Painting Council-SSPC-SP-10 before application of any primer/paint.

4.03.00 Painting

- 4.03.01 Specification for application of paints for external surfaces protection of vessels / tanks / equipment / piping / fittings / valves etc. to be installed indoor shall be as follows :
- a) Surface preparation shall be done either manually or by any other approved method.
 - b) Primer Coat shall consist of one coat (minimum DFT of 50 microns) of chlorinated rubber based zinc phosphate.
 - c) Intermediate Coat (or Under Coat) shall consist of one coat (minimum DFT of 50 microns) of chlorinated rubber based paint pigmented with Titanium Dioxide.
 - d) Top Coat shall consist of one coat (minimum DFT of 50 microns) of chlorinated rubber paint of approved shade and colour with glossy finish.
 - e) Total DFT of paint system shall not be less than 150 microns.
- 4.03.02 Specification for application of paints for external surfaces protection of vessels / tanks / equipment / piping / fittings / valves etc to be installed **outdoor** shall be as follows :
- a) Surface preparation shall be done by means of sand blasting, which shall conform to Sa 2-1/2 Swiss Standard.
 - b) Primer Coat shall consist of one coat (minimum DFT of 100 microns) of epoxy resin based zinc phosphate primer.
 - c) Intermediate Coat (or Under Coat) shall consist of one coat (minimum DFT of 100 microns) epoxy resin based paint pigmented with Titanium Dioxide.
 - d) Top Coat shall consist of one coat (minimum DFT of 75 microns) of epoxy paint of approved shade and colour with glossy finish. Additional one coat (minimum DFT of 25 microns) of Finish Coat of polyurethane shall be provided.
 - e) Total DFT of paint system shall not be less than 300 microns.
- 4.03.03 Specification for application of paints for external surfaces protection of steel pipes and fittings which are **buried underground / laid inside a huge pipe & or submerged Under Water and laid under Pipe Trenches** (in road/rail/pipe or trench crossings) shall be as follows :

External surface of the pipe, fittings, specialties etc. handling raw water/clarified water/filter water shall be painted with one coat of two part chemically cured polyurethane primer of min 50 micron dry film thickness followed by three or maximum four coats of two part solvent less polyurethane to build up coating of dry film thickness of 2000 micron including primer coat.

- 4.03.04 Specification for application of paints for internal surface protection of large diameter pipes (sizes above 600 mm NB and above) if any, shall be as follows :
- a) All Internal surfaces of steel pipes, fittings, specialties etc. buried underground or located within pipe trenches shall be given epoxy coating to protect them from (except for drinking water service, where the compatible painting shall be so selected to meet relevant quality standards) corrosion.
 - b) Internal surface of the pipe should be coated with one coat of two part epoxy primer with not less than 50 micron DFT (dry film thickness) followed by two part polyamide cured solvent less epoxy.
 - c) The minimum dry film thickness (DFT) of internal lining shall be 600 micron.
- 4.03.05 Specification for application of paints for protection of internal surfaces of DM Water Storage Tank(s) shall be as follows :
- a) Primer - One coat of epoxy primer containing high level of Zinc Phosphate anticorrosive pigment. Total Dry Film Thickness (DFT) of primer shall not be less than 125 microns.
 - b) Finish Paint - Three (3) coats Polyamine HB Epoxy Paint. Total Dry Film Thickness (DFT) of finish paint shall not be less than 125 microns per coat.
 - c) Total thickness of primer and paint should not be less than 500 microns.
- 4.03.06 All motors, local push button stations, cable racks, structures used for supports etc. are to be painted with acid proof paint.
- 4.03.07 The following surfaces shall not be painted - stainless steel, galvanized steel, aluminum, copper, brass, bronze and other nonferrous materials.
- 4.03.08 No painting or filler shall be applied until all repairs, hydrostatic tests and final shop inspection are completed.

4.03.09 All machined surfaces shall have two (2) coats of water repellant grease after thorough cleaning.

5.00.00 COATING PROCEDURE AND APPLICATION

5.01.00 Surface Preparation :

Pipe shall be blast cleaned by sand. The cleanliness achieved prior to application shall be in accordance with the requirement of SSPC SP 10 / NACE 2 / Sa2½ of ISO 8501 (near white metal)

- a) The blast pattern or profile depth shall be 40 to 100 micron and shall be measured by dial micrometer.
- b) Before sand blasting is started or during blasting or coating, temperature of the pipe surface should be more than 3°C above dew point temperature. Blast cleaned surface should be primed within 4 hours and shall be protected from rainfall or surface moisture and shall not be allowed to flash rust. If the rust occurs, the surface again to be prepared by sand blasting or wire brushing.

5.02.00 Application of Epoxy Coating

- a) Coating shall be applied when
 - i) When the pipe surface temperature shall be atleast 3°C above dew point temperature.
 - ii) The temperature of mixed coating material and the pipe at the time of application shall not be lower than 10°C or greater than 50°C.
- b) Material preparation shall be in accordance with manufacturer's recommendations.
- c) Application of epoxy coating system :

The epoxy coating system shall be applied as per recommendation of the manufacturer and shall be applied by airless spray / plural component spray machine. For more than one coat, the second shall be applied with the time limits as recommended by the manufacturer.

5.03.00 Application of PU Coating

- a) PU coating shall be applied when the pipe surface temperature atleast 3°C above dew point temperature (when R.H is more than 85%).
- b) Material preparation and application shall be done as per manufacturer recommendation.

6.00.00 TEST REQUIREMENTS :

6.01.00 Measurement of dry film thickness

Measurement of dry film thickness of coating : Coating thickness shall be in the range of $\pm 20\%$ and as per SSPC PA 2.

6.01.01 Apparatus / Instrument:-

The instrument used for dry film thickness may be Type 1 pull of gauges or Type 2 electronic gauges.

6.01.02 Procedures:-

- a) Number of measurements:
For 100 square feet (9.29 square meters), five (5) spots per test area (each spot is 3.8 cm) in diameter. Three gauge readings per spot (average becomes the spot measurement).
- b) If the structure is less than 300 square feet, each 100 square feet should be measured.
- c) If the structure is between 300 and 1000 sq ft, select 3 random 100 square feet test areas and measure.
- d) For structure exceeding 1000 square feet, select 3 random 100 square feet testing areas for the first 1000 sq ft and select 1 random 100 square feet testing area for each additional 1000 square feet
- e) Coating thickness Tolerance: Individual reading taken to get a representative measurement for the spot are unrestricted (usually low or high readings are discarded). Spot measurements (the average of 3 gauge readings) must be within 80% of the minimum thickness and 120% of the maximum thickness. Area measurement must be within specified range.

6.02.00 Electrical Inspection (Holiday) Test

- 6.02.01 All the coated / lined pipes shall be tested with an approved high voltage holiday detector preferably equipped with an audio visual signaling device to indicate any faults, holes, breaks or conductive particles in the protective coating.
- 6.02.02 The applied output voltage of holiday detector shall have a spark discharge of thickness equal to at least twice the thickness of the coating to assure adequate inspection voltage and compensate for any variation in coating thickness. The electrode shall be passed over the coated surface at approximately half the spark discharge distance from the coated surface only one time at the rate of approximately 10 to 20m/min. The edge effect shall be ignored. Excessive voltage shall be avoided as it tends to induce holiday in the coated surface thereby giving erroneous readings.
- 6.02.03 While selecting test voltages, consideration should be given to the tolerance on coating thickness and voltage should be selected on the basis of maximum coating thickness likely to be encountered during testing of a particular pipe.
- The testing voltage shall be calculated by using following formula. (as per NACE 0274 : 2004)
- $$\text{Testing Voltage } V = 7900 \sqrt{T} \pm 10 \text{ percent where } T \text{ is the average coating thickness in mm.}$$
- 6.02.04 Any audio visual sound or spark leads to indicate pinhole, break or conductive particle.
- 6.03.00 Adhesion Pull off Test :**
- After holiday the coated surface is subjected to adhesion pull off test as per ASTM D 4541.
- 6.03.01 Apparatus / Instrument: Adhesion tester consists of three basic components:
- A hand wheel, a black column containing a dragging indicator pin and scale in the middle and a base containing three legs and a pulling "Jaw" at the bottom and also dollies.
- 6.03.02 Prepare the test surface :
- Once test area is selected, test area shall be free of grease, oil, dirt, water. The area should be flat surfaces and large enough to accommodate the specified number of replicate test.
- 6.03.03 Prepare Dolly (Test Pull Stub) :

The dolly is a round, two sided aluminium fixture. Both sides of the dolly looks same, however, one side sloped on top surface while flat on bottom surface. As the surface of the dolly is polished aluminium, roughen the same using a coarse sand paper.

6.03.04 **Select an adhesive:**

Use araldite, a 100% solid epoxy adhesive. This adhesive requires at least 24 hours at room temperature to cure.

6.03.05 **Attach the dolly to the surface.**

- a) Using a wooden stick, apply an even layer of adhesive to the entire contact surface area of the dolly.
- b) Carefully remove the excessive adhesive by using a cotton swab. Allow the adhesive to fully cure before performing the adhesion test.
- c) Attach the dolly to the coated surface and gently push downward to displace any excessive adhesive.
- d) Push the dolly inward against the surface, then apply tape across the head of the dolly.

6.03.06 **Adhesion Test Procedure**

- a) Attach the adhesion tester to the dolly by rotating the hand wheel counter clockwise to lower the jaw of the device.
- b) Slide the jaw completely under the head of the dolly. Position the three legs of the instruments so that they are sitting flat on the coated surface.
- c) Slide the dragging indicator pin on the black column to zero by pushing it downward.
- d) Firmly hold the base of the instrument in one hand and rotate the handwheel clockwise to raise the jaw of the device that is attached to the head of the dolly. The dragging indicator pin will move upward on the black column as the force is increased and will hold the reading. Apply the tension using a moderate speed. Continue to increase the tension on the head of the dolly until (a) the minimum PSI/MPa/Kg/cm² required by project specification is exceeded and the test is discontinued, (b) the maximum PSI/MPa/Kg/cm² of adhesion tester has been achieved and dolly is still attached, (c) The force applied by the adhesion tester causes the dolly to dislodge.

e) Read the scale and record the adhesion value.

6.04.00 Coating Repair

Defective Coating shall be repaired in accordance with the following subsections.

6.04.01 Surface Preparation:

Accessible areas of pipe requiring coating repairs shall be cleaned to remove debris and damaged coating using surface grinders or other means. The adjacent coating shall be feathered by sanding, grinding or other method. Accumulated debris shall be removed by blowing with contaminant free air or wiping with clean rags.

6.04.02 Areas not accessible for coating repair such as interior surfaces of small diameter pipe shall be reprocessed and recoated.

6.04.03 Coating Application :

The coating system shall be applied to the prepared areas in accordance with procedure.

6.04.04 Repair Inspection :

Repaired portion shall be electrically inspected using a holiday detector.

6.05.00 Welded Field Joints

6.05.01 Preparation :

The weld joints shall be cleaned so as to be free from mud, oil, grease, welding flux, weld spatter and other foreign contaminants. The cleaned metal surfaces of the weld joint shall then be blasted or abraded using rotary abrading pads. The adjacent liquid Epoxy / PU coating shall be feathered by abrading the coating surface for a distance of 25 mm.

6.05.02 Electrical Inspection :

After curing the coating system applied to the welding joints shall be holiday tested. Any holidays indicated by the detector shall be marked with chalk to identify the area of repair.

7.00.00 INFORMATION/DATA REQUIRED

The Bidder shall submit complete list of paints and primers proposed, giving detail information, such as, chemical composition, drying time etc. and also unit rates for application of each type of paint along with supply shall be furnished.