

MANUFACTURE'S NAME & ADDRESS				MANUFACTURING QUALITY PLAN				PROJECT						
ITEM : GATE VALVE		ACIQP NO. :		CONTRACT NO.		P.O.NO. :		REV.NO. : DATE :		END USER :				
P.O. DATE :		W.O. NO. :		CONTRACTOR : BHARAT HEAVY ELECTRICAL LIMITED		PAGE. : 1 OF 1								
SL. NO.	COMPONENTS & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMATS OF RECORDS		AGENCY			REMARKS
					M	C/N					M	C	N	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.0 MATERIALS														
1.1	BODY, BONNET, WEDGE, SEATRING & FASTNERS	Chemical Composition	Critical	Chemical Testing	One / Heat	One / Heat	Appd /Drgs Tech Spec	Appd Drgs / DS/MFG STD	Foundry TC	√	P	V	V	
		Mechanical Properties	Critical	Mechanical Testing	One / Heat / Heat Treatment Batch		-	-	Foundry TC	√	P	V	V	
		Heat Treatment (Only For Casting)	Critical	Heat treatment	100%	100%	-	-	Report	√	P	V	V	
		Surface Defects	Major	Visual	100%	100%	MSS-SP-55	MSS-SP-55	Inspection report	-	P	-	-	
1.2	STEM AND GLAND (BAR STOCK)	Chemical Composition	Critical	Chemical Testing	One / Heat	One / Heat	ASTM STD	ASTM STD	Foundry TC & Lab Reports	√	P	V	V	
		Mechanical Properties	Critical	Mechanical Testing	One / Heat / Batch	One / Heat / Batch	ASTM STD	ASTM STD	Foundry TC & Lab Reports	√	P	V	V	
	STEM	Ultrasonic Test for Stem	Critical	Ultrasonic Test	100%	100%	ASTM B 16.34	ASTM B 16.34 & ASME B 16.34 ANNEXURE E	UT REPORT	√	P	V	V	For dia>50mm above only.
2.0 INPROCESS INSPECTION														
2.1	MACHINING OF BODY, BONNET, WEDGE & STEM	Dimension	Major	Measument	100%	100%	Mfg Drgs	Mfg Drgs	Inspection report	√	P	V	-	
2.2	WEDGE & SEATRING	Blue Matching (For Metal Seat)	Critical	Visual	100%	100%	The Surface shall be smooth and shall have uniform contact with seating surface.		IR	√	-	P	-	
3.0	ASSEMBLY	Dimension	Major	Measument	10%	10%	Appd Drgs	Appd Drgs	-	√	P	V	V	
4.0 TESTING														
4.1	SHELL	Leakage	Critical	Hydrostatic Pressure	100%	10%	Approved Drawings / DS/ Ref.standard	No Leakage	Test Certificate	√	P	W	V	
4.2	HYDRO SEAT	Leakage	Critical	Hydrostatic Pressure	100%	10%	Approved Drawings / DS/ Ref.standard	No Leakage	Test Certificate	√	P	W	V	
4.3	PNEUMATIC SEAT	Leakage	Critical	Air Pressure	100%	10%	Approved Drawings / DS/ Ref.standard	No Leakage	Test Certificate	√	P	W	V	
4.4	PERFORMANCE / FUNCTIONAL CHECK	Operation (Opening &Closing)	Major	Visual	100%	10%	Drawing & Techical Spec.	Smooth Operation	Inspection report	√	P	W	V	
5.0	FINAL INSPECTION	Cleanliness Completeness &	Major	Visual	100%	10%	As per Drg/ Tech Spec.	As per Drg/ Tech Spec.	Inspection report	√	P	V	V	
5.1	PAINTING	DFT CHECK	Major	Visual	100%	10%	As per Drg/ Tech Spec.	As per Drg/ Tech Spec.	Inspection report	√	P	V	V	
6.0	PROVISION OF NAME PLATE	As Per Spec	Major	Visual	As per Specification	As per Specification	As per Specification	As per Specification	Inspection report	-	P	V	V	
NOTE:- SS PARTS SHALL BE CHECKED AT 10% POSITIVE MATERIAL IDENTIFICATION (PMI) GRADE ANALYSER														
MANUFACTURER/SUB-SUPPLIER		MAIN SUPPLIER		LEGEND: *RECORDS IDENTIFIED WITH TICK(*) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION. M : MANUFACTURER / SUB-SUPPLIER C : MAIN SUPPLIER N : END USER & BHEL P : PERFORMANCE W : WITNESS V : VERIFICATION AS APPROPRIATE				DOC. NO. :						
SIGNATURE								REVIEWED BY		APPROVED BY		APPROVAL SEAL		

MANUFACTURE'S NAME & ADDRESS				MANUFACTURING QUALITY PLAN				PROJECT							
				ITEM : BUTTERFLY VALVE	ACIQP NO. :		CONTRACT NO. :								
				P.O.NO. :	REV.NO. : DATE :		END USER :								
				P.O. DATE :	W.O. NO. :		CONTRACTOR : BHARAT HEAVY ELECTRICAL LIMITED								
				PAGE. : 1 OF 1											
SL. NO.	COMPONENTS & OPERATION	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENTS	ACCEPTANCE NORMS	FORMATS OF RECORDS	AGENCY			REMARKS		
1	2	3	4	5	M	C/N	7	8	9	10	M	C	N	11	
1.0	MATERIALS														
1.1	BODY & DISC	Chemical Composition	Critical	Chemical Testing	One / Heat	One / Heat	Appd./Drgs Tech Spec	Appd Drgs / DS/MFG STD	Foundry TC	✓	P	V	V		
		Mechanical Properties	Critical	Mechanical Testing	One / Heat / Heat Treatment Batch			-	-	Foundry TC	✓	P	V	V	
		Heat Treatment (Only For Casting)	Critical	Heat treatment	100%	100%		-	-	Report	✓	P	V	V	
		Surface Defects	Major	Visual	100%	100%	MSS -SP-55	MSS-SP-55	Inspection report	-	P	-	-		
1.2	SHAFT (BAR STOCK)	Chemical Composition	Critical	Chemical Testing	One / Heat	One / Heat	ASTM STD	ASTM STD	Foundry TC & Lab Reports	✓	P	V	V		
		Mechanical Properties	Critical	Mechanical Testing	One / Heat / Batch	One / Heat / Batch	ASTM STD	ASTM STD	Foundry TC & Lab Reports	✓	P	V	V		
	SHAFT (BAR STOCK)	Ultrasonic Test for Stem	Critical	Ultrasonic Test	100%	100%	ASTM B 16.34	ASTM B 16.34 & ASME B 16.34 ANNEXURE E	UT REPORT	✓	P	V	V	For dia>50mm above only.	
1.3	Body / Disc Seat	Physical & Ozone Test	Critical	Physical & Ozone Test	One sample / Lot	One sample / Lot	Material specification	Relevant Material Std.	Test report	✓	P	V	V		
2.0	INPROCESS INSPECTION														
2.1	MACHINING OF BODY & DISC	Dimension	Major	Measurement	100%	100%	Mfg Drgs	Mfg Drgs	Inspection report	✓	P	V	-		
3.0	ASSEMBLY	Dimension	Major	Measurement	10%	10%	Appd Drgs	Appd Drgs	-	✓	P	V	V		
4.0	TESTING														
4.1	SHELL	Leakage	Critical	Hydrostatic Pressure	100%	10%	Approved Drawings / DS/ Ref.standard	No Leakage	Test Certificate	✓	P	W	V		
4.2	HYDRO SEAT	Leakage	Critical	Hydrostatic Pressure	100%	10%	Approved Drawings / DS/ Ref.standard	No Leakage	Test Certificate	✓	P	W	V		
4.3	PERFORMANCE / FUNCTIONAL CHECK	Operation (Opening & Closing)	Major	Visual	100%	10%	Drawing & Technical Spec.	Smooth Operation	Inspection report	✓	P	W	V		
5.0	FINAL INSPECTION	Cleanliness Completeness &	Major	Visual	100%	10%	As per Drg/ Tech Spec.	As per Drg/ Tech Spec.	Inspection report	✓	P	V	V		
5.1	PAINTING	DFT CHECK	Major	Visual	100%	10%	As per Drg/ Tech Spec.	As per Drg/ Tech Spec.	Inspection report	✓	P	V	V		
6.0	PROVISION OF NAME PLATE	As Per Spec	Major	Visual	As per Specification	As per Specification	As per Specification	As per Specification	Inspection report	-	P	V	V		
NOTE:- SS PARTS SHALL BE CHECKED AT 10% POSITIVE MATERIAL IDENTIFICATION (PMI) GRADE ANALYSER															
MANUFACTURER/SUB-SUPPLIER		MAIN SUPPLIER		LEGEND: *RECORDS IDENTIFIED WITH TICK(*) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION M : MANUFACTURER / SUB-SUPPLIER C : MAIN SUPPLIER N : END USER & BHEL P : PERFORMANCE W : WITNESS V : VERIFICATION AS APPROPRIATE				DOC. NO. :							
SIGNATURE								REVIEWED BY		APPROVED BY		APPROVAL SEAL			

		MANUFACTURE'S NAME & ADDRESS		REFERENCE QUALITY PLAN										
				ITEM : AIR DRYER		QIP NO. Rev : Date : Page :		Sign of MFG		Qp No : Rev No : Date : Page :		Reviewed By		
SR. NO.	COMPONENTS AND OPERATORS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENTS	ACCEPTANCE	FORMAT OF RECORD	AGENCY				REMARKS
1	2	3	4	5	6		7	8	9	D	M	C	N	11
					M	C/N								
A MATERIAL INSPECTION														
1.1	ROTOR DRUM	CHEMICAL	MAJOR	CHEMICAL ANALYSIS	100%		APPROVED DATASHEET	APPROVED DATASHEET	COC	✓	V	V	V	
1.2	DRYER VESSEL COMPLETE	DIMENSIONS MECHANICAL	MAJOR	DIMENSIONS MECH.PROPERTIES	100%		MFG DRG APPROVED DATASHEET	MFG DRG	COC	✓	V	V	V	
1.3	REGEN.COOLERS	MECHANICAL CHEMICAL	MAJOR	CHEMICAL & MECH.	100%		APPROVED DATASHEET	APPROVED DATASHEET	COC	✓	V	V	V	
B INPROCESS INSPECTION														
2.1	REGEN.COOLERS	TIGHTNESS	MAJOR	HYDROSTATIC	100%		1.5 X DESIGN PRESSURE FOR 5 MIN.	NO LEAKAGE	COC [SEE NOTE 1]	✓	P	V	V	
2.2	DRYER VESSEL WATER SEPERATOR	TIGHTNESS	MAJOR	HYDROSTATIC	100%		1.5 X DESIGN PRESSURE FOR 5 MIN.	NO LEAKAGE	COC [SEE NOTE 1]	✓	P	V	V	
2.3	WATER SEPERATOR GEAR BOX DRAIN VALVES MOTOR	FUNCTIONAL	MAJOR	FUNCTIONAL	100%		MFG DRAWING	MFG DRAWING	COC	✓	P	V	V	
C FINAL INSPECTION														
AT ATLAS COPCO AIRPOWER,BELGIUM														
3.1	ASSEMBLY AND TESTING	DIMENSIONAL APPEARANCE & COMPLETENESS	MAJOR	MEASUREMNT VISUAL	100%		APPROVED DRAWING	APPROVED DRAWING	INSP REPORT	✓	P	V	V	
		MECH.RUN TEST TIGHTNESS	MAJOR	FUNCTIONAL TEST HYDROSTATIC			APPROVED DRAWING 1.5 X DESIGN PRESSURE	APPROVED DRAWING NO LEAKAGE	COC COC [SEE NOTE 1]	✓	P	V	V	
LEGEND: * Records identified with " (*) " shall be essentially included by supplier in QA documentation. ** M: Manufacturer / Sub Supplier, C: Supplier nominated inspection agency, P: Perform, W: Witness and V: Verification. N: END USER & BHEL														

		MANUFACTURE'S NAME & ADDRESS		REFERENCE QUALITY PLAN				एनटीपीसी NTPC		To be Filled				
				ITEM : AIR DRYER		Qp No. : Rev : Date : Page :		Sign of IGR's/		Qp No : Rev No : Date : Page : 2 OF 2 Valid Upto:		Reviewed By:		
SR. NO.	COMPONENTS AND OPERATORS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENTS	ACCEPTANCE	FORMAT OF RECORD	AGENCY			REMARKS	
1	2	3	4	5	6		7	8	9	D	M	C	N	11
					M	C/N								
D FINAL INSPECTION														
4.1	FINAL INSPECTION AT ATLAS COPCO INDIA	MECH RUN TEST OF COMPLETE DRYER TIGHTNESS OF COMPLETE DRYER	MAJOR	DRUM ROTATION CHECK PNEUMATIC TEST	100%	100%	APPROVED DRAWING/ APPROVED DATASHEET 1.1 X WORKING PRESSURE	SMOOTH OPERATION NO LEAKAGE	INSP.REPORT	✓	P	W	W	
E PACKING AND DESPATCH														
5.1	PACKING SHIPPING	CHECK DOC. SEA WORTHY PACKING	MAJOR	VERIFICATION	100%		AS PER PACKING PROCEDURE	AS PER PACKING PROCEDURE	ALL SHIPPING DOCUMENTS		P/V	V		
NOTE : 1		SPECIFIC CONFIRMATION FROM AIRPOWER REGARDING THE HYDROTEST PRESSURE												
NOTE : 2		MATERIAL SHALL BE AS PER APPROVED DRG/TDS. INCASE NOT MENTIONED IN APPROVED DRG/TDS THEN AC STANDARDS SHALL BE APPLICABLE												

LEGEND : * Records identified with " Tick" () shall be essentially included by supplier in QA documentation

** M : Manufacturer / Sub-Supplier C : Supplier nominated inspection agency, P : Perform; W : Witness and V : Verification

N : END USER & BHEL

Note : # NTPC Inspection engineer to check, approval date of reference document viz, a viz approval date of RQP at the time of inspection.

		MANUFACTURER'S NAME AND ADDRESS		MANUFACTURING QUALITY PLAN						OWNER :				
		ITEM	AIR RECEIVER		Q.P. NO.			CONSULTANT :						
					REV			PROJECT :						
		SUB SYSTEM	COMPRESSED AIR SYSTEM.		DATE			PACKAGE VENDOR :						
					PAGE	Page 1 OF 2		BHEL DOC NO :						
SLNO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS	
1.	2.	3.	4.	5.	M	C/N	7.	8.	9.	D	10.		11.	
1.0 RAW MATERIAL INSPECTION														
1.1	MS PLATE FOR SHELL, DISHED END, FLANGES, SOCKET / PIPE FOR NOZZLES	CHEMICAL PROPERTIES	B	CHEMICAL ANALYSIS	1 SAMPLE / HEAT		RELEVANT MATERIAL SPECIFICATION AS PER APPROVED DATA SHEET / APPROVED DRAWING		MILL TC / LAB TC	✓	P	V	V	REFER NOTE 1
		MECHANICAL PROPERTIES	B	MECHANICAL TESTS	1 SAMPLE / HEAT									
		INTERNAL DEFECTS	B	U. T. (32 MM & ABOVE THICK	100 %		ASME SEC. V / ASTM A 435	ASTM A 435	U. T. REPORT	✓	P	V	V	
2.0 IN PROCESS INSPECTION														
2.1	DISHED END	CORRECT DIMENSIONS	B	MEASURE	100%		APPROVED DRAWING/MANUFACTURING DRAWING		DO	✓	P	V	V	IN CASE OF JOINT IN DISH END, 100% RT ON JOINT TO BE DONE.
		DPT ON KNUCKLE	B	DP TEST	100%		ASME SEC. V	ASME SEC. V	✓	✓	P	V	V	
		THICKNESS THINNING	B	MEASURE	100%		APPROVED DRAWING/MANUFACTURING DRAWING / TECHNICAL SPECIFICATION		DO	✓	P	V	V	
2.2	FABRICATION OF AIR RECEIVER	CUTTING OF PLATES	B	VISUAL & MEASURE	100%	-	CUTTING PLAN / MANUFACTURING DRAWINGS		REGISTER		P	-	-	
		EDGE PREPARATION AND FIT UP	B	VISUAL & MEASURE	100 %	-	APPROVED WPS / FABRICATION DRAWING		REGISTER		P	-	-	
		WPS / WELDER QUALIFICATION	B	VISUAL & MECHANICAL TEST	100 %		ASME SEC. IX	ASME SEC. IX	QW 482, 483, 484	✓	P	V	V	REFER NOTE : 3
		NDT ON BUTT WELDS (LONGITUDINAL & CIRCUMFERENTIAL WELD JOINT FOR ADSORPTION TOWERS) AFTER BACK GOUGING & FINAL WELDING	B	DPT AFTER BACK GOUGING	100 %		ASME SEC. V	ASME SEC. VIII DIV. 1 APPENDIX 8	NDT REPORT	✓	P	V	V	
		NDT ON BUTT WELDS & FILLET JOINTS IN SHELL & DISH AFTER FINAL WELDING	B	RT AFTER FINAL WELDING	10 % ON BUTT JOINT INCLUDING 100% CROSS JOINT		ASME SEC. V	ASME SEC VIII DIV.1-UW-52	RT REPORT	✓	P	V	V	RT FILMS & REPORT WILL BE REVIEWED BY NTPC. CHP.
		BOD SHELL STRENGTH TEST	B	DPT	100 %		ASME SECTION V	ASME SEC. VIII DIV. 1 APPENDIX 8	NDT REPORT	✓	P	V	V	CHP, NTPC SHALL WITNESS DPT DURING FINAL INSPECTION
3.0 FINAL INSPECTION														
3.1	FINAL INSPECTION	DIMENSION, ORIENTATION	A	VISUAL & MEASURE	100%		APPROVED DRAWING		IR	✓	P	W	W	
3.2	PAINTING	DFT / SURFACE FINISH	B	VISUAL & MEASURE	100%		AS PER MANUFACTURING STANDARDS,		IR	✓	P	V	-	REFER NOTE 4
		LEGEND : CL: (ACRITICAL, B:MAJOR C:MINOR) ** M: MANUFACTURER/SUB-SUPPLIER, C: NOMINATED INSPECTION AGENCY N: CUSTOMER, P: PERFORM, W: WITNESS AND V: VERIFICATION, ND: NDT LAB R: TEST / DIMENTIONAL REPORT RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER QA DOCUMENTATION.												
MANUFACTURERS / SUB-SUPPLIER		SIGNATURE _____ Page 1 OF 4												
		DOC NO : _____ REVISED BY _____ APPROVED BY _____ APPROVAL SEAL _____												

MANUFACTURER'S NAME AND ADDRESS		MANUFACTURING QUALITY PLAN						OWNER :					
		ITEM	AIR RECEIVER		QP NO			CONSULTANT :					
		REV					PROJECT :						
		SUB SYSTEM	COMPRESSED AIR SYSTEM.		DATE			PACKAGE VENDOR :					
					PAGE	Page 2 OF 2		BHEL DOC NO :					
SLNO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
					M	C/N				M	C	N	
1.	2.	3.	4.	5.	6.		7.	8.	9.	D	10.		11.
3.3	PACKING / AVAILABILITY OF ACCESSORIES	VISUAL	B	VISUAL	100%	-	APPROVED DRAWING		IR/CALIBRATION REPORT	✓	P	V	-
NOTE													
1	MS PLATES USED SHALL BE REPUTED MANUFACTURERS ONLY & BEING THE TOTAL PLATES QTY IS LESS. THESE PLATES SHALL BE SOURCED FROM AUTHORIZED DEALERS LIKE SAIL, JINDAL, ESSAR, LLOYD, & WELLSPUN, ETC.												
2	i. THE MS PLATES SHALL BE CUT ACCORDING TO CUTTING PLAN AND HEAT NO, PLATE NO OF EACH PLATE SHALL BE TRANSFERRED BY PUNCHING ON EACH PIECE FOR PROPER CORRELATION & TRACEABILITY. THE CUTTING PLAN SHALL INCLUDE COMPLETE DETAILS OF HEAT NO, PLATE NO, OF EACH CUT PIECE. ii. THE WELDING PLAN OF EACH FABRICATED PIECE SHALL INCLUDE JOINT NUMBER, WELDER NO, WHO CARRY OUT WELDING FOR COMPLETE TRACEABILITY.												
3	BHEL APPROVED WPS WILL BE USED. QUALIFIED WELDERS WILL BE DEPLOYED. IF WELDERS ARE ALREADY QUALIFIED BY NTPC / LLOYDS/BVQI/BSI/BHEL/TUV AND DOING THE SIMILAR JOBS THEN SAME SHALL BE VERIFIED IN PLACE OF WITNESSING. RECORD WILL BE VERIFIED BY NTPC DURING INSPECTION.												
4	INSIDE PAINTING IS APPLICABLE & SHALL BE DONE AS PER MANUFACTURING STANDARDS.												
ABBREVIATIONS:-													
M.T.C. - MANUFACTURER'S TEST CERTIFICATE, L.T.C. - LAB TEST CERTIFICATE, IR - INSPECTION REPORT, UT REPORT - ULTRASONIC TEST REPORT, RT REPORT - RADIOGRAPHIC REPORT, NDT - NON DESTRUCTIVE TESTING													

MANUFACTURERS / SUB-SUPPLIER	SIGNATURE	LEGEND : CL: (A:CRITICAL, B:MAJOR C:MINOR) ** M: MANUFACTURER/SUB-SUPPLIER, C: NOMINATED INSPECTION AGENCY N: CUSTOMER, W: PERFORM, W: WITNESS AND V: VERIFICATION. ND:NDT LAB R:TEST / DIMENTIONAL REPORT RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER QA DOCUMENTATION.	DOC NO :		
			REVISED BY	APPROVED BY	APPROVAL SEAL

MANUFACTURER'S NAME AND ADDRESS		MANUFACTURING QUALITY PLAN							OWNER :					
		ITEM	HEAT OF COMPRESSION AIR DRYER		QP NO				CONSULTANT :					
					REV				PROJECT :					
		SUB SYSTEM	COMPRESSED AIR SYSTEM.		DATE				PACKAGE VENDOR :					
PAGE	Page 1 OF 4				BHEL DOC NO :									
SLNO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD		AGENCY			REMARKS
					M	C/N				D	M	C	N	
1.	2.	3.	4.	5.	6.		7.	8.	9.	D	10.			11.
1.0 RAW MATERIAL INSPECTION														
1.1	MS PLATE FOR SHELL & DISHED END,	CHEMICAL PROPERTIES	B	CHEMICAL ANALYSIS	1 SAMPLE / HEAT		RELEVANT MATERIAL SPECIFICATION AS PER APPROVED DATA SHEET / APPROVED DRAWING	MILL TC / LAB TC	✓	P	V	V	REFER NOTE 1	
		MECHANICAL PROPERTIES	B	MECHANICAL TESTS	1 SAMPLE / HEAT									
		INTERNAL DEFECTS	B	U. T. (32 MM & ABOVE THICK	100 %									
1.2	PIPES	CHEMICAL PROPERTIES	B	CHEMICAL ANALYSIS	1 SAMPLE / HEAT		RELEVANT MATERIAL SPECIFICATION AS PER APPROVED DATA SHEET / APPROVED DRAWING	MILL TC / LAB TC	✓	P	V	V	REFER NOTE 2	
		MECHANICAL PROPERTIES	B	MECHANICAL TESTS	1 SAMPLE / HEAT									
1.3	BOUGHT OUT ITEMS	VISUAL, DIMENSIONAL	B	ITEM, MAKE, RANGE, DIMENSIONAL	100%		APPROVED DATA SHEET / APPROVED DRAWING	MTC / CALIBRATION REPORT	✓	P	V	V	REFER NOTE - 6	
2.0 IN PROCESS INSPECTION														
2.1	DISHED END	CORRECT DIMENSIONS	B	MEASURE	100%		MANUFACTURING DRAWING		IR	✓	P	V	V	IN CASE OF JOINT IN DISH END, 100% RT ON JOINT TO BE DONE.
		RT ON DISHED ENDS (IF APPLICABLE)	B	RT AFTER FINAL WELDING	100%		ASME SEC. V	ASME SEC VIII DIV.1-UW-51	RT FILM, RT REPORT	✓	P	V	V	
		DPT ON KNUCKLE	B	DP TEST	100%		ASME SEC. V	ASME SEC. V	DPT REPORT	✓	P	V	V	
		THICKNESS THINNING	B	MEASURE	100%		APPROVED DRAWING/MANUFACTURING DRAWING / TECHNICAL SPECIFICATION		I.R.	✓	P	V	V	
2.2	FABRICATION OF AIR DRYER	CUTTING OF PLATES	B	VISUAL & MEASURE	100%	-	CUTTING PLAN / MANUFACTURING DRAWINGS		REGISTER		P	-	-	
		EDGE PREPARATION AND FIT UP	B	VISUAL & MEASURE	100 %	-	APPROVED WPS / FABRICATION DRAWING		REGISTER		P	-	-	
		WPS / WELDER QUALIFICATION	B	VISUAL & MECHANICAL TEST	100 %		ASME SEC. IX	ASME SEC. IX	QW 482, 483, 484	✓	P	V	V	REFER NOTE : 3
		NDT ON BUTT WELDS (LONGITUDINAL & CIRCUMFERENTIAL WELD JOINT FOR ADSORPTION TOWERS) AFTER BACK GOUGING & FINAL WELDING	B	DPT AFTER BACK GOUGING	100 %		ASME SEC. V	ASME SEC. VIII DIV. 1 APPENDIX 8	NDT REPORT	✓	P	V	V	
			B	RT AFTER FINAL WELDING	10 % ON BUTT JOINT INCLUDING 100% CROSS JOINT		ASME SEC. V	ASME SEC VIII DIV.1-UW-52	RT REPORT	✓	P	V	V	RT FILMS & REPORT WILL BE REVIEWED
		NDT ON BUTT WELDS & FILLET JOINTS IN SHELL & DISH AFTER FINAL WELDING	B	DPT	100 %		ASME SECTION V	ASME SEC. VIII DIV. 1 APPENDIX 8	NDT REPORT	✓	P	V	V	
LEGEND : Records, indentified with "Tick" (✓) shall be essentially included by SUPPLIER in QA documentation. ** M: MANUFACTURER/SUB-SUPPLIER, C: NOMINATED INSPECTION AGENCY N: CUSTOMER , P: PERFORM, W: WITNESS AND V: VERIFICATION. ND: NDT LAB R: TEST / DIMENTIONAL REPORT * RECORDS, INDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.														
MANUFACTURERS / SUB-SUPPLIER		MAIN SUPPLIER		SIGNATURE Page 1 OF 4										
				REVIWED BY APPROVED BY APPROVAL SEAL										

MANUFACTURER'S NAME AND ADDRESS		MANUFACTURING QUALITY PLAN							OWNER :			
		ITEM	HEAT OF COMPRESSION AIR DRYER		QP NO				CONSULTANT :			
					REV				PROJECT :			
		SUB SYSTEM	COMPRESSED AIR SYSTEM.		DATE				PACKAGE VENDOR :			
PAGE	Page 2 OF 4				BHEL DOC NO :							

SLNO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD		AGENCY			REMARKS
					M	C/N				D	M	C	N	
1.	2.	3.	4.	5.	6.		7.	8.	9.	D	10.			11.
2.3	WELD QUALITY OF PIPE WELD & FILTERS WELD	DPT ON ROOT RUN & FINAL OF BUTT WELD	B	NDT - DPT	100%		ASME SEC V	ASME SEC. VIII DIV. 1 APPENDIX 8	IR	√	P	V	V	
2.4	HEAT EXCHANGER	TUBE TO TUBE SHEET FILLET WELD JOINT	B	NDT - DPT	100%		ASME SEC V	ASME SEC. VIII DIV. 1 APPENDIX 8	IR	√	P	V	V	
2.5	VESSEL (TOWER) MOISTURE SEPARATOR & HEAT EXCHANGERS	BOD SHELL STRENGTH TEST	B	HYDRO TEST	100 %		HYDRO TEST PRESSURE @ 1.3 TIMES OF DESIGN PRESSURE FOR 30 MIN	NO LEAKAGE & NO PRESSURE DROP	IR	√	P	V	V	
2.6	PNEUMATIC TEST	FOR COMPLETE ASSEMBLY OF AIR DRYER	B	PNEUMATIC TEST WITH SOAP BUBBLE	100%		PNEUMATIC TEST PRESSURE @ 1.1 TIMES OF DESIGN PRESSURE FOR 30MIN	NO LEAKAGE & NO PRESSURE DROP	IR	√	P	W	W	CHP 'W' AT THE TIME OF FINAL INSPECTION
3.0 FINAL INSPECTION														
3.1	FINAL INSPECTION	DIMENSION, ORIENTATION	B	VISUAL	100%		AS PER APPROVED GA DRAWING / DATA SHEET		IR	√	P	W	W	
3.2	FUNCTIONAL TEST	PERFORMANCE TEST AT NO LOAD CONDITIONS	B	FUNCTIONAL / OPERATION OF VALVES & AUTO DRAIN TRAP	100%		APPROVED FUNCTIONAL TEST PROCEDURE (ENCLOSED) / APPROVED DRAWING / DATASHEET		IR	√	P	W	W	
3.2	CONTROL PANEL	WORKMANSHIP FINISH, SHADE	B	VISUAL	100%	100%	AS PER ELECTRICAL DRAWING / APPROVED DATA SHEET/ MFG STANDARD		IR		P	W	W	
		DRY FILM THICKNESS	B	MEASURE	100%	RANDOM	MINIMUM 50 MICRONS (POWDER COATED), 70 MICRONS (PAINTED)		IR		P	W	W	
		ADHESION TEST (PEEL OFF TEST)	B	MEASURE	100%	1 PANEL (RANDOM)	ASTM D 3359	NO PEEL OFF	IR		P	W	W	
		WIRING & COMPONENT LAYOUT, FITTING ACCESSIBILITY & SAFETY	B	VERIFICATION	100%	RANDOM	AS PER ELECTRICAL DRAWING / APPROVED DATA SHEET		IR		P	V	V	
		COMPONENTS MAKE IDENTIFICATION (MARKING / NAME PLATES)	B	VERIFICATION	100%	100%	AS PER ELECTRICAL DRAWING / APPROVED DATA SHEET		IR	√	P	V	V	
		PROPER WIRE TERMINATION	B	VERIFICATION	100%	RANDOM	NO LOOSE CONNECTIONS. ALL TERMINATIONS TO BE LUGGED		IR		P	V	V	
		DOOR AND LOCK FUNCTIONING	B	FUNCTIONAL	100%	RANDOM	PROPER OPENING & CLOSING, NO MISMATCH		IR		P	W	W	
		EARTHING CHECK	B	VERIFICATION	100%	RANDOM	APPROVED DRAWING / AS PER ELECTRICAL DRAWING		IR		P	V	V	
		LEGEND : Records, identified with "Tick" () shall be essentially included by SUPPLIER in QA documentation. ** M: MANUFACTURER/SUB-SUPPLIER, C: NOMINATED INSPECTION AGENCY N: CUSTOMER , P: PERFORM, W: WITNESS AND V: VERIFICATION. ND: NDT LAB R: TEST / DIMENTIONAL REPORT * RECORDS, IDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.												
MANUFACTURERS / SUB-SUPPLIER		MAIN SUPPLIER												
SIGNATURE		Page 2 OF 4												
		QC NO : 0370-102-PE-PVM-Q-003 REVIWED BY APPROVED BY APPROVAL SEAL												

		MANUFACTURER'S NAME AND ADDRESS		MANUFACTURING QUALITY PLAN						OWNER :					
				ITEM		HEAT OF COMPRESSION AIR DRYER		QP NO		CONSULTANT :					
								REV		PROJECT :					
								SUB SYSTEM		COMPRESSED AIR SYSTEM.		DATE		PACKAGE VENDOR :	
						PAGE		Page 3 OF 4		BHEL DOC NO :					
SLNO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD		AGENCY			REMARKS	
					M	C/N				D	M	C	N		
1.	2.	3.	4.	5.	6.		7.	8.	9.	D	10.			11.	
		OVERALL DIMENSIONS	B	MEASURE	100%	RANDOM	AS PER ELECTRICAL DRAWING / DATA SHEET		IR		P	V	V		
		DEGREE OF PROTECTION PAPER INSERTION	A	MEASURE	100%	100%	AS PER ELECTRICAL DRAWING / DATA SHEET		IR	√	P	V	V		
		IR TEST & HIGH VOLTAGE TEST	A	MEASURE	100%	100%	HV TEST AT 1.5 KV FOR ONE MINUTE IR TEST FOR 500V	WITH STOOD More than 50 MOhms	IR	√	P	W	W		
		FUNCTIONAL TEST	A	VISUAL, MEASURE, VERIFICATION	100%	1 PANEL RANDOMLY SELECTED	AS PER ELECTRICAL DRAWING / DATA SHEET / FINCTION TEST PROCEDURE		IR		P	W	W		
3.4	PAINTING	DFT / SURFACE FINISH	B	VISUAL & MEASURE	100%		AS PER MANUFACTURING STANDARDS,		IR	√	P	V	-		
3.5	INSULATION / CLADDING (AS APPLICABLE)	COMPLETENESS	B	VARIFICATION	100%		APPROVED DRAWING / DATASHEET		IR	√	P	V	-		
3.3	PACKING / AVAILABILITY OF ACCESSORIES	VISUAL	B	VISUAL	100%	--	MANFACTURER PROCEDURE.		IR	√	P	V	-		
NOTE															
1	MS PLATES USED SHALL BE REPUTED MANUFACTURERS ONLY & BEING THE TOTAL PLATES QTY IS LESS. THESE PLATES SHALL BE SOURCED FROM AUTHORIZED DEALERS LIKE SAIL, JINDAL, ESSAR, LLOYD, & WELLSPUN, ETC.														
2	ALL THE INTERCONNECTING PIPING USED SHALL BE REPUTED MAKES & BEING THE TOTAL PIPE QTY IS LESS. THESE PIPES SHALL BE SOURCED FROM AUTHORIZED DEALERS OF TATA, JINDAL, SURYA ROSHINI & WELLSPUN														
3	LLOYDS/BVQI/BSI/BHEL/TUV APPROVED WPS WILL BE USED, QUALIFIED WELDERS WILL BE DEPLOYED. IF WELDERS ARE ALREADY QUALIFIED BY LLOYDS/BVQI/BSI/BHEL/TUV AND DOING THE SIMILAR JOBS THEN SAME SHALL BE VERIFIED IN PLACE OF WITNESSING.														
4	MEASUREMENT OF DEW POINT AND PERFORMANCE TEST DURING FINAL INSPECTION IS DEMONSTRATIVE AND INDICATIVE ONLY AND WILL BE DONE AT NO-LOAD AND THE SAME WILL BE ACCEPTED.FINAL DEW POINT & PERFORMANCE PARAMETER WILL BE DEMONSTRATED AT SITE ONLY.														
5.	BOUGHT OUT ITEMS														
Records, indentified with "Tick" () shall be essentially included by SUPPLIER in QA documentation.															
		LEGEND		** M: MANUFACTURER/SUB-SUPPLIER, C: NOMINATED INSPECTION AGENCY N: CUSTOMER , P: PERFORM, W: WITNESS AND V: VERIFICATION. ND:NDT LAB R:TEST / DIMENTIONAL REPORT * RECORDS, INDENTIFIED WITH "TICK" (√) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.						DOC NO :					
MANUFACTURERS / SUB-SUPPLIER		MAIN SUPPLIER													
SIGNATURE		Page 3 OF 4						REVIWED BY		APPROVED BY		APPROVAL SEAL			

		MANUFACTURER'S NAME AND ADDRESS		MANUFACTURING QUALITY PLAN						OWNER :			
				ITEM	HEAT OF COMPRESSION AIR DRYER	QP NO			CONSULTANT :				
						REV			PROJECT :				
				SUB SYSTEM	COMPRESSED AIR SYSTEM.	DATE			PACKAGE VENDOR :				
PAGE	Page 4 OF 4		BHEL DOC NO :										
SLNO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
					M	C/N				M	C	N	
1.	2.	3.	4.	5.	6.		7.	8.	9.	D	10.		11.
	SN	ITEM		MAKE				REMARKS					
	1.	PRESSURE GAUGE		BHEL APPROVED MAKE				VERIFICATION OF MANUFACTURER'S CALIBRATION REPORT, TYPE, MAKE, RANGE, ACCURACY					
	2.	TEMPERATURE GAUGE		BHEL APPROVED MAKE				VERIFICATION OF MANUFACTURER'S CALIBRATION REPORT, TYPE, MAKE, RANGE, ACCURACY					
	3.	CYCLE CHANGE OVER VALVE		BHEL APPROVED MAKE				MANUFACTURER'S TEST CERTIFICATE FOR PNEUMATIC TEST OF BODY AND SEAT & MATERIAL					
	4.	BUTTERFLY VALVE		BHEL APPROVED MAKE				MANUFACTURER'S TEST CERTIFICATE FOR PNEUMATIC TEST OF BODY AND SEAT & MATERIAL					
	5.	5/2 WAY SOLENOID VALVES		BHEL APPROVED MAKE				MANUFACTURER'S TEST CERTIFICATE / INSPECTION REPORT					
	6.	DEW POINT METER		BHEL APPROVED MAKE				MANUFACTURER'S TEST CERTIFICATE /CALIBRATION REPORT					
	7.	AUTO DRAIN VALVE		BHEL APPROVED MAKE				MANUFACTURER'S TEST CERTIFICATE					
	8.	DIFFERENTIAL PRESSURE GAUGE		BHEL APPROVED MAKE				VERIFICATION OF MANUFACTURER'S TEST CERTIFICATE, TYPE, MAKE, RANGE, ACCURACY					
	9.	DIFFERENTIAL PRESSURE SWITCH		BHEL APPROVED MAKE				VERIFICATION OF MANUFACTURER'S TEST CERTIFICATE, TYPE, MAKE, RANGE, ACCURACY					
	10.	TEMPERATURE ELEMENT		BHEL APPROVED MAKE				VERIFICATION OF MANUFACTURER'S TEST CERTIFICATE, TYPE, MAKE, RANGE, ACCURACY					
6.	Note : As per SL NO.5 , the bought out items vendor makes are as per approved data sheet. (Enclosed Documents for reference)												
ABBREVIATIONS:- M.T.C. – MANUFACTURER'S TEST CERTIFICATE, L.T.C. – LAB TEST CERTIFICATE, IR – INSPECTION REPORT, UT REPORT – ULTRASONIC TEST REPORT, RT REPORT – RADIOGRAPHICREPORT, NDT – NON DESTRUCTIVE TESTING, HV – HIGH VOLTAGE TEST													

Records, indentified with "Tick" () shall be essentially included by SUPPLIER in QA documentation.

		LEGEND : ** M: MANUFACTURER/SUB-SUPPLIER, C: NOMINATED INSPECTION AGENCY N: CUSTOMER , P: PERFORM, W: WITNESS AND V: VERIFICATION. ND: NDT LAB R: TEST / DIMENTIONAL REPORT * RECORDS, INDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.		DOC NO :	
MANUFACTURERS / SUB-SUPPLIER		MAIN SUPPLIER			
SIGNATURE		Page 4 OF 4		REVIWED BY APPROVED BY APPROVAL SEAL	

		QUALITY PLAN		CUSTOMER: M/S GSECL		PROJECT:		SPEC. NO : PE-TS-436-555-A001		
		SHEET 1 OF 3		BIDDER/VENDOR:		QP NO. PE-QP-408-555-M001 REV. 00 DT: 20.02.2018		SPEC. TITLE AIR TRAPS		
		SYSTEM		SERVICE AIR/ INSTRUMENT AIR		ITEM: BALL FLOAT AIR TRAP		SECTION VOLUME		
S.NO.	COMPONENT/ OPERATION	CHARACTERISTICS CHECKED	CATE- GORY	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY P W V	REMARKS

1.0	MATERIALS											
1.1	BODY, COVER	1. PHYSICAL & CHEM. PROPERTIES	MA	PHYS. & CHEM. TEST	ONE /HEAT / HEAT BATCH	APPROVED DRAWING / TECH. SPEC.	APPROVED DRAWING/ TECH. SPEC.	TEST CERT.	3/2	2	1	- CO-RELATED TCs SHALL BE FURNISHED.
		2. SURFACE DEFECTS	MA	VISUAL	100%	MSS-SP-55	MSS-SP-55	LOG BOOK	3/2	2	1	
1.2	FLOAT UNIT ASSEMBLY, VALVE SEAT, PIVOT FRAME, SUPPORT FRAME, PIVOT PIN, GASKET	1. PHYS., CHEM. PROPERTIES	MA	PHYS., CHEM. TEST	ONE /HEAT / HEAT BATCH	APPD. DRG	APPD. DRG	TEST CERT	3/2	2	1	
		2. SURFACE DEFECTS	MA	VISUAL	100%	MSS-SP-55	MSS-SP-55	INSPN. REPORT	3/2	2	1	
1.3	FASTENERS	1. PHYS., CHEM. PROPERTIES	MA	PHYS., CHEM. TEST	ONE PER TYPE	APPD. DRG	APPD. DRG	TEST CERT	3/2	2	1	
2.0	IN-PROCESS											
2.1	ALL COMPONENTS	1. DIMENSIONS	MA	MEASUREMENT	100%	MFG. DRAWING	MFG. DRAWING	INT. INSPN. REPORT	3/2	-	2	
		2. SURFACE DEFECTS	MA	VISUAL	100%	-DO-	-DO-	INSPN. REPORT	3/2	-	2	
2.2	VALVE, VALVE SEAT	1. SURFACE DEFECTS	CR	PENETRANT TEST	100%	ASTME-165	NO DEFECTS	INT. INSPN. REPORT	2	2	1	
		2. HARDNESS	MA	TESTING	100%	APPD. DRG.	APPD. DRG.	INT. INSPN. REPORT	2	2	1	
		3. BALL IMPRES	MA	BY AIR	100%	SEAT SURFACE SHALL HAVE METAL TO METAL CONTACT		INT. INSPN. REPORT	2	2	1	
3.0	SUB- ASSEMBLY											
3.1	VALVE & VALVE SEAT	1. LEAK TIGHTNESS	CR	AIR/HYDRO	100%	APPD. DRG	APPD. DRG.	INT. INSPN. REPORT	2	2	1	

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

 QUALITY PLAN		CUSTOMER: M/S GSECL		PROJECT:		SPEC. NO : PE-TS-436-555-A001						
		BIDDER/VENDOR:		QP NO. PE-QP-408-555-M001		REV. 00 DT: 20.02.2018						
SHEET 2 OF 3		SYSTEM SERVICE AIR/ INSTRUMENT AIR		ITEM: BALL FLOAT AIR TRAP		SECTION VOLUME						
S.NO.	COMPONENT/ OPERATION	CHARACTERISTICS CHECKED	CATE- GORY	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	

3.2	COVER	1. ALIGNMENT	MA	VISUAL	100%	—DO—	PROPER FITTING	INT. INSPN. REPORT	2	2	1	The minimum thickness of galvanizing shall be minimum 40 microns.	
4.0	HYDRAULIC TEST (FOR CCS MATERIAL, TEST TO BE CONDUCTED BEFORE GALVANISING)												
4.1	BODY COVER SHELL TEST	LEAK TIGHTNESS OF BODY	CR	HYDRO. TEST AT 1.5 TIMES OF TRAP DESIGN PRESSURE	100%	APPD. DRG./TECH. SPEC./DATA SHEET	NO LEAKAGE	TEST CERT	2	2	1		
5.0	GALVANISING (APPLICABLE FOR CCS MATERIAL ONLY)												
5.1	HOT DIP GALVANISING OF BODY, COVER	1. SURFACE PREPARATION & THICKNESS OF GALVANISING& UNIFORMITY.	MA	VISUAL & MEASURE-MENT	100%	IS:2629	IS:2629	INSPN REPORT	2	2,1*	-		
6.0	ASSEMBLY (FOR CCS MATERIAL, TEST TO BE CONDUCTED AFTER GALVANISING)												
6.1	COMPLETE ASSEMBLY	1. CLEANLINESS & COMPLETENESS, DIMENSIONS, THREADING ENDS, ARROW MARKING ETC.	MA	VISUAL & MEASURE-MENT	100%	APPROVED DRAWING	APPROVED DRAWING	INSPN REPORT	2	2,1*	-		
		2.LEAK TIGHTNESS OF BODY	CR	HYDRO. TEST AT 1.5 TIMES OF TRAP DESIGN PRESSURE	100%	APPD. DRG./TECH. SPEC./DATA SHEET	NO LEAKAGE	TEST CERT	2	1*	-		
		3.FUNCTIONAL TEST	CR	FUNCTIONAL TEST AT MINIMUM 6Kg/cm² PRESSURE (VISUAL DISCHARGE OF CONDENSATE)	100 %	APPD DRG./ GIVEN PROCEDURE ON PAGE 3/3 OF THIS QP.	NO AIR LEAKAGE	TEST CERT.	2	1*	-		

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

		QUALITY PLAN		CUSTOMER: M/S GSECL		PROJECT:		SPEC. NO. PE-TS-436-555-A001				
		SHEET 3 OF 3		BIDDER/VENDOR:		QP NO. PE-QP-408-555-M001		REV. 00 DT: 20.02.2018				
		SYSTEM		SERVICE AIR/ INSTRUMENT AIR		ITEM: BALL FLOAT AIR TRAP		SECTION VOLUME				
S.NO.	COMPONENT/ OPERATION	CHARACTERISTICS CHECKED	CATE- GORY	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
6.2	FLOW CAPACITY TEST (TYPE TEST)	CONDENSATE DISCHARGE	CR	DISCHARGE FLOW	1 PER PRESSURE RATING & ORIFICE SIZE TRAP	APPD. FLOW CAPACITY	APPD. FLOW CAPACITY	TYPE TEST CERTIFICA TE	3/2	2	1	
7.0	END CONN.	DIMENSIONS	CR	MEASUREMENT	100%	APPD. DRG./ TECH. SPEC	APPD.DRG/ TECH.SPEC	INSPN REPORT	3/2	2,1*	-	
8.0	PROVISION OF NAME PLATE WITH PURCHASER'S TRAP TAG NOS. & PACKING IN WOODEN CASES	AS PER TECHNICAL SPECIFICATION	MA	VISUAL	100%	--DO--	--DO--	(Soft copy of photographs)	2	2	1	Vendor to provide the following: Photographs of traps duly placed inside the wooden box just before final packing. Photographs of the wooden box in which the traps have been finally packed just before dispatch. Clearance for dispatch of traps will be given only after receiving the photos of traps in satisfactory condition as mentioned in the condition stated above.

FUNCTIONAL TEST PROCEDURE.

1. COMPRESSED AIR (MINIMUM AT 6 Kg/cm² PRESSURE) TO BE SUPPLIED IN A MIXING CHAMBER.
 2. WATER IS ADDED IN THE SAME CHAMBER SO THAT AIR IN THE CHAMBER HAS SUFFICIENT MOISTURE
 3. TRAP IS INSTALLED AT THE BOTTOM OF THIS CHAMBER AND ITS PERFORMANCE IS CHECKED.
- A GOOD PERFORMING TRAP DRAINS OUT ONLY WATER DROPLETS AND RETAINS COMPRESSED AIR BACK IN THE SYSTEM.

NOTE:-

CR- MEANS CRITICAL ACTIVITY
1 = PURCHASER (BHEL/CUSTOMER)
P = PERFORMED BY

MA- MEANS MAJOR ACTIVITY
2 = VENDOR
W = WITNESSED BY

MI- MEANS MINOR ACTIVITY
3 = SUB VENDOR OF THE VENDOR
V = VERIFIED BY

* The Quantum of check to be witnessed is 10% of quantity or Min. 2 Nos. at random by BHEL/Customer & 100 % by Vendor for each type, Size & Rating.

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

		QUALITY PLAN		CUSTOMER: M/S GSECL		PROJECT:		SPEC. NO : PE-TS-436-555-A001		
				BIDDER/VENDOR:		QP NO.: PE-QP-408-555-M016		REV.00 DT: 20.02.2018		
		SHEET 1 OF 3		SYSTEM SERVICE/INSTRUMENT AIR		ITEM: EXTERNAL Y-TYPE AIR STRAINER		SPEC. TITLE AIR TRAPS SECTION VOLUME		
S.NO.	COMPONENT/ OPERATION	CHARACTERISTICS CHECKED	CATE- GORY	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY P W V	REMARKS

1.0	MATERIAL CONTROL											
1.1	BODY, CAP	1. PHYS & CHEM PROPERTIES	MA	PHYS TESTS CHEM TESTS	ONE/HEAT/ BATCH	APPD. DATA SHEET/ TECH.SPEC.	APPD,DATA SHEET/ TECH.SPEC	TEST CERT.	3/2	2	1	CORRELATION REQD.
		2. SURFACE DEFECTS	MA	VISUAL	100%	—DO—	—DO—	INSPN. REPORT	3/2	2	1	
1.2	MESH	1. CHEM PROPERTIES	MA	CHEM. TESTS	1/SHEET	APPD. DATA SHEET/ TECH.SPEC.	APPD,DATA SHEET/ TECH. SPEC	TEST CERT	3/2	2	1	
		2. MESH SIZE/ PERFORATION DIA	MA	MEASUREMENT	SAMPLE PIECE	—DO—	—DO—	INSPN REPORT	3/2	2	1	
2.0	IN PROCESS CONTROL											
2.1	ALL COMPONENTS	1.WORKMANSHIP & FINISH	MA	VISUAL	100%	MFG DRG	MFG DRG	INSP REPORT	2	2	1	
		2.DIMENSIONS	MA	MEASUREMENT	100%	MFG DRG	MFG DRG	MFG DRG	2	2	1	
3.0	HYDRAULIC TEST (FOR CCS MATERIAL, TEST TO BE CONDUCTED BEFORE GALVANISING)											
3.1	BODY CAP	LEAK TIGHTNESS OF BODY	CR	HYDROTEST AT 1.5 TIMES OF STRAINER DESIGN PRESSURE	100%	APPD.DRG/T ECH. SPEC	NO LEAKAGE	TEST CERT	2	2	1	
4.0	GALVANISING (APPLICABLE FOR CCS MATERIAL ONLY)											

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

		QUALITY PLAN		CUSTOMER: M/S GSECL		PROJECT:		SPEC. NO : PE-TS-436-555-A001		
		SHEET 2 OF 3		BIDDER/VENDOR:		QP NO.. PE-QP-408-555-M016		REV.00 DT: 20.02.2018		
		SYSTEM SERVICE/ INSTRUMENT AIR		ITEM: EXTERNAL Y-TYPE AIR STRAINER		SPEC. TITLE AIR TRAPS		SECTION VOLUME		
S.NO.	COMPONENT/ OPERATION	CHARACTERISTICS CHECKED	CATE- GORY	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY P W V	REMARKS

4.1	HOT DIP GALVANISING OF BODY,COVER	1. SURFACE PREPARATION & THICKNESS OF GALVANISING& UNIFORMITY.	MA	VISUAL & MEASURE-MENT	100%	IS:2629	IS:2629	INSPN REPORT	2	2,1 *	-	The minimum thickness of galvanizing shall be minimum 40 microns.
5.0	ASSEMBLY CONTROL (FOR CCS MATERIAL, TEST TO BE CONDUCTED AFTER GALVANISING)											
5.1	COMPLETE STRAINER	1. WORKMANSHIP AND FINISH	MA	VISUAL	100%	APPD.DRG	APPD.DRG	INSPN. REPORT	2	2	1	
		2. OVERALL DIMENSIONS	CR	MEASUREMENT	100%	--DO--	DO--	--DO--	2	2,1 *	1	
		3. LEAK TIGHTNESS OF BODY	CR	HYDROTEST AT 1.5 TIMES OF STRAINER DESIGN PRESSURE	100%	APPD.DRG/T ECH. SPEC	NO LEAKAGE	TEST CERT	2	2,1 *	1	
6.0	END CONN.	DIMENSIONS	CR	MEASUREMENT	100%	APPD DRG/ TECH SPEC.	APPD DRG/ TECH SPEC	INSPN REPORT	2	2,1 *	-	
7.0	PROVISION OF NAME PLATE WITH PURCHASER'S STRAINER TAG NOS IF ANY & PACKING IN WOODEN CASES	AS PER TECH. SPEC	MA	VISUAL	100%	TECH. SPEC	TECH. SPEC	(Soft copy of photographs)	3/2	2	1	Vendor to provide the following: a) Photographs of strainer duly placed inside the wooden box just before final packing. b) Photographs of the wooden box in which the strainer have been finally packed just before dispatch. Clearance for dispatch of valves/traps will be given

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

		QUALITY PLAN		CUSTOMER: M/S GSECL		PROJECT:		SPEC. NO : PE-TS-436-555-A001		
		SHEET 3 OF 3		BIDDER/VENDOR:		QP NO.. PE-QP-408-555-M016		REV.00 DT: 20.02.2018		
		SYSTEM		SERVICE/ INSTRUMENT AIR		ITEM: EXTERNAL Y-TYPE AIR STRAINER		SPEC. TITLE AIR TRAPS SECTION VOLUME		
S.NO.	COMPONENT/ OPERATION	CHARACTERISTICS CHECKED	CATE- GORY	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	AGENCY P W V	REMARKS
										only after receiving the photos of valves/traps in satisfactory condition as mentioned in the condition stated above.

NOTE: CR = CRITICAL ACTIVITY

MA = MAJOR ACTIVITY

MI = MINOR ACTIVITY

1 = PURCHASER (BHEL/CUSTOMER) 2 = VENDOR

3 = SUB VENDOR OF THE VENDOR

P = PERFORMED BY

W = WITNESSED BY

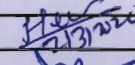
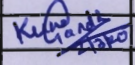
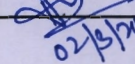
V = VERIFIED BY

* The Quantum of check to be witnessed is 10% of quantity or Min. 2 Nos. at random by BHEL/Customer & 100 % by Vendor for each type, Size & Rating.

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

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO.:		DATE: 27.02.2020
		CUSTOMER:		QP NO.: PED-506-00-Q-006, REV-02		
		PROJECT:		PO NO.:		
		ITEM: AC ELECT. MOTORS UPTO 55KW (LV (415V))		SYSTEM:	SECTION: II	SHEET 1 OF 2

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

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

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO :		DATE:27.02.2020
		CUSTOMER :		QP NO.: PED-506-00-Q-006, REV-02		
		PROJECT:		PO NO.:		
		ITEM: AC ELECT. MOTORS UPTO 55KW (LV (415V))		SYSTEM:	SECTION: II	SHEET 2 OF 2

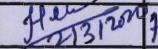
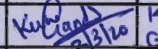
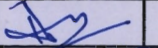
SI No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY		
1	2	3	4	5	6		7	8	9	.	**		
					M	C/N				D	M	C	N
4.0	PACKING	3.NAMEPLATE DETAILS	MA	VISUAL	100%	100%	IS-325 / IS-12615 / APPROVED DATA SHEET	SAME AS COL.7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

NOTES:

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

LEGENDS:

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

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

02/3/2020

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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

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

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

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

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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

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

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

BHEL					
ENGINEERING			QUALITY		
Prepared by:	Sign & Date	Name	Checked by:	Sign & Date	Name
Reviewed by:			Reviewed by:		

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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

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

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

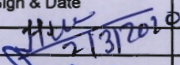
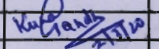
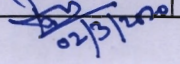
BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:	<i>[Signature]</i>	Hema K.	Checked by:	<i>[Signature]</i>	KUNAL GANDHI
Reviewed by:	<i>[Signature]</i>	P. Dutt	Reviewed by:		

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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

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

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

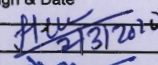
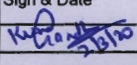
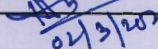
BHEL					
ENGINEERING			QUALITY		
	Sign & Date	Name		Sign & Date	Name
Prepared by:		Hema K.	Checked by:		RUNAL CHANDRA
Reviewed by:		P. Dutta	Reviewed by:		

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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

	MANUFACTURER/ BIDDER/ SUPPLIER NAME & ADDRESS	STANDARD QUALITY PLAN		SPEC. NO.:		DATE: 27.02.2020
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		PROJECT:		PO NO.:		
		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))	SYSTEM:	SECTION: II	SHEET 5 OF 9	

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1	2	3	4	5	6		7	8	9	.	..			
					M	C/N				D	M	C	N	
2.0	IN PROCESS													
2.1	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR)	1.WORKMANSHIP & CLEANNESS	MA	VISUAL	100%	-	-DO-	GOOD FINISH	LOG BOOK		PW	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	-	MANUFACTURER'S DRG	MANUFACTURER'S DRG	-DO-		P	-	-	
2.2	MACHINING	1.FINISH	MA	VISUAL	100%	-	-DO-	GOOD FINISH	LOG BOOK		P	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	-	MANUFACTURER'S DRG	MANUFACTURER'S DRG	-DO-		P	-	-	
		3.SHAFT SURFACE FLOWS	MA	PT	100%	100%	MANUFACTURER'S STD./ ASTM-E165	MANUFACTURER'S STD./ APPROVED DATASHEET.	-DO-	✓	P	V	-	
2.3	PAINTING	1.SURFACE PREPARATION	MA	VISUAL	100%	-	MANUFACTURER'S STD./APPROVED DATASHEET	SAME AS COL.7	LOG BOOK		P	-	-	
		2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT)	MA	MEASUREMENT BY ELCOMETER	SAMPLE	-	-DO-	-DO-	-DO-		P	-	-	
		3.SHADE	MA	VISUAL	-DO-	-	-DO-	-DO-	LOG BOOK		P	-	-	
		4.ADHESION	MA	CROSS CUTTING & TAPE TEST	-DO-	-	-DO-	-DO-	LOG BOOK		P	-	-	

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

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

FOR CUSTOMER REVIEW & APPROVAL			
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		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV (415V))		SYSTEM:	SECTION: II	SHEET 6 OF 9

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

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

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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

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

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

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

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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

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

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

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

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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

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

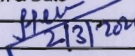
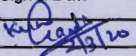
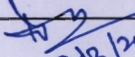
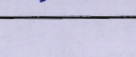
SI No.	Component & Operations	Characteristics	Class	Type of Check	Quantum Of check		Reference Document	Acceptance NORMS	FORMAT OF RECORD		AGENCY		
1	2	3	4	5	6		7	8	9	.	..		
					M	C/N				D	M	C	N
4.0	PACKING	SURFACE FINISH & COMPLETENESS	MA	VISUAL	100%	100%	AS PER MANUFACT. STANDARD / APPROVED CROSS SECTION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

NOTES:

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

LEGENDS:

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

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

BIDDER/ SUPPLIER	
Sign & Date	
Seal	

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



3 X 660 MW NABINAGAR FGD
COMPRESSED AIR SYSTEM

SPECIFICATION No: PE-TS-457-555-A001

VOLUME: II B

SECTION : C-3

REV. 00

DATE: Dec.,19

SHEET: 1 OF 1

SECTION: C-3
TECHNICAL SPECIFICATION (ELECTRICAL PORTION)



TITLE:

**ELECTRICAL EQUIPMENT SPECIFICATION
FOR****COMPRESSED AIR SYSTEM****3X660 MW NABINAGAR-I FGD**

SPECIFICATION NO.

VOLUME NO. : **II-B**SECTION: **I**REV NO. : **00** DATE: 06.01.2020

SHEET: 1 OF 1

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SECTION	TITLE	NO OF SHEETS
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I	ELECTRICAL SCOPE BETWEEN BHEL & VENDOR (ANNEXURE-I)	2
I	ELECTRICAL LOAD DATA FORMAT (ANNEXURE-II)	1
I	CABLE SCHEDULE FORMAT (ANNEXURE-III)	1
I	TECHNICAL SPECIFICATION FOR MOTORS	10
I	MOTOR DATASHEET-A	1
I	MOTOR DATASHEET-C	2
II	STANDARD SPECIFICATION FOR LV MOTORS	5
II	REFERENCE QUALITY PLAN	3
II	TECHNICAL SPECIFICATION FOR CABLE TRAYS & ACCESSORIES	7
II	TYPICAL DETAILS OF CABLE TRAYS AND ACCESSORIES	2

The requirements mentioned in Section-I shall prevail and govern in case of conflict between the same and the corresponding requirements mentioned in the descriptive portion in Section-II.



TITLE :
**ELECTRICAL EQUIPMENT SPECIFICATION
FOR
COMPRESSED AIR SYSTEM
3X660 MW NABINAGAR-I FGD**

SPECIFICATION NO.

VOLUME NO. : **II-B**

SECTION : **I**

REV NO. : **00** DATE : **06.01.2020**

SHEET : 1 OF 3

**TECHNICAL SPECIFICATION
FOR
COMPRESSED AIR SYSTEM
(ELECTRICAL PORTION)**



TITLE :
ELECTRICAL EQUIPMENT SPECIFICATION
FOR
COMPRESSED AIR SYSTEM
3X660 MW NABINAGAR-I FGD

SPECIFICATION NO.
VOLUME NO. : II-B
SECTION : I
REV NO. : 00 DATE : 06.01.2020
SHEET : 2 OF 3

1.0 EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:

- a) Services and equipment as per “Electrical Scope between BHEL and Vendor”.
- b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.
- c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
- d) Electrical load requirement for COMPRESSED AIR SYSTEM (all AC & DC loads at different voltage levels like 415V AC, 240 V AC, 220 V DC etc).
- e) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
- f) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer/BHEL approval without any commercial and delivery implications to BHEL.
- g) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.
- h) Motor shall meet minimum requirement of motor specification.
 - i) Vendor to clearly indicate equipment locations and local routing lengths in their cable listing furnished to BHEL.
 - j) Cable BOQ worked out based on routing of cable listing provided by the vendor for “ both end equipment in vendor’s scope”shall be binding to the vendor with +10 % margin to take care of slight variation in routing length & wastages.

2.0 EQUIPMENT & SERVICES TO BE PROVIDED BY PURCHASER FOR ELECTRICAL & TERMINAL POINTS:

Refer “Electrical Scope between BHEL and Vendor”.

3.0 DOCUMENTS TO BE SUBMITTED ALONG WITH BID

- 3.1 The electrical specification without any deviation from the technical/quality assurance requirements stipulated shall be deemed to be complied by the bidder in case bidder furnishes the overall compliance of package technical specification in the form of compliance certificate/No deviation certificate.
- 3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer.



TITLE :
ELECTRICAL EQUIPMENT SPECIFICATION
FOR
COMPRESSED AIR SYSTEM
3X660 MW NABINAGAR-I FGD

SPECIFICATION NO.

VOLUME NO. : II-B

SECTION : I

REV NO. : 00 DATE : 06.01.2020

SHEET : 3 OF 3

4.0 List of enclosures :

- a) Electrical scope between BHEL & vendor (Annexure –I)
- b) Technical specification for motors.
- c) Datasheets & quality plan for motors.
- d) Electrical Load data format (Annexure –II)
- e) BHEL cable listing format (Annexure –III)

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR**PACKAGES : COMPRESSED AIR SYSTEM****SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT****PROJECT: 3X660 MW NABINAGAR-I FGD**

<u>S.NO</u>	<u>DETAILS</u>	<u>SCOPE SUPPLY</u>	<u>SCOPE E&C</u>	<u>REMARKS</u>
1	11 kV/ 6.6 KV / 3.3 KV / 415 V Switchgear	BHEL	BHEL	240 V AC (supply feeder)/415 V AC (3 PHASE 4 WIRE) supply shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract. Any other voltage level (AC/DC) required will be derived by the vendor.
2	Local Push Button Station (for motors)	BHEL	BHEL	Located near the motors.
3	Power cables, control cables and screened control cables for a) both end equipment in BHEL's scope b) both end equipment in vendor's scope c) one end equipment in vendor's scope	BHEL BHEL BHEL	BHEL Vendor BHEL	1. For 3.b) & c): Sizes of cables required shall be informed by vendor at contract stage (based on inputs provided by BHEL) in the form of cable listing. Finalisation of cable sizes shall be done by BHEL. Vendor shall provide lugs & glands accordingly. 2. Termination at BHEL equipment terminals by BHEL. 3. Termination at Vendor equipment terminals by Vendor.
4	Junction box for control & instrumentation cable	Vendor	Vendor	Number of Junction Boxes shall be sufficient and positioned in the field to minimize local cabling (max 10-12 mtrs) and trunk cable.
5	Any special type of cable like compensating, co-axial, prefab, MICC, etc.	Vendor	Vendor	Refer C&I portion of specification for scope of fibre Optical cables if used between PLC/ microprocessor & DCS.
6	Cable trays, accessories & cable trays supporting system. 100/50 mm cable trays/Conduits/Galvanised steel cable troughs for local cabling	BHEL Vendor	BHEL Vendor	Local cabling from nearby main route cable tray (BHEL scope) to equipment terminal (vendor's scope) shall be through 100/ 50 mm. cable trays/ conduits/ Galvanised steel cable troughs as per approved layout drawing during contract stage.
7	Cable glands, lugs & bimetallic strip for equipments supplied by Vendor	Vendor	Vendor	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type heavy duty tinned copper lugs for power & control cables.
8	Conduit and conduit accessories for cabling between equipments supplied by vendor.	Vendor	Vendor	Conduits shall be medium duty, hot dip galvanised cold rolled mild steel rigid conduit as per IS: 9537.
9	Lighting	BHEL	BHEL	--
10	Equipment grounding (including electronic earthing) & lightning protection	BHEL	BHEL	Refer note no. 4 for electronic earthing
11	Below grade grounding	BHEL	BHEL	--
12	Motors with base plate and foundation hardware	Vendor	Vendor	Makes shall be subject to customer/ BHEL approval at contract stage.
13	Mandatory spares	Vendor	-	Vendor to quote as per specification.
14	Recommended O & M spares	Vendor	-	As specified elsewhere in specification

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR**PACKAGES : COMPRESSED AIR SYSTEM****SCOPE OF VENDOR: SUPPLY, ERECTION & COMMISSIONING OF VENDOR'S EQUIPMENT****PROJECT: 3X660 MW NABINAGAR-I FGD**

15	Any other equipment/material/service required for completeness of system based on the system offered by vendor (to ensure trouble free and efficient operation of the system).	Vendor	Vendor	--
16	a. Input cable schedules (C & I) b. Cable interconnection detail for the above c. Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing for Control and Instrumentation Cable and electronic earthing cable in enclosed excel format shall be submitted by vendor during detailed engineering stage.
17	Cabling layout drawings	BHEL/ Vendor	-	a. In case of Compressor are HT motors, cable tray/trench layout inside compressed air building shall be prepared by BHEL. Vendor to furnish drawing (both in print form as well as in AUTOCAD) of compressor room layout clearly indicating all motors, panels, JB's etc. which require cabling along with their terminal box/location/ Foundation etc. b. In case of Compressor are LT motors, for ensuring cabling requirements are met, vendor shall prepare & submit cable tray/trench & equipment layout (both in print form as well as in AUTOCAD) of the complete plant (including electrical area) indicating location and identification of all equipment requiring cabling for BHEL review & approval.
18	Electrical equipment GA drawing	Vendor	-	For necessary interface review.

NOTES:

1. Make of all electrical equipments/items supplied shall be reputed make & shall be subject to approval of BHEL/customer after award of contract.
2. All QPs shall be subject to approval of BHEL/customer after award of contract without any commercial implication.
3. In case the requirement of junction box arises on account of power cable size mismatch due to vendor engineering at later stage, vendor shall supply the junction box for suitable termination.
4. Vendor shall indicate location of Electronic Earth pit in their Civil assignment drawing.

CABLE SCHEDULE FORMAT

ANNEXURE III

[illegible]

SUB-SECTION-II-E2

MOTORS

LOT-IA PROJECTS
FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE

TECHNICAL SPECIFICATION
SECTION-VI
BID DOCUMENT NO.: CS-0011-109(1A)-2

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	MOTORS			
1.00.00	GENERAL REQUIREMENTS			
1.01.00	For the purpose of design of equipment/systems, an ambient temperature of 50 deg. Centigrade and relative humidity of 95% (at 40 deg C) shall be considered. The equipment shall operate in a highly polluted environment.			
1.02.00	All equipment's shall be suitable for rated frequency of 50 Hz with a variation of +3% & -5%, and 10% combined variation of voltage and frequency unless specifically brought out in the specification.			
1.03.00	Contactor shall provide fully compatible electrical system, equipment's, accessories and services.			
1.04.00	All the equipment, material and systems shall, in general, conform to the latest edition of relevant National and international Codes & Standards, especially the Indian Statutory Regulations.			
1.05.00	Paint shade shall be as per RAL 5012 (Blue) for indoor and outdoor equipment.			
1.06.00	The responsibility of coordination with electrical agencies and obtaining all necessary clearances for Contactors equipment and systems shall be under the Contactor scope.			
1.07.00	Degree of Protection			
	Degree of protection for various enclosures as per IEC60034-05 shall be as follows :-			
	i)	Indoor motors	-	IP 54
	ii)	Outdoor motors	-	IP 55
	iii)	Cable box-indoor area	-	IP 54
	iv)	Cable box-Outdoor area	-	IP 55
2.00.00	CODES AND STANDARDS			
	1)	Three phase induction motors	:	IS/IEC:60034
	2)	Single phase AC motors	:	IS/ IEC:60034
	3)	Crane duty motors	:	IS:3177, IS/IEC:60034
	4)	DC motors/generators	:	IS:4722, IS/IEC:60034
	5)	Energy Efficient motors	:	IS 12615, IEC:60034-30
LOT-IA PROJECTS FLUE GAS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(1)-2 Page 198 of 400		SUB SECTION-II-E2 MOTORS
PAGE 1 OF 9				

CLAUSE NO.	TECHNICAL REQUIREMENTS
3.00.00	TYPE
3.01.00	AC Motors: - Squirrel cage induction motor suitable for direct-on-line starting. - Continuous duty LT motors upto 200 KW Output rating (at 50 deg.C ambient temperature), shall be Premium Efficiency class-IE3, conforming to IS 12615, or IEC:60034-30. - Crane duty motors shall be slip ring/ squirrel cage Induction motor as per the requirement. - Motor operating through variable frequency drives shall be suitable for inverter duty. Also these motors shall comply the requirements stipulated in IEC: 60034-18-41 and IEC: 60034-18-42 as applicable.
3.02.00	DC Motors Shunt wound.
4.00.00	RATING
	- Continuously rated (S1). However, crane motors shall be rated for S4 duty, 40% cyclic duration factor. - Whenever the basis for motor or driven equipment ratings are not specified in the corresponding mechanical specification sub-sections, maximum continuous motor ratings shall be at least 10% above the maximum load demand of the driven equipment under entire operating range including voltage and frequency variations.
5.00.00	TEMPERATURE RISE
	Air cooled motors 70 deg. C by resistance method for both thermal class 130(B) & 155(F) insulation. Water cooled 80 deg. C over inlet cooling water temperature mentioned elsewhere, by resistance method for both thermal class 130(B) & 155(F) insulation.
6.00.00	OPERATIONAL REQUIREMENTS
6.01.00	Starting Time
6.01.01	For motors with starting time upto 20 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 secs. more than starting time.
6.01.02	For motors with starting time more than 20 secs. and upto 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 secs. more than starting time.
LOT-IA PROJECTS FLUE GAS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(1)-2 Page 199 of 400
SUB SECTION-II-E2 MOTORS	PAGE 2 OF 9

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC
6.01.03	For motors with starting time more than 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be more than starting time by at least 10% of the starting time.	
6.01.04	Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.	
6.02.00	Torque Requirements	
6.02.01	Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.	
6.02.02	Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.	
6.03.00	Starting voltage requirement (a) Up to 85% of rated voltage for ratings below 110 KW (b) Up to 80% of rated voltage for ratings from 110 KW to 200 KW (c) Up to 85% of rated voltage for ratings from 201 KW to 1000 KW (d) Up to 80% of rated voltage for ratings from 1001 KW to 4000 KW (e) Up to 75 % of rated voltage for ratings above 4000KW	
7.00.00	DESIGN AND CONSTRUCTIONAL FEATURES	
7.01.00	Suitable single phase space heaters shall be provided on motors rated 30KW and above to maintain windings in dry condition when motor is standstill. Separate terminal box for space heaters & RTDs shall be provided. However for flame proof motors, space heater terminals inside the main terminal box may be acceptable.	
7.02.00	All motors shall be either Totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or Closed air circuit air cooled (CACA) type. However, motors rated 3000KW or above can be Closed air circuit water cooled (CACW). The method of movement of primary and secondary coolant shall be self-circulated by fan or pump directly mounted on the rotor of the main motor as per IEC 60034-6. However VFD driven motors can be offered with forced cooling type with machine mounted fan or pump driven by separate electric motor. Motors and EPB located in hazardous areas shall have flame proof enclosures conforming to IS:2148 as detailed below (a) Fuel oil area : Group – IIB (b) Hydrogen generation : Group - IIC or (Group-I, Div-II as per plant area NEC) or (Class-1, Group-B, Div-II as per NEMA /IEC60034)	
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7.03.00	Winding and Insulation (a) Type : Non-hygroscopic, oil resistant, flame resistant (b) Starting duty : Two hot starts in succession, with motor initially at normal running temperature. (c) 11kV & 3.3 kV AC motors : Thermal class 155 (F) insulation. The winding insulation process shall be total Vacuum Pressure Impregnated i.e resin poor method. The lightning Impulse & interturn insulation surge withstand level shall be as per IEC-60034 part-15. (d) 240VAC, 415V AC & 220V DC motors : Thermal Class (B) or better	
7.04.00	Motors rated above 1000KW shall have insulated bearings to prevent flow of shaft currents.	
7.05.00	Motors with heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate inlet and outlet primary air temperature.	
7.06.00	Noise level for all the motors shall be limited to 85 dB(A) except for BFP motor for which the maximum limit shall be 90dB(A). Vibration shall be limited within the limits prescribed in IS:12075 / IEC 60034-14 . Motors shall withstand vibrations produced by driven equipment. HT motor bearing housings shall have flat surfaces, in both X and Y directions, suitable for mounting 80mmX80mm vibration pads.	
7.07.00	In HT motors, at least four numbers simplex / two numbers duplex platinum resistance type temperature detectors shall be provided in each phase stator winding. Each bearing of HT motor shall be provided with dial type thermometer with adjustable alarm contact and preferably 2 numbers duplex platinum resistance type temperature detectors.	
7.08.00	Motor body shall have two earthing points on opposite sides.	
7.09.00	11 KV motors shall be offered with Separable Insulated Connector (SIC) as per IEEE 386. The offered SIC terminations shall be provided with protective cover and trifurcating sleeves. SIC termination kit shall be suitable for fault level of 25 KA for 0.17 seconds.	
7.10.00	3.3 KV motors shall be offered with dust tight phase separated double walled (metallic as well as insulated barrier) Terminal box. Employer shall provide termination kit for the offered Terminal box. The offered Terminal Box shall be suitable for fault level of 250 MVA for 0.12 sec. Removable gland plates of thickness 3 mm (hot/cold rolled sheet steel) or 4 mm (non magnetic material for single core cables) shall be provided.	
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7.11.00	The spacing between gland plate & centre of terminal stud shall be as per Table-I.																
7.12.00	All motors shall be so designed that maximum inrush currents and locked rotor and pullout torque developed by them at extreme voltage and frequency variations do not endanger the motor and driven equipment.																
7.13.00	The motors shall be suitable for bus transfer schemes provided on the 11kV, 3.3 kV /415V systems without any injurious effect on its life.																
7.14.00	For motors rated 2000 KW & above, neutral current transformers of PS class shall be provided on each phase in a separate neutral terminal box.																
7.15.00	The size and number of cables (for HT motors) to be intimated to the successful Contactor during detailed engineering and the Contactor shall provide terminal box suitable for the same.																
8.00.00	The ratio of locked rotor KVA at rated voltage to rated KW shall not exceed the following (without any further tolerance): <table><tr><td>(a) From 50KW & upto 110KW</td><td>:</td><td>11.0</td></tr><tr><td>(b) From 110 KW & upto 200 KW</td><td>:</td><td>9.0</td></tr><tr><td>(c) Above 200 KW & upto 1000KW</td><td>:</td><td>10.0</td></tr><tr><td>(d) From 1001KW & upto 4000KW</td><td>:</td><td>9.0</td></tr><tr><td>(e) Above 4000KW</td><td>:</td><td>6 to 6.5</td></tr></table>	(a) From 50KW & upto 110KW	:	11.0	(b) From 110 KW & upto 200 KW	:	9.0	(c) Above 200 KW & upto 1000KW	:	10.0	(d) From 1001KW & upto 4000KW	:	9.0	(e) Above 4000KW	:	6 to 6.5	
(a) From 50KW & upto 110KW	:	11.0															
(b) From 110 KW & upto 200 KW	:	9.0															
(c) Above 200 KW & upto 1000KW	:	10.0															
(d) From 1001KW & upto 4000KW	:	9.0															
(e) Above 4000KW	:	6 to 6.5															
10.00.00	TYPE TEST																
10.01.00	HT MOTORS																
10.01.01	The Contactor shall carry out the type tests as listed in this specification on the equipment to be supplied under this contract. The Contactor shall indicate the charges for each of these type tests separately in the relevant schedule of Section - VII- (BPS) and the same shall be considered for the evaluation of the bids. The type tests charges shall be paid only for the test(s) actually conducted successfully under this contract and upon certification by the Employer's engineer.																
10.01.02	The type tests shall be carried out in presence of the Employer's representative, for which minimum 15 days notice shall be given by the Contactor. The Contactor shall obtain the Employer's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set-up, instruments to be used, procedure, acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.																
10.01.03	In case the Contactor has conducted such specified type test(s) within last ten years as on the date of bid opening, he may submit during detailed engineering																
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10.01.04	the type test reports to the Employer for waiver of conductance of such test(s). These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. The Employer reserves the right to waive conducting of any or all the specified type test(s) under this contract. In case type tests are waived, the type test charges shall not be payable to the Contactor. Further the Contactor shall only submit the reports of the type tests as listed in "LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED" and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. However if the Contactor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the Contactor shall conduct all such tests under this contract at no additional cost to the Employer either at third party lab or in presence of client/Employers representative and submit the reports for approval.	
10.01.05	LIST OF TYPE TESTS TO BE CONDUCTED The following type tests shall be conducted on each type and rating of HT motor (a) No load saturation and loss curves upto approximately 115% of rated voltage (b) Measurement of noise at no load. (c) Momentary excess torque test (subject to test bed constraint). (d) Full load test(subject to test bed constraint) (e) Temperature rise test at rated conditions. During heat run test, bearing temp., winding temp.,coolant flow and its temp. shall also be measured. In case the temperature rise test is carried at load other than rated load, specific approval for the test method and procedure is required to be obtained. Wherever ETD's are provided, the temperature shall be measured by ETD's also for the record purpose.	
10.01.06	LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED The following type test reports shall be submitted for each type and rating of HT motor (a) Degree of protection test for the enclosure followed by IR, HV and no load run test.	
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	(b) Terminal box-fault level withstand test for each type of terminal box of HT motors only. (c) Lightning Impulse withstand test on the sample coil shall be as per clause no. 4.3 IEC-60034, part-15 (d) Surge-withstand test on inter-turn insulation shall be as per clause no. 4.2 of IEC 60034, part-15	
10.02.00	LT Motors	
10.02.01	LT Motors supplied shall be of type tested design. During detailed engineering, the Contactor shall submit for Employer's approval the reports of all the type tests as listed in this specification and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.	
10.02.02	However if the Contactor is not able to submit report of the type test(s) conducted within last ten years from the date of bid opening, or in the case of type test report(s) are not found to be meeting the specification requirements, the Contactor shall conduct all such tests under this contract at no additional cost to the Employer either at third party lab or in presence of client/Employers representative and submit the reports for approval.	
10.02.03	LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED The following type test reports shall be submitted for each type and rating of LT motor of above 50 KW only 1. Measurement of resistance of windings of stator and wound rotor. 2. No load test at rated voltage to determine input current power and speed 3. Open circuit voltage ratio of wound rotor motors (in case of Slip ring motors) 4. Full load test to determine efficiency power factor and slip 5. Temperature rise test 6. Momentary excess torque test. 7. High voltage test 8. Test for vibration severity of motor. 9. Test for noise levels of motor(Shall be limited as per clause no 7.06.00 of this section)	
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	10. Test for degree of protection and 11. Overspeed test. 12. Type test reports for motors located in fuel oil area having flame proof enclosures as per IS 2148 / IEC 60079-1			
10.03.00	All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.			
10.04.00	The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and "No design Change". Minor changes if any shall be highlighted on the endorsement sheet.			
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TABLE - I

DIMENSIONS OF TERMINAL BOXES FOR LV MOTORS

Motor MCR in KW Minimum distance between centre of

UP to 3 KW stud and gland plate in mm
As per manufacturer's practice.

Above 3 KW - upto 7 KW 85

Above 7 KW - upto 13 KW 115

Above 13 KW - upto 24 KW 167

Above 24 KW - upto 37 KW 196

Above 37 KW - upto 55 KW 249

Above 55 KW - upto 90 KW 277

Above 90 KW - upto 125 KW 331

Above 125 KW-upto 200 KW 203

For HT motors the distance between gland plate and the terminal studs shall not be less than 500 mm.

PHASE TO PHASE/ PHASE TO EARTH AIR CLEARANCE:

NOTE: Minimum inter-phase and phase-earth air clearances for LT motors with lugs installed shall be as follows:

Motor MCR in KW **Clearance**

UP to 110 KW 10mm

Above 110 KW and upto 150 KW 12.5mm

Above 150 KW 19mm

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ANNEXURE-III

1.0	Design ambient temperature	:	50 °C
2.0	Maximum acceptable kW rating of LV motor	:	200KW *
3.0	Installation (Indoors/ Outdoors)	:	As required
4.0	Details of supply system		
	a) Rated voltage (with variation)	:	415V ± 10%
	b) Rated frequency (with variation)	:	50 Hz + 3 % to - 5%
	c) Combined voltage & freq. variation	:	10% (sum of absolute values)
	d) System fault level at rated voltage	:	50 kA for 1 sec
	e) Short time rating for terminal boxes		
	o 110 kW and above (Breaker Controlled)	:	50 KA for 0.25 sec.
	o Below 110 kW (Contactor Controlled)	:	50 KA protected by HRC fuse
	f) LV System grounding	:	Solidly
5.0	Winding & Insulation	:	Class F with temp rise limited to class B
6.0	Minimum voltage for starting (As percentage of rated voltage)	:	85% for motor ratings below 110kW 80% for motor ratings from 110kW to 200kW.
7.0	Power cables data	:	Shall be given during detailed engg.
8.0	Earth Conductor Size & Material	:	Shall be given during detailed engg.
9.0	Space heater supply (for motors >=30kw)	:	240 V, 1φ, 50 Hz
10.0	Rating up to which Single phase motor	:	Acceptable below 0.2 kW
11.0	Locked rotor current		
	a) Limit as percentage of FLC	:	As per IS 12615
12.0	Makes	:	BHEL/ Customer approval (Package owner to take care)
13.0	Paint shade	:	Blue (RAL 5012) – Corrosion proof
14.0	Degree Of protection for motor/ terminal box	:	Degree of protection for various enclosures as per IEC60034-05 shall be as follows:-
	i) Indoor motors - IP 54		
	ii) Outdoor motors - IP 55		
	iii) Cable box-indoor area - IP 54		
	iv) Cable Box-Outdoor area - IP 55		

*** LT motors of continuous duty shall be energy efficient IE3 class conforming to IS-12615**

15.0 TESTING REQUIREMENTS: IN LINE WITH SPECIFICATION

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S. No.	Description	Data to be filled by successful bidder
A.	General	
1	Manufacturer & country of origin	
2	Motor type	
3	Type of starting	
4	Name of the equipment driven by motor & Quantity	
5	Maximum Power requirement of driven equipment	
6	Rated speed of Driven Equipment	
7	Design ambient temperature	
B.	Design and Performance Data	
1	Frame size & type designation	
2	Type of duty	
3	Rated Voltage	
4	Permissible variation for	
5	a) Voltage	
6	b) Frequency	
7	c) Combined voltage & frequency	
8	Rated output at design ambient temp (by resistance method)	
9	Synchronous speed & Rated slip	
10	Minimum permissible starting voltage	
11	Starting time in sec with mechanism coupled	
12	a) At rated voltage	
13	b) At min starting voltage	
14	Locked rotor current as percentage of FLC (including IS tolerance)	
15	Torque	
	a) Starting	
	b) Maximum	
16	Permissible temp rise at rated output over ambient temp & method	
17	Noise level at 1.0 m (dB)	
18	Amplitude of vibration	
19	Efficiency & P.F. at rated voltage & frequency	
	a) At 100% load	
	c) At 75% load	

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			

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S. No.	Description	Data to be filled by successful bidder
	c) At starting	
C.	Constructional Features	
1	Method of connection of motor driven equipment	
2	Applicable Standard	
3	DOP of Enclosure	
4	Method of cooling	
5	Class of insulation	
6	Main terminal box	
	a) Type	
	b) Power Cable details (Conductor, size, armour/unarmour)	
	c) Cable Gland & lugs details (Size, type & material)	
	d) Permissible Fault level (kArms & duration in sec)	
7	Space heater details (Voltage & watts)	
8	Flame proof motor details (if applicable)	
	a) Enclosure	
	b) suitability for hazardous area	
	i Zone	O / I / II
	ii Group	IIA / IIB / IIC
9	No. of Stator winding	
10	Winding connection	
11	Kind of rotor winding	
12	Kind of bearings	
13	Direction of rotation when viewed from NDE	
14	Paint Shade & type	
15	Net weight of motor	
16	Outline mounting drawing No (To be enclosed as annexure)	
D.	Characteristic curves/ drawings (To be enclosed for motors of rating $\geq 55\text{KW}$)	
	a) Torque speed characteristic	
	b) Thermal withstand characteristic	
	c) Current vs time	
	d) Speed vs time	

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NAME	SIGNATURE	DATE			



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GENERAL TECHNICAL REQUIREMENTs

FOR

LV MOTORS

SPECIFICATION NO.
PE-SS-999-506-E101
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GENERAL TECHNICAL REQUIREMENTS

FOR
LV MOTORS

SPECIFICATION NO.: PE-SS-999-506-E101 Rev 00



TITLE :
GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

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1.0 INTENT OF SPECIFICATION

The specification covers the design, materials, constructional features, manufacture, inspection and testing at manufacturer's work, and packing of Low voltage (LV) squirrel cage induction motors along with all accessories for driving auxiliaries in thermal power station.

Motors having a voltage rating of below 1000V are referred to as low voltage (LV) motors.

2.0 CODES AND STANDARDS

Motors shall fully comply with latest edition, including all amendments and revision, of following codes and standards:

IS:325	Three phase Induction motors
IS : 900	Code of practice for installation and maintenance of induction motors
IS: 996	Single phase small AC and universal motors
IS: 4722	Rotating Electrical machines
IS: 4691	Degree of Protection provided by enclosures for rotating electrical machines
IS: 4728	Terminal marking and direction of rotation rotating electrical machines
IS: 1231	Dimensions of three phase foot mounted induction motors
IS: 8789	Values of performance characteristics for three phase induction motors
IS: 13555	Guide for selection and application of 3-phase A.C. induction motors for different types of driven equipment
IS: 2148	Flame proof enclosures for electrical appliance
IS: 5571	Guide for selection of electrical equipment for hazardous areas
IS: 12824	Type of duty and classes of rating assigned
IS: 12802	Temperature rise measurement for rotating electrical machines
IS: 12065	Permissible limits of noise level for rotating electrical machines
IS: 12075	Mechanical vibration of rotating electrical machines

In case of imported motors, motors as per IEC-34 shall also be acceptable.

3.0 DESIGN REQUIREMENTS

3.1 Motors and accessories shall be designed to operate satisfactorily under conditions specified in data sheet-A and Project Information, including voltage & frequency variation of supply system as defined in Data sheet-A

3.2 Motors shall be continuously rated at the design ambient temperature specified in Data Sheet-A and other site conditions specified under Project Information
Motor ratings shall have at least a 15% margin over the continuous maximum demand of the driven equipment, under entire operating range including voltage & frequency variation specified above.

3.3 Starting Requirements

3.3.1 Motor characteristics such as speed, starting torque, break away torque and starting time shall be properly co-ordinated with the requirements of driven equipment. The accelerating torque at any speed with the minimum starting voltage shall be at least 10% higher than that of the driven equipment.

3.3.2 Motors shall be capable of starting and accelerating the load with direct on line starting without exceeding acceptable winding temperature.



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The limiting value of voltage at rated frequency under which a motor will successfully start and accelerate to rated speed with load shall be taken to be a constant value as per Data Sheet - A during the starting period of motors.

3.3.3 The following frequency of starts shall apply

- i) Two starts in succession with the motor being initially at a temperature not exceeding the rated load temperature.
- ii) Three equally spread starts in an hour the motor being initially at a temperature not exceeding the rated load operating temperature. (not to be repeated in the second successive hour)
- iii) Motors for coal conveyor and coal crusher application shall be suitable for three consecutive hot starts followed by one hour interval with maximum twenty starts per day and shall be suitable for minimum 20,000 starts during the life time of the motor

3.4 **Running Requirements**

3.4.1 Motors shall run satisfactorily at a supply voltage of 75% of rated voltage for 5 minutes with full load without injurious heating to the motor.

3.4.2 Motor shall not stall due to voltage dip in the system causing momentary drop in voltage upto 70% of the rated voltage for duration of 2 secs.

3.5 **Stress During bus Transfer**

3.5.1 Motors shall withstand the voltage, heavy inrush transient current, mechanical and torque stress developed due to the application of 150% of the rated voltage for at least 1 sec. caused due to vector difference between the motor residual voltage and the incoming supply voltage during occasional auto bus transfer.

3.5.2 Motor and driven equipment shafts shall be adequately sized to satisfactorily withstand transient torque under above condition.

3.6 Maximum noise level measured at distance of 1.0 metres from the outline of motor shall not exceed the values specified in IS 12065.

3.7 The max. vibration velocity or double amplitude of motors vibration as measured at motor bearings shall be within the limits specified in IS: 12075.

4.0 **CONSTRUCTIONAL FEATURES**

4.1 Indoor motors shall conform to degree of protection IP: 54 as per IS: 4691. Outdoor or semi-indoor motors shall conform to degree of protection IP: 55 as per IS: 4691 and shall be of weather-proof construction. Outdoor motors shall be installed under a suitable canopy

4.2 Motors upto 160KW shall have Totally Enclosed Fan Cooled (TEFC) enclosures, the method of cooling conforming to IC-0141 or IC-0151 of IS: 6362.

Motors rated above 160 KW shall be Closed Air Circuit Air (CACA) cooled

4.3 Motors shall be designed with cooling fans suitable for both directions of rotation.



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- 4.4. Motors shall not be provided with any electric or pneumatic operated external fan for cooling the motors.
- 4.5. Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point.
- 4.6. In case Class 'F' insulation is provided for LV motors, temperature rise shall be limited to the limits applicable to Class 'B' insulation.
In case of continuous operation at extreme voltage limits the temperature limits specified in table-1 of IS:325 shall not exceed by more than 10°C.
- 4.7. **Terminals and Terminal Boxes**
- 4.7.1 Terminals, terminal leads, terminal boxes, windings tails and associated equipment shall be suitable for connection to a supply system having a short circuit level, specified in the Data Sheet-A.

Unless otherwise stated in Data Sheet-A, motors of rating 110 kW and above will be controlled by circuit breaker and below 110 kW by switch fuse-contactor. The terminal box of motors shall be designed for the fault current mentioned in data sheet "A".
- 4.7.2 unless otherwise specified or approved, phase terminal boxes of horizontal motors shall be positioned on the left hand side of the motor when viewed from the non-driving end.
- 4.7.3 Connections shall be such that when the supply leads R, Y & B are connected to motor terminals A B & C or U, V & W respectively, motor shall rotate in an anticlockwise direction when viewed from the non-driving end. Where such motors require clockwise rotation, the supply leads R, Y, B will be connected to motor terminals A, C, B or U W & V respectively.
- 4.7.4 Permanently attached diagram and instruction plate made preferably of stainless steel shall be mounted inside terminal box cover giving the connection diagram for the desired direction of rotation and reverse rotation.
- 4.7.5 Motor terminals and terminal leads shall be fully insulated with no bar live parts. Adequate space shall be available inside the terminal box so that no difficulty is encountered for terminating the cable specified in Data Sheet-A.
- 4.7.6 Degree of protection for terminal boxes shall be IP 55 as per IS 4691.
- 4.7.7 Separate terminal boxes shall be provided for space heaters.. If this is not possible in case of LV motors, the space heater terminals shall be adequately segregated from the main terminals in the main terminal box. Detachable gland plates with double compression brass glands shall be provided in terminal boxes.
- 4.7.8. Phase terminal boxes shall be suitable for 360 degree of rotation in steps of 90 degree for LV motors.
- 4.7.9 Cable glands and cable lugs as per cable sizes specified in Data Sheet-A shall be included. Cable lugs shall be of tinned Copper, crimping type.
- 4.8 Two separate earthing terminals suitable for connecting G.I. or MS strip grounding conductor of size given in Data Sheet-A shall be provided on opposite sides of motor frame. Each terminal box shall have a grounding terminal.



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- 4.9.1 Motors provided for similar drives shall be interchangeable.
- 4.9.2 Suitable foundation bolts are to be supplied alongwith the motors.
- 4.9.3 Motors shall be provided with eye bolts, or other means to facilitate safe lifting if the weight is 20Kgs. and above.
- 4.9.4 Necessary fitments and accessories shall be provided on motors in accordance with the latest Indian Electricity rules 1956.
- 4.9.5 All motors rated above 30 kW shall be provided with space heaters to maintain the motor internal air temperature above the dew point. Unless otherwise specified, space heaters shall be suitable for a supply of 240V AC, single phase, 50 Hz.
- 4.9.6 Name plate with all particulars as per IS: 325 shall be provided
- 4.9.7 Unless otherwise specified, the colour of finish shall be grey to Shade No. 631 and 632 as per IS:5 for motors installed indoor and outdoor respectively. The paint shall be epoxy based and shall be suitable for withstanding specified site conditions.
- 5.0 INSPECTION AND TESTING**
- 5.1 All materials, components and equipments covered under this specification shall be procured, manufactured, as per the BHEL standard quality plan No. PED-506-00-Q-006/0 and PED-506-00-Q-007/2 enclosed with this specification and which shall be complied.
- 5.2 LV motors of type-tested design shall be provided. Valid type test reports not more than 5 year shall be furnished. In the absence of these, type tests shall have to be conducted by manufacturer without any commercial implication to purchaser.
- 5.3 All motors shall be subjected to routine tests as per IS: 325 and as per BHEL standard quality plan.
- 5.4 Motors shall also be subjected to additional tests, if any, as mentioned in Data Sheet A.
- 6.0 DRAWINGS TO BE SUBMITTED AFTER AWARD OF CONTRACT**
- a) OGA drawing showing the position of terminal boxes, earthing connections etc.
- b) Arrangement drawing of terminal boxes.
- c) Characteristic curves:
(To be given for motor above 55 kW unless otherwise specified in Data Sheet).
- i) Current vs. time at rated voltage and minimum starting voltage.
- ii) Speed vs. time at rated voltage and minimum starting voltage.
- iii) Torque vs. speed at rated voltage and minimum voltage.
For the motors with solid coupling the above curves i), ii), iii) to be furnished for the motors coupled with driven equipment. In case motor is coupled with mechanical equipment by fluid coupling, the above curves shall be furnished with and without coupling.
- iv) Thermal withstand curve under hot and cold conditions at rated voltage and max. permissible voltage.

SUB-SECTION-V-QE1

MOTORS

LOT-IA PROJECTS
FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE

TECHNICAL SPECIFICATION
SECTION-VI
BID DOCUMENT NO.: CS-0011-109(1A)-2

CLAUSE NO.

QUALITY ASSURANCE



MOTOR

TESTS/CHECKS TEMS/COMPONENTS														
	Visual	Dimensional	Make/Type/Rating Physical Inspection	Mech/Chem. Properties	NDT /DP/MP/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-325/IS-4722 /IS- 9283/IS 2148/IEC60034/IEC 60079-1/ 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				
Rotor Copper/Aluminium	Y	Y	Y	Y			Y		Y					
Stator copper	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					

LOT-IA PROJECTS
FLUE GAS DESULPHURISATION SYSTEM PACKAGE

TECHNICAL SPECIFICATION
SECTION – VI, PART-B
BID DOC. NO CS-0011-109(1A)-2

SUB-SECTION-V-QE1
MOTORS

PAGE 1 OF 2

CLAUSE NO.		QUALITY ASSURANCE																	
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, BTDC, Space heater, antifriction bearing, gaskets etc.		Y	Y	Y															
Complete Motor		Y	Y	Y											Y	Y	Y	Y1	Y
Note: 1. This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating the practices & Procedure followed along with relevant supporting documents during QP finalization. However, No QP for LT motor upto 50KW. 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.																			
LOT-IA PROJECTS FLUE GAS DESULPHURISATION SYSTEM PACKAGE					TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC. NO CS-0011-109(1A)-2					SUB-SECTION-V-QE1 MOTORS					PAGE 2 OF 2				

CLAUSE NO.	TECHNICAL REQUIREMENTS			
3.02.00	Support System for Cable Trays			
3.02.01	Cable tray support system shall be pre-fabricated out of single sheet as per enclosed tender drawings.			
3.02.02	Support system for cable trays shall essentially comprise of the two components i.e. main support channel and cantilever arms. The main support channel shall be of two types : (i) C1:- having provision of supporting cable trays on one side and (ii) C2:-having provision of supporting cable trays on both sides. The support system shall be the type described hereunder a. Cable supporting steel work for cable racks/cables shall comprise of various channel sections, cantilever arms, various brackets, clamps, floor plates, all hardwares such as lock washers, hexagon nuts, hexagon head bolt, support hooks, stud nuts, hexagon head screw, channel nut, channel nut with springs, fixing studs, etc. b. The system shall be designed such that it allows easy assembly at site by using bolting. All cable supporting steel work, hardwares fittings and accessories shall be prefabricated factory galvanised. c. The main support and cantilever arms shall be fixed at site using necessary brackets, clamps, fittings, bolts, nuts and other hardware etc. to form various arrangements required to support the cable trays. Welding of the components shall not be allowed. However, welding of the bracket (to which the main support channel is bolted) to the overhead beams, structural steel, insert plates or reinforcement bars will be permitted. Any cutting or welding of the galvanised surface shall be brushed and red lead primer, oil primer & aluminium paint shall be applied d. All steel components, accessories, fittings and hardware shall be hot dip galvanised after completing welding, cutting, drilling and other machining operation. e. The typical arrangement of flexible support system is shown in the enclosed drawings and described briefly below: The main support channel and cantilever arms shall be fabricated out of 2.5 thick rolled steel sheet conforming to IS 1079. f. Cantilever arms of 320 mm, 620mm and 750 mm in length are required, and shall be as shown in the enclosed drawing. The arm portion shall be suitable for assembling the complete arm assembly on to component constructed of standard channel section. The back plate shall allow sufficient clearance for fixing bolt to be tightened with tray in position. g. Support system shall be able to withstand - weight of the cable trays - weight of the cables (75 Kg/Metre run of each cable tray) - Concentrated load of 75 Kg between every support span. - Factor of safety of minimum 1.5 shall be considered.			
3.02.03	The size of structural steel members or thickness of sheet steel of main support channel and cantilever arms and other accessories as indicated above or in the enclosed drawings are indicative only. Nevertheless, the support system shall be designed by the bidder to fully meet the requirements of type tests as specified. In case the system fails in the tests, the components design modification shall be done by the Bidder without any additional cost to			
LOT-1A PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(1A)-2	SUB SECTION-II-E6 CABLING, EARTHING & LIGHTNING PROTECTION	Page 4 of 69

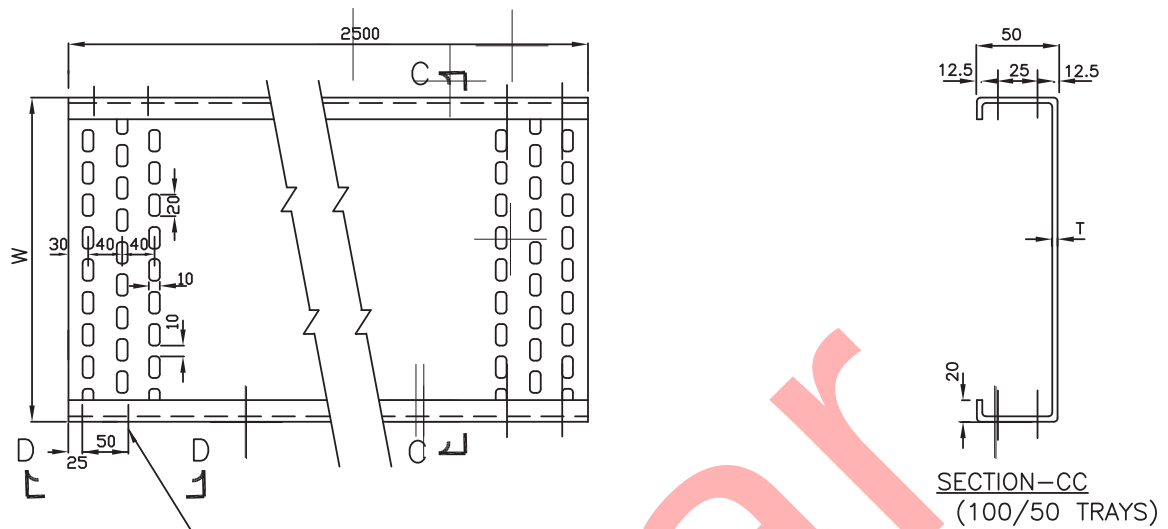
CLAUSE NO.	TECHNICAL REQUIREMENTS	
	the Employer. The bidder shall submit the detailed drawings of the system offered by him alongwith the bid.	
3.02.04	Four legged structure shall be provided wherever there is change in elevation and change in direction	
3.02.05	FOR COAL HANDLING PLANT/ FGD PLANT AREA THE FOLLOWING SHALL ALSO BE APPLICABLE: a) All overhead cable routes shall be along the route of the conveyor gallery on separate supporting structures and cables shall be laid in vertical trays. The bottom of the steel shall be such that the existing facilities, movement of trucks/human beings etc. does not get affected. The cable trestle shall have a minimum 600mm clear walk way and shall have maintenance platforms as required. The bottom of the steel supporting structure shall be generally at 3.0M above the grade level except for rail/road crossings where it shall be at 8.0M above grade level. Tap offs from the overhead cable trestle can be through shallow trenches with prior approval of the Employer. Directly buried cable, if essential, shall not have concentration of more than 4 cables on one route. b) Cable trenches shall be provided only in Switchgear/MCC rooms. c) Cables shall not be routed through the conveyor galleries except for the equipment located in the conveyor galleries for a particular conveyor i.e. protection switches, receptacles etc. d) Cables for PCS and BSS shall be routed along the conveyors through GI conduits.	
3.03.00	Pipes, Fittings & Accessories	
3.03.01	Pipes offered shall be complete with fittings and accessories (like tees, elbows, bends, check nuts, bushings, reducers, enlargers, coupling caps, nipples etc.) The size of the pipe shall be selected on the basis of maximum 40% fill criteria	
3.03.02	GI Pipes shall be of medium duty as per IS: 1239	
3.03.03	Duct banks shall be High Density PE pipes encased in PCC (10% spare of each size, subject to minimum one) with suitable water-proof manholes.	
3.03.04	Hume pipes shall be NP3 type as per IS 458.	
3.03.05	TERNE Coated Flexible Steel Conduits shall be water proof and rust proof made of heat resistant lead coated steel. Conduit diameter shall be uniform throughout its length. Internal surface of the conduit shall be free from burrs and sharp edges. Conduits shall be complete with necessary accessories for proper termination of the conduit with junction boxes and lighting fixtures	
3.03.06	HDPE pipes and conduits shall be PE-80, PN-10 type as per IS 4984/IS 8008 part-I.	
3.04.00	Junction Boxes	
3.04.01	Junction box shall be made of Fire retardant material. Material of JB shall be Thermoplastic or thermosetting or FRP type. The box shall be provided with the terminal blocks, mounting bracket and screws etc. The cable entry shall be through galvanized steel conduits of	
LOT-1A PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(1A)-2
		SUB SECTION-II-E6 CABLING, EARTHING & LIGHTNING PROTECTION
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CLAUSE NO.	TECHNICAL REQUIREMENTS		
	suitable diameter. The JB shall have suitable for installing glands of suitable size on the bottom of the box. The JB shall be suitable for surface mounting on ceiling/structures. The JB shall be of grey color RAL 7035. All the metal parts shall be corrosion protected. Junction box surface should be such that it is free from crazings, blisterings, wrinkling, colour blots/striations. There should not be any mending or repair of surface. JB's will be provided with captive screws so that screws don't fall off when cover is opened. JB's mounting brackets should be of powder coated MS. Type test reports for the following tests shall be furnished:- (a) Impact resistance for impact energy of 2 Joules (IK07) as per BS EN50102 (b) Thermal ageing at 70deg C for 96 hours as per IEC60068-2-2Bb. (c) Class of protection shall be IP 55. (d) HV test.		
3.04.02	Terminal blocks shall be 1100V grade, of suitable current rating, made up of unbreakable polyamide 6.6 grade. The terminals shall be screw type or screw-less (spring loaded) / cage clamp type with lugs. Marking on terminal strips shall correspond to the terminal numbering in wiring diagrams. All metal parts shall be of non-ferrous material. In case of screw type terminals the screw shall be captive, preferably with screw locking design. All terminal blocks shall be suitable for terminating on each side the required cables/wire size. All internal wiring shall be of cu. Conductor PVC wire.		
3.05.00	Terminations & Straight Through Joints		
3.05.01	Termination and jointing kits for 33kV, 11 kV, 6.6 KV and 3.3 kV grade XLPE insulated cables shall be of proven design and make which have already been extensively used and type tested. Termination kits and jointing kits shall be Pre-moulded type or heat shrinkable type. Further Cold shrinkable type termination and jointing kits are also acceptable. The Cold shrinkable type kits shall be type tested as per relevant standards. Calculation to withstand the required fault level shall also be furnished in case of cold shrinkable type kits. 33 kV, 11 kV, 6.6 KV and 3.3kV grade joints and terminations shall be type tested and Type test reports as per IS:13573 Part-II and IEC60502 shall be furnished. Also, heat shrink material shall comply with requirements of ESI 09-13 (external tests). Critical components used in cable accessories shall be of tested and proven quality as per relevant product specification/ESI specification. Cable joints and terminations should be with FRLS properties as per IEC 60754-1&2. Kit contents shall be supplied from the same source as were used for type testing. The kit shall be complete with the tinned copper solderless crimping type cable lugs & ferrule or mechanical connectors (wherein bolts are tightened that shear off at an appropriate torque) as per DIN standard suitable for aluminium compacted conductor cables. (Tender drg. no 0000-211-POE –A-51-RA of cable lug attached at the end of this chapter).		
3.05.02	Straight through joint and termination shall be capable of withstanding the fault level of 21 KA for 0.12 Sec. with dynamic peak of 52 KA for 33 KV system & of 40 kA for 0.12 sec with a dynamic peak of 100 kA for 11 kV, 6.6 KV & 3.3 KV system. Straight through joints shall have provisions for shield connection and earthing wherever required and complete with all accessories and consumables suitable for storage without deterioration at a temperature of 50 deg. C with shelf life of more than five years. 1.1 kV grade straight through joints shall also be of proven design		
3.05.03	1.1 KV grade Straight Through Joint shall be of proven design.		
LOT-1A PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(1A)-2	SUB SECTION-II-E6 CABLING, EARTHING & LIGHTNING PROTECTION
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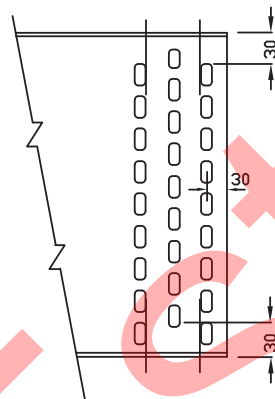
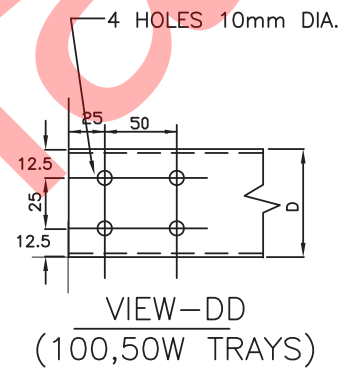
CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC
3.06.00	Cable glands	
3.06.01	Cable shall be terminated using double compression type cable glands. Testing requirements of Cable glands shall conform to BS:6121 and gland shall be of robust construction capable of clamping cable and cable armour (for armoured cables) firmly without injury to insulation. Cable glands shall be made of heavy duty brass machine finished and nickel chrome plated. Thickness of plating shall not be less than 10 micron. All washers and hardware shall also be made of brass with nickel chrome plating Rubber components shall be of neoprene or better synthetic material and of tested quality. Cable glands shall be suitable for the sizes of cable supplied/erected.	
3.07.00	Cable lugs/ferrules	
3.07.01	Cable lugs/ferrules for power cables shall be tinned copper solderless crimping type suitable for aluminium compacted conductor cables. Cable lugs and ferrules for control cables shall be tinned copper type. The cable lugs for control cables shall be provided with insulating sleeve and shall suit the type of terminals provided on the equipments. Cable lugs and ferrule shall conform to IS/DIN standards.	
3.08.00	Trefoil clamps	
3.08.01	Trefoil clamps for single core cables shall be pressure die cast aluminum or fibre glass or nylon and shall include necessary fixing accessories like G.I. nuts, bolts, washers, etc. Trefoil clamps shall have adequate mechanical strength, when installed at 1 mtr intervals, to withstand the forces generated by the peak value of maximum system short circuit current.	
3.09.00	Cable Clamps & Ties	
3.09.01	The cable clamps/ties required to clamp multicore cables shall be of SS-316 material, 12mm wide, polyester coated ladder lock type. The clamps/ties shall have self locking arrangement & shall have sufficient strength. The cable clamps/ties shall be supplied in finished individual pieces of suitable length to meet the site requirements.	
3.10.00	Receptacles	
3.10.01	Receptacles boxes shall be fabricated out of MS sheet of 2mm thickness and hot dipped gavanised or of die-cast aluminium alloy of thickness not less than 2.5 mm. The boxes shall be provided with two nos. earthing terminals, gasket to achieve IP55 degree of protection, terminal blocks for loop-in loop-out for cable of specified sizes, mounting brackets suitable for surface mounting on wall/column/structure, gland plate etc. The ON-OFF switch shall be rotary type heavy duty, double break, AC23 category, suitable for AC supply. Plug and Socket shall be shrouded Die-cast aluminium. Socket shall be provided with lid safety cover. Robust mechanical interlock shall be provided such that the switch can be put ON only when the plug is fully engaged and plug can be withdrawn only when the switch is in OFF position. Also cover can be opened only when the switch is in OFF position. Wiring shall be carried out with 1100 V grade PVC insulated stranded aluminium/copper wire of adequate size. The Terminal blocks shall be of 1100 V grade. The Terminal blocks shall be of 1100 V grade made up of unbreakable polymide 6.6 grade with adequate current rating and size. The welding receptacles shall be provided with inbuilt ELCB rated for suitable mA sensitivity ranging from 30-300 mA .	
3.11.00	Cable Drum Lifting Jack The jack for cable drum lifting shall be of screw type with 10 ton capacity. The cable drum jacks shall be manufactured from fabricated steel. The spindles supplied with the cable drum jack shall be manufactured using BSEN-24 grade steel bar with locking collars. Jack nests shall be of SG cast steel. Cable drum jack supplied shall have undergone load testing and reports for the same shall be submitted. At least Two Nos. of jacks shall be supplied for	
LOT-4A PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE	TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(1A)-2	SUB SECTION-II-E6 CABLING, EARTHING & LIGHTNING PROTECTION Page 7 of 69

CLAUSE NO.	TECHNICAL REQUIREMENTS		
	NTPC use. Contractor has to make arrangements for his own jacks for cable reeling/unreeling under his scope of installation.		
3.12.00	Galvanising		
3.12.01	Galvanising of steel components and accessories shall conform to IS:2629 , IS4759 & IS:2633. Additionally galvanising shall be uniform, clean smooth, continuous and free from acid spots.		
3.12.02	The amount of zinc deposit over threaded portion of bolts, nuts , screws and washers shall be as per IS:1367 . The removal of extra zinc on threaded portion of components shall be carefully done to ensure that the threads shall have the required zinc coating on them as specified		
3.13.00	Welding		
3.13.01	The welding shall be carried out in accordance with IS:9595. All welding procedures and welders qualification shall also be followed strictly in line with IS:9595		
4.00.00	INSTALLATION		
4.01.00	Cable tray and Support System Installation		
4.01.01	Cables shall run in cable trays mounted horizontally or vertically on cable tray support system which in turn shall be supported from floor, ceiling, overhead structures, trestles, pipe racks, trenches or other building structures.		
4.01.02	Horizontally running cable trays shall be clamped by bolting to cantilever arms and vertically running cable trays shall be bolted to main support channel by suitable bracket/clamps on both top and bottom side rails at an interval of 2000 mm in general. For vertical cable risers/shafts cable trays shall be supported at an interval of 1000mm in general. Fixing of cable trays to cantilever arms or main support channel by welding shall not be accepted. Cable tray installation shall generally be carried out as per the approved guidelines/ drawings. Vendor shall design the support system along with tray, spacing etc in line with tray loadings/drawings.		
4.01.03	The cantilever arms shall be positioned on the main support channel with a minimum vertical spacing of 300 mm unless otherwise indicated.		
4.01.04	The contractor shall fix the brackets/ clamps/ insert plates using anchor fasteners. Minimum size of anchor fasteners shall be M 8 X 50 and material shall be stainless steel grade 316 or better. Anchor fastener shall be fixed as recommended by manufacturer and as approved by site engineer. For brick wall suitable anchor fasteners shall be used as per the recommendations of manufacturer. Make of anchor fasteners subject to QA approval and the same shall be finalized at pre-award stage.		
4.01.05	All cable way sections shall have identification, designations as per cable way layout drawings and painted/stenciled at each end of cable way and where there is a branch connection to another cable way. Minimum height of letter shall be not less than 75 mm. For long lengths of trays, the identification shall be painted at every 10 meter. Risers shall additionally be painted/stenciled with identification numbers at every floor.		
4.01.06	In certain cases it may be necessary to site fabricate portions of trays, supports and other non standard bends where the normal prefabricated trays, supports and accessories may not be suitable. Fabricated sections of trays, supports and accessories to make the installation complete at site shall be neat in appearance and shall match with the		
LOT-1A PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(1A)-2	SUB SECTION-II-E6 CABLING, EARTHING & LIGHTNING PROTECTION
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CLAUSE NO.	TECHNICAL REQUIREMENTS												
	prefabricated sections in the dimensions. They shall be applied with one coat of red lead primer, one coat of oil primer followed by two finishing coats of aluminium paint.												
4.02.00	Conduits/Pipes/Ducts Installation												
4.02.01	The Contractor shall ensure for properly embedding conduit pipe sleeves wherever necessary for cabling work. All openings in the floor/roof/wall / cable tunnel/cable trenches made for conduit installation shall be sealed and made water proof by the Contractor.												
4.02.02	GI pull wire of adequate size shall be laid in all conduits before installation. Metallic conduit runs at termination shall have two lock nuts wherever required for junction boxes etc.												
4.02.03	Conduit runs/sleeves shall be provided with PVC bushings having round edge at each end. All conduits/pipes shall have their ends closed by caps until cables are pulled. After cables are pulled, the ends of conduits/pipes shall be sealed with Glass wool/Cement Mortar/Putty to prevent entrance of moisture and foreign material												
4.02.04	Exposed conduit/pipe shall be adequately supported by racks, clamps, straps or by other approved means. Conduits /pipe support shall be installed square and true to line and grade with an average spacing between the supports as given below, unless specified otherwise												
	<table><tr><th>Conduit /pipe size (dia).</th><th>Spacing</th></tr><tr><td>Upto 40 mm</td><td>1 M</td></tr><tr><td>50 mm</td><td>2.0 M</td></tr><tr><td>65-85 mm</td><td>2.5 M</td></tr><tr><td>100 mm and above</td><td>3.0 M</td></tr></table>	Conduit /pipe size (dia).	Spacing	Upto 40 mm	1 M	50 mm	2.0 M	65-85 mm	2.5 M	100 mm and above	3.0 M		
Conduit /pipe size (dia).	Spacing												
Upto 40 mm	1 M												
50 mm	2.0 M												
65-85 mm	2.5 M												
100 mm and above	3.0 M												
4.02.05	For bending of conduits, bending machine shall be arranged at site by the contractor to facilitate cold bending. The bends formed shall be smooth.												
4.03.00	Junction Boxes Installation												
4.03.01	Junction boxes shall be mounted at a height of 1200mm above floor level or as specified in the drawings and shall be adequately supported/mounted on masonry wall by means of anchor fasteners/ expandable bolts or shall be mounted on an angle, plate or other structural supports fixed to floor, wall, ceiling or equipment foundations												
4.04.00	Cable Installation												
4.04.01	Cable installation shall be carried out as per IS:1255 and other applicable standards.												
4.04.02	For Cable unloading, pulling etc following guidelines shall be followed in general:												
	a) Cable drums shall be unloaded, handled and stored in an approved manner on hard and well drained surface so that they may not sink. In no case shall be drum be stored flat i.e. with flange horizontal. Rolling of drums shall be avoided as far as possible. For short distances, the drums may be rolled provided they are rolled slowly and in proper direction as marked on the drum. In absence of any indication, the drums may be rolled in the same direction as it was rolled during taking up the cables. For unreeling the cable, the drum shall be mounted on suitable jacks or on cable wheels and shall be rolled slowly so that cable comes out over the drum and not from below. All possible care shall be taken during unreeling and laying to avoid damage due to twist, kink or sharp bends. Cable ends shall be provided with sealed plastic caps to prevent damage and ingress of moisture.												
LOT-1A PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-B BID DOC NO : CS-0011-109(1A)-2	SUB SECTION-II-E6 CABLING, EARTHING & LIGHTNING PROTECTION										
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4 HOLES 10mm DIA.

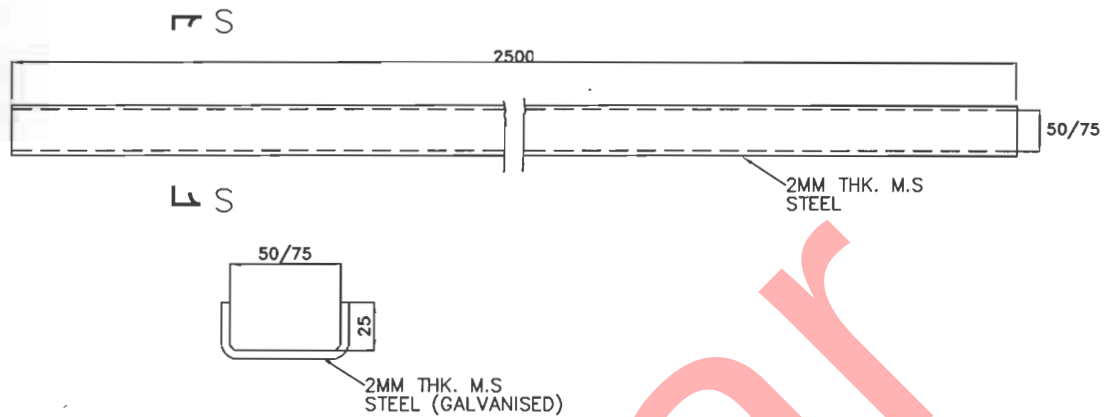
ARRANGEMENT OF
PERFORATIONS

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

PERFORATED TYPE TRAY

TYPICAL DETAILS OF CABLE TRAYS AND
ACCESSORIES

DWG. NO.



SECTION S-S

CABLE TROUGHS

SEE GENERAL NOTES IN SHEET 11.



TYPICAL DETAILS OF
CABLE TRAY AND ACCESSORIES

BHEL DRAWING NO.
PE-DG-427-507-E005

SH 10 OF 11

REV 00



3 X 660 MW NABINAGAR FGD
COMPRESSED AIR SYSTEM

SPECIFICATION No: PE-TS-457-555-A001

VOLUME: II B

SECTION : C-4

REV. 00

DATE: Dec., 19

SHEET: 1 OF 1

SECTION: C-4
TECHNICAL SPECIFICATION (C&I PORTION)

NTPC FGD PACKAGES-LOT-1A, 2 & 3

**C & I TECHNICAL SPECIFICATION
FOR COMPRESSED AIR SYSTEM**

INDEX

S. No.	DESCRIPTION
1	TITLE SHEET
2	INDEX SHEET
3	SPECIFIC TECHNICAL REQUIREMENTS (C&I)
4	INSTRUMENTS & VALVES SPECIFICATIONS
5	SIGNAL EXCHANGE BETWEEN DRIVES & DCS (DCP)
6	INSTRUMENT STUB DETAILS
7	QUALITY ASSURANCE FOR INSTRUMENTS
8	SUB VENDOR LIST
9	INSTRUMENT INSTALLATION DRAWING
10	CABLE INTERCONNECTION AND TERMINATION PHILOSOPHY
11	MANDATORY SPARE
12	CODES AND STANDARDS

	NTPC FGD PACKAGES- LOT-1A,2 & 3	
	C & I TECHNICAL SPECIFICATION FOR COMPRESSED AIR SYSTEM	

**SPECIFIC TECHNICAL
REQUIREMENTS (C&I)**



**NTPC FGD PACKAGES-
LOT-1A, 2 & 3**

**Specific Technical Requirement
For
Compressed Air System**

1. Complete C&I system for Compressed Air System is in bidder scope of supply. The Contractor shall provide complete Instrumentation for control, monitoring and operation of entire CAS.
2. Integrated microprocessor based control system along with suitable operator interface shall be provided for each Instrument Air Compressor, Service Air Compressor & their Dryers. All PT, DPT, TE, and other instruments inside & outside the compressor skid shall also be hooked-up to this system. Compressors connectivity to FGD DCS shall be provided for information and overall control. Soft signal exchange between the microprocessor to FGD DCS (FGD DCS in BHEL scope) shall be through Modbus on RS485 via twisted pair cable. In addition to the soft link, Critical signals exchange among the compressors shall be hardwired (START, STOP and LOAD & UNLOAD commands). The Dew point measurement from FGD DCS to all the compressors & their status feedbacks to FGD DCS shall also be provided. Bidder to furnish the configuration diagram of control system of compressor showing communication with FGD DCS along with the bid. Bidder to furnish signal exchange list between FGD DCS and compressed air system in BHEL format attached elsewhere.
3. Time synchronization of compressor microprocessor system with the DCS has to be done. Bidder to provide necessary hardware/software at their end.
4. All the Electronic Transmitter for Temperature, Pressure, Differential Pressure and DP based Flow /Level measurements shall be genuine, verifiable PROFIBUS PA 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.
5. The PROFIBUS 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 cost & delivery implication.
6. Junction boxes specially designed for PROFIBUS application shall be provided on as required basis. These SS JB's shall house field mounted PROFIBUS components. These SS JB's shall have suitable cover and gasket and shall have protection class of IP-66 or better. SS Cable glands and blind plugs shall be provided by the bidder.
7. All transmitters (except PROFIBUS PA compatible transmitters) shall be smart type and shall have 4-20mA DC signal with superimposed digital communication (HART).
8. The requirements given are to be read in conjunction with detailed Technical specification enclosed. 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/BHEL shall prevail without any cost & delivery implication.



**NTPC FGD PACKAGES-
LOT-1A, 2 & 3**

**Specific Technical Requirement
For
Compressed Air System**

9. The scope of C&I cable shall be referred in Electrical scope split sheet in Electrical portion of the specification.
10. Bidder to include all the instruments required for the package along with fittings, accessories and valve manifold. All instruments shall be provided with durable epoxy coating for housing and all exposed surfaces of the instruments.
11. Bidder to provide mandatory spares as per mandatory spares list mentioned elsewhere in the specification.
12. All Temperature sensors shall be Duplex type and temperature transmitter shall be provided for all temperature measurement applications. compensating cable, JB/rack & other erection hardware as required.
13. All the transmitters supplied by Bidder shall be rack mounted. The transmitter racks shall be in Bidder's scope of supply. All transmitters shall be suitably grouped together and mounted inside (i) Local Instruments Enclosures (LIEs) in case of open areas of the plant and (ii) In Local Instrument Racks (LIRs) in case of covered areas.
14. All field instruments enclosure shall be IP65 local panel/cabinet enclosure shall be IP 55, unless otherwise specified.
15. The solenoid operated valves shall have limit switches for open/close feedback. Solenoid valve shall be rated for 24 V DC only
16. The junction boxes for termination of instruments /actuator limit switches/solenoid valve limit switches etc. are in bidder's scope.
17. 230V AC Redundant UPS supply shall be provided by BHEL at a single point, further distribution to various instruments/equipment's of the CAS shall be in Bidder's scope. Bidder to include the necessary power distribution board in his scope. Any power supply other than the above, if required for any instrument/equipment has to be derived from the above supply & all the necessary hardware for the same shall be in Bidder's scope. Static Switch based Changeover scheme for redundant UPS Feeders shall be used by bidder. It shall be ensured that changeover time between feeders shall be such that that compressor Controller Failure shall not take place during changeover.
18. Bidder to furnish electrical/UPS load data during detailed engineering.
19. Power supply derived for Transmitters, contact interrogation, interposing relay and solenoid shall generally be ungrounded 24V D.C only. In all cases redundancy in power modules shall be considered.
20. Instrument installation and accessories required and same shall be in Bidder's scope and shall be subject to customer/BHEL approval during detailed engineering.



**NTPC FGD PACKAGES-
LOT-1A, 2 & 3**

**Specific Technical Requirement
For
Compressed Air System**

21. Bidder to provide erection hardware including junction boxes, canopies, structural steel as required.
22. The quantity of instruments for the system shall be as per tender P & ID wherever provided of the respective system as a minimum, for bidding purpose. However, Bidder shall also include in his proposal all the instruments and devices that are needed for the completeness of the plant auxiliary system/ equipment supplied by the bidder, even if the same is not specifically appearing in the P & ID. During detail engineering if any additional instruments are required for safe & reliable operation of plant and meeting redundancy requirement under technical specification subject to Employers approval, bidder shall supply the same without any cost & delivery implication.
23. For other critical binary and analog inputs required for protection and interlock purpose of other equipment (e.g. those interlocks which may result in loss of production, non-availability of a major equipment etc.), triple sensors shall be provided. For all control functions dual redundancy of the sensors shall be provided by the bidder.
24. Temperature elements, electronic transmitters etc. are to be provided for all the cases. Use of process actuated switches is acceptable only in the cases as indicated in the tender drawings.
25. Process connection & piping including, all impulse piping, pneumatic piping/tubing, valves, valve manifolds, fittings and all other accessories shall be provided on as required basis for proper installation & completeness of impulse piping system and air supply system,
26. All the DM water 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
27. The system shall be arranged so that the failure of any monitoring device or control components or spurious intermediate grounding in the signal path shall not open the signal loop nor cause the loss or malfunction of signal to other devices using the same signal.
28. To ensure availability, adequate redundancy in system design shall be provided at hardware, software and sensor level. For the protection system, independent sensing device shall be provided to ensure adequate safety of plant equipment.
29. The design of the control systems and related equipments shall adhere to the principle of 'Fail Safe' Operation wherever safety of personnel / plant equipment is involved and shall not cause a hazardous condition. However, it shall also be ensured that occurrence of false trips are avoided / minimized.



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**Specific Technical Requirement
For
Compressed Air System**

30. 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 performed by the bidder without any cost & delivery implication.
31. The equipment shall be of modern, compact design incorporating the latest developments in proven technology. All instruments whether for local indication or remote transmission shall be of good quality and shall have an accuracy and repeatability appropriate to their duty.
32. Bidder shall provide Cable Schedule in BHEL excel format which shall be provided during detailed engineering. Also, Cable Interconnections for Complete System shall be in Bidders' scope. DCS side details for hardwired signals shall be furnished by BHEL during detailed engineering.
33. The make/model of various instruments/items/systems shall be subject to approval of owner/purchaser during detailed engineering stage. No cost/time 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. In case of any contradiction most stringent clause/condition shall prevail without any cost & delivery implication.
34. Bidder's presence is required for 3 Man days (in one visit) at site during commissioning of DDCMIS for assistance related to process correctness. All the expenses like boarding, lodging and travel, Air fare etc. shall be in bidder's scope.
35. Typical hardwired scheme as provided shall be used by bidder for deciding signal interface between Microprocessor panel & MCC/DCS/Solenoid valve /Field instruments etc.
36. 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
37. Local control panel if any required for operation shall be in bidder scope.
38. All instruments should be supplied with valid calibration and test certificates provided by OEM.
39. Diaphragm seal shall be provided with instruments having contact with corrosive media. Double root valves shall be provided for all pressure tapings where the pressure exceeds 40 kg/cm².



**NTPC FGD PACKAGES-
LOT-1A, 2 & 3**

**Specific Technical Requirement
For
Compressed Air System**

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. For instruments which are not located inside covered building, suitable canopy/ protective arrangement shall be provided which shall be approved during detail engineering.
42. Number of pair to be selected for screen control cable (size : 0.5 mm²)
F-type: 2P/4P/8P/12P
G-type: 2P/4P/8P/12P
43. Instrument installation and accessories required shall be in Bidder's scope. Vendor submitted 'Instrument Installation Diagram' shall be subject to customer approval during detail engineering without any cost & delivery implication. For instruments for which Installation Diagram is not attached, vendor's Installation Diagram for such items will also be subject to customer approval during detail engineering without any cost & delivery implication.

Note:

1. All equipment items shall be of latest design with proven on track record.
2. The above given scope is indicative & minimum. Any item/ equipment not indicated above however required for the completeness of the system is to be supplied by bidder without any cost & delivery implication to BHEL.
3. Documents of C&I System shall be submitted to end user/owner for approval during detail engineering. Changes, if any, shall be accommodated by the bidder without any cost & delivery implication.



SPECIFICATION FOR CONTROL & INSTRUMENTATION FOR AUX PACKAGES

SPECIFICATION NO.:

VOLUME

SUB SECTION

REV. NO.

DATE :

SHEET

OF

GENERAL REQUIREMENT

- 1.0 Bidder shall provide complete and independent control & instrumentation system with all accessories, auxiliaries and associated equipments for the safe, efficient and reliable operation of auxiliary systems.
- 2.0 The quantity of instruments for auxiliary system shall be as per tender P & ID wherever provided of the respective system as a minimum, for bidding purpose. However, Bidder shall also include in his proposal all the instruments and devices that are needed for the completeness of the plant auxiliary system/ equipment supplied by the bidder, even if the same is not specifically appearing in the P & ID. During detail engineering if any additional instruments are required for safe & reliable operation of plant, bidder shall supply the same without any price implication.
- 3.0 Measuring instruments/equipment and subsystems offered by the bidder shall be from reputed experienced manufacturers of specified type and range of equipment, whose guaranteed and trouble free operation has been proven. Further all the instruments shall be of proven reliability, accuracy, and acceptable international standards and shall be subject to employer's approval. All instrumentation equipment and accessories under this specification shall be furnished as per technical specification, ranges, makes/ numbers as approved by the employer' during detail engineering.
- 4.0 The necessary root valves, impulse piping, drain cocks, gauge-zeroing cocks, valve manifold and all the other accessories required for mounting/ erection of these local instruments shall be furnished, even if not specifically asked for, on as required basis. The contacts of equipment mounted instruments; sensors, switches etc for external connection including spare contacts shall be wired out to suitably located junction boxes.
- 5.0 The customer specification attached as Specific Technical Requirement will supercede the Data sheets, if there is any mismatch.

	NTPC FGD PACKAGES- LOT-1A, 2 & 3	
	C & I TECHNICAL SPECIFICATION FOR COMPRESSED AIR SYSTEM	

INSTRUMENTS & VALVES SPECIFICATIONS

CLAUSE NO.	TECHNICAL REQUIREMENTS	Annexure-III C	एनटीपीसी NTPC
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. 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 coating for housings and all exposed surfaces of the instruments.		
1.07.00	The instruments, for which technical specification is not attached, shall be supplied as per the standard and proven practice of the contractor. The same shall be established by the contractor during detailed engineering by providing detailed explanation/concepts, if required by the employer, of such implementation along with standard documentation.		

CLAUSE NO.	TECHNICAL REQUIREMENTS 	
3.05.00	10. Electrical Connection Plug and socket type except in hazardous area 11. Process connection 1/2 inch NPT (F) 12. Span and Zero Continuous, tamper proof, Remote as well as manual adjustability from instrument with zero suppression and elevation facility. 13. Accessories -Diaphragm seal, pulsation dampeners, syphon etc. as required by service and operating condition. Diagnostics and Display Self-Indicating feature and digital display 14. Accessories 2 valve manifold for absolute & Gauge pressure transmitters, 3-valve manifold for Differential Pressure and 5 valve manifold for Level /Flow applications. The valve manifold shall be non integral type (except Fuel Oil area). -For hazardous area, enclosure as described in NEC article 500 -2 inch pipe for mounting with Enclosure /Rack/Canopy 15. Certification SIL 2 or Better 16. Adjustment/calibration/maintenance From hand held HART calibrator Notes LVDT type is not acceptable. For primary air/ secondary air/flue gas applications, DP type transmitters shall be provided for pressure measurement below range of 2000 mmwc 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.	
	TEMPERATURE TRANSMITTER (TT) Following specifications are applicable for Dual input/ Single input temperature transmitter. Temperature transmitter shall be 2-wire (loop powered) directly powered from 4-20mA input cards of DDCMIS. TT shall be fully compatible with thermocouples and RTDs being	

CLAUSE NO.	TECHNICAL REQUIREMENTS		
	provided by the contractor. Temperature compensation for thermocouples shall be performed in the temperature transmitter itself.		
	S No.	Features	Essential/Minimum Requirements
	1.	Output	2-wire (power supply from input card of control system) with 4-20mA output with superimposed HART protocol signal
	2.	Input	Same transmitter shall be capable to handle Pt-100 RTD, Thermocouples –K, R & ,S types (Selectable through HART terminal/calibrator)
		Isolation	Min 500 VAC
		EMC compatibility	As per EN 61326
		Power supply	24 V C +/- 10%
	3.	Housing	Weather proof as per IP-67, metallic housing with durable corrosion resistant coating
	4.	Electrical connection	Plug and Socket connector except hazardous area
	5.	Diagnostics display	& Self-Indicating feature and digital display on transmitter
	6.	Operating Ambient temperature	85 deg C without display. 70 deg C with display.
	7.	Mounting	2 inch pipe mounting with Canopy.
	8.	Accessories	As required by service and operating condition.
	9.	Composite Accuracy	(Refer note 2) RTD =<0.25% of 0-250 deg C span T/C-K type =<0.2% of 0-600 deg C span CJC accuracy (for thermocouples) shall be =< 1 deg C
	Notes:		
	1. In case of failure (open or burn-out) of RTD/thermocouple, transmitter shall provide low temperature output.		
	2. 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.		
	3. 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		

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	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. All such accuracy/ temperature effect figures in catalogue shall be first converted to deg C, and then percentage of this converted accuracy in specified span shall be calculated to compare with the specified composite accuracy figures. All temperature transmitters shall be interchangeable (i.e. can be used for either RTD or thermocouple) and composite accuracy shall be met for each type of input as specified above. 4. Above mentioned parameters/features of offered models shall be strictly as defined in standard published catalogue of the manufacturer only. 5. Dual input temperature transmitters can also be accepted in place of single input TT.			
15.00.00	Vibration Monitoring System The Vibration Monitoring System shall be furnished on a system basis including, vibration transducers, phase marker sensor with low noise flexible cables in flexible conduit, terminated in local terminal boxes, necessary pre-amplifier/electronics mounted in local weather proof boxes, vibration monitors, mounting racks and cabinets etc. The vibration monitoring system shall include all power supplies, interconnecting cabling, calibration equipment, indicators, integrating units, signal conditioning devices and all other accessories, erection hardware required for monitoring of Vibration at each point. The contractor shall provide the vibration pads. Contractor can offer up to Four Channel Vibration monitors. The allocation of channels shall be such that loss of one monitor shall not affect more than one side of the bearing of one machine. In the case of more than two channel Vibration monitors being provided by the Contractor, then one spare monitor shall be provided mounted in the panel to take care of immediate replacement of any failed monitors. Offered vibration monitors shall be modular in construction, plug in type. Eddy current / piezoelectric type transducers shall be used. The sensors shall be either proximity or velocity or accelerometer type. However, the finally selected sensor type shall also depend on recommendation of the equipment manufacturer & suitable for application requirement which shall be finalised during detail engineering and without any extra price. Transducers shall be furnished in weatherproof housing suitable for field conditions. Cables/cabling from transducers local JB to Vibration Monitoring system in Control Room/Control Equipment Room shall be provided by the Contractor. Vibration monitoring system shall give one no. buffered output of 4-20 mA DC and two no. of buffered raw signal for each point monitored and one no. of buffered raw signal for each phase marker sensor. The 4-20mA signal shall be suitable for use as an input to DDCMIS, linear in proportion to vibration velocity or displacement. Raw buffered signal(s) shall be suitable for archiving and analysis. Monitor shall provide vibration indication calibrated in velocity units along with provisions of changing to displacement unit (field-programmable) for each measurement point in both horizontal & vertical planes. The generation of alarm and trip signals is not envisaged in vibration monitoring system, the same shall be derived in DDCMIS. However in case of vibration initiated protection of equipments, OEM standard and proven practices shall also be considered.			
LOT-1B PROJECTS, FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE		TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS-0011-109(1B)-9	PART-B SUB-SECTION-III-C2 MEASURING INSTRUMENTS	PAGE 4 OF 8