Manufacturer's Name & Address

P.O. No.

STANDARD QUALITY PLAN

Item : Self Cleaning Strainer

Vendor Q.P. NO.

PACKAGE : SELF CLEANING STRAINER

Date :

Page 02 of 12

BHEL Doc No.: PE-V4-XXX-165-N08

PROJECT:

CUSTOMER:

PURCHASER:

CONSULTANT:

Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record		Agency M	Agency C	Agency O	Remarks
1	2	3	4	5	6	7	8	9		**	10		11
1.0.0	SELF CLEANING STRAINER												
1.1.0	Raw Material												
[a]	Housing Shell, Nozzle flanges & Main flanges/Counter Flange	Chemical properties	Major	Chemical Analysis	One sample/cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / lab test report / raw material flow sheet	*	P	V	V	All raw material identification as per manufacturer TC/Lab report by BHEL
		Physical properties	Major	Physical test	One sample/cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / lab test report / raw material flow sheet	*	P	V	V	
		Surface Defects	Minor	Visual	100%	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate /Inspection Report	-	P	V	V	
		Sub Surface Defects	Major	Ultrasonic Test	100%	ASME A 435/A809	ASME A 435/A809	Inspection report	*	P	V	V	Plates > 20mm Thk only
[b]	Nozzle Pipes	Chemical properties	Major	Chemical Analysis	One sample/cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / lab test report / raw material flow sheet	*	P	V	V	
		Physical properties	Major	Physical test	One sample/cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / lab test report / raw material flow sheet	*	P	V	V	
		Surface defects	Minor	Visual	100%	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate /Inspection Report	-	P	V	V	
		Leak tightness	Major	Hydrostatic test	100%	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate /Inspection Report	-	P	V	V	
[c]	Screen basket, Nozzle flanges	Chemical properties	Major	Chemical Analysis	One sample/cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / lab test report / raw material flow sheet	*	P	V	V	
		Physical properties	Major	Physical test	One sample/cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / lab test report / raw material flow sheet	*	P	V	V	
		Surface Defects	Minor	Visual	100%	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate /Inspection Report	-	P	V	V	
		Sub-surface defects	Major	Ultrasonic test	100%	ASME A 745	ASME A 745	Inspection report	*	P	V	V	Plates > 20mm Thk only (UT full volume)
		Corrosion Resistance	Major	IGCI	One/Heat	ASTM A 262	Practice E of ASTM A 262	Test Report	*	P	V	V	

LEGEND

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Indicate : "P" - Perform, "W" - Witness and "V" - Verification

Manufacturer / Sub-Contractor	Contractor	Name & Sign. Of approving authority & Seal
Signature		

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		Manufacturer's Name & Address			STANDARD QUALITY PLAN				BHEL Doc No.: PE-V4-XXX-165-N08				
					Item :		Vendor Q.P. NO.		PROJECT:				
					Self Cleaning Strainer		PACKAGE : SELF CLEANING STRAINER		CUSTOMER:				
		P.O. No.					Date :		PURCHASER:				
							Page 03 of 12		CONSULTANT:				
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record		Agency			Remarks
										M	C	O	
1	2	3	4	5	6	7	8	9		**	10		11
(d)	Nozzle Pipes	Chemical properties	Major	Chemical Analysis	One sample/cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / lab test report / raw material flow sheet	*	P	V	V	
		Physical properties	Major	Physical test	One sample/cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate / lab test report / raw material flow sheet	*	P	V	V	
		Surface defects	Minor	Visual	100%	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate/ Inspection Report	-	P	V	V	
		Leak tightness	Major	Hydrostatic test	100%	Approved drg/Data sheet	Approved drg/Data sheet	Mill Test Certificate/ Inspection Report	-	P	V	V	
1.2.0	Inprocess Quality Control												
1.2.1	Welding procedure specification	Correctness	Critical	Scrutiny	100%	ASME Sec. IX	ASME Sec. IX	QW 482 of ASME Sec.IX	-	P	V	V	Welders already qualified by BHEL/ LRQA / NTPC in the past shall be employed for this job.
1.2.2	Welding procedure qualification	Weld soundness	Critical	Physical test	100%	ASME Sec. IX	ASME Sec. IX	QW 483 of ASME Sec.IX	-	P	V	V	Welding procedure already approved by BHEL/ LRQA / NTPC shall be followed.
1.2.3	Welder performance qualification	Weld soundness	Critical	Physical test	100%	ASME Sec. IX	ASME Sec. IX	QW 484 of ASME Sec.IX	-	P	V	V	Welders already qualified by BHEL/ LRQA / NTPC shall be employed for this job.
1.2.4	Fit-up of butt weld	Alignment and dimensions	Major	Template, visual	100%	Manufacturing Drawng	ASME Sec.VIII Div. I	Log book	-	P	V	-	BHEL to witness >20mm thick butt joint.
1.2.5	Fit-up of shell flange and nozzle assembly to shell	Orientation,alignment and dimensions	Major	Template, visual	100%	Manufacturing Drawng	ASME Sec.VIII Div. I	Log book	-	P	-	-	
1.2.6	Weld quality for Pressure Parts												
	(a) Root run	Surface defects	Major	Penetrant test / Visual	100%	ASME Sec.VIII Div. I / sec V	ASME Sec.VIII Div. I Appendix 8	Operation Process Sheet		P	--	--	
1.2.7	(a) Completed butt welds	1.Surface defects	Major	Penetrant test	100%	ASME Sec.VIII Div. I / sec V	ASME Sec.VIII Div. I Appendix 8	Inspection report	*	P	V	V	
		2.Sub-surface defects	Critical	Radiography test	10% of total weld length+ 100% T Joints,	ASME Sec.VIII Div. I / sec V	ASME Sec.VIII Div. I Appendix 4 / UW 52	Radiographs and inspection report	*	P	V	V	RT films will be reviewed by BHEL
	(b) Completed fillet welds	Surface defects	Major	Penetrant test	100%	ASME Sec.VIII Div. I / sec V	ASME Sec.VIII Div. I Appendix 8	Inspection report	*	P	V	V	

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Manufacturer / Sub-Contractor	Contractor	Name & Sign. Of approving authority & Seal
Signature		

	BHEL	Manufacturer's Name & Address			STANDARD QUALITY PLAN				BHEL Doc No.: PE-V4-XXX-165-N08					
					Item :		Vendor Q.P. NO.		PROJECT:					
					Self Cleaning Strainer		PACKAGE : SELF CLEANING STRAINER		CUSTOMER:					
		P.O. No.					Date :		PURCHASER:					
							Page 04 of 12		CONSULTANT:					
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record		Agency			Remarks
										M	C	O	
1	2	3	4	5	6	7	8	9		**	10		11
1.2.8	Pickling and Passivation	Protection Layer	Major	Visual	100%	IS : 10117	IS : 10117	Log Book	--	P	-	-	
1.2.9	Fabricated Shell (Prior to sand blasting)	1.Dimensions, Orientation	Major	Measurement by visual	100%	Manufacturing Drawing	Manufacturing Drawing	Inspection report	*	P	V	V	
		2. Hydro test	Critical	Hydrostatic Pr. @ 1.5 times of design pr.(positive) [Duration 30 minutes]	100%	ASME Sec.VIII Div.1	ASME Sec.VIII Div.1	Inspection report	*	P	V	V	
1.3.0	Final tests (completed equipments) - After assembly	1.Dimensions, orientation, workmanship & finish	Major	Measurement by visual	100%	G.A.drawing	G.A.drawing	Inspection report	*	P	V	V	
		2. Leak tightness for assembly	Critical	Leak test @ design pr.(positive) [Duration 30 minutes]	100%	ASME Sec.VIII Div.1	No leakage	Inspection report	*	P	W	V	
		3.Dry function test for Debris filter	Critical	Operational test	100%	Approved Procedure	Approved Procedure	Inspection report	*	P	W	V	
1.4.0	Rubber Lining (Shell)												
1.4.1	Rubber Formulation	Tensile, elongation & hardness	Major	Physical test	One per lot	Manufacturer's procedure	BS 6374/Equivalent	Manufacturers Test certificate	*	P	V	V	
		Polymer Identification	Major	Flame test	One per lot	For Semi Ebonite /Ebonite Polymer catches fire and on removal from fire continues to burn	For Semi Ebonite /Ebonite Polymer catches fire and on removal from fire continues to burn	Inspection report		P	V	V	
		% Change in weight after 24 hours of immersion in sea water at 70°	Major	Immersion test (bleeding test)	One per lot	ASTM D 471	+/- 1%	Inspection report		P	V	V	
1.4.2	Surface preparation of items to be lined	Free from rust, scale,dust & grease	Major	Visual	100%	SA 2.5	SA 2.5	Manufacturers internal inspection report		P	-	-	
1.4.3	Vulcanising	Temperature, Pressure & Time	Major	Process monitoring	100%	Manufacturer's procedure	Manufacturer Procedure	Process Procedure		P	-	-	
1.4.4	Vulcanised Rubber Lined Items	(a) Chip test	Major	Chip test	One per lot	Approved Drawing & BS 6374/Equivalent	BS 6374/Equivalent	Inspection report	*	P	V	V	
		(b) Adhesion, Visual defects, Thickness & Hardness	Major	Measurement, Visual inspection	100% visual, Thickness/ hardness at random	Approved Drawing & BS 6374/Equivalent	BS 6374/Equivalent	Inspection report	*	P	V	V	
		(c) Spark test for Pin Holes at 5 kv/mm	Major	Spark test for Pin Holes	100%	Approved Drawing & BS 6374/Equivalent	BS 6374/Equivalent	Inspection report	*	P	V	V	

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Manufacturer / Sub-Contractor Signature | Contractor | Name & Sign. Of approving authority & Seal

	Manufacturer's Name & Address				STANDARD QUALITY PLAN				BHEL Doc No.: PE-V4-XXX-165-N08				
					Item :		Vendor Q.P. NO.		PROJECT:				
					Ball Valves		PACKAGE : SELF CLEANING STRAINER		CUSTOMER:				
	P.O. No.						Date :		PURCHASER:				
							Page 05 of 12		CONSULTANT:				
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record		Agency			Remarks
										M	C	O	
1	2	3	4	5	6	7	8	9		10			11
2.0.0	Ball valves												
2.1.0	Materials												
	Body and Tail end pieces	Chemical properties	Major	Chemical properties	One Sample/Cast / heat	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's T.C.	*	P	V	V	
		Physical properties	Major	Physical properties	One Sample/Cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's T.C.	*	P	V	V	
2.1.1	Ball	Chemical properties	Major	Chemical properties	One Sample/Cast / heat	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's T.C.	*	P	V	V	
		Physical properties	Major	Physical properties	One Sample/Cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's T.C.	*	P	V	V	
2.1.2	Stem	Chemical properties	Major	Chemical properties	One Sample/Cast / heat	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's T.C.	*	P	V	V	
		Physical properties	Major	Physical properties	One Sample/Cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's T.C.	*	P	V	V	
2.2.0	In-process inspection												
2.2.1	Ball	Hardness	Major	Hardness Testing	Random	Approved Drg. / Data Sheet	Approved Drg. / Data Sheet	Manufacturers TC	*	P	V	V	
2.3.0	Assembly	a) Dimensions	Major	Measurement	100%	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's T.C.	*	P	V	V	
		b) Opening / Closing	Major	Operation	100%	---	As per approved data sheet	---		P	-	V	
2.4.0	Testing												
	[a] Body	Leakage	Critical	Hydraulic test	100%	EN 12266-1&2	EN 12266-1&2 / Appd. Data sheet	Manufacturer's T.C.	*	P	V	V	
	[b] Seat test	Leakage	Critical	Hydraulic test	100%	EN 12266-1&2	EN 12266-1&2 / Appd. Data sheet	Manufacturer's T.C.	*	P	V	V	
	[c] Seat	Leakage	Critical	Air test	100%	EN 12266-1&2	EN 12266-1&2 / Appd. Data sheet	Manufacturer's T.C.	*	P	V	V	

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Manufacturer / Sub-Contractor	Contractor	Name & Sign. Of approving authority & Seal
Signature		

		Manufacturer's Name & Address			STANDARD QUALITY PLAN				BHEL Doc No.: PE-V4-XXX-165-N08				
					Item :		Vendor Q.P. NO.		PROJECT:				
					Self Cleaning Strainer		PACKAGE : SELF CLEANING STRAINER		CUSTOMER:				
		P.O. No.					Date :		PURCHASER:				
							Page 06 of 12		CONSULTANT:				
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record		Agency			Remarks
										M	C	O	
1	2	3	4	5	6	7	8	9		**	10		11
3.0.0	Butterfly valves												
3.1.0	Materials												
	Body and Disc	Chemical properties	Major	Chemical properties	One Sample/Cast / heat	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's T.C.	*	P	V	V	
		Physical properties	Major	Physical properties	One Sample/Cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's T.C.	*	P	V	V	
3.1.1	Shaft	Chemical properties	Major	Chemical properties	One Sample/Cast / heat	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's T.C.	*	P	V	V	
		Physical properties	Major	Physical properties	One Sample/Cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's T.C.	*	P	V	V	
3.1.2	Seat	-	Major	-	One Sample/Cast / heat	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's T.C.	*	P	V	V	
3.1.3	Stem	Chemical properties	Major	Chemical properties	One Sample/Cast / heat	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's T.C.	*	P	V	V	
		Physical properties	Major	Physical properties	One Sample/Cast / heat / batch	Approved drg/Data sheet	Approved drg/Data sheet	Manufacturer's T.C.	*	P	V	V	
3.2.0	Assembly	a) Dimensions	Major	Measurement	100%	EN ISO 17292/Appd data sheet	EN ISO 17292/Appd data sheet	Manufacturer's T.C.	*	P	V	V	
		b) Opening / Closing	Major	Operation	100%	---	As per approved data sheet	---	*	P	-	-	
3.3.0	Testing												
	[a] Body	Leakage	Critical	Hydraulic test	100%	EN 12266-1&2/API598	EN 12266-1&2/API 598 & Appd. Data sheet	Manufacturer's T.C.	*	P	V	V	
	[b] Seat test	Leakage	Critical	Hydraulic test	100%	EN 12266-1&2/API598	EN 12266-1&2/API 598 & Appd. Data sheet	Manufacturer's T.C.	*	P	V	V	
	[c] Seat	Leakage	Critical	Air test	100%	EN 12266-1&2/API598	EN 12266-1&2/API 598 & Appd. Data sheet	Manufacturer's T.C.	*	P	V	V	

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Signature		

Manufacturer's Name & Address	Manufacturing Quality Plan	BHEL Doc No.: PE-V4-XXX-165-N08
	Vendor Q.P. NO.	PROJECT:
	Item : Pressure Gauge, DP Gauge, DP switch&DP Transmitter — PACKAGE : SELF CLEANING STRAINER	CUSTOMER:
P.O. No.	Date :	PURCHASER:
	Page 07 of 12	CONSULTANT:

Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record		Agency M	Agency C	Agency O	Remarks
1	2	3	4	5	6	7	8	9		**	10		11
4.0.0	In process quality control	Make, Range and Model	Critical	Visual	100%	Approved Data Sheet	Approved Data Sheet	Manufacturer test certificate	*	P	V	V	
		Calibration	Critical	Calibration test	100%	Approved Data Sheet	Approved Data Sheet	Manufacturer test certificate	*	V	V	V	
		Degree of protection	Critical	–	Type test certificate	Approved Data Sheet	Approved Data Sheet	Manufacturer test certificate	*	V	V	V	

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Manufacturer / Sub-Contractor	Contractor	Name & Sign. Of approving authority & Seal
Signature		

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Manufacturer's Name & Address

P.O. No.

Manufacturing Quality Plan

Item : Geared Motor drive & Worm planetary Gear box

Vendor Q.P. NO.
PACKAGE : SELF CLEANING STRAINER
Date :
Page 08 of 12

BHEL Doc No.: PE-V4-XXX-165-N08
PROJECT:
CUSTOMER:
PURCHASER:
CONSULTANT:

Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record		Agency M	Agency C	Agency O	Remarks
1	2	3	4	5	6	7	8	9		**	10		11
5.0.0	GEARED MOTOR DRIVE	Running Test	Critical	Functional Test	100%	Approved Data Sheet	Approved Data Sheet	Manufacturer's compliance certificate	*	P	V	V	
		No load	Critical	Functional test	100%	Approved Data Sheet	Approved Data Sheet		*	P	V	V	
		Noise test	Critical	Functional test	100%	Approved Data Sheet	Approved Data Sheet		*	P	V	V	
		Oil leakage test	Critical	Functional test	100%	Approved Data Sheet	Approved Data Sheet		*	P	V	V	
		Visual	Critical	-	100%	Approved Data Sheet	Approved Data Sheet		*	P	V	V	
		Name plate verification	Critical	-	100%	Approved Data Sheet	Approved Data Sheet		*	P	V	V	
5.1.0	Complete Unit of planetary gear	No Leak Test	Critical	Functional test	One Sample/lot	Approved Data Sheet	Supplier Catalogue	Manufacturer's compliance certificate	*	P	V	V	
		Noise Level	Minor	Functional test	One Sample/lot	Approved Data Sheet	Approved Data Sheet			P	V	V	
		Visual Name plate Verification	Minor	-	100%	Approved Data Sheet	Approved Data Sheet			P	V	V	

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Manufacturer / Sub-Contractor	Contractor
Signature	

Name & Sign. Of approving authority & Seal

44

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Manufacturer's Name & Address	Manufacturing Quality Plan		BHEL Doc No.: PE-V4-XXX-165-N08
	Item : Actuators	Vendor Q.P. NO.	PROJECT:
		PACKAGE : SELF CLEANING STRAINER	CUSTOMER:
P.O. No.		Date :	PURCHASER:
		Page 09 of 12	CONSULTANT:

Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	*	Agency M	Agency C	Agency O	Remarks
1	2	3	4	5	6	7	8	9	**	10			11
6.0.0	Actuators	Functional test	Major	Electrical test	100%	Supplier catalogue/Appd data sheet	Supplier catalogue/Appd data sheet	Test certificate	*	P	V	V	
		Make, Range, Model	Major	Visual	100%	Supplier catalogue/Appd data sheet	Supplier catalogue/Appd data sheet	Inspection Report	-	P	-	-	
		Assembly check alongwith valves	Major	Visual	100%	Supplier catalogue/Appd data sheet	Supplier catalogue/Appd data sheet	Inspection Report	-	P	-	-	
		Functional Check along with settings / Auxiliary Ceontacts	Major	Visual	100%	Supplier catalogue	Supplier catalogue/Appd data sheet	Inspection Report	-	P	-	-	Review of TC's

LEGEND

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Manufacturer / Sub-Contractor	Contractor	Name & Sign. Of approving authority & Seal
Signature		

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		Manufacturer's Name & Address			Manufacturing Quality Plan				BHEL Doc No.: PE-V4-XXX-165-N08				
					Item : Starter Panel		Vendor Q.P. NO.		PROJECT:				
		P.O. No.					PACKAGE : SELF CLEANING STRAINER		CUSTOMER:				
							Date :		PURCHASER:				
							Page 10 of 12		CONSULTANT:				
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record		Agency			Remarks
										M	C	O	
1	2	3	4	5	6	7	8	9		**	10		11
7.0.0	**Starter panel**												
7.1.0	**Incoming Material**												
7.1.1	Fabricated & Painted Panel	Dimension	Major	Measurement	100%	Approved Drgs.	Approved Drgs.	Inspection report	-	P	--	--	7 Tank treatment before painting
		Panel G.A.	Major	Measurement	100%	Approved Drgs.	Approved Drgs.	Inspection report	-	P	--	--	
		Paint colour	Major	Visual	100%	Approved Drgs.	Approved Drgs.	Inspection report	-	P	--	--	
		Paint thickness	Major	Measurement	100%	Approved Drgs.	Approved Drgs.	Inspection report	-	P	--	--	
		Paint Shade, Adhesion	Major	Visual	Sample	Approved Drgs.	Approved Drgs.	Inspection report	-	P	--	--	
7.1.2	Wire	Size / Colour / Rating / Surface Defects	Major	Visual / Dimension	Sample	IS 694	Specification / drawings	Inspection report	-	P	--	--	ISI Marked wire
7.1.3	Panel Mounting	Make, Functional, Type & Rating	Major	Visual / Electrical	100%	Approved BOM	Approved BOM	---		P	V	V	For bolt list refer starter panel document Part - II
7.2.0	**In Process Inspection**												
7.2.1	Name Plate, Component Mounting, Etc.	Workmanship, Finish, Correctness	Major	Visual	100%	Approved Drgs.	Approved drawings	Inspection report	-	P	--	--	
7.2.2	Electrical Wiring of Panels	Continuity, Colour of wires, Bunching and Grouping	Major	Visual	100%	Mounting Drawing	Approved drawings	Inspection report	-	P	--	--	
7.2.3	Ferruling of Cables	Start & End	Major	Visual	100%	Manufacturer's drawing	Manufacturer's drawing	Inspection report	-	P	--	--	
7.3.0	**Final Inspection**									P	--	--	
7.3.1	Workmanship, Finish & Paint shade / Thickness	Visual	Major	Visual	100%	G.A Drawing	Approved drgs.	Inspection report	*	P	W	V	
7.3.2	Overall Dimension, G.A of starter panel	Measurement	Major	Visual	100%	G.A Drawing	Approved drgs.	Test Certificate	-	P	W	V	
7.3.3	Component Identification	Visual	Major	Visual	100%	G.A Drawing	Approved drgs.	Inspection report	-	P	W	V	
7.3.4	IR - HV - IR	Electrical	Critical	Electrical	100%	Mfg.Procedure	Mfg. Pocedure	Inspection report	-	P	W	V	
7.3.5	Functional & Continuity	Functional	Major	Functional	100%	Appd Drawing	Appd Drawing	Inspection report	*	P	W	V	

LEGEND

* Records identified with "STAR" shall be essentially included by contractor in QA Documentation.

** M : Manufacturer/ Sub-contractor

C : CONTRACTOR O: OWNER

Indicate : "P" - Perform, "W" - Witness and "V" - Verification

Manufacturer / Sub-Contractor Signature	Contractor	Name & Sign. Of approving authority & Seal

		Manufacturer's Name & Address			Manufacturing Quality Plan				BHEL Doc No.: PE-V4-XXX-165-N08				
					Item : Fasteners		Vendor Q.P. NO.		PROJECT:				
							PACKAGE : SELF CLEANING STRAINER		CUSTOMER:				
		P.O. No.					Date :		PURCHASER:				
							Page 11 of 12		CONSULTANT:				
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record		Agency			Remarks
										M	C	O	
1	2	3	4	5	6	7	8	9		** 10			11
8.1.0	**Internal Fasteners - SS**												
8.1.1	Stainless Steel Fasteners	Chemical properties	Major	Chemical analysis	1 Per heat/HT Batch	Approved Drawing	Approved Drawing	Test certificate/Compliance certificate	--	P	V	V	
		Physical properties	Major	Physical test	1 per heat	Approved Drawing	Approved Drawing	Test certificate/Compliance certificate	--	P	V	V	
		Visual and Workmanship finish	Major	Visual	Sample	Approved Drawing	Approved Drawing	Inspection report	--	P	V	V	
		Dimensions	Major	Measurement	Sample	Approved Drawing	Approved Drawing	Inspection report	--	P	V	V	
8.2.0	Carbon steel fasteners	Visual	Major	Visual	Sample	Approved Drawing	Approved Drawing	Manufacturer's certificate / Lab Report	--	P	V	V	
		Dimensions	Major	Measurement	Sample	Approved Drawing	Approved Drawing	Manufacturer's certificate / Lab Report	--	P	V	V	
		Physical properties	--	Physical test	1 sample per heat	IS : 1367	IS : 1367	Manufacturer's certificate / Lab Report	--	P	V	V	
				a) Tensile									
				b) Yield									
				c) Elongation									
				d) Proof load									

LEGEND

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** M : Manufacturer/ Sub-contractor C : CONTRACTOR O: OWNER

Indicate : "P" - Perform, "W" - Witness and "V" - Verification

Manufacturer / Sub-Contractor Signature	Contractor	Name & Sign. Of approving authority & Seal

	Manufacturer's Name & Address	Manufacturing Quality Plan		BHEL Doc No.: PE-V4-XXX-165-N08
		Item : All components / Equipments	Vendor Q.P. NO.	PROJECT:
			PACKAGE : SELF CLEANING STRAINER	CUSTOMER:
	P.O. No.		Date :	PURCHASER:
			Page 12 of 12	CONSULTANT:

Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	Agency M	Agency C	Agency O	Remarks
1	2	3	4	5	6	7	8	9	**	10		11
9.0.0	All Components / Equipments	Painting Dry film thickness and	Major	Measurement	Random	Painting schedule	Painting schedule	Inspection report	P	V	V	
		Packing	Major	Measurement	100%	Packing Procedure	Packing Procedure	Inspection report	P	-	-	

LEGEND
* Records identified with "STAR" shall be essentially included by contractor in QA Documentation.
** M : Manufacturer/ Sub-contractor
C : CONTRACTOR O: OWNER
Indicate : "P" - Perform, "W" - Witness and "V" - Verification

Manufacturer / Sub-Contractor	Contractor	
Signature		Name & Sign. Of approving authority & Seal

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SECTION D2

STANDARD TECHNICAL SPECIFICATION FOR ELECTRICAL SYSTEMS

CLAUSE NO.	LT SWITCHGEAR (Starter Panel).	
1.00.00	CODES AND STANDARDS	
	IEC 947, IS 13947	
2.00.00	TYPE	
	Circuit Breakers	Shall be air break, three pole, spring charged, horizontal drawout type, suitable for electrical operation.
	Switchgear	Fully drawout type single front
	MCC	Fully drawout type single front/Double front.
	ACDB/DCDB	Fixed type single front
3.00.00	SYSTEM PARAMETERS	
	415VAC +/- 10 % (SOLIDLY GROUNDED)	
	50 Hz +3%/-5%	
	45KA RMS / 1 SEC (FAULT LEVEL)	
	220V DC NOMINAL (190V DC-240V DC) ISOLATED TYPE	
4.00.00	TEMPERATURE RISE	
	The temperature rise of the horizontal and vertical busbars and main bus link including all power drawout contacts when carrying 90% of the rated current along the full run shall in no case exceed 55 deg. C with silver plated joints and 40 deg. C with all other types of joints over an ambient of 50 deg C.	
5.00.00	OPERATIONAL REQUIREMENTS	
5.01.00	Breakers	
5.01.01	Breakers shall have anti-pumping feature.	
5.01.02	The incomer and bus coupler breakers for switchgear shall be electrically operated with over current releases or relays.	
5.01.03	Breakers shall have inherent fault making and breaking capacities. They shall have shunt trip coils. In case releases are offered, the same shall have contact for energisation of lockout relay. All breakers Shall have built in interlocks for equipment and personnel safety.	
5.01.04	Paralleling of two supplies shall be avoided by interlocking except for switchgear where auto-changeover is provided. Breaker contact multiplication, if required, shall be through latch relay.	

CLAUSE NO.	LT SWITCHGEAR
01.05	Mechanical tripping shall be through red 'Trip' push button outside the panels for breakers, and through control switches for other circuits.
01.06	Provision of mechanical closing of breaker only in 'Test' and 'Withdrawn' position shall be made. Alternatively, mechanical closing facility should be normally inaccessible, accessibility rendered only after deliberate removal of shrouds.It shall be possible to close the door with breaker in test position.
01.07	Clear status indication for each circuit shall be provided through lamps, switch positions or other mechanical means.
01.08	Supervision relay shall be provided for trip coil monitoring.
02.00	Switches, Contactors and Fuses
02.01	Incomers for MCCs and DBs rated upto 630A could be load break isolators.
02.02	Motor starter contactors shall be of air break, electromagnetic type suitable for DOL starting of motor, and shall be of utilisation category AC-3 for ordinary and AC-4 for reversing starters. DC contactor shall be of DC-3 utilisation category.
02.03	Fuses shall be HRC type with operation indicator. Isolating switches shall be of AC 23A category when used in motor circuit, and AC 22A category for other applications. Fuse switch combination shall be provided wherever possible.
02.04	Isolating switches and MCCBs shall have door interlocks and padlocking facility.
03.00	Panels
03.01	All switchgears, MCCs, DBs, panels, modules, local starters and push buttons shall have prominent engraved indentification plates.
03.02	Local push button stations shall have metal enclosure of die cast aluminium or rolled sheet steel of 1.6mm thickness & shall have DOP of IP-55. Push buttons shall be of latch type with mushroom knobs.
03.03	Where breaker/starter module front serves as compartment cover, suitable blanking covers, one for each size of modules per switchboard shall be supplied for use when carriage is withdrawn.
03.04	All non-current carrying metal work of boards/panels shall be effectively bonded to earth bus of galavanised steel, extending throughout the switchboard/MCC/DB. Positive earthing shall be maintained for all positions of chassis and breaker frame.
03.05	Suitable trolley arrangement shall be provided for breaker/starter modules. Two trolleys per switchgear room shall be provided so that top most breaker module of all types, sizes and rating can be withdrawn on trolley and lowered for maintenance purpose.
03.06	The incoming connection to transformer of more than 1000KVA and inter-connecting sections between switchboards shall preferably be of busducts.The busduct enclosure

CLAUSE NO.	LT SWITCHGEAR
	shall be made of minimum 3mm thick aluminium alloy. The section of the busduct should have adequate strength to withstand internal and external forces resulting from the various operating conditions. Aluminium sheet hood shall be provided for outdoor busduct enclosure joints to provide additional protection against water ingress. The busduct top shall be sloped to prevent retention of water.The busduct shall have DOP of IP55.
5.03.07	It should be possible to carryout maintenance on a feeder with adjacent feeders alive
5.04.00	Control, Protection & Metering Requirements
5.04.01	Control circuits shall operate at suitable voltage of 110V AC or 220V DC. Necessary control supply transformers having primary and secondary fuses shall be provided for each MCC, 2 x 100% per section. However the breakers shall operate on 220V DC The auxiliary bus bars for control supply shall be segregated from main bus bars. The control supplies shall be monitored.
5.04.02	Contractor shall fully co-ordinate overload and short circuit tripping of breaker with up-stream and down stream breakers/fuses/MCCBs motor starters. Various equipments shall meet requirement of Type-II class of coordination as per IEC.
5.04.03	All relays and timers shall operate on available DC supply and not have any inbuilt batteries. They shall be provided with hand-reset operation indicator (flags) or LEDs with pushbuttons for resetting.
5.04.04	All equipments shall have necessary protections. However, following minimum protections shall be provided: 1) Contactor controlled motor feeders (Motors up to 160 kW) a) Instantaneous short circuit protection on all phases through HRC cartridge type fuses rated for 80 kA rms (prospective breaking capacity at 415V). b) Thermal overload protection. c) Single phasing protection for motors protected by fuses. 2) Breaker controlled motors feeders (motors rated above 160kW) a) Instantaneous short circuit protection on all phases b) Overload protection on two phases c) Over load alarm on third phase d) Earth fault protection e) Under voltage protection

CLAUSE NO.	LT SWITCHGEAR
	f) hand reset lockout relay with a blue lamp for monitoring
	3) Incomers/bus coupler/outgoing breaker feeders other than motor feeders
	a) Definite time delay short circuit protection
	b) Hand reset lockout relay with a blue lamp
	4) Incomer From DG Set.
	a) Differential Protection (87) - Three Pole
	b) Reverse Power Protection.
	c) Overload Alarm on one phase
	d) Earth Fault Detection Relay (64)
	e) Voltage controlled overcurrent relay
	e) Generator under/over voltage Protection
	f) Hand Reset/Lockout Relay with a blue lamp.
	g) 3 Phase Energy Meter having accuracy of 1.0 class.
5.04.05	Meters / instruments
	All meters/ instrument shall be flush mounted on front panel, at least 96 sq.mm. size with 90 degree linear scales and accuracy class of 2.0.
5.04.06	All motors of 30kW and above shall have an Ammeter. Bus-section shall have bus VT, voltmeter with selector switch, and other relay and timers required for protection. Adequate control and selector switches, push buttons and indicating lamps shall be provided. Thermostatically controlled space heaters with switches shall be provided to prevent condensation.
5.04.07	In case of remote controlled breaker panels,following shall be ensured.
	Each feeder shall have local/remote selector switch. Closing from local shall be possible only in test possition whereas closing from remote shall be possible in either service or test position.Tripping from local shall be possible only when local/remote selector switch is in local position.Tripping from remote shall be either breaker in service position or selector switch being in remote position
05.00	Control from Remote
	Necessary hardware shall be provided in the switchgear panel like coupling relays(24V DC,with max burden 2.5VA), auxiliary relays, current & voltage transducers(4-20 mA, dual output) etc. to effect interlocks, exchange information / status and exercise control from remote.

CLAUSE NO.	LT SWITCHGEAR
6.00.00	DESIGN AND CONSTRUCTIONAL FEATURES
6.01.00	All 415V switch gear motor control centers (MCCs), AC & DC distribution boards (DBs), etc shall have following features :

1) Shall be of metal enclosed, indoor, floor mounted and free standing type.

2) All frames and load bearing members shall be fabricated using mild steel structural sections or pressed and shaped cold rolled sheet steel of thickness not less than 2mm.

3) Frame shall be enclosed in cold rolled sheet steel of thickness not less than 1.6mm.Doors and covers shall also be of cold rolled sheet steel of thickness not less than 1.6 mm.Stiffeners shall be provided whereever necessary. Removable gland plates of thickness 3mm (hot/cold rolled sheet steel) or 4 mm (non-magnetic material) shall be provided for all panels.

4) All switchboards/panels shall be of dust and vermin proof. All cutouts shall have synthetic rubber gaskets.

5) For motors above 160kW, remote controlled electrical circuit breakers, and for smaller motors, switch-fuse contactor feeders shall be provided. The other outgoing feeders would be switch-fuse units or moulded case circuit breakers.

6) All switchboards, MCCs and DB s shall have following distinct vertical sections.

   a) Completely enclosed bus bar compartment for horizontal and vertical bus bars.

   b) Completely enclosed switchgear compartments (one for each circuit housing circuit breakers, motor starter or switch-fuse feeder).

   c) Compartment for cable alley or cable box for power and control cables

      In case of cable box, they shall be segregated with complete shrouding for individual feeders at the rear for direct termination of cables.

   d) For cable connection to circuit breaker, a separatelly enclosed cable compartment shall also be acceptable.

   e) Compartment for relays and other control devices associated with a circuit breaker, wherever necessary.

   f) The switchboards/MCC/DBs of 1600A & above rating shall be of DOP IP42 & of IP52 for less than 1600A rating

   g) All 415V switchgears,MCC's, AC & DC distribution boards etc. shall be painted by powder coating process. Paint shade shall be as follows

(i)	Front & Back	:	RAL 9002
(ii)	Extreme end covers	:	RAL 5012

7) Busbars shall be of high conductivity aluminium alloy or copper.

8) Minimum air clearance in air between phases and phase-earth shall be 25 mm for busbars and cable terminations. For all other components, the Clearances shall be at least 10mm. Wherever above is not possible except for horizontal and vertical busbars, insulation shall be provided by anti tracking sleeving or barriers. However for horizontal and vertical busbars, clearances specified above shall be maintained even when busbars are insulated/sleeved. In case of DC DBs/ fuse boards, the busbar system shall be insulated or physically segregated with barriers to prevent interpole short circuit.

9) Busbar insulators shall be of track-resistant high strength non-hygro-scopic, non-combustible type and suitable to withstand stresses due to over-voltages and short circuit current. Insulators and barrier of inflammable material such as Hylam shall not be accepted.

10) All types of relays and timer shall be subject to Employer's approval. They shall be flush mounted with connections from inside, and shall have transparent & dust tight cover, removable from front, drawout construction for easy replacement and testing facility. The auxiliary relays and timer may be provided in fixed cases.

11) Maxi terminal /cage clamp type terminal blocks shall be provided for signals to be interfaced with DDCMIS/PLC.

12) The switchgears/MCC shall be designed to offer adequate level of safety to operating/maintenance personnel. Means shall be provided to prevent access to the live part to avoid accidents during service as well as maintenance period. Bidder shall bring out the safety means provided to achieve above. A detailed instruction plate suitable for wall mounting shall be provided for each switchgear/MCC room discribing various safe operating procedure/safety precautions for safe operation and maintenance of switchgear/MCC.

13) All current and voltage transformers as required for metering & protection specified shall be completely encapsulated, cast resin insulated type. Incomers from transformers shall have CTs for transformer REF protection. All current and voltage transformers as required for metering and protection specified shall be completely encapsulated, cast resin insulated type. Incomers from transformers shall have CTs for transformer restricted earth fault protection. The accuracy shall be as follows:

	CTs	PTs
Protection	5P20	3P
Metering	1.0	1.0
REF	PS	

CLAUSE NO.	LT SWITCHGEAR
6.02.00	Indicating lamps shall be cluster LED type.
6.03.00	20% spare feeders of each type & rating used in the MCC with a minimum one (1) number on each bus section shall be provided.
7.00.00	TYPE TESTS (a) All equipments to be supplied shall be of type tested quality. The Contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last five years from the date of bid opening. These reports should be for the tests 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. (b) In case the Contractor is not able to submit report of the type test(s) conducted within last five years from the date of bid opening, or in case the type test report(s) are not found to be meeting the specification requirements, the Contractor shall conduct all such tests under this contract free of cost to the Owner and submit the reports for approval. (c) 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.
8.01.00	L. T. SWITCHGEAR The following type test certificates on each type & rating of L.T. Switchgear, MCC panel and distribution boards shall be submitted. (a) Short time withstand test with circuit breaker mounted inside the switchgear panel. (b) Temperature rise test. (c) Type II :- Short circuit co-ordination test for any three ratings of MCC module as selected by the Employer. (d) Test sequence -1 & combined test sequence shall be carried out on each rating of circuit breaker mounted inside the panel. (e) Degree of protection tests

GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

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

1.0 INTENT OF SPECIFIATION

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 ofr rotating electrical machnines
IS: 12065	Permissible limits of noise level for rotating electrical machines
IS: 12075	Mechnical vibration of rotatinf 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.

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 fro three consecutive hot starts followed by one hour interval with maximum twenty starts per day and shall be sutable fro mimimum 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, mechnical 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: 4691and 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.

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 statedin 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 V 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.

4.9 **General**

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.

B - 3

L.T. POWER CABLES

LARA SUPER THERMAL POWER PROJECT, STAGE-I (2X800 MW) DARLIPALI SUPER THERMAL POWER PROJECT, STAGE-I (2X800 MW) GAJMARA SUPER THERMAL POWER PROJECT, STAGE-I (2X800 MW) KUDGI SUPER THERMAL POWER PROJECT, STAGE-I (3X800 MW) STEAM TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATION SECTION-VI PART-B

299 ~~308~~

LT POWER CABLES

1.00.00 CODES & STANDARDS

1.01.00 All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions. In case of conflict between this specification and those (IS : codes, standards, etc.) referred to herein, the former shall prevail. All the cables shall conform to the requirements of the following standards and codes:

IS :1554 - I	PVC insulated (heavy duty) electric cables for working voltages upto and including 1100V.
IS : 3961	Recommended current ratings for cables
IS : 3975	Low carbon galvanised steel wires, formed wires and tapes for armouring of cables.
IS : 5831	PVC insulation and sheath of electrical cables.
IS:7098 (Part -I)	Cross linked polyethylene insulated PVC sheathed cables for working voltages upto and including 1100V.
IS : 8130	Conductors for insulated electrical cables and flexible cords.
IS : 10418	Specification for drums for electric cables.
IS : 10810	Methods of tests for cables.
ASTM-D -2843	Standard test method for density of smoke from the burning or decomposition of plastics.
IEC-754 (Part-I)	Tests on gases evolved during combustion of electric cables.
IEC-332	Tests on electric cables under fire conditions. Part-3: Tests on bunched wires or cables (Category-B).

CLAUSE NO.	TECHNICAL REQUIREMENTS
2.00.00	**TECHNICAL REQUIREMENTS**
2.01.00	The cables shall be suitable for laying on racks, in ducts, trenches, conduits and under ground buried installation with chances of flooding by water.
2.02.00	Cables shall be flame retardant, low smoke (FRLS) type designed to withstand all mechanical, electrical and thermal stresses developed under steady state and transient operating conditions as specified elsewhere in this specification.
2.03.00	Aluminium conductor used in power cables shall have tensile strength of more than 100 N/ sq.mm. Conductors shall be stranded.
2.04.00	XLPE insulation shall be suitable for a continuous conductor temperature of 90 deg. C and short circuit conductor temperature of 250 deg C. PVC insulation shall be suitable for continuous conductor temperature of 70 deg C and short circuit conductor temperature of 160 deg. C.
2.05.00	The cable cores shall be laid up with fillers between the cores wherever necessary. It shall not stick to insulation and inner sheath. All the cables, other than single core unarmoured cables, shall have distinct extruded PVC inner sheath of black colour as per IS : 5831.
2.06.00	For single core armoured cables, armouring shall be of aluminium wires/ formed wires. For multicore armoured cables, armouring shall be of galvanised steel as follows :

Calculated nominal dia. of cable under armour	**Size and Type of armour**
Upto 13 mm	1.4mm dia GS wire
Above 13 & upto 25mm	0.8 mm thick GS formed wire / 1.6 mm dia GS wire
Above 25 & upto 40 mm	0.8mm thick GS formed wire / 2.0mm dia GS wire
Above 40 & upto 55mm	1.4 mm thick GS formed wire /2.5mm dia GS wire
Above 55 & upto 70 mm	1.4mm thick GS formed wire / 3.15mm dia GS wire
Above 70mm	1.4 mm thick GS formed wire / 4.0 mm dia GS wire

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CLAUSE NO.	TECHNICAL REQUIREMENTS
2.06.01	The aluminium used for armouring shall be of H4 grade as per IS: 8130 with maximum resistivity of 0.028264 ohm mm^2 per meter at 20 deg C. The sizes of aluminium armouring shall be same as indicated above for galvanized steel.
2.06.02	The gap between armour wires / formed wires shall not exceed one armour wire / formed wire space and there shall be no cross over / over-riding of armour wire / formed wire. The minimum area of coverage of armouring shall be 90%. The breaking load of armour joint shall not be less than 95% of that of armour wire / formed wire. Zinc rich paint shall be applied on armour joint surface of G.S.wire/ formed wire.
2.07.00	Outer sheath shall be of PVC as per IS: 5831 & black in colour. In addition to meeting all the requirements of Indian standards referred to, outer sheath of all the cables shall have the following FRLS properties. (a.) Oxygen index of min. 29 (as per IS 10810 Part-58). (b.) Acid gas emission of max. 20% (as per IEC-754-I). (c.) Smoke density rating shall not be more than 60 % (as per ASTMD-2843).
2.08.00	Cores of the cables shall be identified by colouring of insulation. Following colour scheme shall be adopted: 1 core - Red, Black, Yellow or Blue 2 core - Red & Black 3 core - Red, Yellow & Blue 4 core - Red, Yellow, Blue and Black
2.09.00	For reduced neutral conductors, the core shall be black.
2.10.00	In addition to manufacturer's identification on cables as per IS, following marking shall also be provided over outer sheath. (a.) Cable size and voltage grade - To be embossed (b.) Word 'FRLS' at every 5 metre - To be embossed (c.) Sequential marking of length of the cable in metres at every one metre -To be embossed / printed The embossing shall be progressive, automatic, in line and marking shall be legible and indelible.

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CLAUSE NO.	TECHNICAL REQUIREMENTS
2.11.00	All cables shall meet the fire resistance requirement as per Category-B of IEC 332 Part-3.
2.12.00	Allowable tolerances on the overall diameter of the cables shall be +\-2 mm maximum, over the declared value in the technical data sheets.
2.13.00	In plant repairs to the cables shall not be accepted. Pimples, fish eye, blow holes etc. are not acceptable.
3.00.00	**Cable selection & sizing**
3.01.00	LT Power cables shall be sized based on the following considerations: (a) Rated current of the equipment (b) The voltage drop in the cable, during motor starting condition, shall be limited to 10% and during full load running condition, shall be limited to 3% of the rated voltage (c) Short circuit withstand capability This will depend on the feeder type. For a fuse protected circuit, cable should be sized to withstand the let out energy of the fuse.For breaker controlled feeder, cable shall be capable of withstanding the system fault current level for total breaker tripping time inclusive of relay pickup time. (d) The minimum conductor size shall be 6 sqmm for aluminium conductor cables and 2.5 sqmm for copper conductor cables. The constructional details of copper conductor cables shall be same as indicated for copper control cable.
302.00	Derating Factors Derating factors for various conditions of installations including the following shall be considered while selecting the cable sizes: a) Variation in ambient temperature for cables laid in air b) Grouping of cables c) Variation in ground temperature and soil resistivity for buried cables.
3.03.00	Cable lengths shall be considered in such a way that straight through cable joints are avoided.
3.04.00	Cables shall be armoured type if laid in switchyard area or directly buried.

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CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC
3.05.00	All LT power cables of sizes more than 120 sq.mm. shall be XLPE insulated and preferable sizes are 1Cx150, 1Cx300, 1Cx630, 3Cx150 & 3Cx240 sq.mm.	
4.00.00	**CONSTRUCTIONAL FEATURES**	
	(a.) **1.1 KV grade XLPE power cables** shall have compacted aluminium conductor, XLPE insulated, PVC inner sheathed (as applicable), armoured/ unarmoured, FRLS PVC outer sheathed conforming to IS:7098. (Part-I).	
	(b.) **1.1KV grade PVC power cables** shall have aluminium conductor (compacted type for sizes above 10 sq.mm), PVC insulated, PVC inner sheathed, armoured/ unarmoured, FRLS PVC outer sheathed conforming to IS:1554 (Part-I).	
5.00.00	**CABLE DRUMS**	
	(a) Cables shall be supplied in non returnable wooden or steel drums of heavy construction. The surface of the drum and the outer most cable layer shall be covered with water proof cover. Both the ends of the cables shall be properly sealed with heat shrinkable PVC/ rubber caps secured by 'U' nails so as to eliminate ingress of water during transportation, storage and erection. Wood preservative anti-termite treatment shall be applied to the entire drum. Wooden drums shall comply with IS: 10418.	
	(b) Each drum shall carry manufacturer's name, purchaser's name, address and contract number, item number and type, size and length of cable and net gross weight stencilled on both sides of the drum. A tag containing same information shall be attached to the leading end of the cable. An arrow and suitable accompanying wording shall be marked on one end of the reel indicating the direction in which it should be rolled.	
	(c) The standard drum length for power cables shall not be less than 500 meters. The length per drum shall be subjected to a maximum tolerance of +/- 5% of the standard drum length. The Employer shall have the option of rejecting cable drum with shorter lengths. For each size, the variance of total quantity, adding all the supplied drum lengths, from the ordered quantity, shall not exceed +/- 2%.	
5.00.00	**TYPE TESTS**	
5.01.00	General	
	All equipments to be supplied shall be of type tested design. During detailed engineering, the contractor shall submit for Owner's approval the reports of all the type tests as listed in this specification and carried out within last ten years from the	

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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 contractor 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 contractor shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client /owners representative and submit the reports for approval.

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.

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.

5.02.00 **Type Tests**

5.02.01 The reports for the following type tests shall be submitted for one size each of LT XLPE and LT PVC Power cables. Size shall be decided by the employer during detailed engineering :

S.No.	Type test	Remarks
	For Conductor	
1.	Resistance test	
2.	Tensile test	For circular non-compacted conductors only
3.	Wrapping test	For circular non-compacted only
	For Armour Wires/ Formed Wires	
4.	Measurement of Dimensions	
5.	Tensile Test	
6.	Elongation test	

	7.	Torsion test	For round wires only
	8.	Wrapping test	For aluminium wires / formed wires only.
	9.	Resistance test	
	10(a)	Mass of zinc coating test	For GS Formed wires/wires only
	10(b)	Uniformity of zinc coating	For GS Formed wires /wires only
	11.	Adhesion test	For GS Formed wires/wires only
		For PVC/XLPE insulation & PVC Sheath	
	12.	Test for thickness	
	13.	Tensile strength & elongation tests	before ageing and after ageing
	14.	Ageing in air oven	
	15.	Loss of mass test	For PVC insulation and sheath only
	16.	Hot deformation test	For PVC insulation and sheath only
	17.	Heat shock test	For PVC insulation and sheath only
	18.	Shrinkage test	
	19.	Thermal stability test	For PVC insulation and sheath only
	20.	Hot set test	For XLPE insulation only
	21.	Water absorption test	For XLPE insulation only
	22.	Oxygen index test	For outer sheath only
	23.	Smoke density test	For outer sheath only

CLAUSE NO.	TECHNICAL REQUIREMENTS	
	24. Acid gas generation test	For outer sheath only
	For completed cables	
	25. Insulation resistance test (Volume resistivity method)	
	26. High voltage test	
	27. Flammability test as per IEC-332 Part-3 (Category-B)	
5.02.02	**Acceptance Tests** (as per QA table)	
5.02.03	**Routine Tests** (as per QA table)	

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L.T. CONTROL CABLES

LARA SUPER THERMAL POWER PROJECT, STAGE-I (2X800 MW) DARLIPALI SUPER THERMAL POWER PROJECT, STAGE-I (2X800 MW) GAJMARA SUPER THERMAL POWER PROJECT, STAGE-I (2X800 MW) KUDGI SUPER THERMAL POWER PROJECT, STAGE-I (3X800 MW) STEAM TURBINE GENERATOR PACKAGE	TECHNICAL SPECIFICATION SECTION-VI PART-B

CLAUSE NO.	TECHNICAL REQUIREMENTS	NTPC

LT CONTROL CABLES

1.00.00 CODES & STANDARDS

1.01.00 All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions. In case of conflict between this specification and those (IS : codes, standards, etc.) referred to herein, the former shall prevail. All the cables shall conform to the requirements of the following standards and codes :

IS :1554 - I	PVC insulated (heavy duty) electric cables for working voltages upto and including 1100V.
IS : 3961	Recommended current ratings for cables
IS : 3975	Low carbon galvanised steel wires, formed wire and tapes for armouring of cables.
IS : 4905	Methods for random sampling.
IS : 5831	PVC insulation and sheath of electrical cables.
IS : 8130	Conductors for insulated electrical cables and flexible cords.
IS : 10418	Specification for drums for electric cables.
IS : 10810	Methods of tests for cables.
ASTM-D -2843	Standard test method for density of smoke from the burning or decomposition of plastics.
IEC-754 (Part-I)	Test on gases evolved during combustion of electric cables.
IEC -332	Tests on Electric cables under fire conditions Part-3 : Tests on bunched wires or cables (category - B)

2.00.00 TECHNICAL REQUIREMENTS

2.01.00 The cables shall be suitable for laying on racks, in ducts, trenches, conduits and under ground burried installation with chances of flooding by water.

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC
2.02.00	Cables shall be flame retardant, low smoke (FRLS) type designed to withstand all mechanical, electrical and thermal stresses develop under steady state and transient operating conditions as specified elsewhere in this specification.	
2.03.00	Conductor of control cables shall be made of multi stranded, plain annealed copper.	
2.04.00	PVC insulation shall be suitable for continuous conductor temperature of 70 deg C and short circuit conductor temperature of 160 deg. C.	
2.05.00	The cable cores shall be laid up with fillers between the cores wherever necessary. It shall not stick to insulation and inner sheath. All the cables, other than single core unarmoured cables, shall have distinct extruded PVC inner sheath of black colour as per IS : 5831.	
2.06.00	For multicore armoured cables, the armouring shall be of galvanised steel as follows :-	
	Calculated nominal dia of cable under armour	**Size and Type of armour**
	1) Upto 13 mm	1.4mm dia GS wire
	2) Above 13 upto 25 mm	0.8 mm thick GS formed wire / 1.6 mm dia GS wire
	3) Above 25 upto 40 mm	0.8mm thick GS formed wire / 2.0mm dia GS wire
	4) Above 40 upto 55mm	1.4 mm thick GS formed wire/ 2.5mm dia GS wire
	5) Above 55 upto 70 mm	1.4mm thick GS formed wire / 3.15mm dia GS wire
	6) Above 70mm	1.4 mm thick GS formed wire / 4.0 mm dia GS wire
	The gap between armour wire / formed wire shall not exceed one armour wire / formed wire space and there shall be no cross over / over-riding of armour wire / formed wire. The minimum area of coverage of armouring shall be 90%. The breaking load of armour joint shall not be less than 95% of that of armour wire / formed wire. Zinc rich paint shall be applied on armour joint surface.	
2.07.00	Outer sheath shall be of PVC(grade as applicable) and grey in colour . In addition to meeting all the requirements of Indian standards referred to, outer sheath of all the cables shall have the following FRLS properties.	

CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC
	(a) Oxygen index of min. 29 (As per IS:10810 (part-58)) (b) Acid gas emission of max. 20% (As per IEC-754-I). (c) Smoke density rating shall not be more than 60% during Smoke Density Test as per ASTMD-2843.	
2.08.00	Cores of the cables of upto 5 cores shall be identified by colouring of insulation. Following colour scheme shall be adopted. 1 core - Red, Black, Yellow or Blue 2 core - Red & Black 3 core - Red, Yellow & Blue 4 core - Red, Yellow, Blue and Black 5 core - Red, Yellow, Blue, Black and Grey	
2.09.00	For cables having more than 5 cores, core identification shall be done by numbering the insulation of cores sequentially, starting by number 1 in the inner layer (e.g. say for 10 core cable, core numbering shall be from 1 to 10). The number shall be printed in Hindu-Arabic numerals on the outer surfaces of the cores. All the numbers shall be of the same colour, which shall contrast with the colour of insulation. The colour of insulation for all the cores shall be grey only. The numerals shall be legible and indelible. The numbers shall be repeated at regular intervals along the core, consecutive numbers being inverted in relation to each other. When the number is a single numeral, a dash shall be placed under neath it. If the number consists of two numerals, these shall be disposed one below the other and a dash placed below the lower numeral. The spacing between consecuture numbers shall not exceed 50 mm.	
2.10.00	In addition to manufacturer's identification on cables as per IS, following marking shall also be provided over outer sheath : (a) Cable size and voltage grade - To be embossed (b) Word 'FRLS' at every 5 metre - To be embossed (c) Sequential marking of length of the cable in metres at every one metre. - To be embossed / printed. The embossing / printing shall be progressive, automatic, in line and marking shall be legible and indelible.	

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CLAUSE NO.	TECHNICAL REQUIREMENTS
2.11.00	All cables shall meet the fire resistance requirement as per Category-B of IEC 332 Part -3.
2.12.00	Allowable tolerances on the overall diameter of the cables shall be +\-2 mm maximum over the declared value in the technical data sheets.
2.13.00	In plant repairs to the cables shall not be accepted. Pimples, fish eye, blow holes etc. are not acceptable.
2.14.00	**Cable selection & sizing**
2.14.01	LT Control cables shall be sized based on the following considerations: (a) Rated current of the equipment (b) The voltage drop in the cable, during motor starting condition, shall be limited to 10% and during full load running condition, shall be limited to 3% of the rated voltage (c) Short circuit withstand capability This will depend on the feeder type. For a fuse protected circuit, cable should be sized to withstand the let out energy of the fuse.For breaker controlled feeder, cable shall be capable of withstanding the system fault current level for total breaker tripping time inclusive of relay pickup time. (d) The minimum size of conductor shall be 1.5 sqmm
2.14.02	Derating Factors Derating factors for various conditions of installations including the following shall be considered while selecting the cable sizes: a) Variation in ambient temperature for cables laid in air b) Grouping of cables c) Variation in ground temperature and soil resistivity for buried cables.
2.14.03	Cable lengths shall be considered in such a way that straight through cable joints are avoided.
2.14.04	Cables shall be armoured type if laid in switchyard area or directly buried.

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CLAUSE NO.	TECHNICAL REQUIREMENTS
3.00.00	**CONSTRUCTIONAL FEATURES**
3.01.00	**1.1 KV Grade Control Cables** Control Cables shall have stranded copper conductor multicore PVC insulated, PVC inner-sheathed, armoured / unarmoured, PVC outer-sheathed conforming to IS:1554. (Part-I).
3.02.00	**Cable Drums** (a) Cables shall be supplied in non returnable wooden or steel drums of heavy construction. The surface of the drum and the outer most cable layer shall be covered with water proof layer. Both the ends of the cables shall be properly sealed with heat shrinkable PVC/ rubber caps secured by 'U' nails so as to eliminate ingress of water during transportation, storage and erection. Wood preservative anti-termite treatment shall be applied to the entire drum. Wooden drums shall comply with IS : 10418. (b) Each drum shall carry manufacturer's name, purchaser's name, address and contract number, item number and type, size and length of cable and net gross weight stencilled on both the sides of the drum. A tag containing same information shall be attached to the leading end of the cable. An arrow and suitable accompanying wording shall be marked on one end of the reel indicating the direction in which it should be rolled. (c.) The standard drum length for control cables shall not be less than 1000 metres. The length per drum shall be subjected to a maximum tolerance of +/- 5% of the standard drum length. The Employer shall have the option of rejecting cable drums with shorter lengths. For each size, the variance of total quantity, adding all the supplied drum lengths, from the ordered quantity, shall not exceed +/- 2%.
4.00.00	**TESTS**
4.01.00	**GENERAL** All equipments to be supplied shall be of type tested design. During detailed engineering, the contractor shall submit for Owner'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.

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However if the contractor 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 contractor shall conduct all such tests under this contract at no additional cost to the owner either at third party lab or in presence of client /owners representative and submit the reports for approval.

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.

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.

4.02.00 **TYPE TESTS:**

4.02.01 The Type tests reports for the following shall be submitted for one size of LT control cable :

S. No.	Type Test	Remarks
a)	**For Conductor**	
1.	Resistance test	
b)	**For Armour Wires / Formed wires**	
2.	Measurement of Dimensions	
3.	Tensile Test	
4.	Elongation test	
5.	Torsion test	For round wire only
6.	Winding test	For Formed wires
7.	Resistance test	
8.	Zinc Coating test	For G.S. conductors only.
c)	**For PVC insulation & PVC Sheath**	
9.	Test for thickness	

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	10. Tensile strength and elongation test before ageing and after ageing	
	11. Ageing in air oven	
	12. Loss of mass test	For PVC insulation and sheath only
	13. Hot deformation test	For PVC insulation and sheath only
	14. Heat shock test	For PVC insulation and sheath only
	15. Shrinkage test	
	16. Thermal stability test	For PVC insulation and sheath only
	17. Oxygen index test	For outer sheath only
	18. Smoke density test	For outer sheath only
	19. Acid gas generation test	For outer sheath only
	d) **For completed cables**	
	20. Insulation resistance test (Volume resistivity method)	
	21. High voltage test	
	23. Flammability test as per IEC - 332 Part-3 (Category-B)	
4.02.02	**Acceptance Tests** (as per QA table)	
4.03.00	**Routine Tests** (as per QA table)	

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	TITLE	SPECIFICATION NO.
BHEL	MOTOR DATA SHEET - C	VOLUME II B SECTION D REV NO. 00 DATE 28.01.10 SHEET 1 OF 2

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			

	TITLE	SPECIFICATION NO.
BHEL	MOTOR DATA SHEET - C	VOLUME II B SECTION D REV NO. 00 DATE 28.01.10 SHEET 2 OF 2

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 ≥ 55KW)	
	a) Torque speed characteristic	
	b) Thermal withstand characteristic	
	c) Current vs time	
	d) Speed vs time	

NAME OF VENDOR					
			SEAL	REV.	
NAME	SIGNATURE	DATE			

	QUALITY PLAN	CUSTOMER :	PROJECT TITLE	SPECIFICATION : NUMBER :
	SHEET 1 OF 2	BIDDER/ VENDOR :	QUALITY PLAN NUMBER PED-506-00-Q-006/0	SPECIFICATION TITLE
		SYSTEM	ITEM AC ELECT. MOTORS BELOW 75KW (LV)	SECTION VOLUME III

SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.O	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	MANUFR'S SPEC/BHEL SPEC./RELEVANT STANDARD	BHEL SPEC. SAME AS COL.7	LOG BOOK	3	-	-	
2.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	MANUF'S SPEC	MANUF'S SPEC	-DO-	3	-	-	
		2.DIMENSIONS	MA	-DO-	-DO-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	-DO-	3	-	-	
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	MFG.SPEC./ RELEVANT IS	MFG.SPEC. RELEVANT IS	-DO-	3	-	-	
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	IS-325/ BHEL SPEC./ DATA SHEET	SAME AS COL.7	TEST REPORT	3	2,1	2,1	NOTE -1
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPN. REPORT	2	1	-	

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

	QUALITY PLAN	CUSTOMER :	PROJECT TITLE	SPECIFICATION : NUMBER :
		BIDDER/ VENDOR :	QUALITY PLAN NUMBER PED-506-00-Q-006/0	SPECIFICATION : TITLE :
	SHEET 2 OF 2	SYSTEM	ITEM AC ELECT. MOTORS BELOW 75KW (LV)	SECTION VOLUME III

SL. NO.	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
		3.NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPN. REPORT	3	1	-	

NOTES:

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

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

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

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

SECTION D3

STANDARD TECHNICAL SPECIFICATION FOR C&I SYSTEMS

FORM NO. PEM-6666-0

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

Data Sheet No.: **PE-DC-999-145-I026-A**

		TECHNICAL REQUIREMENTS FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE (TO BE FILLED BY PURCHASER)	TO BE FILLED-UP /CONFIRMED BY BIDDER
GENERAL	MANUFACTURER		
	MODEL NUMBER		
TECHNICAL	SENSING ELEMENT	☐ BOURDON ☐ DIAPHRAGM (BOURDON FOR HIGH PRESS AND DIAPHRAGM FOR LOW PRESS APPLICATION)	
	MATERIAL	SENSING ELEMENT – AISI 316 SS MOVEMENT – AISI 304 SS CASING – ■ DIE CAST AL ☐ SS	
	ENCLOSURE	CLASS: ■ IP-55 ☐ IP-65 ☐ EXPL PROOF PAINT: ■ ENAMEL ☐ EPOXY	
	DIAL	SIZE: 150 MM COLOR: WHITE NUMERALS: BLACK SCALE: LINEAR, 270° ARC GRADUATED IN METRIC UNITS	
	CASE	COLOUR : BLACK	
	SPAN/ ZERO ADJUSTMENT	INT. MICRO SCREW	
	RANGE SELECTION	SHOULD COVER 125% OF OPRATING PARAMETER	
	OVER RANGE PROTECTION	1.5 TIMES OF FSD	
	BLOW OUT DISC	REQUIRED	
	SWITCHING FACILITY (IF APPLICABLE)	NOT REQUIRED	
	TYPE	☐ MICRO SWITCH ☐ OTHER	
	NO. / TYPE OF CONTACTS	2 NOS. SPDT	
	CONTACT RATING	5A 230V AC, 0.25A 220V DC	
	SETTING RANGE	FIELD ADJUSTABLE OVER FULL RANGE	
	REPEATABILITY	± 1% OF FSR	
	POWER SUPPLY	☐ 230V AC ☐ 110V AC	
PERFORMANCE	ACCURACY	± 1% OR BETTER OF FULL SCALE DEFLECTION	
CONNECTION	PROCESS	☐ M20 x 1.5 (M) ■ ½" NPT (M) ☐ ½" NPT (F) ☐ OTHER	
	LOCATION	BOTTOM	
ACCESSORIES	NAME PLATE / METAL TAG	SS	
	OTHER	SIPHON FOR STEAM, SNUBBER FOR PUMP DISCHARGE, CHEMICAL SEAL DIAPHRAGM FOR CORROSSIVE, OIL SERVICES and SLURRY APPLICATION TO BE PROVIDED	
OTHER REQUIREMENT	INSTRUMENT LIST	INSTRUMENT LIST COMPRISING OF TAG NO., SERVICE, DESIGN/OPERATING PRESSURE & TEMPERATURE TO BE ATTACHED	
QUALITY REQUIREMENT	CHECK LIST FOR PG/DPG	REFER CHECK LIST NO PE-CL-999-145-I 026-0	

NOTE - Wherever capillary is applicable, length of the capillary shall be 5 metres.

FORM NO. PEM-6666-0

	CHECK LIST FOR PRESSURE / DIFFERENTIAL PRESSURE GAUGE (Mechanical Auxiliary Packages)	SPECIFICATION NO.:
		VOLUME
		SECTION
		REV. NO. / DATE:
		SHEET 2 OF 2

Data Sheet No.: **PE-CL-999-145-I026-0**

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

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

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

FORM NO. PEM-6666-0

	TECHNICAL REQUIREMENTS FOR PRESSURE /DIFFERENTIAL PRESSURE SWITCH (Mechanical Auxiliary Packages)	SPECIFICATION NO.:
		VOLUME
		SECTION
		REV. NO. / DATE:
		SHEET 1 OF 2

Data Sheet No.: **PE-DC-999-145-I031-0A**

TECHNICAL REQUIREMENT FOR PRESSURE / DIFFERENTIAL PRESSURE SWITCH (TO BE FILLED BY PURCHASER)			TO BE FILLED BY THE BIDDER
GENERAL	MANUFACTURER		
	MODEL NUMBER		
TECHNICAL	PRESSURE ELEMENT	☐ DIAPHRAGM ☐ BELLOW (for low range) ☐ PISTON ☐ BOURDON (for high range)	
	MATERIAL	ELEMENT: ■ AISI 316 SS ☐ Ph. Br. CASING : DIE CAST AL WITH EPOXY COATING	
	ENCLOSURE	☐ IP-55 ■ IP-65 ☐ EXPL. PROOF	
	SWITCH TYPE	☐ MICRO ☐ ENCLOSURE HERMETICALLY SEALED	
	SWITCH CONTACT	TWO NOS. SPDT	
	SWITCH RATING	5A 230V AC, 0.25A 220V DC	
	SET POINT	ADJUSTABLE THROUGHOUT THE RANGE	
	DIFFERENTIAL	☐ FIXED ■ ADJUSTABLE OVER WIDE RANGE	
	MOUNTING	■ DIRECT ☐ PANEL OR RACK	
	OVER RANGE PROTECTION	150% OF FSD	
PERFORMANCE	REPEATABILITY	± 0.5 %	
	DIAPHRAGM SEAL	DIAPHRAGM WITH CHEMICAL SEAL FOR CORROSSIVE & OIL SERVICES TO BE PROVIDED	
	NAME PLATE/METAL TAG	SS	
CONNECTION	PROCESS	½" NPT (F) AT BOTTOM	
	ELECTRICAL	PLUG IN SOCKET	
OTHER REQUIREMENT	INSTRUMENT SCHEDULE	INSTRUMENT LIST COMPRISING OF TAG NO., SERVICE, RANGE, MEDIUM, STATIC PRESSURE, DESIGN/OPERATING PRESSURE & TEMPERATURE TO BE ATTACHED	
QUALITY REQUIREMENT	CHECKLIST FOR PS/DPS	REFER CHECK LIST NO. PE-CL-999-145-I031-0	

NOTE - Wherever capillary is applicable, length of the capillary shall be 5 metres.

FORM NO. PEM-6666-0

BHEL	**CHECK LIST FOR PRESSURE / DIFFERENTIAL PRESSURE SWITCH (Mechanical Auxiliary Packages)**	SPECIFICATION NO.: VOLUME SECTION REV. NO. / DATE: SHEET 2 OF 2 Data Sheet No.: **PE-CL-999-145-I031-0**

SL NO	TESTS/CHECKS	QUANTUM OF CHECK	REFERENCE DOC. ACCEPTANCE NORMS	AGENCY P	AGENCY W	AGENCY V	REMARKS
1.0	CHECK FOR		APPROVED TECHINCAL REQUIREMENT/ DATA SHEET/ RELEVANT STANDARD / MANUFACTURER CATALOGUE				MFR TO CARRY OUT ROUTINE TEST ON 100%.
	1.1 MODEL NO/TAG NO	100%		M	C	C	
	1.2 RANGE/SCALE	100%		M	C	C	
	1.3 END CONNECTION	100%		M	C	C	
	1.4 SWITCH CONTACT RATING & NOS	100%		M	C	C	
2.0	CALIBRATION						
	2.1 REPEATABILITY	100%		M	C	B	
	2.2 DIFFERENTIAL	100%		M	C	B	
	2.3 SET POINT ADJUSTMENT	100%		M	C	B	
3.0	OVER PRESSURE & LEAK TEST	100%		M	C	C	
4.0	REVIEW OF T.C. FOR MATERIAL OF--						WHEN TC FOR MATERIAL FOR THE PROJECT NOT AVAILABLE , COMPLIANCE CERTIFICATE TO BE PROVIDED BY THE MANUFACTURER.
	5.1 SENSOR	FOR LOT		-	-	B	
	5.2 MOVEMENT			-	-	B	
	5.3 HOUSING			-	-	B	
5.0	REVIEW OF T.C. FOR DEGREE OF PROTECTION	TYPE TEST		-	-	B	
6.0	REVIEW OF T.C. FOR MICRO SWITCH	FOR LOT		-	-	B	
7.0	ACCESSORIES AS APPLICABLE	100%		M	C	C	

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

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

FORM NO. PEM-6666-0

	DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER	SPECIFICATION NO.:
		VOLUME
		SECTION
		REV. NO. / DATE:
		SHEET 1 OF 3

TAG No. ..... Qty.....

Data Sheet No.: **PES-145-01-DS1-** A

Data Sheet A & B

		DATA SHEET-A FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER (TO BE FILLED BY PURCHASER)	DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
GENERAL	MANUFACTURER		
	MODEL NUMBER		
TECHNICAL	TYPE	TRANSMITTER OF MICROPROCESSOR BASED 2 WIRE TYPE ,HART PROTOCOL COMPATIBLE	
	TRANSMITTER MEASUREMENT	☐ PRESSURE ■ DIFF. PRESSURE	
	OUTPUT RANGE	SIGNAL 4-20MA DC (ANALOG) along WITH SUPERIMPOSED DIGITAL SIGNAL (BASED ON HART PROTOCOL)	
	TURN DOWN RATIO	10:1 FOR VACUUM /VERY LOW PRESSURE APPLICATION 30:1 FOR OTHER APPLICATION	
	ACCURACY	± 0.1% OF CALIBRATED SPAN(MINIMUM)	
	STABILITY	± 0.1% OF CALIBRATED SPAN FOR 6 MONTHS FOR RANGE UPTO AND INCLUDING 70 Kg/cm2 ± 0.25% OF CALIBRATED SPAN FOR 6 MONTHS FOR RANGE MORE THAN 70 Kg/cm2	
	LOAD IMPEDANCE	500 OHM (MIN)	
	RESPONSE TIME (TIME TAKEN FROM CHANGE IN PHYSICAL PARAMETER INPUT CHANGE TO TRANSMITTER , OUTPUT REACHING 63.2 % OF IT'S TOTAL CHANGE INCLUDING THAT TIME)	100 ms OR BETTER	
	HOUSING	IP 55(with corrosion resistance epoxy coating)	
	OVER PRESSURE	150 % OF MAX OPERATING PRESSURE	
	CONNECTION (ELECTRICAL)	PLUG & SOCKET TYPE	
	PROCESS CONNECTION	1" , 150# RF	
	ZERO DRIFT & SPAN DRIFT	+/- 0.015 PER DEG C AT AT MAX SPAN +/- 0.11 PER DEG C AT AT MAX SPAN	
	SPAN & ZERO	CONTINOUS TEMPER PROOF,REMOTE AS WELL AS ADJUSTABLY MANUAL FROM INSTRUMENT WITH ZERO SUPPRESSION & ELEVATION FACILITY	
	DAIGNOSTICS	SELF INDICATING FEATURE	
	POWER SUPPLY	24 V DC ± 10%	

FORM NO. PEM-6666-0

	DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER	SPECIFICATION NO.:
		VOLUME
		SECTION
		REV. NO. / DATE:
		SHEET 2 OF 3

TAG No. ..... Qty..... Data Sheet No.: PES-145-01-DS1-A

Data Sheet A & B

DATA SHEET-A FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
	ADJUSTMENT/CALIBRATION/MAINTENANCE	HAND HELD CALIBRATOR/HART .	
	ACCESSORIES	DIAPHRAGM SEAL,PULSATIONS DAMPENERS,SYPHON ETC AS REQUIRED BY SERVICE & OPERATING CONDITION, 2 VALVE MANIFOLD FOR ABSOLUTE PRESSURE TRANSMITTER (3 –VALVE MANIFOLD FOR GAUGE /VACUUM PRESSURE TRANSMITTER)AND 5 VALVE MANYFOLD FOR DP /LEVEL/FLOW TRANSMITTER	

NOTE - Wherever capillary is applicable, length of the capillary shall be 5 metres.

FORM NO. PEM-6666-0

	CHECK LIST FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER (Mechanical Auxiliary Packages)	SPECIFICATION NO.:	
		VOLUME	
		SECTION	
		REV. NO.	DATE:
		SHEET 3 OF 3	
		Data Sheet No.: PE-CL-999-145-I026-0	

SL NO	TESTS/CHECKS	QUANTM OF CHECK	REFERENCE DOC. ACCEPTANCE NORMS	AGENCY			REMARKS
				M	C	B	
1.0	CHECKS FOR VISULA, MODEL TAG NO.	SEE NOTE-1 BELOW	APPROVED TECHINCAL REQUIREMENT/ DATA SHEET	P	W	V	MFR TO CARRY OUT ROUTINE TEST ON 100%. WHEN MATERIAL CORELATION ARE NOT AVAILABLE MFR'S COMPLIANCE TO BE PROVIDED
2.0	PROCESS CONNECTION	-do-		P	W	V	
3.0	ACCURACY	-do-		P	W	V	
4.0	REPEATEABILITY	-do-		P	W	V	
5.0	HYSTERISIS	-do-		P	W	V	
6.0	EFFECT OF TEMP VARIATION ON ACCURACY	-do-		P	W	V	
7.0	SPAN /ZERO ADJUSTMENT	ONE/TYPE		P	W	V	
8.0	EFFECT OF SUPPLY VOLTAGE VARIATION	ONE/TYPE		P	W	V	
9.0	HIGH PRESSURE TEST	SEE NOTE-1 BELOW		P	W	V	
10.0	BURN IN TEST	ONE/TYPE		P	W	V	
11.0	DEGREE OF PROTECTION	ONE/TYPE		P	W	V	

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

NOTE:

1. QUANTUM OF CHECK SHALL BE AS BELOW
   100 % - BY MANUFACTURER
   RANDOM FOR EACH TYPE – BY BHEL & CUSTOMER
2. MANUFACTURER TO MAINTAIN CALIBRATED INSTRUMENT HAVING BETTER ACCURACY THAN THE ITEM UNDER TEST. INSPECTING ENGINEER SHALL CHECK THE SAME.
3. IN CASE OF IMPORTED ITEMS CONTRACTORS SHALL REVIEW TC's AND NOT INSPECT.

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

FORM NO. PEM-6666-0

BHEL	**SPECIFICATION FOR MOTORISED VALVE ACTUATOR**	SPECIFICATION NO.: PE-SS-394-145-I007 VOLUME II B SECTION D REV. NO. 00 DATE: 01.08.13 SHEET 1 OF 3

Data Sheet A & B

		DATA SHEET-A (TO BE FILLED BY PURCHASER)	DATA SHEET-B (TO BE FILLED-UP BY BIDDER)
GENERAL*	* PROJECT	2X800 MW GADARWARA-TG	
	OFFER REFERENCE		
	* TAG NO. SERVICE		
	* DUTY	☐ ON / OFF ☐ INCHING	
	* LINE SIZE (inlet/outlet): MATERIAL		
	* VALVE TYPE	☐ GLOBE ☐ GATE ☐ REG. GLOBE ☐ BUTTERFLY	
	* OPENING / CLOSING TIME		
	* WORKING PRESSURE		
	AMBIENT CONDITION	SHALL BE SUITABLE FOR CONTINUOUS OPERATION UNDER AN AMBIENT TEMP. OF 0-55 DEG C AND RELATIVE HUMIDITY OF 0-95%	
	VALVE SEAT TEST PRESS	BIDDER TO SPECIFY	
	REQUIRED VALVE TORQUE	BIDDER TO SPECIFY	
	ACTUATOR RATED TORQUE	BIDDER TO SPECIFY	
CONSTRUCTION AND SIZING	CONSTRUCTION	TOTALLY ENCLOSED, WEATHER PROOF, IP:55	
	MECHANICAL POSITION INDICATOR	TO BE PROVIDED FOR 0-100% TRAVEL	
	BEARINGS	DOUBLE SHIELDED, GREASE LUBRICATED ANTI-FRICTION.	
	GEAR TRAIN FOR LIMIT SWITCH/TORQUE SWITCH OPERATION	METAL (NOT FIBRE GEARS). SELF-LOCKING TO PREVENT DRIFT UNDER TORQUE SWITCH SPRING PRESSURE WHEN MOTOR IS DE-ENERGIZED.	
	SIZING	OPEN/CLOSE AT RATED SPEED AGAINST DESIGNED DIFFERENTIAL PRESSURE AT 85% OF RATED VOLTAGE. FOR ISOLATING SERVICE THREE SUCCESSIVE OPEN-CLOSE OPERATIONS OR 15 MINS. WHICHEVER IS HIGHER. **FOR INCHING SERVICE - 150 STARTS/HR MINIMUM & FOR REGULATING SERVICE - 600 STARTS/HR MINIMUM.**	
HANDWHEEL	* REQUIRED	☐ YES ☐ NO	
	* ORIENTATION	☐ TOP MOUNTED ☐ SIDE MOUNTED	
	*TO DISENGAGE AUTOMATICALLY DURING MOTOR OPERATION.		
ELECTRIC ACTUATOR	ACTUATOR MAKE/MODEL	BIDDER TO SPECIFY	
	MOTOR MAKE / MODEL / TYPE / RATING (KW)	BIDDER TO SPECIFY	
	@ MOTOR TYPE	SQUIRREL CAGE INDUCTION MOTOR, STARTING CURRENT LIMITED TO SIX TIMES THE RATED CURRENT-INCLUSIVE OF I.S. TOLERANCE	
	ACTUATOR APPLICABLE WIRING DIAGRAM	■ ENCLOSED (BIDDER TO CONFIRM) A: ☐ DRG. NO. 3-V-MISC-24227 R00 B: ☐ DRG. NO. 3-V-MISC-24550 R00 C: ■ DRG. NO. 3-V-MISC-24283 R00 D: ☐ DRG. NO. 4-V-MISC-90271 R11 E: ☐ For Thyristor based Integral starter, Bidder/Vendor to furnish wiring diagram	
	COLOUR SHADE	■ BLUE (RAL 5012) ☐	
	PAINT TYPE **(## Refer Notes)**	■ ENAMEL ☐ EPOXY ☐	
	SHAFT RPM	BIDDER TO SPECIFY	
	OLR SET VALUE	BIDDER TO SPECIFY	
	@ STARTING / FULL LOAD CURRENT	BIDDER TO SPECIFY	
	NO. OF REV FOR FULL TRAVEL	BIDDER TO SPECIFY	
	@ PWR SUPP TO MTR / STARTER	415V, 3PH,3 wire, 50Hz AC	
	@ CONTROL VOLTAGE REQUIREMENT	TO BE DERIVED FROM THE POWER SUPPLY TO THE STARTER ☐ 230 V ☐ 110 V	

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR	SPECIFICATION NO.: PE-SS-394-145-I007	
		VOLUME II B	
		SECTION D	
		REV. NO. 00	DATE: 01.08.13
		SHEET 2 OF 3	

Data Sheet A & B

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

FORM NO. PEM-6666-0

BHEL	**SPECIFICATION FOR MOTORISED VALVE ACTUATOR**	SPECIFICATION NO.: PE-SS-394-145-I007 VOLUME II B SECTION D REV. NO. 00 DATE: 01.08.13 SHEET 3 OF 3

Data Sheet A & B

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

NOTES:

1. SCOPE: DESIGN, MANUFACTURE, INSPECTION, TESTING AND DELIVERY TO SITE OF ELECTRIC ACTUATOR FOR INCHING OR OPEN / CLOSE DUTY.
2. CODES & STANDARDS: DESIGN AND MATERIALS USED SHALL COMPLY WITH THE RELEVANT LATEST NATIONAL AND INTERNATION STANDARD. AS A MINIMUM, THE FOLLOWING STANDARDS SHALL BE COMPLIED WITH:
   IS-9334, IS-2147, IS-2148, IS-325, IS-2959, IS-4691 AND IS-4722
3. TEMPERATURE RISE SHALL BE RESTRICTED TO 70 DEG. C FOR AMBIENT TEMPERATURE OF 50 DEG C.
4. CABLE GLANDS OF DOUBLE COMPRESSION TYPE, BRASS MATERIAL SHALL BE PROVIDED.
5. THE TORQUE SWITCHES SHALL BE PROVIDED WITH MECHANICAL LATCHING DEVICE TO PREVENT OPERATION WHEN UNSEATING FROM THE END POSITIONS. THE LATCHING DEVICE SHALL UNLATCH AS SOON AS THE VALVE LEAVES THE END POSITION. IF SUCH PROVISION IS NOT POSSIBLE, THE TORQUE SWITCHES SHALL BE BYPASSED BY END-POSITION LIMIT SWITCHES WHICH OPENS ON VALVE LEAVING END POSITION.THESE LIMIT SWITCHES ARE ADDITIONAL TO THE NUMBER OF LIMIT SWITCHES SPECIFIED ELSEWHERE.
6. THE MOTOR SHALL OPERATE SATISFACTORILY UNDER THE +/- 10% SUPPLY VOLTAGE VARIATION AT RATED FREQUENCY, -5% TO +3% VARIATION IN FREQUENCY AT RATED SUPPLY VOLTAGE, SIMULTANEOUS VARIATION IN VOLTAGE & FREQUENCY THE SUM OF ABSOLUTE PERCENTAGE NOT EXCEEDING 10%.
7. THE MOTOR SHALL BE SUITABLE FOR DIRECT ON LINE STARTING.

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

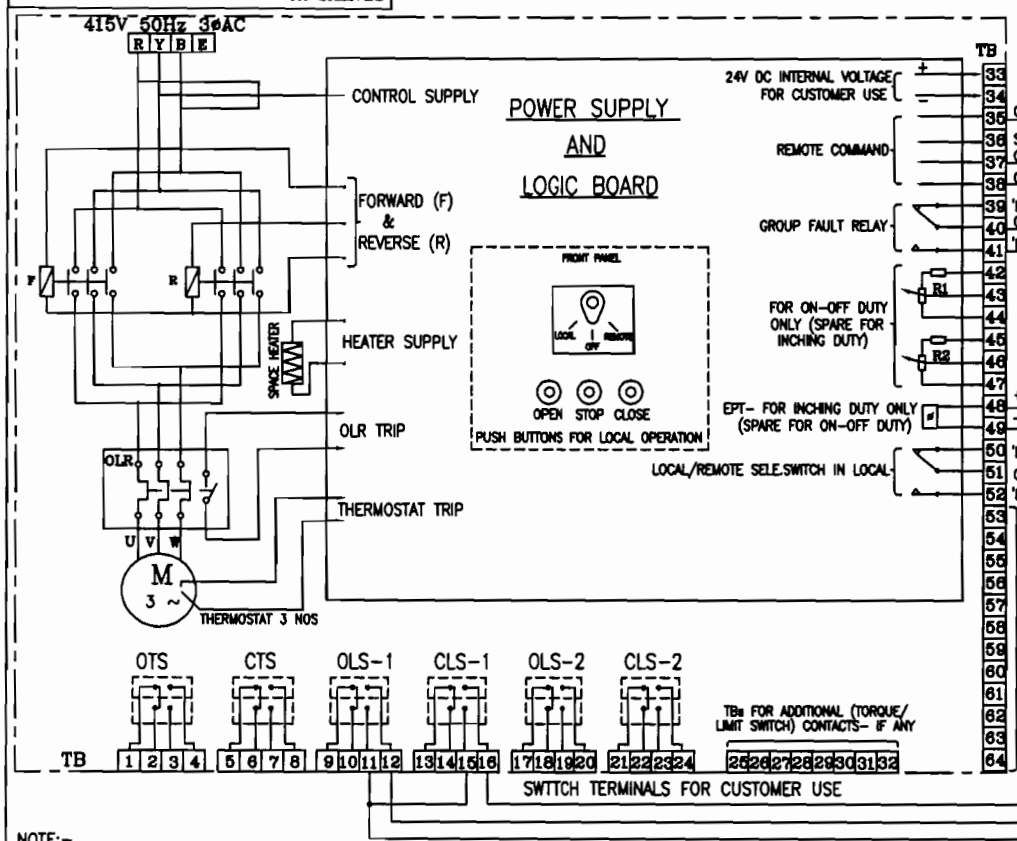
EPOXY PAINT IS RECOMMENDED FOR COASTAL AREAS.

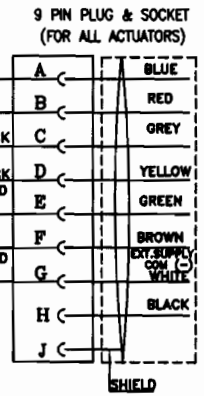
	PREPARED BY	CHECKED BY	APPROVED BY	VENDOR COMPANY SEAL
NAME	ANUJ WADHWA	CHETAN MALIK	M.A.MANSOORI	NAME
SIGNATURE				SIGNATURE
DATE	20.06.2013	20.06.2013	20.06.2013	DATE

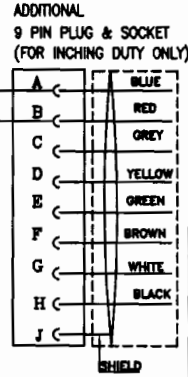
NOTES* = TO BE FILLED BY MPL (LEAD AGENCY). @= TO BE FILLED BY ES

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

DRAWING NO. 3-V-MISC-24283







CONTACT DEVELOPMENT DIAGRAM

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

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

——— INDICATES CONTACT CLOSED
- - - - - - INDICATES CONTACT OPEN

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

SETTING PROCEDURE OF POSITION LIMIT AND TORQUE SWITCH

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

– CLS NOT TO BE CONNECTED IN TRIP CIRCUIT
* – BYPASS OTS FOR INITIAL 5% OF TRAVEL(FOR GATE VALVES ONLY)

NOTE:-

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

REV	DATE	ALTERED
		CHD & APPD

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

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

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

DEPT	SCALE	WEIGHT (KG).	REFERENCE INFORMATIONS	NO. OF SHEETS
VL	NTS	-		-
CODE: -				

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

CARD CODE: U 01

DRAWING NO.: 3-V-MISC-24283

REV: 0

Size A3

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	TITLE : TECHNICAL SPECIFICATION FOR SELF CLEANING STRAINERS (SCS)	SPEC. NO. PE-TS-394-165-N002	
		VOLUME : IIB	
		SECTION : D	
		REV. NO. 0	DATE : 30.06.14
		SHEET 1of 1	

LIST OF SUB-VENDORS

NTPC	PROJECT : BULK TENDER (9 x 800 MW)	LIST OF ITEMS REQUIRING QP	REF. NO :
	PACKAGE : TG PACKAGE	APPROVAL & ACCEPTABLE	REVISION NO : 00
	CONTRACTOR : BHEL	VENDOR AS APPROVED BY	DATE : 05/07/2011
	CONTRACT NO :		

No.	Major Equipment	QP Inspection Category	QP No. 9575-110/ 9586-110-QVI-Q	QP Sub	QP Approval SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub.SCH	SS Approval SCH	Remark
		I				Dressor Masoneilan	France	A			
		I				HORA	Germany	A			
6	Control valve(For severe service application)	I				CCI	USA/Sweden /Korea	A			
		I				Dressor Masoneilan	France	A			
		I				HORA	Germany	A			
		I				EMERSON (Fisher)	USA/France /Japan	A			
		*				LESLIE	USA	DR			
		*				WEAR VALVES & Controls	UK	DR			
		*				KOSO	COIMBATORE	DR			
7	Control valve(other than severe service application) - up to 600 ANSI CLASS	I				MIL	Alwaye	A			Vendors at sl no 5 & 6 are also acceptable. For Sr. No. 7, higher rating of approval of sub supplier to be decided based on valve application and references during detail engineering.
		I				IL	Palghat	A			
		I				Fisher Sanmar	Chennai	A			
		I				Dressor	Coimbatore	A			
		II				Copes Vulcan	UK	A			
		*				Forbes Marshall	Pune	DR			
8	Conduits/Pipe(GI)	III				BIS Approved Sources		A			
9	Electronic transmitters (pressure, DP & flow)	II				EMERSON (Rosemount)	USA/pawane	A			
		II				FUJI ELECTRIC	JAPAN	A			
		II				YOKOGAWA	JAPAN	A			Testing and Calibration at M/s YIL, Bangalore is also acceptable.
		I				ABB	FARIDABAD	A			Model - 2600 T
		II				ABB	GERMANY	A			Model - 2600 T

NTPC	PROJECT : BULK TENDER (9 x 800 MW)	LIST OF ITEMS REQUIRING QP	REF. NO :
	PACKAGE : TG PACKAGE	APPROVAL & ACCEPTABLE	REVISION NO : 00
	CONTRACTOR : BHEL	VENDOR AS APPROVED BY	DATE : 05/07/2011
	CONTRACT NO :		

No.	Major Equipment	QP Inspection Category	QP No. 9575-110/ 9586-110-QVI-Q	QP Sub	QP Approval SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub.SCH	SS Approval SCH	Remark
10	Thermocouples, RTD & Thermowell	II				HERAUS SENSOR	GERMANY	A			
		II				WISE Control	Korea	A			
		I				Tempsens	Udaipur	A			
		I				Pyroelectric	Goa	A			
		I				Detriv Instrumentation & Electro	Mumbai	A			
		II				Minco	USA	A			
		II				OKAZAKI	JAPAN	A			
		II				Yamari	JAPAN	A			
		II				ABB(SENSYCON)	Germany	A			
		II				EMERSON (Rosemount)	Germany	A			
		II				EMERSON (Rosemount)	pawane	A			Imported from Emerson, Germany (make)
		I				GIC(Thermal Instruments)	Savantwadi	A			
11	Ultrasonic type level Transmitter	III				E & H	Aurangabad/ Germany	A			
		III				EMERSON	pawane	A			
		III				SIEMENS MILTRONICS	CANADA	A			
		*				Khrone	France	DR			
12	Orifice plate assembly	III				Instrumentation Limited	Palghat	A			
		III				Microprecision	Faridabad	A			
		III				Starmech	Pune	A			
		*				Engg. Specialities	Kolkata	DR			
		*				MINCO	GOA	DR			
		*				BALIGA	CHENNAI	DR			
13	Pressure, DP Gauge	III				BUDENBERG	UK	A			

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NTPC	PROJECT : BULK TENDER (9 x 800 MW)	LIST OF ITEMS REQUIRING QP	REF. NO :
	PACKAGE : TG PACKAGE	APPROVAL & ACCEPTABLE	REVISION NO : 00
	CONTRACTOR : BHEL	VENDOR AS APPROVED BY	DATE : 05/07/2011
	CONTRACT NO :		

No.	Major Equipment	QP Inspection Category	QP No. 9575-110/ 9586-110-QVI-Q	QP Sul	QP Approval SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub.SCH	SS Approval SCH	Remark
		III				ASHCROFT	USA/Germany	A			
		III				Wika	GERMANY/ Pune	A			
		III				WISE Control	Korea	A			
		III				Nagano KEIKI	Japan	A			
		III				H.Guru South India	Bangalore	A			Not for MS & FW application
		III				A.N. Instruments	Kolakatta	A			Not for MS & FW application
		III				GIC(Gauge Bourdon)	Panvel	A			Not for MS & FW application
		III				Manometer	Mumbai	A			Not for MS & FW application
		III				Goa Thermostatic	GOA	A			Not for MS & FW application
		III				GLUCK	Mumbai	A			Not for MS & FW application
		III				Switzer	Chennai	A			Not for MS & FW application - only for DP Indicator
		III				PTCI	Kolkata	A			Not for MS & FW application
		II				Waaree	Vapi	A			Not for MS & FW application
		*				Forbes Marshall	Hyderabad	DR			* - Inspection category to be decided during vendor evaluation.
		III				Ashcroft	Gandhinagar	A			Not for MS & FW application - for Mass brand

NTPC	PROJECT : BULK TENDER (9 x 800 MW)	LIST OF ITEMS REQUIRING QP	REF. NO :
	PACKAGE : TG PACKAGE	APPROVAL & ACCEPTABLE	REVISION NO : 00
	CONTRACTOR : BHEL	VENDOR AS APPROVED BY	DATE : 05/07/2011
	CONTRACT NO :		

No.	Major Equipment	QP Inspection Category	QP No. 9575-110/ 9586-110-QVI-Q	QP Sul	QP Approval SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub.SCH	SS Approval SCH	Remark
		III				H Guru	Rishra/Muzaffarpur	A			Not for MS & FW application
14	Level gauge (Transperent & Reflex, Tubular type)	III				Nihon Klingage Co.,Ltd	Japan	NOTED			Up to 40 Kg/cm2
		III				Bunkabokei Kogyo Co., Ltd	Japan	NOTED			Up to 40 Kg/cm2
		III				tokyo keiso	Japan	NOTED			Up to 40 Kg/cm2
		III				Samil industries Inc.	Korea	NOTED			Up to 40 Kg/cm2
		III				HITROL	Korea	NOTED			Up to 40 Kg/cm2
		III				Levcon	Kolkatta	NOTED			Up to 40 Kg/cm2
		III				Sigma	Mumbai	NOTED			Up to 40 Kg/cm2
		III				SBEM	Pune	NOTED			Up to 40 Kg/cm3
		III				Chemtrol	GOA	NOTED			Up to 40 Kg/cm4
		III				ASIAN INDUSTRIAL VALVES	CHENNAI	NOTED			Up to 40 Kg/cm5
		III				D.K.Instruments	Kolkotta	NOTED			Up to 40 Kg/cm2
		III				Flow Star	Faridabad	NOTED			Up to 40 Kg/cm2
		III				V-Automat	NewDelhi	NOTED			Up to 40 Kg/cm2
15	Press. DP, Vaccum Switch	II				SOR	USA	A			
		II				DRESSOR (ASHCROFT)	USA/Germany	A			
		II				ITT BARTON	USA	A			
		II				HERION	GERMANY	A			
		II				BARKSDALE	GERMANY	A			
		II				Switzer	Chennai	$			Up to 40kg/cm2 & not for Compound Switch and except 900 series
		I				Trafag	Ranipet	$			Up to 40kg/cm2 & not for Compound Switch
		II				Indfos	Ghaziabad	$			Up to 40kg/cm2 & not for Compound Switch

NTPC	PROJECT : BULK TENDER (9 x 800 MW)	LIST OF ITEMS REQUIRING QP	REF. NO :
	PACKAGE : TG PACKAGE	APPROVAL & ACCEPTABLE	REVISION NO : 00
	CONTRACTOR : BHEL	VENDOR AS APPROVED BY	DATE : 05/07/2011
	CONTRACT NO :		

No.	Major Equipment	QP Inspection Category	QP No. 9575-110/ 9586-110-QVI-Q	QP Sub	QP Approval SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub.SCH	SS Approval SCH	Remark
		III				Aura INC	New Delhi	A			¼" to 1/2" up to 5 way with Pressure rating up to 4000 Psi
		III				HP Valves and fittings	CHENNAI	A			
		III				HYD AIR	LONAVALA	A			
		III				Fluid control	Mumbai	A			
		III				Microprecision	Faridabad	A			
		III				Parker	USA	A			
		III				Swagelock	USA	A			
		III				Baldota	Mumbai	A			
28	Local Instrument Enclosure/Rack	I				Pyrotech	Udaipur	A			
		I				IL	Kota	A			
		I				Sajas electrical	Trichurapalli	A			
		*				Forbes Marshall	Pune	DR			
		I				ECIL	Hyderabad	DR *			Record updation - See footnotes
		I				Prammen	Puddukottai	A			
		I				Chemin	Pondicherry	A			
29	Instrument Cables	I				Paramount	Khuskhera	A			PVC,FRLS type,RQP
		I				Polycab	pawane	A			PVC,FRLS type,RQP
		I				Delton	Faridabad	A			PVC,FRLS type,RQP
		I				KEI	Bhiwadi	A			PVC,FRLS type
		I				Elkey Telelinks	Faridabad	A			PVC,FRLS type
		I				CORDS	Bhiwadi	A			PVC,FRLS type,RQP
		I				RELIANCE	Bangalore	DR*			PVC,FRLS type,RQP Record updation - See footnotes

NTPC	PROJECT : BULK TENDER (9 x 800 MW)	LIST OF ITEMS REQUIRING QP	REF. NO :
	PACKAGE : TG PACKAGE	APPROVAL & ACCEPTABLE	REVISION NO : 00
	CONTRACTOR : BHEL	VENDOR AS APPROVED BY	DATE : 05/07/2011
	CONTRACT NO :		

No.	Major Equipment	QP Inspection Category	QP No. 9575-110/ 9586-110-QVI-Q	QP Sub	QP Approval SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub.SCH	SS Approval SCH	Remark
		I				Nicco	Kolkata	A			PVC,FRLS type
		II				TEW & C	USA	A			
		II				Habia cables	Sweeden	A			
		II				Kerpen cables	Germany	A			
		II				Lapp cables	Germany	A			
		II				Thermo elecrta Bv	Netherland	A			
		I				Universal Cable	Satna	A			PVC,FRLS type
30	Electrical actuator	II				Auma	Germany	A			
		II				Limitorque	USA	A			
		II				Rotorq	UK	A			
		I				Limitorque	Faridabad	A			
		II / I				Rotork	Chennai/ Bangalore	A			For Bangalore - CAT - I
		II				Nippon gear	Japan	A			
		II				Auma	Bangalore	A			
31	Flow nozzle assembly	II				Microprecision	Faridabad	A			Except P-91 Material
		II				SEKO	Austria	A			
		II				TECHNOMATIC	Italy	A			
		II				ABB/ H&B	UK	A			
		II				IL	Palghat	A			
		II				Daniel	USA	A			
		II				Starmech	Pune	A			Except P-91 Material
		*				MINCO	GOA	DR			
		*				Engg. Specialities	Kolkata	DR			
32	HIGH Temp. cable (PTFE/FEP)	III				Habia cables	Sweden	A			
		III				Lapp cables	Germany	A			
		III				Kerpen cables	Germany	A			

NTPC	PROJECT: BULKSPPLY(9X800MW) Package: TG & AUXILIARY CONTRACTOR: BHEL-[redacted] PGM CONT NO:	LIST OF ITEMS REQUIRING QUALITY PLAN AND SUB SUPPLIER APPROVAL SUB SYSTEM: ELECTRICAL	Ref No: 9548/9549/9566/9573-110 Revision No: 00 Date: 11-03-10

SR NO	ITEM	QP /INS-PN CAT	QP NO. 2250-186	QP SUB-MISSION SCHEDU-LE	QP APPL SCHED ULE	PROPOSED SUB SUPPLIER	PLACE	SS APPL STATUS / CAT	SS DETAIL SUB-SCHEDU LE	SS APPL SCHED ULE	REMARKS
1	LT MOTOR (Ref NOTE 2)	1				CGL	AHMEDNAGAR	A			RQP
		1				KEC	BANGLORE/ HUBLI*	A			*upto 90kw,RQP
		1				JYOTI	VADODARA	A			
		1				NGEF	BANGALORE	A			UPTO 15 KW
		1				LHP	SOLAPUR	A			UPTO 120 KW
		1				ABB	FARIDABAD*/BANGALORE	A			* RQP& UPTO 55 KW
		1				SIEMENS	MUMBAI	A			RQP
		1				BHARAT BIJLEE	MUMBAI	A			UPTO 160 KW
		1				MARATHON	KOLKATA	A			RQP(UP TO 690 V & 600 KW)
2	CONTROL PANEL(NON PLC) FOR MECHANICAL SYSTEM & GENERATOR,AC & DC MOTOR STARTER AUXILIARY SYSTEM	1									
		1				SCHEINDER	NASHIK	A			
		1				JOLLY ENGG	KOLKATA	A			
		1				ELECHMECH	AHMEDABAD	A			
		1				SWITCHING CIRCUIT	KOLKATA	A			
		1				L&T	MUMBAI/COIMBATORE	A			
		1				CONTROL & SWITCHGEAR	NOIDA/HARDWAR	A			

SR NO	ITEM	QP /INS-PN CAT	QP NO. 2250-186	QP SUB-MISSION SCHEDULE	QP APPL SCHEDULE	PROPOSED SUB SUPPLIER	PLACE	SS APPL STATUS / CAT	SS DETAIL SUB-SCHEDULE	SS APPL SCHEDULE	REMARKS
2	CONTROL PANEL(NON PLC) FOR MECHANICAL SYSTEM & GENERATOR,AC & DC MOTOR STARTER AUXILIARY SYSTEM	I				JACKSON	G.NOIDA	A			
		I				MILTON ROY	KOLKATAA	A			WITH PUMP OF MILTON RAY-CHENNAI
		I				POSITRONICS	BARODA	A			
		I				UNILEC	GURGAON	A			
		I				Amrey control	Pune	A			WITH PUMP OF KISHOR PUMP-PUNE
		I				GEII	BANGLORE	A			
		I				MPP	BANGLORE	A			WITH PUMP OF GEA-BGR-CHENNAI
		I				SIEMENS	MUMBAI	A			
		I				PYROTECH	UDAIPUR	A			
		I				CONTROL DEVICES	KOLKATA	A			
		I				PROCON	BANGLORE	A			
3	1.1 KV XLPE POWER CABLE	I				TORRENT	NADIAD	A			
		I				UNIVERSAL CABLE	SATNA	A			RQP
		I				POLYCAB	DAMAN	A			RQP
		I				INCAB	PUNE	A			
		I				HVPL	FARIDABAD	A			
		I				NICCO	SHYAMNAGAR	A			
		I				RADIANT	HYDERABAD	A			
		I				PARAMOUNT	KHUSHKHERA	A			
		I				HAVELL	ALWAR	A			

ENGG. DIV / QAI

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SR NO	ITEM	QP /INS-PN CAT	QP NO. 2250-188	QP SUB-MISSION SCHEDULE	QP APPL SCHEDULE	PROPOSED SUB SUPPLIER	PLACE	SS APPL STATUS / CAT	SS DETAIL SUB-SCHEDULE	SS APPL SCHEDULE	REMARKS
3	1.1 KV XLPE POWER CABLE	I				KEI	BHIWADI	A			
		I				RALLISON	BHIWADI	A			
		I				CORDS	BHIWADI	A			
		I				DELTON	FARIDABAD	A			Armoured cable up to 3.5 CX 240 sqmm
		I				GEMSCAB	BHIWADI	A			
		I				SRIRAM CABLE	BHIWADI	DR			
		I				SPECIAL CABLE	DELHI	DR			
4	1.1 KV PVC POWER CABLE	I				KEI	BHIWADI	A			
		I				NICCO	SHYAMNAGAR	A			
		I				HVPL	FARIDABAD	A			
		I				TORRENT	NADIAD	A			
		I				UNIVERSAL CABLE	SATNA	A			RQP
		I				HAVELL	ALWAR	A			
		I				POLYCAB	DAMAN	A			RQP
		I				GEMSCAB	BHIWADI	A			
		I				DELTON	FARIDABAD	A			Armoured cable up to 3.5 CX 240 sqmm
		I				INCAB	PUNE	A			
		I				CORDS	BHIWADI	A			
		I				RALLISON	BHIWADI	A			
		I				PARAMOUNT	KHUSKHERA	A			
		I				RADIANT CABLE	HYDERABAD	A			
5	1.1 KV CONTROL CABLE	I				KEI	BHIWADI	A			
		I				DELTON	FARIDABAD	A			RQP

SR NO	ITEM	QP /INS--PN CAT	QP NO. 2250-186	QP SUB-MISSION SCHEDU-LE	QP APPL SCHED ULE	PROPOSED SUB SUPPLIER	PLACE	SS APPL STATUS / CAT	SS DETAIL SUB-SCHEDU LE	SS APPL SCHED ULE	REMARKS
5	1.1 KV CONTROL CABLE	I				GEMSCAB	BHIWADI	A			
		I				UNIVERSAL CABLES	SATNA	A			RQP
		I				TORRENT	NADIAD	A			
		I				POLYCAB	DAMAN	A			RQP
		I				PARAMOUNT CABLES	ALWAR	A			RQP
		I				NICCO	SHYAMNAGAR	A			
		I				HVPL	FARIDABAD	A			
		I				RADIANT	HYDERABAD	A			
		I				CORDS CABLE	BHIWADI	A			
		I				ELKAY TELELINK	BHIWADI	A			
		I				HAVELL	ALWAR	A			
		I				RALLISON	BHIWADI	A			
		I				SUYOG ELECTRICAL	BARODA	DR			
		I				THERMO CABLE	HYDERABAD	DR			
6	CABLE TRAY	I				INAR PROFILES LTD	ANKAPALLY	A			GALVANISING AT VISAKHA STEEL-ANAKAPALLI
		I				INDIANA GRATINGS	PUNE	A			SQP,GALVANISING AT POONA GALVANISER-PUNE
		I				JAMNA METALS	DELHI	A			SQP
		I				MJ ENGG	DELHI	A			SQP
		I				INDIA ELECTRIC SYNDICATE	KOLKATA	A			SQP,GALVANISING AT NTPC APPR. SOURCES

SR. NO	ITEM	QP /INS-PN CAT	QP NO. 2250-186	QP SUB-MISSION SCHEDU-LE	QP APPL SCHEDULE	PROPOSED SUB SUPPLIER	PLACE	SS APPL STATUS / CAT	SS DETAIL SUB-SCHEDULE	SS APPL SCHEDULE	REMARKS
6	CABLE TRAY	I				RATAN ENGG	KOLKATA	A			SQP,GALVANISING AT NTPC APPR. SOURCES
		I				VATCO	MUMBAI	A			SQP,GALVANISING AT SIGMA MUMBAI
		I				INDIANA	MUMBAI	A			SQP,GALVANISING AT KARAMTARA
		I				TECHNO ENGG	CHANDIGARH	A			SQP
		I				ANAND UDYOG	THANE	A			SQP
		I				INDUSTRIAL PERFORATION	KOLKATA	A			SQP,GALVANISING AT UNISTAR
		I				STEELITE	MUMBAI	A			SQP
		I				PATNY SYSTEM	HYDERABAD	DR			
		I				UNITECH FABRICATOR	KOLKATA	DR			
7	CABLE GLAND	III				SUNIL & CO	KOLKATA	A			
		III				QUALITY PRECISION	KOLKATA	A			
		III				ARUP ENGG	KOLKATA	A			
		III				COMET	MUMBAI	A			
8	LUGS	III				CHETNA	NASHIK	A			
		III				3D	UMBERGAON	A			
		III				DOWELLS	MUMBAI	A			
9	GALVANISEDJB &EARTHING MATERIAL	III				BHEL APPROVED SOURCES					GALVANISING AT NTPC APPROVED SOURCES
10	ELEVATOR	I				KONE	CHENNAI	A			
		I				SAMUEL TEC	KOREA	A			
		I				TECHNO INDUCTRIES	AHMEDABAD	A			

FORM NO.: C[illegible]-QAI-[illegible]-F3-R0

ENGG.[illegible] / QA[illegible]

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SR - NO	ITEM	QP /INS--PN CAT	QP NO. 2250-166	QP SUB-MISSION SCHEDU-LE	QP APPL SCHED ULE	PROPOSED SUB SUPPLIER	PLACE	SS APPL STATUS / CAT	SS DETAIL SUB-SCHEDU LE	SS APPL SCHED ULE	REMARKS
10	ELEVATOR	I				OTIS	MUMBAI	A			
		I				JOHSON	CHENNAI	DR			
		I				OMEGA INDUSTRIESL	AHMEDABAD	DR			
		I				ECS	GHAZIABAD	DR			
11	NG RESISTOR	I				SR NARKHEDE	PUNE	A			
		I				RESITECH ELECTRICALS	KOLKATA	A			
		I				SR NARKHEDE	PUNE	A			
		I				RSI SWITCHGEAR	GURGAON	A			
		I				LACHHMAN ELECTRONICS	DELHI	A			
		I				SPEED-O-CONTROLS	MUMBAI	DR			
12	FQP of ELECTRICAL EQUIPMENT- RECEIPT, STORAGE & ERECTION	I									

SR. NO	ITEM	QP /INS-PN CAT	QP NO. 2250-166	QP SUB-MISSION SCHEDULE	QP APPL SCHEDULE	PROPOSED SUB SUPPLIER	PLACE	SS APPL STATUS / CAT	SS DETAIL SUB-SCHEDULE	SS APPL SCHEDULE	REMARKS

NOTE 1 : NOMENCLATURES USED
CAT-I QP APPROVAL AND INSPECTION BY NTPC: CAT-II QP APPROVAL BY NTPC INSPECTION BY TEL
CAT-III INSPECTION AS PER TEL QUALITY SYSYTEM
A: APPROVED VENDOR : DR: DETAILS REQUIRED : DR* VENDOR HISTORICALLY APPROVED, UPDATION OF DATA REQUIRED.

NOTE 2: A) MOTORS Less than 30 KW
Acceptance of Motor less than 30 KW is based on COC of the Manufacturer and the Contractor confirming as follows:
It is hereby confirmed that the above mentioned motor /motors was/ were manufactured taking care of NTPC specific requirements regarding ambient temp., voltage ,frequency variation, hot starts, pull out torque, starting KVA/KW, temp. rise, distance between centre of stud gland plate and tested in accordance with approved drawing /data sheets 7 NTPC specification

B) Between 30 KW and 50KW
Acceptance of Motor rating between 30 KW and 50 KW is based on NTPC review of Routine Test inspection report as per IS 325 witnessed by main contractor along with COC of the Manufacturer and the Contractor confirming as follows:
It is hereby confirmed that the above mentioned motor /motors was/ were manufactured taking care of NTPC specific requirements regarding ambient temp., voltage frequency variation, hot starts, pull out torque, starting KVA/KW, temp. rise, distance between centre of stud gland plate, space heater and tested in accordance with approved drawing /data sheets. FOR MOTORS ABOVE 50 KW: AS PER NTPC APPROVED QUALITY PLAN

NOTE3 : IN CASE OF GALVANISED JB EARTHING MATL GALVANISATION TO BE CARRIED OUT AT NTPC APPROVED GALVANISER INDICATED FOR CABLE TRAY
NOTE 4:ELECTRICAL SUB VENDOR LIST UNDER HYDROGEN PLANT SHALL BE FINALIZED AFTER FINALIZATION OF VENDOR FOR HYDROGEN PLANT. NOTE 5: ITEMS NOT REFERED IN ABOVE SHALL BE INTIMATED TO NTPC FOR APPROVVAA

NTPC