

3 X 660 MW NTPC NORTH KARANPURA STPP

TECHNICAL SPECIFICATION FOR SELF CLEANING STRAINERS (SCS)

Specification No. : PE-TS- 405-165-N003(REV. 0)

VOLUME -IIB



**BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
PPEI BLDG., SEC-16A, PLOT NO. 25
NOIDA – 201301 (UP)**

	TITLE : TECHNICAL SPECIFICATION FOR SELF CLEANING STRAINERS (SCS) PREAMBLE	SPEC. NO. PE-TS- 405-165-N003	
		VOLUME : II B	
		REV. NO. 0	DATE :15.07.2014
		SHEET1	OF 2

1.0 The tender document contains three (3) volumes. The bidder shall meet the requirements of all the three volumes.

1.1 **Volume -I CONDITIONS OF CONTRACT**

This consists of four parts as below :

Volume - I A : This part contains instructions to bidders for making bids to BHEL.

Volume - I B : This part contains general commercial conditions of the tender and include provision that vendor shall be responsible for the quality of item supplied by their sub-vendors.

Volume - I C : This part contains special conditions of contract.

Volume - I D : This part contains commercial conditions for erection and commissioning site work, as applicable.

1.2 **Volume - II TECHNICAL SPECIFICATIONS**

Technical requirements are stipulated in Volume II which comprises of :

Volume - II A : General Technical Conditions

Volume - II B : Technical specification including drawings, if any

1.2.1 **Volume - II B :**

This volume is sub-divided into following sections:

Section - A : This section outlines the scope of enquiry.

Section - B : This section provides "Project Information"

Section - C : This section indicates technical requirements specific to the contract, not covered in Section-D.

Section - D : This section comprises of standard technical specifications of equipments complete with data sheet A, B & C.

Data sheet-A specifies data and other requirements pertaining to the equipment.

Data sheet - B specifies data to be filled by the bidder (Data Sheet B is contained in Volume - III)

Data sheet - C indicates data documents to be furnished after the award of contract as per agreed schedule by the vendor (as applicable).

	TITLE : TECHNICAL SPECIFICATION FOR SELF CLEANING STRAINERS (SCS) PREAMBLE	SPEC. NO. PE-TS- 405-165-N003	
		VOLUME : II B	
		REV. NO. 0	DATE :15.07.2014
		SHEET2 OF 2	

1.2.2 Volume - III TECHNICAL SCHEDULES

- 1.0 This volume contains technical schedules and Data Sheets - B, which are to be duly filled by the bidder and the same shall be furnished with the technical bid as per instructions given in Document No.PES-100-901 in Volume-III.
- 2.0 The requirements mentioned in Section C/Data Sheets-A of Section-D shall prevail and govern in case of conflict between the same and the corresponding requirements mentioned in the descriptive portion in Section -D.



**TITLE : TECHNICAL SPECIFICATION
FOR
SELF CLEANING STRAINERS (SCS)**

SPEC. NO. PE-TS-405-165-N003

VOLUME : II B

SECTION : A

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SHEET

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C2 SPECIFIC TECHNICAL REQUIREMENTS (ELECTRICAL)

C3 SPECIFIC TECHNICAL REQUIREMENTS (C&I)

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SELF CLEANING STRAINER

- ◆ STANDARD TECHNICAL
SPEC.NO. PE-TS-999-165-N002
- ◆ DATA SHEET-A
- ◆ QUALITY PLAN

D2ELECTRICAL SYSTEMS

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**TITLE : TECHNICAL SPECIFICATION
FOR
SELF CLEANING STRAINERS (SCS)**

SPEC. NO. PE-TS-405-165-N003

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**SECTION - A
SCOPE OF ENQUIRY**

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**SECTION - A
SCOPE OF ENQUIRY**



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1.00.0 SCOPE

This enquiry covers the design, manufacture, assembly, inspection and testing at manufacturer's and/or his sub-contractors works properly packed for delivery of the items as follows:

1.01.0 Self Cleaning Strainers :

Self Cleaning Strainers (SCS) complete with all accessories as per the requirements specified in different sections of this specification for 3 X660 MW NTPC NORTH KARANPURA STPP.

The bidder's scope also includes installation checks, commissioning, trial runs & PG Testing at site of SCS.

1.01.1 The bids shall be evaluated as per NIT.

2.00.00 GENERAL TECHNICAL INSTRUCTIONS:

2.01.00 It is not the intent to specify herein all the details of design and manufacture. However the equipment shall conform in all respects to high standard of design, engineering and workmanship, and shall be capable of performing the required duties in a manner acceptable to Engineer/ Owner, who will interpret the meaning of drawing and specifications, and shall be entitled to reject any component or material, which in his judgement is not in full accordance herewith.

2.02.00 The omission of specific reference to any component/ accessory necessary for the proper performance of the equipments shall not relieve the bidder of the responsibility of providing such facilities to complete the supply of the equipments at quoted prices.

2.03.00 In case of any deviation from this Technical specification (Vol. IIB) and General Technical Conditions (Vol. IIC), the same shall be indicated in the schedule of deviations enclosed in Volume-III, Part-A. In the absence of duly filled schedules it will be assumed that the bid strictly conforms to the specification.

2.04.00 BHEL's/ Customer's representatives shall be given full access to the shop in which the equipments are being manufactured or tested and all test records shall be made available to him.

2.05.00 The equipments covered under this specification shall not be despatched unless the same have been finally inspected, accepted and shipping release issued by BHEL/ Customer

2.06.00 Un-priced copy of price bid shall be furnished alongwith the technical bid.



**TITLE : TECHNICAL SPECIFICATION
FOR
SELF CLEANING STRAINERS (SCS)**

SPEC. NO. PE-TS-405-165-N003

VOLUME : II B

SECTION : C

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SECTION - B

PROJECT INFORMATION

SUB-SECTION-I-B

PROJECT INFORMATION

**NORTH KARANPURA STPP
(3 X 660 MW)
EPC PACKAGE**

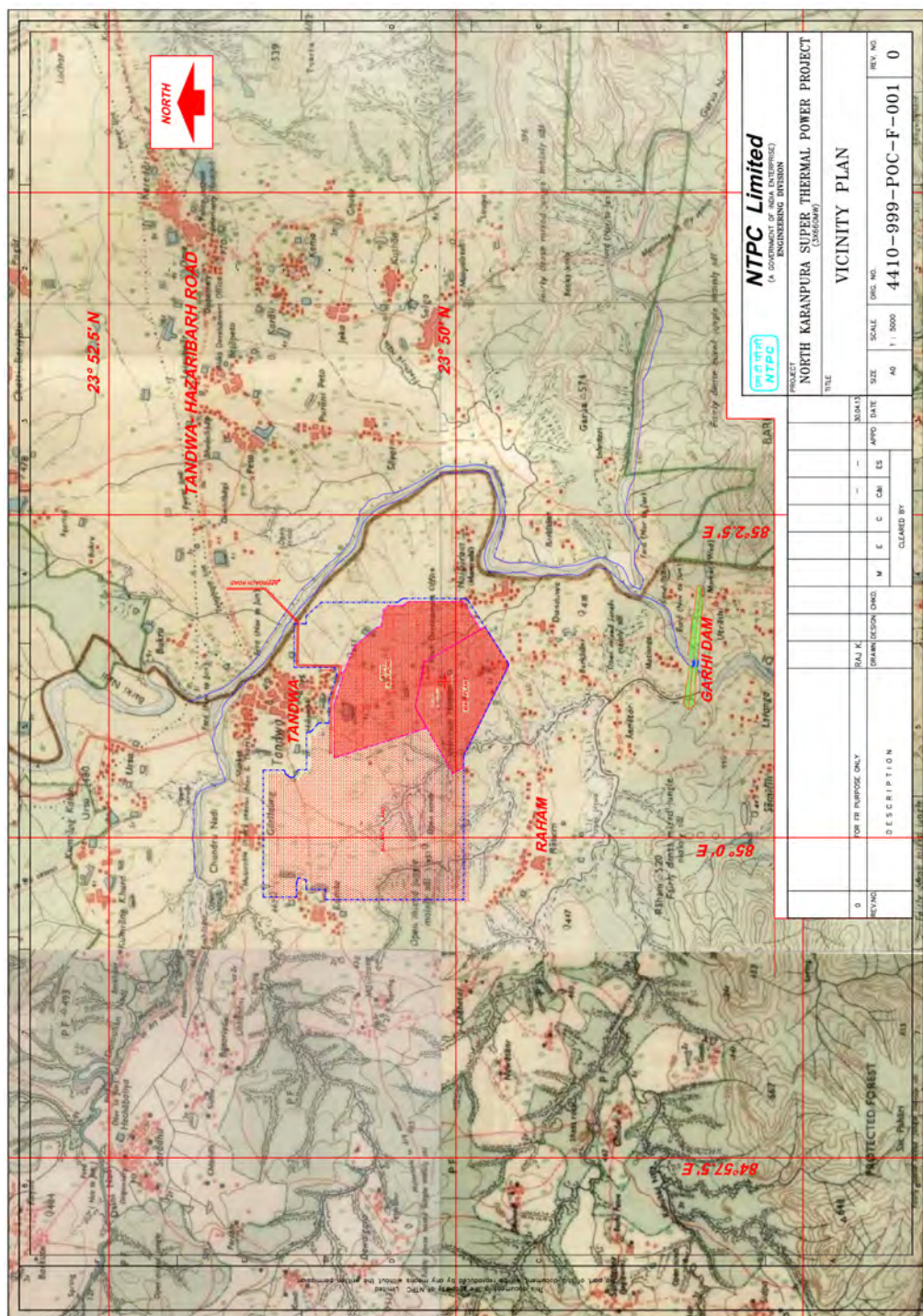
**TECHNICAL SPECIFICATION
SECTION-VI, PART-A
BID DOC NO: CS-4410-001-2**

CLAUSE NO.	PROJECT INFORMATION												
1.00.00	BACKGROUND North Karanpura Super Thermal Power Project (3x660 MW), a pit head coal based thermal power project, is located in Hazaribagh and Chatra districts of Jharkhand State. Basic inputs i.e. coal, water and land have already been tied up. The project is proposed for the States & Union Territories of Northern, Western and Eastern Regions and the State of Jharkhand. The capacity of the project is 1980 MW comprising of three (3) units of 660 MW each.												
1.01.00	Location and Approach The power project is proposed to be located near Tandwa town in Chatra districts in the state of Jharkhand on Hazaribagh-Chatra State highway at a distance of about 50 kms from Hazaribagh city. The nearest commercial airport is Ranchi at a distance of 150 kms from project site. The nearest railhead Khalari Railway Station on Ranchi-Garhwa section of Eastern Railways is about 40 kms from project site. Major rail/road distances from the project site are as under: <table border="1"><thead><tr><th>City</th><th></th><th>Distance Approx. (kms)</th></tr></thead><tbody><tr><td>Ranchi</td><td>:</td><td>150</td></tr><tr><td>Khalari</td><td>:</td><td>40</td></tr></tbody></table> The site is located near Tandwa town having latitude and longitude of about 23° 50' N to 23° 52' N and 84° 59' E to 85° 2' E respectively. The Vicinity Plan of the project is placed at Annexure-I . Further to the information given in this sub-section, Bidders are also advised to visit the project site and collect data on local site conditions.				City		Distance Approx. (kms)	Ranchi	:	150	Khalari	:	40
City		Distance Approx. (kms)											
Ranchi	:	150											
Khalari	:	40											
1.02.00	Land About 2245 acres of land is being acquired for the project. About 1500 acres of land is under possession/legal possession and out of 1500 acres, about 890 acres of land is to be used for plant, ash dyke and initial enabling township. No additional land is envisaged to be acquired in plant area. About 15 acres of land is envisaged to be acquired in Hazaribagh city for Township. Commissioner, Chatra vide dated 25.05.1999 and 14.06.2000 has given in-principle clearance for NKSTPP.												
1.03.00	Water Make up water available for this project would be about 22 cusec and will be arranged by constructing a dam/reservoir across river Garhi.												
1.04.00	Fuel (Coal)												
1.04.01	Coal Requirement, Availability and Linkage Coal requirement for the project is estimated as 10.6 Million Tonne/Annum (MTPA), considering a GCV of 3800 kcal/kg. Ministry of Coal vide letter dated 21.10.99 accorded in-principle coal linkage of 10.00 MTPA subject to ratification by Standing Linkage Committee-Long Term (SLC (LT)), of MOC. SLC (LT) in its meeting held on 15.12.2000 firmed up the coal linkage of 10.24 MTPA for the project. Subsequently, the coal linkage was withdrawn by SLC (LT) in its meeting held on 22/23.10.08.												
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.:CS-4410-001-2	SUB-SECTION-IB PROJECT INFORMATION	PAGE 1 OF 10									

CLAUSE NO.	PROJECT INFORMATION			
	Cabinet Committee on Investment (GOI) in its meeting on 20.02.13 decided in-principle to restore the original coal linkage granted to NKSTPP (i.e. from Magadh Coal Block) with the stipulation that the coal supply will commence during the 13th Five Year Plan. MOC vide letter dated 09.05.2013 restored the coal linkage with the stipulation that the coal supply will commence during the 13th five year plan.			
1.04.02	Coal Transportation			
	Coal from Magadh block of North Karanpura Coalfields is proposed to be transported to the project site through conveyor belt system. One external coal handling plant and one internal coal handling plant are envisaged.			
1.05.00	Meteorological Data			
	Important meteorological data from nearest observatory at Hazaribag is placed at Annexure-II.			
1.06.00	Plant Water Scheme			
	The Plant water scheme is described below.			
1.06.01	Condenser Cooling System			
	It is proposed to adopt Air Cooled Condenser for the project.			
1.06.02	Equipment Cooling Water (ECW) System (Unit Auxiliaries)			
	All plant auxiliaries shall be cooled by De-mineralized water (DM) in a closed circuit. The primary circuit DM water shall be cooled through heat exchangers by auxiliary cooling water system. The hot secondary circuit cooling water shall be cooled in the cooling towers and shall be returned back to the system.			
1.06.03	Ash Water System			
	It is proposed to have HCSD (High concentration Slurry Disposal) system for combined fly ash and bottom ash. No recirculation of ash water from ash disposal area is envisaged.			
1.06.04	Other Miscellaneous Water Systems			
	(a) Raw water shall be used for meeting the Fly ash and bottom ash system requirement etc. (b) The service water shall be taken from clarified water tank of Pretreatment plant. Service water (wash water) collected from various areas shall be treated using oil water separators, tube settlers, coal settling pits etc. as per requirement and treated water from liquid effluent treatment plant shall be recycled back to the service water system for re-use. (c) The drinking water requirement of the plant shall be provided from water treatment plant.			
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.:CS-4410-001-2	SUB-SECTION-IB PROJECT INFORMATION	PAGE 2 OF 10

CLAUSE NO.	PROJECT INFORMATION 		
1.07.00	(d) Steam Cycle make-up water, makeup to the primary circuit of ECW (unit auxiliaries) system, boiler fill water and makeup to the hydrogen generation plant shall be provided from Demineralising plant.		
	(e) The quality of Raw water is enclosed with this sub-section as Annexure-III. Criteria for Earthquake Resistant Design of Structures and Equipment All power plant structures and equipment, including plant auxiliary structures and equipment shall be designed for seismic forces as given in the Part - B of this section.		
1.08.00	Criteria for Wind Resistant Design of Structures and Equipment All structures and equipment of the power plant, including plant auxiliary structures and equipment, shall be designed for wind forces as given as given in Part B of this section.		
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.:CS-4410-001-2	SUB-SECTION-IB PROJECT INFORMATION PAGE 3 OF 10

VICINITY PLAN



CLIMATOLOGICAL TABLE

CLIMATOLOGICAL TABLE																			
STATION : हजारीबाग STATION : Hazaribagh										अक्षांश देशांतर LAT 23°59' N LONG 85°22' E					समुद्री सत मध्य से ऊँचाई HEIGHT ABOVE M. S. L. 611 METRES				
1951 से 1980 तक के दिनों पर अवलंबित BASED ON OBSERVATIONS FROM 1951 TO 1980																			
वायु तापमान										वर्षा									
AIR TEMPERATURE										RAINFALL									
MEAN										EXTREMES									
HUMIDITY										CLOUD AMOUNT									
RELATIVE VAPOUR PRESSURE										ALL MONTHLY TOTALS									
NO. OF RAINY DAYS										TOTAL IN MONTH WITH YEAR									
DATE OF FALL IN YEAR										DATE OF RAIN IN YEAR									
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CLAUSE NO.	PROJECT INFORMATION			एनटीपीसी NTPC
	Annexure-III			
	RAW WATER ANALYSIS			
	Sl. No.	Constituent	as	mg per litre
	1.	Calcium	CaCO3	65
	2.	Magnesium	CaCO3	41
	3.	Sodium	CaCO3	98
	4.	Potassium	CaCO3	5
	5.	Total Cations	CaCO3	209
	6.	Total Alkalinity	CaCO3	150
	7.	Chloride	CaCO3	25
	8.	Sulphate	CaCO3	34
	9.	Total Anions	CaCO3	209
	9.	Silica (Reactive)	SiO2	9
	11.	Iron	Fe	1.2
	12.	pH Value	-	7.6-8.2
13.	Turbidity	NTU	200	
14.	Organics(As per KMnO4 method)	Number	2	
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.:CS-4410-001-2	SUB-SECTION-IB PROJECT INFORMATION	PAGE 6 OF 10

CLARIFIED WATER ANALYSIS

Sl. No.	Constituent	as	mg per litre
1.	Calcium	CaCO ₃	65
2.	Magnesium	CaCO ₃	41
3.	Sodium	CaCO ₃	98
4.	Potassium	CaCO ₃	5
5.	Total Cations	CaCO ₃	209
6.	Total Alkalinity	CaCO ₃	150
7.	Chloride	CaCO ₃	25
8.	Sulphate	CaCO ₃	34
9.	Total Anions	CaCO ₃	209
9.	Silica (Reactive)	SiO ₂	9
11.	Iron	Fe	.03
12.	pH Value	-	7.6-8.2
13.	Turbidity	NTU	10
14.	Organics(As per KMnO ₄ method)	Number	.05

CLAUSE NO.	PROJECT INFORMATION		एनटीपीसी NTPC																								
	ANNEXURE-IV-1																										
	TABLE-1 LIGHT DIESEL OIL CHARACTERISTICS (AS PER IS 15770-2008) <table><tr><th>Characteristics</th><th>LDO</th></tr><tr><td>1. Pour Point (max)</td><td>21 °C & 12°C for Summer and Winter respectively</td></tr><tr><td>2. Kinematic viscosity in centistokes at 40 deg.C</td><td>2.5 to 15.0</td></tr><tr><td>3. Sediment percent by mass (max)</td><td>0.10</td></tr><tr><td>4. Total sulphur percent by mass (max)</td><td>1.5</td></tr><tr><td>5. Ash percentage by mass (max)</td><td>0.02</td></tr><tr><td>6. Carbon residue (Rams bottom) percent by pass (max.)</td><td>1.50</td></tr><tr><td>7. Acidity inorganic</td><td>Nil</td></tr><tr><td>8. Flash point (Min.) - Pensky Martens</td><td>66 deg.C</td></tr><tr><td>9. Copper strip corrosion for 3 hours at 100 °C</td><td>Not worse than No. 2</td></tr><tr><td>10. Water content, % by volume (max)</td><td>0.25</td></tr><tr><td>11. GCV(kcal/kg)</td><td>10,000</td></tr></table>			Characteristics	LDO	1. Pour Point (max)	21 °C & 12°C for Summer and Winter respectively	2. Kinematic viscosity in centistokes at 40 deg.C	2.5 to 15.0	3. Sediment percent by mass (max)	0.10	4. Total sulphur percent by mass (max)	1.5	5. Ash percentage by mass (max)	0.02	6. Carbon residue (Rams bottom) percent by pass (max.)	1.50	7. Acidity inorganic	Nil	8. Flash point (Min.) - Pensky Martens	66 deg.C	9. Copper strip corrosion for 3 hours at 100 °C	Not worse than No. 2	10. Water content, % by volume (max)	0.25	11. GCV(kcal/kg)	10,000
Characteristics	LDO																										
1. Pour Point (max)	21 °C & 12°C for Summer and Winter respectively																										
2. Kinematic viscosity in centistokes at 40 deg.C	2.5 to 15.0																										
3. Sediment percent by mass (max)	0.10																										
4. Total sulphur percent by mass (max)	1.5																										
5. Ash percentage by mass (max)	0.02																										
6. Carbon residue (Rams bottom) percent by pass (max.)	1.50																										
7. Acidity inorganic	Nil																										
8. Flash point (Min.) - Pensky Martens	66 deg.C																										
9. Copper strip corrosion for 3 hours at 100 °C	Not worse than No. 2																										
10. Water content, % by volume (max)	0.25																										
11. GCV(kcal/kg)	10,000																										
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.:CS-4410-001-2	SUB-SECTION-IB PROJECT INFORMATION																								
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CLAUSE NO.	PROJECT INFORMATION			
	TABLE-2 ANNEXURE-IV-2 <u>HIGH SPEED DIESEL OIL CHARACTERISTICS</u> [AS PER IS 1460-2005 (BS-II)]			
	S. No.	Particulars	Unit	Value
	1.	PHYSICAL PROPERTIES		
		a. Distillation volume recovery @ 350 ⁰ C	% vol. (min)	85
		b. Distillation volume recovery @ 370 ⁰ C	% vol. (min)	95
		c. Kinematic Viscosity @ 40 Degree C	cSt	2.0 – 5.0
		d. Density @ 15 Degree C	kg/m ³	820 – 860
		e. Pour Point		
		- Summer	Degree C (max)	15
		- Winter	Degree C (max)	03
		f. Cold Filter Plugging Point		
		- Summer	Degree C (max)	18
		- Winter	Degree C (max)	06
		g. Flash Point (Abal)	Degree C (max)	35
		h. Lubricity WSD 1.4 @ 60 Degree C	Microns (max)	460
	2.	HEATING VALUE		
		a. Higher Heating Value (HHV)	Kcal/Kg	11,000
		b. Lower Heating Value (LHV)	Kcal/Kg	10,300
	3.	ACIDITY		
		a. Inorganic	mg KOH/g	Nil
		b. Total	mg KOH/g	0.2 (max.)
	4.	Copper Strip Corrosion 3 hours @100 ⁰ C	No.	1 (max)
	5.	RCR on 10% residue	% wt.	0.3 (max)
	6.	CONTAMINANTS		
		a. Ash	ppm (wt.)	100 (max)
		b. Sediments	% wt	0.05 (max)
		c. Total Sulphur	% wt	0.05 (max)
		d. Water Content	% volume	0.05 (max)
		e. Trace Metals		
		- Na + K	ppm (wt)	0.30 (max)
		- Vanadium	ppm (wt)	0.50 (max)
		- Lead	ppm (wt)	0.50 (max)
		- Calcium	ppm (wt)	2.0
		- Ni + Zn	ppm (wt)	Nil
	7.	Nitrogen content (FBN)	% wt.	0.015
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.:CS-4410-001-2	SUB-SECTION-IB PROJECT INFORMATION	PAGE 8 OF 10

TABLE-3

ANNEXURE-IV-3

PROPOSED COAL CHARACTERISTICS FOR NORTH KARANPURA

STPP (3 x 660 MW)

S.No.	Characteristics (as received basis)	Range of 95 % coal supplies			Range of 5 % coal supplies
		Column - 1	Column - 2	Column - 3	
1.0	PROXIMATE ANALYSIS	Design	Worst	Best	
1.1	Total Moisture (%)	15	18	12	12-18
1.2	Ash (%)	40	46	36	33-46
1.3	Volatile Matter (%)	19	18	22	23-18
1.4	Fixed Carbon (%)	26	18	30	31-18
1.5	Total (%)	100	100	100	
2.0	ULTIMATE ANALYSIS				
2.1	Carbon (%)	29.73	23.08	37.32	40.62-23.08
2.2	Hydrogen (%)	3.7	3.54	3.92	4.02-3.54
2.3	Sulphur (%)	0.5	0.6	0.4	0.4-0.6
2.4	Nitrogen(%)	1.8	1.45	1.6	1.4-1.45
2.5	Oxygen(%) (By difference)	8.66	6.7	8.32	8.12-6.7
2.6	Carbonates (%)	0.58	0.6	0.4	0.4-0.6
2.7	Phosphorous(%)	0.03	0.03	0.04	0.04-0.03
2.8	Total Moisture (%)	15	18	12	12-18
2.9	Ash (%)	40	46	36	33-46
	Total	100	100	100	
2.10	GCV (Kcal/Kg)	3300	2800	4000	4300-2800
2.11	Hard Grove Index	55	50	60	50-65
3.0	ASH ANALYSIS				
3.1	Silica (%)	59.79	61.3	56.7	62-56
3.2	Alumina(%)	25.36	28	23.5	28-23
3.3	Iron Oxide (%)	7.2	6	10	6-10
3.4	Titania	1.2	1	1.5	1-1.7
3.5	Phosphoric Anhydride (%)	2.6	1.5	3	1-3
3.6	Lime (%)	0.88	0.5	1.5	0.5-1.7
3.7	Magnesia (%)	0.55	0.4	1	0.4-1.1
3.8	Sulphuric Anhydride (%)	1.2	0.5	1.4	0.5-1.7
3.9	Alkalies (by difference)	1.22	0.8	1.4	0.6-1.8
	Total	100	100	100	
4.0	ASH FUSION RANGE				
	REDUCING ATMOSPHERE				
4.1	Initial Deformation Temp.(oC)	1100	1100	1100	1100-1150
4.2	Hemispherical Temp. (oC)	1300	1250	1350	1250-1400
4.3	Fusion Temperature (oC)	1400	1400	1400	1400-1450

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	ANNEXURE-IV-4			
	TABLE – 4			
	TYPICAL IMPORTED COAL AND ASH CHARACTERISTICS			
	SI.No.	Characteristics (as received basis)	Imported Coal	
			Worst	Best
	1.0	Proximate Analysis		
	1.1	Total Moisture (%)	20	16
	1.2	Ash (%)	10	10
	1.3	Volatile Matter (%)	30	45
	1.4	Fixed Carbon (%)	40	29
	1.5	Total (%)	100	100
	2.0	Ultimate Analysis		
	2.1	Carbon (%)	56.4	62.4
	2.2	Hydrogen (%)	4.5	4.9
	2.3	Sulphur (%)	0.9	0.8
	2.4	Nitrogen (%)	0.9	0.5
	2.5	Oxygen (%) (By difference)	7.3	5.4
	2.6	Carbonates (%)	0	0
	2.7	Phosphorous (%)	0	0
	2.8	Total Moisture (%)	20	16
	2.9	Ash (%)	10	10
		Total	100	100
	2.10	GCV (Kcal/Kg)	5800	6500
	2.11	Hard Grove Index	45	60
	2.12	YGP (mg/kg)	100	70
	3.0	Ash Analysis		
	3.1	Silica (SiO2) (%)	32.74	34.94
	3.2	Alumina(Al2O3) (%)	30.5	28.43
	3.3	Iron Oxides(Fe2O3) (%)	18.2	15.2
	3.4	Titania (TiO2)	1.56	1.76
	3.5	Phosphoric Anhydride(P2O5) (%)	0.44	0.54
	3.6	Lime (CaO) (%)	6.12	7.62
	3.7	Magnesia (MgO) (%)	1.83	1.93
	3.8	Sulphuric Anhydride (%)	6.95	7.65
	3.9	Sodium Oxide (Na2O) (%)	0.3	0.4
	3.10	Balance alkalies (by difference)	1.36	1.56
		Total	100	100
	4.0	Ash Fusion Temperature reducing temperature		
	4.1	Initial deformation Temp (°C)	1100	1250
	4.2	Hemispherical Temp. (°C)	1300	1350
	4.3	Flow Temp. (°C)	1400	1400
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SECTION – C

SPECIFIC REQUIREMENTS

SECTION C1 : SELF CLEANING STRAINERS

SECTION C2 : ELECTRICAL SYSTEMS

SECTION C3 : C&I SYSTEMS



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SECTION C1

SELF CLEANING STRAINERS

(MECHANICAL DETAILS)



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1.0 GENERAL

The Self Cleaning Strainers (SCS) complete with all accessories shall conform to the standard technical specifications (Section-D) and Data Sheet-A enclosed herewith. In addition the requirements of this section C shall also be complied with. However, wherever the details given in Section-D and Data Sheet-A are different, the requirements of Data Sheet-A shall prevail. Similarly in the event of contradictions between Section-C & Section-D/ Data Sheet-A, Section-C shall prevail.

Section C consists of 3 parts viz. Sec. C1, C2 and C3 for Mechanical, Electrical and C&I respectively, the requirements of all 3 sections shall be complied with.

2.0 DESCRIPTION OF EQUIPMENTS :

2.1 Self Cleaning Strainers (SCS) :

Self Cleaning Strainers per unit where specified shall be installed on the discharge side of ACW pumps. The water through the self cleaning strainers outlet shall be supplied to the Secondary side of Plate Heat Exchangers. The water analysis is indicated in project information in section B.

3.0 SCOPE OF SUPPLY UNDER THE SPECIFICATION IN THE BIDDER'S SCOPE FOR SELF CLEANING STRAINERS.

3.1 The scope of supply for Self Cleaning Strainers covered under this specification is as under.

The size, MOC's and other particulars of the equipments are detailed in Data Sheet A annexed with Section – D of the specification.

SL.NO.	PROJECT	SELF CLEANING STRAINERS	
1.	3X660 MW NTPC No. 1 st Karanpura	- 2 SETS PER UNIT VIZ. TOTAL 6 SETS FOR 3 UNIT	- 2 SETS COMMON FOR STATION- AHS COMPRESSORS COOLING SYSTEM viz 2 nos.



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3.2 SCOPE OF SUPPLY OF SCS INCLUDED IN THE BIDDER'S SCOPE :

The Qty of SCS covered under the specification shall be as per Data Sheet A of respective projects.

Each self cleaning strainer shall be complete with following accessories and auxiliaries.

- a) All equipment's for this package viz. Strainers, actuators, instruments etc. shall be suitable for outdoor operation.
- b) Flushing pump with drive Motor (as per manufacturer's design) - 1 No.
- c) Supply of complete debris disposal pipe work shall be in scope of Bidder. However bidder is to consider minimum 40 mtr. of debris disposal pipe work and 5 numbers bends for each SCS in their scope of supply. In case actual piping comes out to be less than 40 mtrs. and number of bends less than 5 nos. still bidder has to supply 40 mtrs pipework and 5 nos. bends as minimum requirement. Bidder shall finalize the pipework to suit the layout at contract stage in such a way that no site welding is required for his pipework otherwise the same shall be carried out by bidder at site.
- d) Filter body/ housing Vent and Drain connections along with their isolating valves.
- e) SCS shall be supplied along with flanges as well as the Counter flanges, complete with bolts, nuts and gaskets.
- f) Differential pressure measuring system for SCS. DP measuring system shall comprise of 2 Nos. DPT + 1 No. DPG for SCS and shall be with *Remote seal* arrangement. Stubs for DPT and DPG shall be independent.
- g) Supporting arrangement complete with foundation plates, anchor bolts, nuts, sleeves, inserts, all installation materials, fixing bolts, clamps, saddle supports (if applicable) and other accessories etc for complete equipment supplied under this package.
- h) Set of commissioning spares, on "As required basis".
- i) The Electrical & C&I items/ accessories as specified in succeeding clause / respective sections herein.
- j) Scope of Starter Panel (Switch Gear Panel) shall be as follows:

2 Sets of SCS shall have one Common Starter Panel (Switch Gear Panel) for


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DCS based control system in line with C&I requirement (refer section C-3).

Switch Gear Panel should have suitable arrangement like Bus Coupler for providing redundancy to incoming supply feeder (1 Working + 1 Standby feeder).

- k) Power and Control cables between Starter Panel (Switch Gear Panel) and various drives in bidder's scope of supply.
- l) Control cables between field instruments and junction box / Starter Panel (Switch Gear Panel).
- m) Set of mandatory spares as indicated in Data Sheet A.
- n) All the field instruments stipulated in this specification shall be in Bidder's scope.
- o) Finish paints for touch up painting of equipment after erection at site, in sealed containers.
- p) Set of special tools and tackles if required for maintenance and erection of the equipment supplied.
- q) Various drawings, data test reports/ certificates instruction manuals for erection operation and maintenance etc. as specified in Data Sheet-C. and cables schedule indicating BOQ for power & control cables.
- r) Local Control Panels & Instruments: Scope and Type as specified in C&I section wherever required.

Any item not specified but required to make SCS a complete package shall also be in bidders scope.

4.0 SCOPE OF SERVICES INCLUDED IN THE BIDDER'S SCOPE :

The bidder's scope also includes following services at site, for scope under this specification for SCS for respective projects

- a) Installation checks (Erection in BHEL's scope).
- b) Commissioning of equipment.
- c) Trial run for requisite period
- d) Performance Testing

The trial run of equipment shall be generally conducted immediately after commissioning while PG testing shall be conducted at a later date. These activities for different units shall be timed separately.


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The no. of visits may be suitably assessed by bidders as per their experience with site stay periods on as required basis.

In the event of order no. of visits as follows shall be made as a minimum with charges included in the bidder's base price itself.

- **For drawings/documents approval**

In the event of order all drawings / documents in soft as well as hard copy shall be submitted as per NIT.

Further on receipt of Customer comments, if required bidder's engineer shall visit BHEL/ Customer alongwith soft copy to resolve all issues and incorporate comments in the soft copy for across the table finalisation and Category-I approval.

- **Site Visits :**

- i. No. of site visits for combined activities of erection checks and commissioning for SCS as applicable shall be one per unit - for both sets of equipments of one unit. Time duration for erection and commissioning shall be "on as required basis" with equipments run for trial operation thereafter for requisite period to demonstrate satisfactory operation.

However the no. of visits may be suitably assessed by bidders as per their experience with site stay periods on as required basis.

- ii. Bidder shall demonstrate guarantees including pressure drops at site during subsequent visit for SCS of each unit.
- iii. For trouble shooting on "as required basis".

5.0 EXCLUSIONS :

The following are excluded from the bidder's scope .

- 5.1 Civil foundation works required for installation
- 5.2 Erection of Equipment at site.

6.0 DESIGN CONSTRUCTION :

In addition to the requirements of Section-D the following shall also be complied with for packages/ projects under scope of this specification:



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- 6.1 The materials of construction specified in Data Sheet-A are minimum requirements and materials of construction for other components not specified shall be similarly selected by the bidder for the intended duty which shall be subject to purchaser's approval during detailed engineering in the event of order.
- 6.2 Housing/ body of SCS Filter shall be designed and manufactured as per the applicable codes for pressure vessels and to take care of force and moments as enclosed in the specification. However in no case thickness of housing/ body shall be less than the thickness as specified in "Pipe size Table" enclosed in Data Sheet-A of SCS.
- 6.3 Adequate provision for future installation of Cathodic Protection for SCS (Sacrificial type shall be in Purchaser Scope) shall be kept by the bidder in the equipment.
- 6.4 Velocity in the pipe work shall be less than 1.5 m/ sec for pump suction and less than 2.2 m/ sec. in other pipe work. All valves upto 150 NB shall be ball valves. For higher sizes, gate/ globe/ B.F. valves shall be provided. All instrument valves shall be needle valves.

7.0 Self Cleaning Strainers :

- 7.1.1 Performance Guarantee Parameters shall be as under :
- Pressure drop in Self Cleaning Strainers in clean condition viz. after backwashing.
- 7.1.2 Bidder to note that bids shall be evaluated on account of pressure drop across Self Cleaning Strainers (in clean condition) & liquidated damages on account of not meeting the same shall be in accordance with following :

A) Bid Evaluation Criteria and Liquidated Damages:

The bids received shall be evaluated for Pressure drop across Self Cleaning strainers :

- The permissible limit of pressure drop across self cleaning strainers in clean condition shall be 0.6 MWC.
- If the pressure drops quoted are higher than above limit, the bids shall be technically loaded @ Rate as mentioned in Data Sheet-A on pro-rata basis per **0.1 MWC** pressure drop (viz. per unit).
- However no advantage shall be given for pressure drops quoted less than above permissible limit.
- The maximum acceptable limit for pressure drop across self cleaning strainer (with technical loadings) shall be 1.0 MWC. The bids will be technically rejected for pressure drops quoted higher than above maximum limit.


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- The guaranteed pressure drops shall be demonstrated at site by vendors and if found higher shall be subject to LD @ twice the bid evaluation factor as above.

8.0 SPARES :
8.1 Recommended Spares :

The supply of spare parts as necessary recommended by the manufacture for three (3) years of reliable operation and maintenance of SCS of respective projects shall be supplied. List of such spares along with the unit price shall not be included in base price but indicated separately in the schedule of prices for recommended spares enclosed in Vol. -III.

8.2 Mandatory Spares

Mandatory Spares shall be as per Data Sheet-A, prices for same shall be included by bidder in the equipment base price itself.

9.0 Quality Plan

Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL/ Customer approval and customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. Charges for 3rd party inspection (TUV/ equivalent) for imported components wherever required shall be included by bidder in the base price itself. Witness for all the test identified under agency "C" & "N" in Quality plan shall be by third party.

If BHEL or BHEL customer decides to witness the tests along with third party, the cost of travel of BHEL or BHEL customer shall be borne by BHEL or BHEL customer themselves.

10.0 DELIVERY & DRAWINGS/ DOCUMENTS DISTRIBUTION SCHEDULE :

- Delivery of Equipment for each project shall be as per NIT.
- The drawings to be submitted by bidder in event of award of contract for SCS for project shall be as follows:
 - Technical Data Sheets, P&ID, Installation Plan, for SCS.
 - GA drawings, C & I Document(Part-I & II) of SCS as applicable.
 - Quality Plan.
 - O & M Manual
- Drawings submission schedule shall be as per NIT/as advised by Project Group.



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11.0 The makes of various bought out items shall be subjected to purchaser's approval in the event of order.

12.0 It is mandatory for the bidders to submit along with the bid the deviations if any whether major or minor in the schedule of deviations only. ***In the absence of deviations listed in the schedule of deviations the offer shall be deemed to be in full conformity with the specification "non-withstanding" any thing else stated elsewhere in bidder's offer, data sheets etc. The implied/ indirect deviations in data sheets etc. Shall not be binding on the purchaser.***

13.0 The following documents shall be furnished by the bidder with his offer :

- Compliance certificate duly signed and stamped (Enclosed at Schedules).
- Guarantee schedule duly signed and stamped (Enclosed at Schedules).
- GA drawings of following with empty/ filled-ups.
 - GA of SCS (As applicable).
 - Debris Flushing pumps (if applicable)
 - Other equipments considered necessary for Layout/ Civil.
- Electrical Load Data (Enclosed at Vol. III of Specification)
- Schedule of Deviation (Enclosed at Schedules).

The bidder to note that load requirement furnished and finalised during tender stage shall only be provided by BHEL and any changes or additional requirement of Electrical load by bidder during contract stage shall be provided by BHEL with cost repercussions to the bidder.

14.0 Important Note:-

- i. Bidder to note that C&I, Electrical, Fragile materials shall be sent in separate proper packing (segregating from heavy items).
- ii. Bidder to include handling instructions in engineering drawing/doc and packing to be done in such a way to avoid damage of items mentioned above in transit and long storage at site and same shall be approved in contract stage by BHEL/ Customer.

NOTE: Apart from above, no other drawing/ document/ data sheet etc. shall be submitted along with the offer. If any drawing/ document etc. is submitted with the offer, same shall be considered as for 'Reference' purpose only and shall not be reviewed/ commented upon and any deviation, exclusion to scope, etc. taken in documents but not highlighted in the deviation schedule shall not be taken cognizance of.



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ANNEXURE-I

SELF CLEANING STRAINERS

SL.NO.	Projects	Size (NB)	Length of SCS (Including Counter Flange)	Scope of Counter Flange	Scope of nuts and bolts.
1.	3X660 MW NTPC North Karanpura	800 NB	2500 mm	In Bidder's Scope	In Bidder's Scope
2.	3X660 MW NTPC North Karanpura	400 NB	2500 mm	In Bidder's Scope	In Bidder's Scope



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SECTION C2

SELF CLEANING STRAINERS

ELECTRICAL DETAILS

ELECTRICAL EQUIPMENT SPECIFICATION FOR SCS 3X660MW NORTH KATANPURA STPP	SPECIFICATION NO.
	VOLUME NO. : II-B
	SECTION : C
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1.0 **EQUIPMENT & SERVICES TO BE PROVIDED BY BIDDER:**

- a) Services and equipment as per “Electrical Scope between BHEL and Vendor”.
- b) Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the work for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The same shall be provided by the bidder without any extra charge.
- c) Supply of mandatory spares as specified in the specifications of mechanical equipments.
- d) Erection and Commissioning spares.
- e) Erection & Maintenance tools & tackles.
- f) Electrical load requirement for SCS system.
- g) All equipment shall be suitable for the power supply fault levels and other climatic conditions mentioned in the enclosed project information.
- h) Bidder to furnish list of makes for each equipment at contract stage, which shall be subject to customer/BHEL approval without any commercial and delivery implications to BHEL
- i) Various drawings, data sheets as per required format, Quality plans, calculations, test reports, test certificates, operation and maintenance manuals etc shall be furnished as specified at contract stage. All documents shall be subject to customer/BHEL approval without any commercial implication to BHEL.
- j) Motor shall meet minimum requirement of motor specification.
- k) LT power & control cables shall meet minimum requirement of LT power & control cables specification.
- l) Cabling, earthing & lightning protection shall meet minimum requirement of cabling, earthing & lightning protection specification.

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

Refer “Electrical Scope between BHEL and Vendor”.

3.0 **DOCUMENTS TO BE SUBMITTED ALONG WITH BID**

- 3.1 Bidder shall confirm total compliance to the electrical specification without any deviation from the technical/quality assurance requirements stipulated. In line with this two signed and stamped copies of the following shall be furnished by the bidder as technical offer:
 - a) A copy of this sheet “Electrical equipment Specification for SCS and sheet “Electrical Scope between BHEL and Vendor” with bidder’s signature and company stamp.
 - b) List of Erection and Commissioning spares.
 - c) List of Erection & Maintenance tools & tackles.
 - d) Electrical load requirement
- 3.2 No technical submittal such as copies of data sheets, drawings, write-up, quality plans, type test certificates, technical literature, etc, is required during tender stage. Any such submission even if made, shall not be considered as part of offer.

	ELECTRICAL EQUIPMENT SPECIFICATION FOR SCS 3X660MW NORTH KATANPURA STPP	SPECIFICATION NO.
		VOLUME NO. : II-B
		SECTION : C
		REV NO. : 00 DATE : 17.07.14
		SHEET : 2 OF 2

4.0 List of enclosures :

- a) Electrical scope between BHEL & vendor.
- b) Technical specification, datasheets & quality plans for 415V Electric motors.
- c) Technical Specification, datasheets & quality plans for LT power & control cables.
- d) Technical Specification, datasheets & quality plans for cabling, earthing & lightning protection.
- e) Electrical Load data format.

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGES : SCS

SCOPE OF CIVIL WORKS: BHEL

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
1	a) 415V MCC b) Starter panel	BHEL Vendor	BHEL BHEL	<i>a1. 415 V AC/240 V AC supply shall be provided by BHEL based on load data provided by vendor at contract stage for all equipment supplied by vendor as part of contract including power supply equipment (battery charger etc) required for the PLC/control panel (as applicable) for the system supplied by vendor.</i> a2. Interposing relays (RE 302 of Jyoti make or equivalent), if required for PLC and microprocessor based systems, shall be provided by BHEL in MCCs. Requirement of these relays shall be furnished by vendor during detailed engineering stage.
2	Local Push Button Station (for motors)	BHEL	BHEL	Located near the motor.
3	Power cables, control cables and screened control cables for a) both end equipment in BHEL's scope b) both end equipment in vendor's scope c) one end equipment in vendor's scope	BHEL Vendor BHEL	BHEL BHEL BHEL	1. Sizes and quantity of cables required shall be informed by vendor at contract stage (based on inputs provided by BHEL). Finalisation of cable sizes shall be done by BHEL. Vendor shall provide lugs & glands accordingly.
4	Any special type of cable like compensating, co-axial, prefab, MICC, fibre optical etc.	Vendor	BHEL	
5	Cable trays, accessories & cable trays supporting system	BHEL	BHEL	Local cabling from nearby tray to equipment terminal shall be through conduits.
6	Cable glands and lugs for equipment supplied by Vendor	Vendor	BHEL	1. Double compression Ni-Cr plated brass cable glands 2. Solder less crimping type tinned copper heavy duty lugs for power cables suitable for aluminium compacted conductor cables 3. Solder less crimping type heavy duty copper lugs for control cables.
7	Conduit and conduit accessories for cabling between equipment supplied by vendor	Vendor	BHEL	Conduits shall be medium duty, hot dip galvanised cold rolled mild steel rigid conduit as per IS: 9537. Makes of conduits shall be subject to customer/ BHEL approval at contract stage.

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR

PACKAGES : SCS

SCOPE OF CIVIL WORKS: BHEL

S.NO	DETAILS	SCOPE SUPPLY	SCOPE E&C	REMARKS
8	Lighting	BHEL	BHEL	
9	Equipment grounding & lightning protection	BHEL	BHEL	
10	Below grade grounding	BHEL	BHEL	
11	LT Motors with base plate and foundation hardware	Vendor	BHEL	Makes shall be subject to customer/ BHEL approval at contract stage.
12	Mandatory spares	Vendor	-	Vendor to quote as per specification.
13	Recommended O & M spares, E & C spares, erection & maintenance tools & tackle.	Vendor	-	As per specification
14	Any other equipment/ material/ service required for completeness of system based on system offered by the vendor (to ensure trouble free and efficient operation of the system).	Vendor	BHEL	
15	a) Input cable schedules (C & I) b) Cable interconnection details for above c) Cable block diagram	Vendor Vendor Vendor	- - -	Cable listing (including soft copy)/ BHEL Cable Schedule in excel format (excel format shall be provided to vendor during contract stage) for C & I system for the package shall be submitted by vendor during detailed engineering stage.
16	Equipment layout drawings	Vendor	-	- For ensuring cabling requirements are met, vendor shall furnish layout drawings (both in print form as well as in AUTOCAD) of the complete plant (including electrical area) indicating location and identification of all equipment requiring cabling, and shall incorporate cable trays routing details marked on the drawing as per PEM interface comments. Electrical equipment layout drawing shall be subjected to BHEL/ customer approval. - Layout drawing preparation wherever in vendor's scope: the cabling arrangement of the same (wherever overhead cable trays, trenches, cable ducts etc) shall be decided during contract stage, and the arrangement philosophy/ approval of the same shall be subject to BHEL/Customer approval without any commercial implications to BHEL.
17	Electrical Equipment GA drawing	Vendor	-	For necessary interface review.

ELECTRICAL SCOPE BETWEEN BHEL AND VENDOR**PACKAGES : SCS****SCOPE OF CIVIL WORKS: BHEL****NOTES:**

1. Make of all electrical equipments/items supplied shall be reputed make & shall be subject to approval of BHEL/customer after award of contract.
2. All QPs shall be subject to approval of BHEL/customer after award of contract without any commercial implication.
3. For skid mounted system, 2 nos. (1W+1S) supply feeders of 415 V, 3 phase AC shall be provided by BHEL. Complete skid including changeover between feeders/starters/LCP/ inter-locks/protection devices /any other supply etc. shall be in bidder's scope only. Bidder to also provide 24 V AC supply and suitable arrangement for switching it on automatically for heating of motor stator winding during motor's idle time

	TITLE	LV MOTORS <u>DATA SHEET-A</u>	SPECIFICATION NO.	
			VOLUME II B	
			SECTION	D
			REV NO. 00	DATE 01/10/2012
			SHEET 1 OF 1	

1.0	Design ambient temperature	:	50 °C
2.0	Maximum acceptable kW rating of LV motor	:	≤200KW
3.0	Installation (Indoors/ Outdoors)	:	As required
4.0	Degree Of Protection (Indoor/Outdoor)	:	IP54/IP55
5.0	Type of Cooling	:	TEFC/CACA/TETV
6.0	Details of supply system		
	a)	Rated voltage (with variation)	: 415V ± 10%
	b)	Rated frequency (with variation)	: 50 Hz (Variation: +3% TO –5%)
	c)	Combined voltage & freq. variation	: 10%
	d)	System fault level at rated voltage	: 45 kA for 1 sec
	e)	Short time rating for terminal boxes	
		o 110kW & Above (Breaker controlled)	: 45 kA for 1 sec
		o Below 110kW (SFU+ Contactor controlled)	: 45 KA for 0.20 sec.
	f)	LV System grounding	: Solidly
7.0	Class of insulation	:	Class 'F', with temp rise limited to class B. (Refer clause 5.00.00 of Motors)
8.0	Minimum voltage for starting (As percentage of rated voltage)	:	85% of rated voltage
9.0	Power cables data	:	Shall be given during Detailed engg.
10.0	Earth Conductor Size & Material	:	Shall be given during Detailed engg.
11.0	Space heater supply	:	240 V, 1Φ , 50 Hz
12.0	Rating up to which Single phase motor	:	Acceptable below 0.20 kW
13.0	Tests	:	As per Customer motor spec. (enclosed)
14.0	Energy efficient/ Flame proof motor	:	As per Customer spec. requirement

- Also detail Customer spec. for Motors to be referred as enclosed with spec.

SUB-SECTION – B-07

MOTORS

CLAUSE NO.	TECHNICAL REQUIREMENTS																												
	MOTORS 1.00.00 GENERAL REQUIREMENTS 1.01.00 For the purpose of design of equipment/systems, an ambient temperature of 50 deg. Centigrade and relative humidity of 95% (at 40 deg C) shall be considered. The equipment shall operate in a highly polluted environment. 1.02.00 All equipments shall be suitable for rated frequency of 50 Hz with a variation of +3% & - 5%, and 10% combined variation of voltage and frequency unless specifically brought out in the specification. 1.03.00 Contractor shall provide fully compatible electrical system, equipments, accessories and services. 1.04.00 All the equipment, material and systems shall, in general, conform to the latest edition of relevant National and international Codes & Standards, especially the Indian Statutory Regulations. 1.05.00 Paint shade shall be as per RAL 5012 (Blue) for indoor and outdoor equipment. 1.06.00 The responsibility of coordination with electrical agencies and obtaining all necessary clearances for contractors equipment and systems shall be under the contractor scope. 1.07.00 Degree of Protection Degree of protection for various enclosures as per IS:4691, IEC60034-05 shall be as follows :- <table border="0"> <tr> <td>i) Indoor motors</td><td>-</td><td>IP 54</td></tr> <tr> <td>ii) Outdoor motors</td><td>-</td><td>IP 55</td></tr> <tr> <td>iii) Cable box-indoor area</td><td>-</td><td>IP 54</td></tr> <tr> <td>iv) Cable box-Outdoor area</td><td>-</td><td>IP 55</td></tr> </table> 2.00.00 CODES AND STANDARDS <table border="0"> <tr> <td>1) Three phase induction motors</td><td>:</td><td>IS:325, IEC:60034</td></tr> <tr> <td>2) Single phase AC motors</td><td>:</td><td>IS:996, IEC:60034</td></tr> <tr> <td>3) Crane duty motors</td><td>:</td><td>IS:3177, IEC:60034</td></tr> <tr> <td>4) DC motors/generators</td><td>:</td><td>IS:4722</td></tr> <tr> <td>5) Energy Efficient motors</td><td>:</td><td>IS 12615, IEC:60034-30</td></tr> </table>	i) Indoor motors	-	IP 54	ii) Outdoor motors	-	IP 55	iii) Cable box-indoor area	-	IP 54	iv) Cable box-Outdoor area	-	IP 55	1) Three phase induction motors	:	IS:325, IEC:60034	2) Single phase AC motors	:	IS:996, IEC:60034	3) Crane duty motors	:	IS:3177, IEC:60034	4) DC motors/generators	:	IS:4722	5) Energy Efficient motors	:	IS 12615, IEC:60034-30	
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NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2	SUB SECTION B-07 MOTORS Page 1 of 9																											

CLAUSE NO.	TECHNICAL REQUIREMENTS		
3.00.00	TYPE		
3.01.00	AC Motors: - Squirrel cage induction motor suitable for direct-on-line starting. - Continuous duty LT motors upto 160 KW Output rating (at 50 deg.C ambient temperature), shall be Premium Efficiency class-IE3, conforming to IS 12615, or IEC:60034-30. - Crane duty motors shall be slip ring/ squirrel cage Induction motor as per the requirement.		
3.02.00	DC Motors	Shunt wound.	
4.00.00	RATING		
	- Continuously rated (S1). However, crane motors shall be rated for S4 duty, 40% cyclic duration factor. - Whenever the basis for motor or driven equipment ratings are not specified in the corresponding mechanical specification sub-sections, maximum continuous motor ratings shall be at least 10% above the maximum load demand of the driven equipment under entire operating range including voltage and frequency variations. - For BFP motors starting MVA shall be restricted to 60 MVA.		
5.00.00	TEMPERATURE RISE		
	Air cooled motors		
	70 deg. C by resistance method for both thermal class 130(B) & 155(F) insulation.		
	Water cooled		
	80 deg. C over inlet cooling water temperature mentioned elsewhere, by resistance method for both thermal class 130(B) & 155(F) insulation.		
6.00.00	OPERATIONAL REQUIREMENTS		
6.01.00	Starting Time		
6.01.01	For motors with starting time upto 20 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 2.5 secs. more than starting time.		
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2	SUB SECTION B-07 MOTORS Page 2 of 9

CLAUSE NO.	TECHNICAL REQUIREMENTS			
6.01.02	For motors with starting time more than 20 secs. and upto 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be at least 5 secs. more than starting time.			
6.01.03	For motors with starting time more than 45 secs. at minimum permissible voltage during starting, the locked rotor withstand time under hot condition at highest voltage limit shall be more than starting time by at least 10% of the starting time.			
6.01.04	Speed switches mounted on the motor shaft shall be provided in cases where above requirements are not met.			
6.02.00	Torque Requirements			
6.02.01	Accelerating torque at any speed with the lowest permissible starting voltage shall be at least 10% motor full load torque.			
6.02.02	Pull out torque at rated voltage shall not be less than 205% of full load torque. It shall be 275% for crane duty motors.			
6.03.00	Starting voltage requirement			
	(a) 85% below 110 KW			
	(b) 80% from 110 KW to 200 KW			
	(c) 85% above 200 KW to 1000 KW			
	(d) 80% from 1001 KW to 4000 KW			
	(e) 75% above 4000KW			
	Except AOP & JOP motors running on D.G emergency supply, starting voltage shall be 80%.			
7.00.00	DESIGN AND CONSTRUCTIONAL FEATURES			
7.01.00	Suitable single phase space heaters shall be provided on motors rated 30KW and above to maintain windings in dry condition when motor is standstill. Separate terminal box for space heaters & RTDs shall be provided. However for flame proof motors , space heater terminals inside the main terminal box may be acceptable.			
7.02.00	All motors shall be either Totally enclosed fan cooled (TEFC) or totally enclosed tube ventilated (TETV) or Closed air circuit air cooled (CACA) type. However, motors rated 3000KW or above can be Closed air circuit water cooled (CACW). Motors and EPB located in hazardous areas shall have flame proof enclosures conforming to IS:2148 as detailed below			
	(a) Fuel oil area : Group – IIB			
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2		SUB SECTION B-07 MOTORS
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
7.03.00	(b)	Hydrogen generation	:Group - IIC or (Group-I, Div-II as per plant area NEC) or (Class-1, Group-B, Div-II as per NEMA /IEC60034)	
	Winding and Insulation			
	(a)	Type	: Non-hygroscopic, oil resistant, flame resistant	
	(b)	Starting duty	: Two hot starts in succession, with motor initially at normal running temperature.	
	(c)	11kV & 3.3 kV AC motors	: Thermal class 155 (F) insulation. The winding insulation process shall be total Vacuum Pressure Impregnated i.e resin poor method. The lightning Impulse & interturn insulation surge withstand level shall be as per IEC-60034 part-15	
	(d)	240VAC, 415V AC & 220V DC motors	: Thermal Class(B) or better	
7.04.00	Motors rated above 1000KW shall have insulated bearings to prevent flow of shaft currents.			
7.05.00	Motors with heat exchangers shall have dial type thermometer with adjustable alarm contacts to indicate inlet and outlet primary air temperature.			
7.06.00	Noise level for all the motors shall be limited to 85dB(A) except for BFP motor for which the maximum limit shall be 90dB(A). Vibration shall be limited within the limits prescribed in IS:12075 / IEC 60034-14 . Motors shall withstand vibrations produced by driven equipment. HT motor bearing housings shall have flat surfaces, in both X and Y directions, suitable for mounting 80mmX80mm vibration pads.			
7.07.00	In HT motors, at least four numbers simplex / two numbers duplex platinum resistance type temperature detectors shall be provided in each phase stator winding. Each bearing of HT motor shall be provided with dial type thermometer with adjustable alarm contact and preferably 2 numbers duplex platinum resistance type temperature detectors.			
7.08.00	Motor body shall have two earthing points on opposite sides.			
7.09.00	11 KV motors shall be offered with Separate Insulated Connector (Elastimould or Equivalent make) as per IEEE 386. The offered Elastimould terminations shall be provided with protective cover and trifurcating sleeves. Elastimould termination kit shall be suitable for fault level of 25 KA for 0.17 seconds.			
7.10.00	3.3 KV motors shall be offered with dust tight phase separated double walled (metallic as well as insulated barrier) Terminal box. Suitable termination kit shall be provided for the offered Terminal box. The offered Terminal Box shall be suitable for fault level of 250			
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2	SUB SECTION B-07 MOTORS	Page 4 of 9

CLAUSE NO.	TECHNICAL REQUIREMENTS																							
	MVA for 0.12 sec. Removable gland plates of thickness 3 mm (hot/cold rolled sheet steel) or 4 mm (non magnetic material for single core cables) shall be provided.																							
7.11.00	The spacing between gland plate & centre of terminal stud shall be as per Table-I.																							
7.12.00	All motors shall be so designed that maximum inrush currents and locked rotor and pullout torque developed by them at extreme voltage and frequency variations do not endanger the motor and driven equipment.																							
7.13.00	The motors shall be suitable for bus transfer schemes provided on the 11kV, 3.3 kV /415V systems without any injurious effect on its life.																							
7.14.00	For motors rated 2000 KW & above, neutral current transformers of PS class shall be provided on each phase in a separate neutral terminal box.																							
7.15.00	The size and number of cables (for HT and LT motors) to be intimated to the successful bidder during detailed engineering and the contractor shall provide terminal box suitable for the same.																							
8.00.00	The ratio of locked rotor KVA at rated voltage to rated KW shall not exceed the following (without any further tolerance) except for BFP motor. <table><tr><td>(a)</td><td>Below 110KW</td><td>:</td><td>10.0</td></tr><tr><td>(b)</td><td>From 110 KW & upto 200 KW</td><td>:</td><td>9.0</td></tr><tr><td>(c)</td><td>Above 200 KW & upto 1000KW</td><td>:</td><td>10.0</td></tr><tr><td>(d)</td><td>From 1001KW & upto 4000KW</td><td>:</td><td>9.0</td></tr><tr><td>(e)</td><td>Above 4000KW</td><td>:</td><td>6 to 6.5</td></tr></table>				(a)	Below 110KW	:	10.0	(b)	From 110 KW & upto 200 KW	:	9.0	(c)	Above 200 KW & upto 1000KW	:	10.0	(d)	From 1001KW & upto 4000KW	:	9.0	(e)	Above 4000KW	:	6 to 6.5
(a)	Below 110KW	:	10.0																					
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(d)	From 1001KW & upto 4000KW	:	9.0																					
(e)	Above 4000KW	:	6 to 6.5																					
10.00.00	TYPE TEST																							
10.01.00	HT MOTORS																							
10.01.01	The contractor shall carry out the type tests as listed in this specification on the equipment to be supplied under this contract. The bidder shall indicate the charges for each of these type tests separately in the relevant schedule of Section - VII- (BPS) and the same shall be considered for the evaluation of the bids. The type tests charges shall be paid only for the test(s) actually conducted successfully under this contract and upon certification by the employer's engineer.																							
10.01.02	The type tests shall be carried out in presence of the employer's representative, for which minimum 15 days notice shall be given by the contractor. The contractor shall obtain the employer's approval for the type test procedure before conducting the type test. The type test procedure shall clearly specify the test set-up, instruments to be used, procedure,																							
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2	SUB SECTION B-07 MOTORS	Page 5 of 9																				

CLAUSE NO.	TECHNICAL REQUIREMENTS			
10.01.03	acceptance norms, recording of different parameters, interval of recording, precautions to be taken etc. for the type test(s) to be carried out.			
10.01.04	In case the contractor has conducted such specified type test(s) within last ten years as on the date of bid opening, he may submit during detailed engineering the type test reports to the Employer for waiver of conductance of such test(s). These reports should be for the tests conducted on the equipment similar to those proposed to be supplied under this contract and test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. The Employer reserves the right to waive conducting of any or all the specified type test(s) under this contract. In case type tests are waived, the type test charges shall not be payable to the contractor.			
10.01.05	Further the Contractor shall only submit the reports of the type tests as listed in "LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED" and carried out within last ten years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client. However if the 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 Employer either at third party lab or in presence of client/Employers representative and submit the reports for approval. LIST OF TYPE TESTS TO BE CONDUCTED The following type tests shall be conducted on each type and rating of HT motor (a) No load saturation and loss curves upto approximately 115% of rated voltage (b) Measurement of noise at no load. (c) Momentary excess torque test (subject to test bed constraint). (d) Full load test(subject to test bed constraint) (e) Temperature rise test at rated conditions. During heat run test, bearing temp., winding temp., coolant flow and its temp. shall also be measured. In case the temperature rise test is carried at load other than rated load, specific approval for the test method and procedure is required to be obtained. Wherever ETD's are provided, the temperature shall be measured by ETD's also for the record purpose.			
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2		SUB SECTION B-07 MOTORS
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
10.01.06	LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED The following type test reports shall be submitted for each type and rating of HT motor			
	(a) Degree of protection test for the enclosure followed by IR, HV and no load run test. (b) Terminal box-fault level withstand test for each type of terminal box of HT motors only. (c) Lightning Impulse withstand test on the sample coil shall be as per clause no. 4.3 IEC-60034, part-15 (d) Surge-withstand test on interturn insulation shall be as per clause no. 4.2 of IEC 60034, part-15			
10.02.00	LT Motors			
10.02.01	LT Motors supplied shall be of type tested design. During detailed engineering, the contractor shall submit for Employer's approval the reports of all the type tests as listed in this specification and carried out within last <i>ten</i> years from the date of bid opening. These reports should be for the test conducted on the equipment similar to those proposed to be supplied under this contract and the test(s) should have been either conducted at an independent laboratory or should have been witnessed by a client.			
10.02.02	However if the 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 Employer either at third party lab or in presence of client/Employers representative and submit the reports for approval.			
10.02.03	LIST OF TESTS FOR WHICH REPORTS HAVE TO BE SUBMITTED The following type test reports shall be submitted for each type and rating of LT motor of above 50 KW only			
	1. Measurement of resistance of windings of stator and wound rotor. 2. No load test at rated voltage to determine input current power and speed 3. Open circuit voltage ratio of wound rotor motors (in case of Slip ring motors) 4. Full load test to determine efficiency power factor and slip . 5. Temperature rise test . 6. Momentary excess torque test. 7. High voltage test .			
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2		SUB SECTION B-07 MOTORS
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CLAUSE NO.	TECHNICAL REQUIREMENTS	एनटीपीसी NTPC																					
	8. Test for vibration severity of motor. 9. Test for noise levels of motor(Shall be limited as per clause no 7.06.00 of this section) 10. Test for degree of protection and 11. Over speed test. 12. Type test reports for motors located in fuel oil area having flame proof enclosures as per IS 2148 / IEC 60079-1																						
10.03.00	All acceptance and routine tests as per the specification and relevant standards shall be carried out. Charges for these shall be deemed to be included in the equipment price.																						
10.04.00	The type test reports once approved for any projects shall be treated as reference. For subsequent projects of NTPC, an endorsement sheet will be furnished by the manufacturer confirming similarity and “No design Change”. Minor changes if any shall be highlighted on the endorsement sheet.																						
TABLE - I DIMENSIONS OF TERMINAL BOXES FOR LV MOTORS <table><tr><th>Motor MCR in KW</th><th>Minimum distance between centre of stud and gland plate in mm</th></tr><tr><td>UP to 3 KW</td><td>As per manufacturer's practice.</td></tr><tr><td>Above 3 KW - upto 7 KW</td><td>85</td></tr><tr><td>Above 7 KW - upto 13 KW</td><td>115</td></tr><tr><td>Above 13 KW - upto 24 KW</td><td>167</td></tr><tr><td>Above 24 KW - upto 37 KW</td><td>196</td></tr><tr><td>Above 37 KW - upto 55 KW</td><td>249</td></tr><tr><td>Above 55 KW - upto 90 KW</td><td>277</td></tr><tr><td>Above 90 KW - upto 125 KW</td><td>331</td></tr><tr><td>Above 125 KW-upto 200 KW</td><td>203</td></tr></table> For HT motors the distance between gland plate and the terminal studs shall not be less than 500 mm.				Motor MCR in KW	Minimum distance between centre of stud and gland plate in mm	UP to 3 KW	As per manufacturer's practice.	Above 3 KW - upto 7 KW	85	Above 7 KW - upto 13 KW	115	Above 13 KW - upto 24 KW	167	Above 24 KW - upto 37 KW	196	Above 37 KW - upto 55 KW	249	Above 55 KW - upto 90 KW	277	Above 90 KW - upto 125 KW	331	Above 125 KW-upto 200 KW	203
Motor MCR in KW	Minimum distance between centre of stud and gland plate in mm																						
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NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2	SUB SECTION B-07 MOTORS																				
			Page 8 of 9																				

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC								
	PHASE TO PHASE/ PHASE TO EARTH AIR CLEARANCE: NOTE: Minimum inter-phase and phase-earth air clearances for LT motors with lugs installed shall be as follows: <table><tr><th>Motor MCR in KW</th><th>Clearance</th></tr><tr><td>UP to 110 KW</td><td>10mm</td></tr><tr><td>Above 110 KW and upto 150 KW</td><td>12.5mm</td></tr><tr><td>Above 150 KW</td><td>19mm</td></tr></table>				Motor MCR in KW	Clearance	UP to 110 KW	10mm	Above 110 KW and upto 150 KW	12.5mm	Above 150 KW	19mm
Motor MCR in KW	Clearance											
UP to 110 KW	10mm											
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NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2	SUB SECTION B-07 MOTORS	Page 9 of 9								

SUB-SECTION – B-06

LT SWITCHGEARS

CLAUSE NO.	TECHNICAL REQUIREMENTS			
1.00.00	DESIGN PHILOSOPHY / PRACTICE FOR LV BOARD SIZING			
	The sizing of LV boards shall be primarily dependent on the following conditions such as total load connected onto a Board, diversity factors for various loads connected, Fault Level and Voltage Regulation Considerations.			
	As far as practicable the system shall provide segregated supplies to main and standby auxiliaries so that failure of supply to main auxiliary shall in no way jeopardize the standby auxiliary feed. Automatic changeover at critical switchgear/ MCC sections shall be provided as necessary to prevent the loss of a unit or to ensure the equipment safety.			
1.01.00	Design Considerations:			
1.01.01	Sizing of Unit and Station boards			
	a) Input KVA for a Drive = (Rating KW X Load Factor) / (Efficiency X Power Factor) where values of load factor , power factor and efficiency are defined below: b) Load (service) factor for 415 V loads is taken as 0.85 c) Power factor 415 V Uni-Directional drives is taken as 0.8 and efficiency as 0.85 d) Power factor of 415 V bidirectional drive Loads is taken as 0.65 and efficiency as 0.8 for motor rating less than 15 KW For motor ratings above 15 KW and above the corresponding values are 0.75 and 0.8. e) The Finally selected Bus Bar ratings for switchboards, MCC s and ACDB and Busduct shall include a 10 % margin over the calculated values. f) The LDB' s shall be considered to be loaded to 70 % of their KVA rating g) A spare capacity of about 10 % shall be kept for addition of loads during detail engineering as many of the LT loads cannot be predicted during the Rating selection of the Board. h) Busbar Ratings of valves/dampers boards shall be derived by summing up to 5% of the total KVA load connected. With the largest Value /damper Connected. i) Welding sockets shall be connected from Welding DBs. j) ESP consumption for 100 % BMCR operation shall be considered and further this load shall be uniformly divided among ESP Switchgears.			
1.01.02	Sizing of Offsite Boards			
	a) The loads for mechanical auxiliary systems shall be met by auxiliary transformers based on the criteria that each switchgear/MCC/Distribution board shall be fed either by 2x100% or 3x50% transformers/feeders and, these shall be rated to carry the maximum load expected to be imposed. Each of the above boards shall be sectionalized. b) The sizing of Unit Emergency boards shall be in according to the DG rating. The Emergency board shall have tie to both sections of Unit Service Switchgear for catering unit loads in Blackout Conditions.			
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT	PAGE 1 OF 71

CLAUSE NO.	TECHNICAL REQUIREMENTS			
1.02.00	Layout Criteria The switchboards can be split into two sections based on layout constraints in case of long switchboards to optimize Switchgear room layouts. The two sections of the split shall be connected by Bus duct/Cable as per layout requirements.			
1.03.00	Spare capacity and Future Requirements Each of the LV switchboards shall be designed for 1.1 times the required rating as a spare capacity. Further all LV Switchboard shall be provided with 10 % spare modules of each rating and type of module.			
1.04.00	Standardization The LV Boards shall be fed through either LT auxiliary transformers. MCC, and Distributed boards are fed further through these main boards. The Standard rating of the main boards fed through Unit Auxiliary Service and Station Service Transformers shall be 3500 Amp .Other Standard ratings used shall be 3000,2500, 2000 Amp, 1600 Amp, 1000 Amp, 600 Amp, 400 & 250 Amp. Preferred ratings for LV Busduct rating are 3500 Amp, 3000 Amp, 2500 Amp and 1600 amp. It shall be preferred to have all LV Switchboards for the entire plant from a One/Two/Three manufacturer from maintainability and spares management point of view. It shall be preferred to follow a standardization of Terminal Numbers across all LV Modules for ease of Interconnection and standardization.			
1.05.00	Plant control cable Interconnections a) Standard control cable sizes shall preferably be 3CX1.5, 5CX1.5, 7CX1.5 & 10CX1.5 b) Cable size for motor space heater application shall be 2CX2.5 c) Interconnections for Current Transformer terminals shall use two cores of 1.5mm ² size per phase d) Core identification shall be using core color for up to 5-core cable and core number for cable with more cores e) Separate control cables shall be used for current transformers. f) At least one spare core shall be made available in each of the control cable			
1.00.00	CODES AND STANDARDS			
1.01.00	All equipment shall, generally, comply with the updated issues of (a.) Applicable Indian Standards (b.) Indian Electricity Act. (c.) Indian electricity rules			
1.02.00	Equipment complying with any other authoritative / internationally recognized standards such as IEC, British, U.S.A., German, etc. will also be considered if it ensures performance equivalent or superior to Indian Standards. In such cases the contractor shall clearly indicate the standard adopted and furnish the copy of latest English version of the same along with the bid and bring out the salient features for comparison.			
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT	PAGE 2 OF 71

CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
1.03.00	All standards, specifications and codes of practice referred to herein shall be the latest editions including all applicable official amendments and revisions as published one month prior to the date of opening of bids. In case of conflict between this specification and those (IS codes, Standards etc.) referred to herein, the former shall prevail. All work shall be carried out as per the following codes and standards.			
	IS: 5	Colors for ready-mixed paints and enamels.		
	IS: 694	PVC insulated cables for working voltages upto and including 1100V.		
	IS: 722	A.C. Electricity Meters		
	IS: 1248	Electrical Indicating instruments		
	IS/IEC: 60947-1	Degree of protection provided by enclosures for low voltage Switchgear and Control gear		
	IS/IEC: 60947-2	A.C. circuit Breakers		
	IS: 2551	Danger Notice Plates		
	IS: 2629	Hot dip galvanising		
	IS: 2705	Current Transformers		
	IS/IEC: IEC-60947-4-1	Contactors and motors starter for voltages not exceeding 1000 V AC or 1200 V DC		
	IS: 3043	Code of practice for earthing.		
	IS: 3072	Code of practice for installation and maintenance of Switchgear		
	IS: 3156	Voltage Transformers		
	IS: 3202	Code of practice for climate proofing of electrical equipment.		
	IS: 3231	Electrical relays for power system protection.		
	IS/IEC 60947	Air-Break Switches, air break disconnectors, air break disconnector and fuse combination units for voltages not exceeding 1000V AC or 1200 V DC.		
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT	PAGE 3 OF 71

CLAUSE NO.	TECHNICAL REQUIREMENTS			
	IS/IEC 60947-1 / IEC-60947-1	General Requirements for Switchgear and Control gear for voltages not exceeding 1000 V.		
	IS: 5082	Wrought Aluminum and Aluminum alloys for electrical purposes.		
	IS: 6005	Code of practice of phosphating of iron and steel.		
	IS/IEC 60947-5-1 / IEC-60947-5-1	LV switchgear and Control gear Control current devices and switching element.		
	IS: 8623 (3 parts) / IEC: 60439	Specification for factory built assemblies of Switchgear & Control gear for voltages upto and including 1000 V AC & 1200 V DC.		
	IS: 8686	Static Relays		
	IS: 13703 / IEC: 60269	HRC Cartridge fuses		
	IS: 10118 (4 parts)	Code of practice for selection, installation and maintenance of switchgear and control gear.		
	IS: 11171	Specification for dry type transformers.		
	IEC: 60255	Electrical Relays		
	IEC: 61850	Communication networks and systems in substations		
	IS: 11353	Guide for uniform system of marking and identification of conductors and apparatus terminals		
	IS: 12021	Specification of control transformers for switchgear and Control gear for voltage not exceeding 1000V AC.		
	IEC: 60947-7-1	Terminal blocks for copper conductors		
	IS :513 (2008)	Cold Rolled Low Carbon Steel Sheets and Strips		
	IEC 60439(1&2)/ IS 8623(1&2)	Bus trunking system (sandwich busduct)		
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT	PAGE 4 OF 71

CLAUSE NO.	TECHNICAL REQUIREMENTS	
2.00.00	TECHNICAL PARAMETERS	
2.01.00	POWER SUPPLY	
2.01.01	AC SYSTEM	
	1) Voltage 415 V $\pm$ 10%, 3 Phase, 4 wire, solidly earthed 2) Frequency 50 Hz $\pm$ 5% 3) Combined variation (in volts & frequency) 10% absolute sum 4) Fault Level 50KA(RMS)	
2.01.02	DC SYSTEM	
	1) System Voltage 240VDC 2-Wire, Unearthed 2) Fault Level 20 KA	
2.01.03	CONTROL SUPPLY VOLTAGE	
	1) Trip & closing coil of circuit breaker 240V DC/120V DC 2) Spring charging motor 240V DC/120V DC 3) MCC control supply 110V AC Neutral solidly earthed 4) Space heater & lighting 240V AC Neutral solidly earthed	
2.02.00	CUBICLE DATA Busbar Rating 1) Continuous Current rating As per requirement 2) Short time rating where a) CB is used as incomer 50KA(RMS) for one sec b) Fuse protection is used in Incomer Prospective current of 50KA(RMS) for the fuse clearing time	
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT PAGE 5 OF 71

CLAUSE NO.	TECHNICAL REQUIREMENTS		एनटीपीसी NTPC	
2.03.00	3)	Dynamic Rating where		
	a)	CB is used as incomer	105KA(PEAK)	
	b)	Fuse Protection is used in incomer	Prospective current of 105KA (PEAK) as limited by fuse	
	4)	Busbar insulation		
	a)	For switchgear	PVC Sleeve insulated	
	b)	For MCC	PVC Sleeve insulated	
	c)	ACDB	PVC Sleeve insulated	
	d)	DCDB	PVC Sleeve insulated	
	e)	For fuse boards	PVC Sleeve insulated/ epoxy coated	
	CIRCUIT BREAKER			
	1)	Type	Air break spring charged stored energy type	
	2)	Operating duty	B-3 MIN-MB-3 MIN-MB	
	3)	Symmetrical interrupting	50KA(RMS)	
	4)	Short circuit rating	105KA(PEAK)	
	5)	Short Circuit Breaking current		
	a)	AC Component	50KA(RMS)	
	b)	DC Component	As per IS/IEC 60947	
6)	Short time withstand	50KA(RMS) for one sec		
7)	No of aux. contacts	4 NO + 4 NC for DDCMIS interface		
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CLAUSE NO.	एनडीपीसी NTPC TECHNICAL REQUIREMENTS		
2.04.00	METERS - Accuracy class 2.0 - One min. power frequency withstand test voltage 2.0 KV (rms)		
2.05.00	CURRENT TRANSFORMERS - Type Cast Resin Bar Primary - Voltage class and frequency 650 V, 50 HZ - Class of insulation E or better - Accuracy class & burden - For protection 5P20, 5VA PS Class for REF - For metering class 1.0, 5VA (min) - Short time withstand - For CT Associated with circuit breaker 50KA(RMS) for 1 sec - For CT Associated with fuse protected feeders Prospective current of 50KA(RMS) for the Fuse clearing time - Dynamic withstand - For CTs Associated with circuit breaker 105KA(PEAK) - For CT Associated with fuse protected feeders Prospective current of 105KA(PEAK) as Limited by fuse		
2.06.00	BUSDUCT - Type Non-Segregated - One minute power frequency withstand voltage 2.5 kV		
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT PAGE 7 OF 71

CLAUSE NO.	TECHNICAL REQUIREMENTS एनटीपीसी NTPC		
2.07.00	3) One second short ckt withstand current 50KA(RMS) 4) Momentary dynamic current withstand 105KA(PEAK)		
	BUSDUCT (SANDWICH TYPE)		
	1) Type Bus Trunking		
	2) Rated Insulation voltage 1000V		
	3) One second short ckt withstand current 50KA(RMS)		
	4) Momentary dynamic current withstand 105KA(PEAK)		
	5) Power frequency withstand voltage 3.5kv		
	6) Impulse withstand voltage 8kV		
	7) Insulation Class F		
	VOLTAGE TRANSFORMERS		
	1) Type Cast Resin		
	2) Voltage Ratio 415 / 110 V for line PT		
	415/$\sqrt{3}$ / 110/$\sqrt{3}$ V for Bus PT		
	3) Method of Construction Vee Vee		
	4) Accuracy Class 0.5		
	5) Rated Voltage factor 1.1continuous, 1.5 for 30 sec.		
	6) Class of insulation E or better		
	7) One minute power frequency withstand voltage 2.5 KV		
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT PAGE 8 OF 71

CLAUSE NO.	TECHNICAL REQUIREMENTS		
2.08.00	HRC FUSES		
	1) Voltage Class	650 Volts	
	2) Rupturing capacity	80 KA (rms) for AC ckt. 20 KA for DC ckt.	
2.09.00	CONTACTORS		
	Type	Air break electro magnetic	
	2) Utilising Category	AC3 of IS/IEC 60947 for non reversible AC4 of IS/IEC 60947 for reversible drives	
2.10.00	RELAYS		
	1) Power frequency withstand voltage	2.5KV for 1 sec. or 2.0 KV for 1 min.	
2.11.00	CONTROL TRANSFORMERS		
	1) Type	Dry / Cast Resin	
	2) Voltage Ratio	415 / 110 with taps $\pm$ 5% in steps of 2.5%	
	3) Class of insulation	Class-B or better	
	4) One minute power frequency withstand voltage	2.5 KV	
	5) Rating	1.5 x Adequate for application.	
2.12.00	LIGHTING TRANSFORMER / WELDING TRANSFORMER		
	1) Type & Rating	Dry type / 100 KVA	
	2) Voltage Ratio	415/415V, +/- 5% taps in steps of 2.5%	
	3) Class of insulation	B or better	
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT
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CLAUSE NO.	TECHNICAL REQUIREMENTS 		
2.13.00 2.14.00	4) One minute power frequency withstand 2.5 KV voltage 5) Enclosure protection IP-42 TRANSDUCERS 1) Current transducers a) Input 0-1 A (CT secondary) b) Rated frequency 50HZ c) Output 4-20 mA (2 Nos. decoupled) d) Over current Transducer for motor current ammeters shall be capable of withstanding min. 6 times CT sec. current of 1A for a min period of 30 seconds e) Accuracy 1.0 2) Voltage Transducers a) Input 110 V(VT secondary) ,50 HZ (for AC)/240 V DC (for DC) b) Output 4-20 mA (2 Nos. decoupled) c) Accuracy 1.0 MCCB 1) Rated voltage 415V 2) Rated insulation level 690V 3) Rated ultimate &Service S.C. breaking capacity 50KA 4) Rated making capacity 105KA 5) Utilization category A		
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT	PAGE 10 OF 71

CLAUSE NO.	TECHNICAL REQUIREMENTS			
3.00.00	CONSTRUCTIONAL DETAILS OF SWITCHBOARDS			
3.01.00	All Switchboards i.e., 415 V Switchgears, Motor Control Centres (MCCs), AC Distribution Boards (ACDBs), 220 V DC Distribution Boards (DCDBs) and Solenoid Valve Distribution Boards, shall be of metal enclosed, indoor, floor-mounted, free-standing type.			
3.02.00	All switchboard frames and load bearing members shall be fabricated using suitable mild steel structural sections or pressed and shaped cold-rolled sheet steel of thickness 2.0 mm. Frames shall be enclosed in cold-rolled sheet steel of thickness 1.6 mm. Doors and covers shall also be of cold rolled sheet steel of thickness 1.6 mm. Stiffeners shall be provided wherever necessary. The gland plate thickness shall be 3.0 mm for hot / cold-rolled sheet steel and 4.0 mm for non-magnetic material.			
3.03.00	All panel edges and cover / door edges shall be reinforced against distortion by rolling, bending or by the addition of welded reinforcement members. The top covers of the panels should be designed such that they do not permanently bulge/ bend by the weight of maintenance personnel working on it.			
3.04.00	The switchboards shall be of bolted design. The complete structures shall be rigid, self-supporting, and free from flaws, twists and bends. All cutouts shall be true in shape and devoid of sharp edges.			
3.05.00	All switchboards shall be of dust-proof and vermin-proof construction and shall be provided with a degree of protection of IP: 5X as per IS/IEC 60947. However, the busbar chambers having a degree of protection of IP: 42 are also acceptable where continuous busbar rating is 1600A and above. Provision shall be made in all compartments for providing IP: 5X degree of protection, when circuit - breaker or module trolley has been removed. All cutouts shall be provided with EPDM / Neoprene gaskets.			
3.06.00	Provision of louvers on switchboards would not be preferred. However, louvers backed with metal screen are acceptable on the busbar chambers where continuous busbar rating is 1600 A and above. The enclosure for outdoor oil filtration panels shall be constructed of stainless steel sheets in order to have protection against corrosion.The Degree of protection for outdoor panels shall be IP:65.The panels shall be mounted on a pedestal at a height of 500mm from ground level.			
3.07.00	All switchboards shall be of uniform height not exceeding 2450 mm.			
3.08.00	Switchboards shall be easily extendable on both sides by the addition of vertical sections after removing the end covers.			
3.09.00	Switchboards shall be supplied with base frames made of structural steel sections, along with all necessary mounting hardware required for welding down the base frame to the foundation			
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT	PAGE 11 OF 71

CLAUSE NO.	TECHNICAL REQUIREMENTS				
3.10.00	/ steel insert plates. The base frame height shall be such that floor finishing (50 mm thick) to be done by Contractor after erection of the switchboards does not obstruct the movement of doors, covers, withdraw able modules etc.				
	All switchboards shall be divided into distinct vertical sections (panels), each comprising of the following compartments:				
	(a.) BUSBAR COMPARTMENT A completely enclosed bus bar compartment shall be provided for the horizontal and vertical bus bars. Bolted covers shall be provided for access to horizontal and vertical busbars and all joints for repair and maintenance, which shall be feasible without disturbing any feeder compartment. Auxiliary and power bus bars shall be in separate compartments.				
	(b.) SWITCHGEAR / FEEDER COMPARTMENT All equipment associated with an incomer or outgoing feeder shall be housed in a separate compartment of the vertical section. Two-tier breaker arrangement in a vertical section shall be offered for outgoing breaker feeders of rating up to 1600A. The design of the vertical section for such an arrangement shall ensure ease of termination of power cables of size & quantity as specified in clause 42.00.00. The compartment shall be sheet steel enclosed on all sides with the withdraw able units in position or removed. Insulating sheet at rear of the compartment is also acceptable. The front of the compartment shall be provided with the hinged single leaf door with captive screws for positive closure.				
3.11.00	(c.) CABLE COMPARTMENT OR CABLE ALLEY A full-height vertical cable alley of minimum 250mm width shall be provided for power and control cables. Cable alley shall have no exposed live parts and shall have no communication with busbar compartment. Cable terminations located in cable alley shall be designed to meet the Form IVb Type 7 (as per IEC 60439) for safety purpose. The termination for each module shall have its own integral glanding facility. Wherever cable alleys are not provided for distribution boards, segregated cable boxes for individual feeders shall be provided at the rear for direct termination of cables. For circuit breaker external cable connections, a separately enclosed cable compartment shall also be acceptable. The contractor shall furnish suitable plugs to cover the cable openings in the partition between feeder compartment and cable alley. Cable alley door shall be hinged.				
	(d.) CONTROL COMPARTMENT A separate compartment shall be provided for relays and other control devices associated with a circuit breaker.				
3.12.00	Sheet steel barriers shall be provided between two adjacent vertical panels running to the full height of the switchboard, except for the horizontal busbar compartment. EPDM / Neoprene gasket shall be provided between the panel sections to avoid ingress of dust into panels. After isolation of power and control circuit connections it shall be possible to safely carryout maintenance in a compartment with the busbar and adjacent circuit live. Necessary shrouding arrangement shall be provided for this purpose. Wherever two breaker compartments are provided in the same vertical section insulating barriers and shrouds shall be provided in the rear cable compartment to avoid accidental touch with the live parts of one circuit when working on the other circuit.				
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2		SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT	PAGE 12 OF 71

CLAUSE NO.	TECHNICAL REQUIREMENTS			
3.13.00	All 415V switchgear (circuit-breaker) panels shall be of single-front type. MCCs and DBs shall be of single-front / double-front construction as per the requirements. All single-front switch boards shall be provided with single-leaf, hinged or bolted covers at the rear. The bolts shall be of captive type. The covers shall be provided with "DANGER" labels. All panel doors shall open by 90 deg or more. In case of double-front MCCs, if this cannot be achieved for panels adjacent to a breaker panel, suitable dummy panel shall be provided by the Contractor wherever necessary.			
4.13.01	MCCs located on the Stacker reclaimers, paddle feeders, traveling trippers shall be fixed type, compartmentalized, single front and suitable for the system fault level. No spare feeders are to be provided on these MCCs, Degree of protection for the MCCs mounted on paddle feeders and traveling trippers shall be IP-65.			
3.14.00	All ACDBs, DCDBs and Solenoid Valve DBs shall be of fixed module type. All 415V circuit-breaker modules and contactor controlled motor modules shall be of fully draw out type having distinct 'Service' and 'Test' positions. The equipment pertaining to a draw out type incomer or feeder module shall be mounted on a fully withdrawable chassis which can be drawn out without having to unscrew any wire or cable connection. Suitable arrangement with cradle/ rollers, guides along with tool/lever operated racking in/out mechanism shall be provided for smooth and effortless movement of the chassis. For modules of size more than half the panel height, double guides shall be provided for smooth removal or insertion of module. All identical module chassis of same size shall be fully interchangeable without having to carryout any modifications. Suitable interlock shall be provided in DCDB for prevention of opening of Isolator (Incomer) when the bus coupler is open and vice-versa.			
3.15.00	All disconnecting contacts for power and control circuits of drawout modules shall be of robust and proven design, fully self aligning and spring-loaded. Both fixed and moving contacts shall be silver-plated and replaceable. The spring-loaded power and control drawout contacts shall be on withdrawable chassis and the same on fixed portion shall not be accepted. Detachable plug and socket type control terminals shall also be acceptable.			
3.16.00	Individual opening in the vertical bus enclosure shall permit the entry of moving contacts from the drawout modules into vertical droppers.			
3.17.00	As indicated in schematic drawings of DDCMIS controlled modules, contractor shall supply & mount two (2) coupling relays in the corresponding modules.			
3.18.00	All equipment and components shall be neatly arranged and shall be easily accessible for operation and maintenance. The internal layout of all modules shall be subject to owner's approval. The Contractor shall submit dimensional drawings showing complete internal details of busbars and module components, for each type and rating for approval of owner.			
3.19.00	Owner reserves the right to alter the cable entries, if required during detailed engineering, without any additional commercial implication.			
3.20.00	Each switchboard shall be provided with undrilled, removable type gland plate, which shall cover the entire cable alley. Contractor shall ensure that sufficient cable glanding space is			
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	available for all the cables coming in a particular section through gland plate. For all single core cables, gland plate shall be of non-magnetic material. The gland plate shall preferably be provided in two distinct parts for the easy of terminating addition cables in future. The gland plate shall be provided with gasket to ensure enclosure protection. Recommended drilling chart of gland plates for all power and control cables in the vertical panels shall be indicated by the Contractor in the respective G.A. drawings of the boards.			
3.21.00	The Contractor shall consider layout of panels in a switchboard consisting of various feeder modules in a straight line, unless specified otherwise. The actual composition and disposition of various modules in a switchboard shall be finalised during detailed engineering. The Contractor shall provide adopter panel / dummy panel required to meet various configuration / arrangement of busbars adopted by the Contractor. The Switchboards fed from indoor transformer will be flange connected to the same and the same shall be located as close as desirable to the transformer. The details of transformer flanges for those transformers not being supplied under this package shall be given to the contractor for matching the connections. The switchboards fed from outdoor transformers of rating 1MVA and above shall preferably be connected through busducts. Busduct connections wherever applicable shall be preferably in a straight line alignment. The centre line of the busduct will be finalized during detailed engineering. Adopter panels and dummy panels shall be provided wherever required.			
3.22.00	Adequate space in a separate compartment shall be identified for mounting of Ethernet Switch (19" rack mounting) in all switchgears provided with numerical relays. Further, mounting of Ethernet switch in the above compartment and inter-panel wiring of Ethernet cable for connection of numerical relays to Ethernet switch shall be in the contractor's scope. Arrangement to provide required control supply to Ethernet switch shall be made in the switchgear.			
3.23.00	CLEARANCES The minimum clearance in air between phases and between phases and earth for the entire run of horizontal and vertical busbars and bus-link connections at circuit-breaker shall be 25 mm. For all other components, the clearance between "two live parts", "a live part and an earthed part", shall be atleast ten (10) mm throughout. Wherever it is not possible to maintain these clearances, insulation shall be provided by sleeving or barriers. However, for horizontal and vertical busbars the clearances specified above should be maintained even when the busbars are sleeved or insulated. All connections from the busbars upto switch / fuses shall be fully shrouded / insulated and securely bolted to minimize the risk of phase to phase and phase to earth short circuits.			
4.00.00	CONSTRUCTIONAL DETAILS OF AC & DC FUSE BOARDS			
4.01.00	All fuse boards shall be metal enclosed, fixed type, non-compartmentalized construction, suitable for indoor/ outdoor mounting on wall or steel structure.			
4.02.00	The fuse board frame shall be fabricated using suitable mild steel structures or pressed and shaped cold rolled sheet steel of thickness not less than 2.0 mm. The frames shall be enclosed by cold rolled sheet steel of thickness not less than 1.6 mm.			
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4.03.00	The fuse boards shall be provided with doors on the front. The doors shall preferably be in two halves with hinges at the extreme ends and locking facility at the centre.			
4.04.00	Suitable EPDM/Neoprene gaskets shall be provided to make fuse boards completely dust and vermin-proof with a degree of protection of IP-52 for indoor and IP-54 for outdoor application, as per IS/IEC 60947.			
4.05.00	Each DC fuse board shall comprise of the following :			
	(a.) 1 no. 63 A switch as incomer			
	(b.) 100 A fully insulated (PVC sleeved or epoxy coated) busbars.			
	(c.) 8 nos. 16A outgoing Fuse feeders.			
	(d.) 1 no. auxiliary contactor for supply monitoring.			
	(e.) 1 no. indicating lamp with resistor and blue coloured lens.			
4.06.00	Each AC fuse board shall comprise of the following :			
	(a.) 1 no. 63A TPN switch as incomer.			
	(b.) 100 A, 3-phase, 4-wire, fully insulated (PVC sleeved or epoxy coated) busbars.			
	(c.) 9 nos. 16 A single phase switch fuse units and 3 nos. 16 A TPN switch fuse units as outgoing feeders or alternatively 16 amps MCCB can be provided.			
	(d.) 3 nos. indicating lamps with resistors and coloured lenses (R, Y, B) for incoming supply monitoring.			
4.07.00	The fuses shall be mounted in an insulating fuse carrier and it shall be possible to replace the outgoing feeder fuses without disturbing the other feeders. The handle of incoming switch shall be mounted on the door of the fuse board, with padlocking facility in both 'ON' and 'OFF' positions. The outgoing feeder switches shall preferably be of rotary type.			
4.08.00	Cable entry facilities shall be provided at top / bottom with removable gland plates of suitable thickness. All incoming and outgoing cables shall be terminated on suitable terminal blocks.			
5.00.00	POWER BUSBARS AND INSULATORS			
	All 415 V Switchboards, MCCs and ACDBs shall be provided with three phase and neutral busbars as specified in BOM. Two separate sets of vertical busbars shall be provided in each panel of double front MCCs. Interleaving arrangement for busbars shall be adopted for switchboards with a rating of more than 1600A. DCDBs shall be provided with two (2)			
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	busbars. Entire busbar system shall be insulated with PVC sleeves. Busbar sleeves shall be compliant to UL224 (Extruded insulating tubing),CE/UL certified, having fire retardant properties and working temperature of 105°C.			
5.01.00	All busbars and jumper connections shall be of high conductivity aluminum alloy / copper of adequate size.			
5.02.00	The cross-section of the busbars shall be uniform throughout the length of switchboard section and shall be adequately supported and braced to withstand the stresses due to the specified short circuit currents. Neutral busbar short circuit strength shall be same as main busbars.			
5.03.00	All busbars shall be adequately supported by non-hygroscopic, non-combustible, track-resistant and high strength sheet molded compound or equivalent type polyester fiber glass molded insulator. Separate supports shall be provided for each phase and neutral busbar. If a common support is provided, anti-tracking barriers shall be provided between the supports. Insulator and barriers of inflammable material such as Hylam shall not be accepted. The busbar insulators shall be supported on the main structure.			
5.04.00	All busbar joints shall be provided with high tensile steel bolts, belleville / spring washers and nuts, so as to ensure good contacts at the joints. Non-silver plated busbar joints shall be thoroughly cleaned at the jointed locations and suitable contact grease shall be applied just before making a joint. All bolts shall be tightened by torque spanner to the recommended value. The overlap of the busbars at each joint surface shall be such that the length of overlap shall be equal to or greater than the width of the busbar. All copper to aluminum joints shall be provided with suitable bimetallic washers.			
5.05.00	All busbars shall be color coded as per IS: 375.			
5.06.00	Wherever the busbars are painted with black Matt paint, the same should be suitable for temperature encountered in the switchboard under normal operating conditions.			
5.07.00	The Contractor shall furnish calculations establishing the adequacy of bus bar sizes for specified current ratings.			
6.00.00	AUXILIARY BUSBARS AND CONTROL TRANSFORMERS			
6.01.00	AC CONTROL SUPPLY BUSBAR Each bus-section of all Switchgears and MCCs shall be provided with two (2) nos. 415V / 110V control transformers. The 110V AC control supply from the control transformers shall be run through the MCC by means of two sets of control supply busbars of electrolytic copper. In case of one transformer failure, whole bus section can be fed through single transformer. The control supply to different modules shall be tapped individually from the control supply busbars.			
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6.02.00	DC CONTROL SUPPLY BUSBARS Electrically controlled circuit breaker boards shall be provided with DC control supply busbars. The manually controlled breakers shall also be provided with such busbars in case relays are provided. Each section of the switchboard shall be provided with a DC supply by the Contractor. The Contractor shall provide suitable terminals, switch-fuse etc. to receive the DC supply and distribute the same through above mentioned control busbars to the required modules of the respective section. The DC control supply bus of one section shall be coupled to the control supply of other section through a switch located in the bus-coupler breaker panel. The DC supply to the bus-coupler breaker may be given from any of the control buses. For emergency switchgear, Contractor shall provide two DC supplies. The contractor shall provide suitable diodes to derive the control supply through diode auctioneering from the above two supplies. Power Supply to Numerical Relay and Ethernet switch shall be an independent circuit with switch and fuse tapped from the panel DC supply. Exact scheme for segregation of switchgear & numerical relay DC supplies shall be finalized during detailed engineering.			
6.03.00	SPACE HEATER BUSBARS Panel and motor space heaters shall be fed from separate AC auxiliary busbars running throughout the switchboard. The supply for these busbars shall be tapped from incomer, before the isolating switch/ circuit breaker. Incoming circuit to space-heater bus shall have an isolating switch, HRC fuse and neutral link of suitable rating. Suitable terminals shall also be provided to facilitate energisation of space-heater bus from outside during long shutdowns of unit / switch-board.			
6.04.00	CONTROL TRANSFORMERS The control transformers shall be 415 V/110 V with neutral point-earthed, of insulation class 'B' or better. The sizing of Control transformers shall be carried out by Contractor considering the actual load of power contactors, auxiliary contactors, indicating lamps and other equipment in the module circuit. An additional load of 15 watts should also be considered for each module, for remote auxiliary relays and lamps to be connected in the control circuit of modules. Contractor shall also ensure that control transformers are adequately designed for meeting the momentary loading requirements & the voltage drop during this condition shall not be more than 5%.			
7.00.00	EARTH BUS AND EARTHING			
7.01.00	A galvanized steel / Copper / Aluminum earth bus shall be provided at the bottom of each panel and shall extend throughout the length of each switchboard. It shall be welded / bolted to the framework of each panel and breaker earthing contact bar. Vertical earth bus shall be provided in each vertical section which shall in turn be bolted / welded to main horizontal earth bus.			
7.02.00	The earth bus shall have sufficient cross section to carry the momentary short circuit and short time fault current to earth, as indicated in "Technical Parameters", without exceeding the allowable temperature rise.			
7.03.00	Suitable arrangements shall be provided at each end of the horizontal earth bus for bolting to Contractor's earthing conductors. The horizontal earth bus shall project out of the switchboard ends and shall have predrilled holes for this connection. All joint splices to earth bus shall be made through at least two bolts, and taps by proper lug and bolt connection.			
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7.04.00	All non-current carrying metal work of the switchboard shall be effectively bonded to the earth bus. Electrical conductivity of the whole switchgear enclosure framework and truck shall be maintained even after painting.			
7.05.00	The carriage and breaker frame shall get earthed while being inserted in the panel and positive earthing of the breaker frame shall be maintained in all positions, i.e. SERVICE & ISOLATED, as well as throughout the intermediate travel.			
7.06.00	Each module frame shall get engaged to the vertical earth bus before the disconnecting contacts on the module are engaged to the vertical busbars.			
7.07.00	All metallic cases of relays, instruments and other panel-mounted equipment shall be connected to earth by independent stranded copper wires of size not less than 2.5 sq. mm. All the equipment mounted on the door shall be earthed through flexible wire/braids. Insulation color code of earthing wires shall be green. Earthing wires shall be connected to terminals with suitable clamp connectors, soldering is not acceptable. Looping of earth connections, which would result in loss of earth connections to other devices, when a device is removed, is not acceptable. However, looping of earth connections between equipment to provide alternative paths to earth bus is acceptable.			
7.08.00	VT and CT secondary neutral point earthing shall be at one place only, i.e. on the terminal block. Such earthing shall be made through links so that earthing of one secondary circuit shall be removed without disturbing the earthing of other circuit.			
7.09.00	All hinged doors having potential carrying equipment mounted on it shall be earthed by flexible wire/ braid. For doors not having potential carrying equipment mounted on it, earth continuity through scraping hinges/ hinge pins of proven design may also acceptable. The Contractor shall establish earth continuity at site also.			
8.00.00	CIRCUIT BREAKERS			
8.01.00	Circuit breakers shall be three pole, air break, horizontal draw out type, and shall have fault making and breaking capacities as specified in "Technical Parameters". The circuit breakers which meet specified parameters of continuous current rating and fault making / breaking capacity only after provision of cooling fans or special device shall not be acceptable.			
8.02.00	Circuit breakers along with its operating mechanism shall be provided with suitable arrangement for easy withdrawal. Suitable guides shall be provided to minimize misalignment of the breaker.			
8.03.00	There shall be "SERVICE", "TEST" and "FULLY WITHDRAWN" positions for the breakers. In "Test" position the circuit breaker shall be capable of being tested for operation without energizing the power circuits i.e. the power contacts shall be disconnected, while the control circuits shall remain undisturbed. Locking facilities shall be provided so as to prevent movement of the circuit breaker from the "SERVICE", "TEST" or "FULLLY WITHDRAWN"			
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	position. It shall be possible to close the door in "Test" position. The circuit breaker rack in and rack out from Service to Test, Test to Isolated position or vice-versa shall be possible only in the door closed position.			
8.04.00	All circuit breakers shall be provided with "6 NO" and "6NC" potential free auxiliary contacts. These contacts shall be in addition to those required, for internal mechanism of the breaker and should be directly operated from breaker operating mechanism. In case the manufacturer does not have a proven arrangement for providing the required number of circuit breaker auxiliary contacts on the fixed portion of the cubicle, necessary electrically reset latched relays shall be provided complete with all wiring in series with service position limit switch contacts, for multiplying the circuit breaker mounted auxiliary contacts and provide 4 NO and 4 NC contacts. Separate limit switches, each having required numbers of contacts shall be provided in both "SERVICE" and "TEST" position of the breaker. All contacts shall be rated for making, continuously carrying and breaking 10 Amp at 240 V AC and 1 Amp (Inductive) at 240 V DC respectively.			
8.05.00	Suitable mechanical indications shall be provided on all circuit breakers to show "OPEN", "CLOSE", "SERVICE ", "TEST" AND "SPRING CHARGED" positions.			
8.06.00	Main poles of the circuit breakers shall operate simultaneously in such a way that the maximum difference between the instants of contacts touching during closing shall not exceed half a cycle of rated frequency.			
8.07.00	All circuit breakers shall be provided with the following interlocks :			
8.07.01	Movement of a circuit breaker between "SERVICE" and "TEST" position shall not be possible unless it is in open position. Attempted withdrawal of a closed circuit breaker shall preferably not trip the circuit breaker. In case the offered circuit breaker trips on attempted withdrawal as a standard interlock, it shall be ensured that sufficient contact exists between the fixed and draw out contact at the time of breaker trip so that no arcing takes place even with the breaker carrying its full rated current.			
8.07.02	Closing of a circuit breaker shall not be possible unless it is in "SERVICE" position, "TEST" position or in "FULLY WITHDRAWN" position.			
8.07.03	Circuit-breaker cubicles shall be provided with safety shutters operated automatically by the movement of the circuit breaker carriage, to cover the stationary isolated contacts when the breaker is withdrawn. It shall however be possible to open the shutters intentionally against pressure for testing purposes.			
8.07.04	A breaker of particular rating shall be prevented from insertion in a cubicle of a different rating.			
8.07.05	Circuit breakers shall be provided with coded key / electrical interlocking devices, as per requirements.			
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8.08.00	Circuit breaker shall be provided with anti-pumping feature (soft) and trip free feature, even if mechanical anti-pumping feature is provided.			
8.09.00	Mechanical tripping shall be possible by means of front mounted Red "trip" push-button. In case of electrically operated breakers these push buttons shall be shrouded to prevent accidental operation.			
8.10.00	Complete shrouding / segregation shall be provided between incoming and outgoing bus links of breakers. In case of bus coupler breaker panels the busbar connection to and from the breaker terminals shall be segregated such that each connection can be approached and maintained independently with the other bus section live. Dummy panels if required to achieve the above feature shall be included in the Contractor's scope of supply.			
8.11.00	Circuit breaker shall be provided with Power operated mechanism as follows.			
	1.	Power operated mechanism shall be provided with a universal motor suitable for operation on 240 V DC / 240 AC Control supply, with voltage variation from 198 V to DC to 242 V DC . Motor insulation shall be class "E" or better.		
	2.	The motor shall be such that it requires not more than 30 seconds for fully charging the closing spring at minimum available control voltage.		
	3.	Once the closing springs are discharged, after one closing operation of circuit breaker, it shall automatically initiate recharging of the spring.		
	4.	The mechanism shall be such that as long as power is available to the motor, a continuous sequence of closing and opening operations shall be possible. After failure of power supply at least one open-close-open operation shall be possible.		
	5.	Provision shall be made for emergency manual charging and as soon as this manual charging handle is coupled, the motor shall automatically get mechanically decoupled.		
	6.	All circuit breakers shall be provided with closing and trip coils. The closing coil shall operate correctly at all values of voltage from 187-242 V DC. The trip coil shall operate satisfactorily at all values of voltage from 154-242V DC / 77 V-121 V DC		
	7.	Provision for mechanical closing of the breaker only in "Test" and "WITHDRAWN" positions shall be made. Alternately, the mechanical closing facility shall be normally made inaccessible; accessibility being rendered only after deliberate removal of shrouds.		
	8.	It shall not be possible to open the ACB panel door in breaker closed condition.		
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8.12.00	Further, the racking mechanism shall be accessible only after opening the breaker panel door.			
	Note: The circuit breakers for DC applications shall have manually operated mechanism of spring charged, stored energy type. The closing operation of the circuit breaker shall charge the tripping spring. Necessary interlocks shall be provided to inhibit closing of the circuit breaker unless the closing spring is fully charged.			
	TELESCOPIC TROLLEY Telescopic trolley or suitable arrangement shall be provided for maintenance of circuit-breaker module in a cubicle. The trolley shall be such that the top most breaker module can be withdrawn on the trolley and can be lowered for maintenance purpose. The telescopic trolley shall be such that all type, size and rating of breaker can be withdrawn /inserted of particular switchgear. The quantity of telescopic trolleys to be supplied shall be adequate for the number of switchgears / switchgear rooms.			
	AIR BREAK SWITCHES			
	Air break switches shall be of heavy duty, single throw, group operated, load break, fault make type when associated with fuses. All switches for motor circuits shall be of utilization category AC-23A with 1NO +1NC auxiliary contact, which shall be wired to the control circuit as shown in the schematic drawings. All switches for other outgoing feeders shall be of utilization category AC-22A. All switches for DC circuits shall be suitable for 240 V DC and shall be of DC-22 utilization category.			
	Continuous current rating of the switches shall be selected from the 'Module Selection tables' for various feeders.			
	The combination of switch-fuse unit would be preferred. However, if separate switch and fuses are provided, switch shall be located before fuses.			
	The main switches shall be operable from outside the module door. The switch handle shall clearly indicate the position of switch. Switch operating handles shall be provided with padlocking facilities. However, incomer switches of switchboards shall be provided with padlocking facility in both 'ON' and 'OFF' positions.			
	Interlocks shall be provided such that the cubicle door will not open when the switch is in closed position and the switch will close only when the door is closed.			
	Switches and fuses for AC/DC control supply and heater supply wherever required, shall be mounted inside the cubicles. Toggle switch is not acceptable.			
Even if a single phase feeder is required for certain applications, Contractor shall provide TPN switch, fuse-bases and cable/ link connections between switch/fuse and vertical busbars for all the three phases, so that changing from single phase feeder to three phase feeder is possible without any modification other than inserting fuses at site.				
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10.00.00	MCCB			
10.01.00	MCCB shall be fixed type/part of withdraw able feeder module as per specification, three pole, air break type having trip free mechanism with quick make and quick break type contacts. MCCB shall have current limiting feature. MCCB of identical ratings shall be physically and electrically interchangeable. MCCB shall be provided with 1 NO and 1NC auxiliary contacts.			
10.02.00	MCCB shall be provided with Microprocessor based inbuilt front adjustable releases (overload & short circuit) and shall have adjustable earth fault protection unit also. The protection settings shall have suitable range to achieve the required time & current settings. LED indications shall also be provided for faults, MCCB status(on/off etc).			
10.03.00	MCCB terminals shall be shrouded and designed to receive cable lugs for cable sizes relevant to circuit rating. Extended cable terminal arrangement for higher size cable may also be offered. ON and OFF position of the operating handle of MCCB shall be displayed and the rotary operating handle shall be mounted on the door of the compartment housing MCCB. The compartment door shall be interlocked mechanically with the MCCB, such that the door can not be opened unless the MCCB is in OFF position. MCCB shall be provided with padlocking facility to enable the operating mechanism to be padlocked. The MCCBs being offered shall have common/interchangeable accessories for all ratings like aux. switch ,shunt trip, alarm switch etc. The MCCBs shall have the current discrimination up to full short circuit capacity and shall be selected as per manufacturers discrimination table.			
10.04.00	The auxiliary contacts of the MCCB shall be fed to the digital inputs available in the numerical relays of Incomer/bus coupler/motor circuit breaker feeders , for integration in to the numerical relay network.			
11.00.00	CONTROL AND SELECTOR SWITCHES			
11.01.00	Control and selector switches shall be of heavy duty, rotary type with escutcheon plates clearly marked to show the positions. The control & selector switches should be as per IS/IEC 60947 Part V section 1. The switches shall be of sturdy construction suitable for mounting on panel front. Switches with shrouding of live parts and sealing of contacts against dust ingress shall be preferred.			
11.02.00	Ammeter and voltmeter selector switches shall have four stay put positions with adequate number of contacts for 3-phase 4-wire system. These shall have oval handles. Ammeter selector switches shall have make before break type contacts to prevent open circuiting of CT secondary.			
11.03.00	Contacts of the switches shall be spring assisted and shall be of suitable material to give a long trouble free service.			
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11.04.00	The contact ratings shall be at least the following :			
	1.	Make and carry, continuously, 10 A at 240 V DC and 110 V AC		
	2.	Breaking current at 240 V DC, 1 A (inductive)		
	3.	Breaking current at 110 V AC and 0.3 lagging p.f., 5A		
12.00.00	CONTACTORS			
12.01.00	Motor starter contactors shall be of air break, electromagnetic type rated for uninterrupted duty as per IS/IEC 60947 Part-4 Section- 1.			
12.02.00	Contactors shall be double-break, non-gravity type and their main contacts shall be silver faced.			
12.03.00	Direct-on-line contactors shall be of utilization category AC3. Reversing starters shall comprise of Forward and Reverse contactors mechanically and electrically interlocked with each other. These contactors shall be of utilization category AC4. DC contactors shall be of DC3 utilization category. For CHP conveyor motors, minimum rating of power contactors shall be 240% of full load current of the motors. For other CHP drives, minimum rating of power contactors shall be 160% of full load current of motor.			
12.04.00	The number of normally open (NO) and normally closed (NC) auxiliary contacts of a contactor shall be as per requirement shown in the respective module drawings. It shall, however, be not less than 2NO+2NC.			
12.05.00	Operating coil of contactors shall be of 110 V AC unless otherwise specified elsewhere. The contactor shall operate satisfactorily between 85% and 110% of the rated voltage. The contactor shall not drop out at 70% of the rated voltage but shall definitely drop out at 20% of the rated voltage.			
12.06.00	Contactors for DC drives shall have a coil voltage of 240 V DC. DC operated contactor coil shall have an economy resistor and shall be suitable for satisfactory continuous operation at 187-242 V DC/ 93.5-121 V			
13.00.00	FUSES			
13.01.00	All fuses shall be of HRC cartridge fuse link type. Screw type fuses shall not be accepted. Fuses for AC circuits shall be rated for 80kA rms (prospective) breaking capacity at 415V AC and for DC circuits, 20kA rms breaking capacity at 240V DC.			
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13.02.00	Fuse shall have visible operation indicators. Insulating barriers shall be provided between individual power fuses.		
13.03.00	Fuse shall be mounted on insulated fuse carriers, which are mounted on fuse bases. Wherever it is not possible to mount fuses on carriers, fuses shall be directly mounted on plug-in type of bases. In such cases one set of insulated fuse pulling handles shall be supplied with each switchboard.		
13.04.00	Fuse ratings shall be selected by the Contractor from the 'Module Selection Tables' for various feeder ratings. However, the fuse ratings for motor feeders given in the 'Motor Module Selection Table' are indicative only, and the same shall be coordinated by the Contractor to achieve class-II protection coordination and also to match the motor characteristics. Switch rating shall in no case be less than the fuse rating.		
13.05.00	The Neutral links shall be mounted on fuse carriers which shall be mounted on fuse bases.		
14.00.00	INSTRUMENT TRANSFORMERS		
14.01.00	All current and voltage transformers shall be completely encapsulated, cast resin insulated type suitable for continuous operation at the temperature prevailing inside the switchgear enclosure, when the switchboard is operating at its rated condition and the specified ambient temperature. The class of insulation shall be 'E' or better.		
14.02.00	All instrument transformers shall be able to withstand the thermal and mechanical stresses resulting from the maximum RMS short circuit breaking and peak making current ratings of the associated switchgear.		
14.03.00	All instrument transformers shall have clear indelible polarity markings. All secondary terminals shall be wired to separate terminals on an accessible terminal block where star point formation and earthing shall be done.		
14.04.00	Current transformers may be multi or single-core type. All voltage transformers shall be single phase type.		
14.05.00	The bus VTs shall be housed in a separate compartment. All VTs shall have readily accessible HRC current limiting fuses on both primary and secondary sides.		
14.06.00	All CTs shall be provided with supports independent of busbar / busbar supports.		
14.07.00	The CTs shall be located in such a way that they can be easily approached for maintenance without necessitating shut down of adjacent feeders.		
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15.00.00	NUMERICAL RELAYS & NETWORKING			
15.01.00	All relays in protective circuits shall be flush mounted on panel front with connections from the inside. The protective relays shall be communicable numerical relays. These numerical relays shall be of types as proven for the application and shall be subject to owner's approval. Numerical relays shall have appropriate setting ranges, accuracy, resetting ratio and other characteristics to provide required sensitivity. All equipments shall have necessary protections as detailed in the standard scheme drawings.			
15.02.00	The circuit breaker will normally be controlled from remote control panels (DDCMIS) through closing and shunt trip coils. Additionally, control shall be carried out from the Switchgear SCADA System through the Numerical relay. The Local control console of the relay flush mounted on the switchgear would normally be used only for testing of circuit breaker in isolated position, and for tripping it in an emergency. Provision for closing & tripping of the circuit breaker locally from laptop through serial port shall be possible to facilitate commissioning activities. The basic control scheme of breaker feeders shall be developed as per the schematic logics in the relay. The schematics shall be developed in soft inside the relay. Numerical relays shall be interfaced with DDCMIS through 24V DC signal for closing / opening operations.			
15.03.00	The numerical relay shall be capable of measuring and storing values of a wide range of quantities, events, faults and disturbance recordings. The alarm / status of each of protection function and trip operation shall be communicated to DDCMIS. The numerical relays shall have built in feature / hardware interface to provide such inputs to DDCMIS for analog / digital values. All the numerical relays shall have communications on three ports; local front port communication to laptop and a dual port on IEC 61850 to communicate with the data concentrator through LAN and Ethernet switches. Ethernet switches shall be connected through Fibre Optic cable to Numerical Relay network as specified elsewhere. Preferably, the numerical relays shall be capable of communicating simultaneously on both the redundant ring networks for seamless switchover.			
15.04.00	All relays and timers shall be rated for control supply voltage as mentioned elsewhere under parameters and shall be capable of satisfactory continuous operation between 80-120% of the rated voltage. Making, carrying and breaking current ratings of their contacts shall be adequate for the circuits in which they are used.			
15.05.00	The protective relays shall have at least 10 Nos programmable potential free contacts. Programmable Auxiliary relays shall have contacts as required.			
15.06.00	Failure of a control or auxiliary supply and deenergisation of a relay shall not initiate any circuit breaker /contactor operation. All relay digital output contacts shall withstand a minimum test voltage of 2kV AC rms for one minute.			
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15.07.00	All the numerical relays shall have adequate processor memory for implementing the programmable scheme logic required for the realization of the protection / control schemes, in addition to the built in protection algorithms.		
15.08.00	Relays shall be suitable for electrical measurement including voltage, current, power (active/reactive) and energy parameters.		
15.09.00	Relays shall have separate output for individual functionality and the master trip shall be software configurable in case of multi output relays. Relays shall have event recording feature, recording of abnormalities and operating parameters with time stamping		
15.10.00	Preferably comprehensive single numerical relay shall have provision of both current and voltage inputs. The current operated relay shall have provision for 4 sets of CT inputs, 3 nos. for phase fault & 1 CT input for earth fault. Relay shall be suitable for both residually connected CT input as well as CBCT input. The voltage-operated relay shall have provision for 3 PT inputs. Relays shall be suitable for CT secondary current of 1A / 5A selectable at site. Relays used in incomers and bus couplers shall have provision of two sets of voltage signal inputs for the purpose of synchronization.		
15.11.00	All CT & PT terminals shall be provided as fixed type terminals on the relay to avoid any hazard due to loose connection leading to CT opening or any other loose connection. In no circumstances Plug In type connectors shall be used for CT / PT connections. Contractor to ensure the same for all protective relay models offered.		
15.12.00	All numerical relay shall have key pad / keys to allow relay settings from relay front. All hand reset relays shall have reset button on the relay front. Relay to be self or hand reset shall be software selectable. Manual resetting shall be possible from remote.		
15.13.00	Relays shall have suitable output contact for breaker failure protection.		
15.14.00	Relays shall have self diagnostic feature with self check for power failure, programmable routines, memory and main CPU failures.		
15.15.00	Relays shall have at least two sets or groups of two different sets of adaptable settings. Relays shall have multiple IEC / ANSI programmable characteristics. Relays shall have self reset auxiliary contacts of programmable type.		
15.16.00	Design of the relay must be immune to any kind of electromagnetic interference. Contractor to submit all related type test reports for the offered model along with the offer.		
15.17.00	Relay shall be immune to capacitance effect due to long length of connected control cables. Any external hardware, if required for avoiding mal operation of the relay due to cable capacitance shall be included as a standard feature.		
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	All I/Os shall have galvanic isolation. Analog inputs shall be protected against switching surges, harmonics etc. Relays shall be provided with suitable harsh environment coating for protection against failure due to high temperature, humidity and dust.			
15.18.00	Numerical relays shall have two level password protections, one for read only and other for authorization for modifying the setting etc.			
15.19.00	Time clock synchronization feature shall be provided for synchronization of clocks of numerical relay and metering LAN with data concentrator time clock. Required hardware and software interface to receive GPS/Time signal to achieve time synchronization shall be supplied by the contractor. The resolution of time synchronization shall be +/- 1.0 millisecond or better throughout the entire system.			
15.20.00	Relays shall be suitable to accept both AC & DC supplies with range 110V or 240V with tolerance of 70 % to 120 % of rated voltage & shall be finalized during detailed engineering.			
16.00.00	OTHER PROTECTIONS AND CONTROL FUNCTIONS IN THE RELAYS			
16.01.00	For control from DDCMIS, 24V DC signal shall be provided from DDCMIS to the numerical relays. Preferably, no separate coupling relays shall be provided.			
16.02.00	Trip circuit supervision shall be provided for all feeders to monitor the circuit breaker trip circuit both in pre trip and post trip conditions.			
16.03.00	Schematics requiring auxiliary relays /timers for protection function shall be a part of numerical relay. The number of auxiliary relay and timer function for protection function shall be as required. Auxiliary relays for interlocking purpose shall be of self reset type.			
16.04.00	Bus no volt condition shall be configured to a output contact of the relay of all incomers for suitably interfacing with DDCMIS.			
16.05.00	Timer functions shall be programmable for on/off delays.			
16.06.00	The numerical relay shall be able to provide supervisory functions such as trip circuit monitoring, circuit breaker state monitoring, PT and CT supervisions and recording facilities with Post fault analysis.			
16.07.00	The numerical processor shall be capable of measuring and storing values of a wide range of quantities, all events, faults and disturbance recordings with a time stamping using the internal real time clock. Battery back up for real time clock in the event of power supply failure shall be provided.			
16.08.00	250 time tagged events /records should be able to store with time stamping Last 5 faults storage including the indication, protection operated , fault location relay and operating time, currents, voltage and time.			
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16.09.00	Diagnostics Automatic testing, power on diagnostics with continuous monitoring to ensure high degree of reliability shall be shall be provided. The results of the self reset functions shall be stored in battery back memory. Test features such as examination of input quantities, status of digital inputs and relay outputs shall be shall be available on the user interface.			
16.10.00	The alarm/status of each individual protection function and trip operation shall be communicated to DDCMIS.			
16.11.00	Sequence of events shall have 1 ms resolution at device level.			
16.12.00	Measurement accuracy shall be 1 % for RMS Current and voltage (20-120% of rated value).			
16.13.00	It shall be possible to carryout open / close operation of breakers from a laptop by interfacing from the relay front port during initial commissioning.			
16.14.00	Required no. of extra digital inputs shall be provided in the numerical relay for digital inputs from various outgoing MCCB feeders on that switchgear section.			
16.15.00	At least two licensed copies of necessary software for numerical relay configuration / setting / disturbance analysis and other utilities shall be supplied. Numerical relay configuration for all relays being supplied under the package shall be carried out in line with the approved schematics and shall be submitted for owner's approval. Setting calculations and relay settings configured in relay software for all relays shall be submitted for owner's approval. Approved relay configuration / settings shall be loaded in all the relays prior to dispatch to site.			
17.00.00	TRAINING The contractor shall arrange for training on system design, engineering, operation and maintenance of Numerical relays and Switchgear networking system at the principal's facility for duration of two (2) man-months. Workshop Training at site shall aim for familiarization of Site Engineers for commissioning and day to day O & M of Numerical Relays and trouble shooting. The scope shall include Two No's of Numerical Relay and Training for a batch of 20 Engineers at Project Site. One such Workshop shall be organized before the commissioning of First LV Switchboard and the Second workshop shall be conducted before Unit Commissioning. Owner shall provide the required Infrastructure such as Training Conference room, Projection systems etc.			
18.00.00	INDICATING INSTRUMENTS			
18.01.00	All indicating and integrating meters shall be flush mounted on panel front. The instruments shall be of at least 96mm square size with 90 degree linear scale and shall have an accuracy			
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	class of 1.0 or better. The covers and cases of instruments and meters shall provide a dust and vermin proof construction. 18.02.00 All instruments shall be compensated for temperature errors and factory calibrated to directly read the primary quantities. Means shall be provided for zero adjustment without removing or dismantling the instruments. 18.03.00 All instruments shall have white dials with black numerals & lettering. Black knife edge pointer shall be provided for meters. 18.04.00 Ammeters provided for motor feeders (for motors of rating $\geq 30\text{kW}$ & $< 100\text{kW}$) shall have a compressed scale at the upper current region to cover the starting current upto 6.0 times the CT primary current. 18.05.00 All motor feeders of rating $\geq 30\text{ kW}$ and $< 110\text{ kW}$ and all motors of Dust Suppression System shall be provided with Multifunction Digital Energy Meter with communication facility to display the current, voltage, power factor, power energy related data locally as well as communicate these for remote metering/audit/analysis purposes. These meters shall The technical specification for Digital indicating energy meter shall be as follows: a) Input Voltage:110VAC / 240VDC b) Input Current:1A c) Size:96X96 SQ.MM d) Power & Energy Accuracy: 1.0 e) Mounting: Flush mounting f) Type: True RMS 3-PHASE V,I, kW,PF & kWh indication g) 4 Digit, seven segment LED display/LCD display, with floating decimal h) Communication: In built RS 485 bus port i) Operating Frequency: 45 HZ-65HZ j) Dielectric Test: 2KV RMS for 1 minute k) Over Current: 10 times for 3 sec. l) Aux supply: 90V-300V AC/DC m) Compliance: EMC/EMI n) Field programmable CT ratio o) Analog Current Output (4-20 mA) 19.00.00 PUSH BUTTONS 19.01.00 Push-buttons shall be of spring return, push-to-actuate type. Their contacts shall be rated to make, continuously carry and break 10 A at 110 V AC and 1 A (inductive) at 240 V DC.			
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19.02.00	All push buttons shall have two (2) normally open and two (2) normally closed contact, unless specified otherwise. The contact faces shall be of silver alloy.			
19.03.00	All push-buttons shall be provided with integral escutcheon plates marked with its function.			
19.04.00	The color of the button shall as follows :			
	Green	for motor START, breaker CLOSE , valve/ damper OPEN commands.		
	Red	for motor trip, breaker open, valve / damper close commands.		
	Black	for all annunciation functions, overload reset and miscellaneous commands including reverse for clinker grinder etc.		
19.05.00	All push buttons on panels shall be located in such a way that Red push button shall always be to the left of Green push button. In case of clinker grinder etc. the push buttons would be black - red-green from left to right.			
19.06.00	All emergency push buttons shall have mushroom knobs.			
20.00.00	INDICATING LAMPS			
20.01.00	Indicating lamps shall be of CLUSTER LED type. The lamps shall have escutcheon plates marked with its function, wherever necessary.			
20.02.00	Lamps shall have translucent lamp-covers of the following colours, as warranted by the application :			
	Red	for motor ON, valve / damper OPEN, breaker CLOSE.		
	Green	for motor OFF , valve / damper CLOSE, breaker OPEN.		
	White	for motor AUTO TRIP.		
	Blue	for all healthy conditions (e.g. control supply, and also for SPRING CHARGED").		
	Amber	for all Alarm Conditions (e.g. overload). Also for "SERVICE" and "TEST" position indications.		
20.03.00	Bulbs and lamp covers shall be easily replaceable from the front of the cubicle. The method of mounting indicating lamp fittings on panels shall prevent their rotation under the action of lamp removal or replacements, reliance upon the tightness of ring nut for the purpose is not sufficient.			
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20.04.00	Indicating lamps should be located just above the associated push-button / control switches. Red lamps shall invariably be located to the right of green lamps. In case a white lamp is also provided, it shall be placed between the red and green lamps along the centre line of control switch / push button pair. Blue and Amber should normally be located above the Red and Green lamps.			
20.05.00	When associated with push-buttons, red lamps shall be directly above the green push-button and green lamp shall be directly above the red push button.			
20.06.00	All indicating lamps shall be suitable for continuous operation at 90% to 110% of their rated voltage.			
21.00.00	SPACE HEATER			
21.01.00	Space heaters shall be provided in the switchboards wherever the manufacturer considers them necessary and recommends their provision for preventing harmful moisture condensation.			
21.02.00	The space heaters shall be suitable for continuous operation on 240 V AC, 50 Hz, single phase supply, and shall be automatically controlled by thermostats. Necessary switches and fuses shall be provided.			
21.03.00	The circuit for each panel and motor space heater should have an isolating switch, HRC fuse and isolating link. In addition, the space heater circuit of each panel shall also have a thermostat of suitable rating.			
22.00.00	INTERNAL WIRING			
22.01.00	All switchboards shall be supplied completely wired internally upto the terminals, ready to receive external cables.			
22.02.00	All intercubicle and interpanel wiring and connections between panels of same switchboard including all bus wiring for AC and DC supplies shall be provided by the Contractor.			
22.03.00	All auxiliary wiring shall be carried out with 650V grade, single core stranded copper conductor, color coded, PVC insulated wires. Conductor size shall be 1.5 mm ² (min.) for control circuit wiring and 2.5 mm ² (min) for CT and space heater circuits.			
22.04.00	Extra flexible wires shall be used for wiring to devices mounted on moving parts such as hinged doors. The wire bunches from the panel inside to the doors shall be properly sleeved or taped.			
22.05.00	All wiring shall be properly supported, neatly arranged, readily accessible and securely connected to equipment terminals and terminal blocks.			
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22.06.00	All internal wiring terminations shall be made with solderless crimping type tinned copper lugs which shall firmly grip the conductor or an equally secure method. Similar lugs shall also be provided at both ends of component to component wiring. Insulating sleeves shall be provided over the exposed parts of lugs to the extent possible. Screw-less (spring loaded) / cage clamp type terminal shall also be provided with lugs.			
22.07.00	Printed single tube ferrules marked to correspond with panel wiring diagram shall be fitted at both ends of each wire. The wire identification marking shall be in accordance with IS: 375. Red Ferrules should be provided on trip circuit wiring.			
22.08.00	Wiring for equipment, which are to be supplied by the Contractor and for which the Contractor has to provide mounting arrangement in his panels, shall also be provided by the Contractor, upto the terminal blocks.			
22.09.00	All connections from vertical busbars for individual modules above 100 A shall be by Copper / Aluminum links only. The cable connections for modules less than 100 A shall be selected in such a way that there will not be any melting / shorting in case of a short circuit inside the module and the cable shall have current rating to carry the let through energy of the corresponding fuses in case of a fault. The insulation of the cable and its cross section shall be decided considering the high ambient temperature within the module. For all modules where use of cable is envisaged by the Contractor specific approval from the Contractor regarding cable details are to be taken. For power wiring color coded wire insulation / tapes shall be provided.			
23.00.00	CONTROL TERMINAL BLOCKS			
23.01.00	Terminal blocks shall be 650V grade, 10Amps rated, made up of unbreakable polyamide 6.6 grade. The terminals shall be either screw type or screw-less (spring loaded) / cage clamp type with lugs. Marking on terminal strips shall correspond to the terminal numbering in wiring diagrams. All metal parts shall be of non-ferrous material. In case of screw type terminals the screw shall be captive, preferably with screw locking design.			
23.02.00	Terminal blocks for CT and VT secondary leads shall be of stud type, made up of unbreakable polyamide 6.6 grade. They shall be provided with links to facilitate testing, isolation star / delta formation and earthing. Terminal blocks for CT secondary shall have the short circuiting facility. The terminals for remote ammeter connection etc. shall also be disconnecting type only. All metal parts shall be of non-ferrous material. Screws shall be captive.			
23.03.00	In all circuit breaker panels MCC modules at least 10% spare terminals for external connections shall be provided and these spare terminals shall be uniformly distributed on all terminal blocks.			
23.04.00	All terminal blocks shall be suitable for terminating on each side two (2) nos. stranded copper conductors of size upto 2.5 sq. mm each, or alternatively, the terminal blocks shall have the			
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	possibility of double shorting space to facilitate looping. However for DDCMIS terminals shall be suitable for 1.5 mm2 cable.			
23.05.00	All terminals shall be numbered for identification and grouped according to the function. Engraved white-in-black labels shall be provided on the terminal blocks.			
25.06.00	Wherever duplication of a terminal block is necessary it shall be achieved by solid bonding links.			
25.07.00	Terminal blocks shall be arranged with at least 100mm clearance between two sets of terminal blocks. The minimum clearance between the first row of terminal blocks and the associated cable gland plate shall be 250 mm.			
24.00.00	POWER CABLE TERMINATION			
24.01.00	Cable termination compartment and arrangement for power cables shall be suitable for heavy duty, 1.1 kV grade, stranded aluminum conductor, PVC/ XLPE insulated, armored / unarmored and PVC sheathed cables. The size and type of cable for individual modules shall, preferably, be as indicated in the 'Module Selection Tables'. All necessary cable terminating accessories such as supporting clamps and brackets, hardware etc. for cables shall be provided by the contractor to suit the final cable sizes.			
24.02.00	All power cable terminals shall be of stud type and the power cable lugs shall be of tinned copper solderless crimping ring type conforming to IS: 8309. All lugs shall be insulated/ sleeved.			
25.00.00	LOCAL PUSH BUTTON STATIONS			
25.01.00	The local push button stations shall be metal enclosed, suitable for outdoor / indoor mounting on wall or steel structures. The enclosure shall be die-cast aluminum or cold-rolled sheet steel of at least 1.6 mm thickness. The enclosure shall be provided with a hinged guard at the front, covering full length, to avoid inadvertent operation of push buttons. LPBS shall be painted to shade no. RAL: 9002. Support structure for mounting the LPBS shall also be supplied by Contractor.			
25.02.00	The local push button stations shall be dust and vermin proof and shall have a degree of protection of IP -55 as per IS/IEC 60947. The DOP shall be IP-65 in case the same are located in dusty areas.			
25.03.00	The push button stations shall be suitable for bottom cable entry and shall be provided with removable undrilled gland plates or knockouts. Adequate space shall be available inside the push button station enclosure for terminating external cables directly on pushbutton terminals. Overall size of push button stations shall be subject to owner's approval.			
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25.04.00	The push button station shall comprise of a latched type EMERGENCY STOP push button with two (2) NO and two (2) NC contacts.			
26.00.00	LOCAL MOTOR STARTERS			
26.01.00	Local motor starters shall be suitable for manual switching of 415 V, 3-phase, squirrel cage motors rated upto 5.5 KW. They shall have constructional features similar to those specified for local push button stations.			
26.02.00	Each starter shall comprise of :			
	1.	A 3-pole contactor, mechanically latched type.		
	2.	Start push button, colored green.		
	3.	Stop push button, colored red.		
	4.	Ambient temperature compensated, thermal over load relay with single phasing protection. The continuously variable relay setting range shall be suitable for the motor rating which shall be advised to the Contractor in due course. The relay shall trip the contactor.		
26.03.00	The start push button, when pressed, shall preferably remain in depressed position and shall be released along with the contactor when the stop push button is pressed or when thermal overload relay operates.			
26.04.00	Local starters shall be suitable for loop-in and loop-out of incoming cable and for one outgoing cable to motor. Final cable sizes and number of lugs required will be intimated to the contractor. Support structure for mounting in local motor starters shall be supplied by the Contractor.			
27.00.00	NAME PLATES AND LABELS			
27.01.00	All Switchgears, MCCs, Distribution Boards, Fuse boards, all feeders, local push-button stations and local motor starters shall be provided with prominent, engraved identification plates. The module identification plate shall clearly give the feeder number and feeder designation. For single front switchboards, similar panel and board identification labels shall be provided at the rear switchgear also.			
27.02.00	All name plates shall be of non-rusting metal or 3-ply Lamicoid, with white engraved lettering on black background. Inscription & lettering sizes shall be subject to owner's approval.			
27.03.00	Suitable stenciled paint mark shall be provided inside the panel/module for identification of all equipment in addition to the plastic sticker labels, if provided. These labels shall be			
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	positioned so as to be clearly visible and shall have the device number, as mentioned in the module wiring drawings.			
27.04.00	Caution name plate "Caution Live Terminals" shall be provided at all points where the terminals are likely to remain live and isolation is possible only at remote end.			
28.00.00	METAL ENCLOSED NON SEGREGATED PHASE BUSDUCT(AIR INSULATED)			
28.01.00	Three phase and neutral metal enclosed non segregated phase bus duct assemblies shall be supplied for incoming connections from the transformers to the switch boards and inter connecting sections between switch boards, wherever called for.			
28.02.00	The enclosure shall be made of minimum 3 mm thick aluminum alloy. The section of the bus duct shall be rectangular. The design of the bus duct enclosures shall be of sturdy construction such that it will withstand the internal or external forces resulting from the various operating conditions.			
28.03.00	The entire bus duct shall be designed for dust, vermin and weather proof construction. A suitable aluminum sheet flange-protection hood shall be provided to cover all outdoor bus duct enclosure joints to facilitate additional protection against rain water ingress. All horizontal runs of bus ducts shall have a suitable sloped enclosure top to prevent retention of water for both indoor and out door portion of bus ducts. Bus duct enclosure shall have a degree of protection of IP-55.			
28.04.00	The inside of the bus enclosure may be treated with black paint to enable efficient heat dissipation. The matt paint used shall be suitable for temperature experienced during continuous loading of the bus conductor. The bus duct exterior paint shade shall be RAL 5012.			
28.05.00	Flexible expansion joints for the enclosure shall be provided wherever deemed necessary by the Contractor. Necessary bonding shall be provided at the expansion joints if made of insulating materials.			
28.06.00	Enclosures shall be provided with flanged ends with drilling dimensions to suit the flanges at the switchgear and transformer terminals. Any adapter boxes required for this purpose are in the Contractor's scope of supply. The flanges shall be provided with gaskets, nuts, bolts, etc. Details of the flanges provided on transformer ends will be furnished to the successful Contractor.			
28.07.00	Suitable Inspection covers shall be provided for periodic inspection of insulators. Handle shall be provided on each inspection cover to facilitate easy lifting.			
28.08.00	The EPDM / Neoprene gaskets shall be provided so as to satisfy the operating conditions imposed by temperature, weathering, durability etc. Flange gaskets shall be provided at the equipment terminal connections.			
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28.09.00	Necessary earthing arrangement as applicable shall be provided with clamps to receive station earthing bus. All accessories and hardware required for the earthing arrangement shall be provided by the Contractor. This shall be a GI strip of adequate size, continuously running along the bus duct and shall be earthed at both ends. Bus duct enclosures shall be bolted type.			
28.10.00	The material of the conductor shall be aluminum. The minimum clearance in air between phase to phase, phase to neutral and phase to earth for the entire run of bus duct shall be 25 mm The bus bars shall be rated in accordance with the service conditions and the rated continuous and short time current ratings calculated for specific application / specified elsewhere.			
28.11.00	All steel structures required for bus duct support shall be hot dip galvanized.			
28.12.00	Space heaters shall be provided in the bus duct wherever the manufacturer considers them necessary and recommends their provision for preventing harmful moisture condensation.			
28.13.00	The space heaters shall be suitable for continuous operation on 240 V AC, 50 Hz single phase supply and shall be automatically controlled by thermostats. Necessary wiring upto junction boxes mounted on bus duct and from junction boxes to switch boards shall be provided by the Contractor.			
29.00.00	BUS TRUNKING SYSTEM (SANDWICH TYPE BUSDUCT)			
29.01.00	Three phase Bus trunking system conforming to IEC 60439 (Parts 1 & 2) / IS 8623 (Parts 1 & 2) shall be provided for connecting the Main and Standby DG sets to Unit Emergency Switchgears as indicated in the BOQ.			
29.02.00	The enclosure shall be made of CRCA (1.6mm thick) / GI (1.6mm thick) / Aluminium (2.5mm thick) sheet. The design of the bus duct enclosure shall be of sturdy construction such that it will withstand the internal or external forces resulting from the various operating conditions.			
29.03.00	The entire bus duct shall be designed for dust, vermin and weather proof construction. A suitable aluminium sheet flange-protection hood shall be provided to cover all outdoor bus duct enclosure joints to facilitate additional protection against rain water ingress. All horizontal runs of bus ducts shall have a suitable sloped enclosure top to prevent retention of water for both indoor and out door portion of busducts. Busduct enclosure shall have a degree of protection of IP-55.			
29.04.00	The busduct exterior paint shade shall be RAL 5012.			
29.05.00	Enclosures shall be provided with flanged ends with drilling dimensions to suit the flanges at the switchgear and DG terminals. Any adapter boxes required for this purpose are in the contractor's scope of supply. The flanges shall be provided with gaskets, nuts, bolts, etc.			
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29.06.00	EPDM / Neoprene gaskets shall be provided so as to satisfy the operating conditions imposed by temperature, weathering, durability etc. Flange gaskets shall be provided at the equipment terminal connections.			
29.07.00	Necessary earthing arrangement as applicable shall be provided with clamps to receive station earthing bus. All accessories and hardware required for the earthing arrangement shall be provided by the contractor. This shall be a GI strip of adequate size, continuously running along the busduct and shall be earthed at both ends. busduct enclosures shall be bolted type.			
29.08.00	The material of the conductor shall be high conductivity aluminum / copper. The busbars shall be rated in accordance with the service conditions and the rated continuous and short time current ratings specified elsewhere.			
29.09.00	All steel structures required for busduct support shall be hot dip galvanized.			
29.10.00	Space heaters shall be provided in the busduct wherever the manufacturer considers them necessary and recommends their provision for preventing harmful moisture condensation.			
29.11.00	The space heaters shall be suitable for continuous operation on 240 V AC, 50 Hz single phase supply and shall be automatically controlled by thermostats. Necessary wiring upto junction boxes mounted on busduct and from junction boxes to switch boards shall be provided by the contractor.			
30.00.00	LIGHTING / WELDING TRANSFORMERS Each AC Lighting Distribution Board (LDB) / Welding DB shall be fed from 415V / 415V, 100kVA isolating transformer. The lighting / welding transformer may, preferably, be located inside the LDB / Welding DB panel itself. Otherwise, the same shall be located by the side of respective LDB / Welding DB. Lighting / Welding transformers shall be dry type, natural air cooled with class B insulation or better. Impedance of lighting / Welding transformer shall be so selected that the fault level of lighting /Welding system shall be reduced to 3 to 5 KA. Lighting / Welding transformers shall be tested as per IS: 2026. Off-circuit tap changer with ± 2.5% and ± 5% tapping shall be provided. In case the transformers are not mounted inside the LDB panels, the same shall be housed in a separate 2 mm thick CR sheet steel enclosure with IP-42 degree of protection as per IS/IEC 60947. However, the transformer terminal box shall have IP-52 degree of protection.			
31.00.00	PAINTING All sheet steel work shall be pretreated, in tanks, in accordance with IS: 6005. Degreasing shall be done by alkaline cleaning. Rust and scales shall be removed by pickling with acid. After pickling, the parts shall be washed in running water. Then these shall be rinsed in slightly alkaline hot water and dried. The phosphate coating shall be "Class-C" as specified in IS: 6005. The phosphated surfaces shall be rinsed and passivated. After passivation, Electrostatic Powder Coating shall be used. Powder should meet requirements of IS 13871 (Powder costing specification). Finishing paint shade for complete panels excluding end covers shall be RAL9002 & RAL5012 for extreme end covers of all boards, unless required otherwise by the owner. The paint thickness shall not be less than 50 microns. Finished parts shall be suitably packed and wrapped with protective covering to protect the finished surfaces from scratches, grease, dirt and oil spots during testing, transportation, handling and erection.			
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
32.00.00	GASKETS The gaskets, wherever specified, shall be of good quality EPDM / Neoprene with good ageing, compression and oil resistance characteristics suitable for panel applications.			
33.00.00	TEMPERATURE –RISE The temperature rise of the horizontal and vertical busbars and main bus links 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 outside ambient temperature of 50 deg C. The temperature rise of the accessible parts/external enclosures expected to be touched in normal operation shall not exceed 20deg. C. The temperature rise of manual operating means shall not exceed 10deg. C for metallic & 15 deg. C for insulating material. Temperature rise for the busbars shall be carried out at 90% of the rated current. The above temperature rise limits are applicable for busducts also without any current derating.			
34.00.00	DERATING OF EQUIPMENTS The Contractor shall ensure that the equipment offered will carry the required load current at site ambient conditions specified and perform the operating duties without exceeding the permissible temperature as per Indian Standards / Specification. Continuous current rating at 50 deg C ambient in no case shall be less than 90% of the normal rating specified. The Contractor shall indicate clearly the derating factors if any employed for each component and furnish the basis for arriving at these derating factors duly considering the specified current ratings and ambient temperature of 50 deg C.			
35.00.00	PROTECTION CO-ORDINATION It shall be the responsibility of the Contractor to fully coordinate the overload and short circuit tripping of the circuit breakers with the upstream and downstream circuit breakers / fuses / motor starters, to provide satisfactory discrimination. Further the various equipment supplied shall meet the requirements of Type II class of Co-ordination as per IS: 8544.			
36.00.00	TESTS AND TEST REPORTS GENERAL (a.) All equipments to be supplied shall be of type tested design. 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 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 ten 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 at no additional cost either at third party lab or in presence of client/owner's representative and submit the reports for approval.			
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CLAUSE NO.	TECHNICAL REQUIREMENTS					
	(c.) All routine tests as per the specification and relevant standards shall be carried out..					
	The following type test certificates on each type & rating of L.T. Switchgear and MCC panel shall be submitted.					
	1)	Switchgear / MCC panels of each rating				
		a)	Short time withstand test.			
		b)	Temperature rise test.			
		c)	Degree of protection test			
	2)	Circuit breaker of each rating				
		a)	Test sequence 1			
			-	Dielectric properties.		
			-	Mechanical operation and operational performance capability		
			-	Verification of dielectric withstand.		
			-	Verification of temperature-rise		
		b)	Combined test sequence (With Circuit breakers mounted inside the Switchgear panel)			
			-	Rated short-time withstand current		
			-	Rated service short-circuit breaking capacity		
			-	Verification of dielectric withstand		
			-	Verification of temperature-rise		
	3)	MCC modules of any three ratings, as selected by the owner, for class - II protection Co-ordination.				
	4)	Test for single phasing protection feature on 3 nos. bimetallic thermal overload relay selected by owner. The relay shall be tested for compliance with manufacturer's printed / declared characteristic curve.				
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36.01.00	For the following equipment the contractor shall submit the reports of all the type tests as per applicable standards and carried out within last ten 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. In case 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 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 at no additional cost to the owner either at third party lab or in presence of client/owner's representative and submit the reports for approval. (a.) NUMERICAL RELAYS (b.) ETHERNET SWITCHES (c.) FIBRE OPTIC CABLE (d.) LOCAL PUSH BUTTON STATION (e.) LOCAL MOTOR STARTER (f.) LIGHTING / WELDING TRANSFORMER (g) MCCB																			
36.02.00	Type test reports for the following tests on the model of the Numerical relays, Ethernet switches shall be submitted for owner's review. <table><thead><tr><th>Test</th><th>Specification</th></tr></thead><tbody><tr><td colspan="2">1 Functional requirements</td></tr><tr><td>1 Features and logics</td><td>IEC61850</td></tr><tr><td>2 Checking of compatibility with co-operating devices</td><td>IEC61850</td></tr><tr><td>3 Communication</td><td>IEC61850</td></tr><tr><td colspan="2">2 Mechanical construction requirements</td></tr><tr><td>1 General inspection</td><td>Manufacturer's document</td></tr><tr><td>2 Inspection of marking and data</td><td>IEC 60255-6</td></tr></tbody></table>				Test	Specification	1 Functional requirements		1 Features and logics	IEC61850	2 Checking of compatibility with co-operating devices	IEC61850	3 Communication	IEC61850	2 Mechanical construction requirements		1 General inspection	Manufacturer's document	2 Inspection of marking and data	IEC 60255-6
Test	Specification																			
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CLAUSE NO.	TECHNICAL REQUIREMENTS		एनटीपीसी NTPC
	3	Clearances and creepage distances IEC 60255-5	
	4	Degree of protection by enclosure IEC 60529	
	3	Insulation requirements	
	1	Dielectric test IEC 60255-5	
	2	Impulse voltage test IEC 60255-5	
	3	Insulation resistance measurements IEC 60255-5	
	4	Accuracy requirements	
	1	Measurement accuracy of characteristic quantity and specified time IEC 60255-6	
	2	Limits of frequency range and frequency dependence IEC 60255-6	
	3	Limits of ambient temperature and ambient temperature dependence IEC 60255-6	
	4	Limits of operative range of auxiliary energizing inputs and auxiliary voltage dependence IEC 60255-6	
	5	Rated burden requirements	
	1	Measuring circuits IEC 60255-6	
	2	Auxiliary circuits IEC 60255-6	
	3	Signalling inputs IEC 60255-6	
	6	Thermal requirements	
	1	Temperature rise IEC 60255-6	
	2	Limiting continuous thermal withstand values IEC 60255-6	
	3	Limiting short-time thermal withstand values IEC 60255-6	
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CLAUSE NO.	TECHNICAL REQUIREMENTS	
	7 Limiting dynamic value requirements IEC 60255-6 8 Power supply requirements 1 Limiting duration of interruptions to dc auxiliary voltage IEC 60255-11 2 Limiting value of ripple in dc auxiliary voltage IEC 60255-11 3 Limiting value of voltage dips to ac auxiliary voltage IEC 61000-4-11 4 Limiting duration of interruptions to ac auxiliary voltage IEC 61000-4-11 5 Limiting variations of ac auxiliary voltage IEC 61000-4-11 9 Electromagnetic compatibility requirements 1 High frequency disturbance test IEC 60255-22-1 2 Electrostatic discharge test IEC 60255-22-2, 61000-4-2 3 Radiated, radio-frequency, electromagnetic field immunity test IEC 60255-22-3, 61000-4-3 4 Fast transient disturbance test IEC 60255-22-4, 61000-4-4 5 Surge immunity test IEC 60255-22-5, 61000-4-5 6 Immunity to conducted disturbances, induced by radio-frequency fields IEC 60255-22-6, 61000-4-6 7 Power frequency immunity test IEC 60255-22-7 8 Conducted and Radiated radio-frequency emission tests IEC 60255-25, EN55011-CISPR 11 9 Power frequency magnetic field immunity test IEC 61000-4-8	
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CLAUSE NO.	TECHNICAL REQUIREMENTS		एनटीपीसी NTPC	
37.05.00	10 Environmental requirements			
	1	Dry cold test	IEC 60068-2-1	
	2	Dry heat test	IEC 60068-2-2	
	3	Storage temperature test	IEC 60068-2-8	
	4	Damp heat test, cyclic (12 + 12 hour cycle)	IEC 60068-2-30	
	11 Contact performance requirements			
	1	Make and carry for dc	IEC 60255-23	
	2	Breaking capacity for dc	IEC 60255-23	
	3	Make and break ac	IEC 60255-23	
	12 Mechanical performance requirements			
	1	Durability of relay operation	IEC 60255-6	
	2	Durability of plug-in relays	IEC 60255-6	
	3	Durability of relay setting controls	IEC 60255-6	
	4	Vibration response and endurance test	IEC 60255-21-1	
	5	Shock response and withstand test	IEC 60255-21-2	
	6	Bump test	IEC 60255-21-2	
	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. All routine tests as per the specification and relevant standard IS 8623 shall be carried out. An indicative lists of tests / checks is mentioned as QA chapter . However, the manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.			
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
37.06.00	All procedures for type tests shall be approved by owner before commencement of type tests. However, the following points may be specifically noted.			
	1)	For temperature rise tests, the connection arrangement between the source and the test equipment shall be such that the temperature gradient in the connection piece of cable at a distance of one meter away from the test equipment shall be restricted to 5 deg C.		
	2)	Milli Volt drop test shall be done on switching devices before and after the type tests.		
	3)	Bolt tightness of busbar joints shall be checked with torque wrench before and after short time rating tests on the circuit breaker and MCC panels.		
37.07.00	Routine checking to observe compliance to degree of protection, first numeral , on switchboard enclosures and busbar chambers shall be as under :			
	1) IP -4 X	It shall not be possible to insert a one mm dia. Steel wire into the enclosure from any direction, without using force.		
	2) IP-5X	It shall not be possible to insert a thin sheet of paper under gaskets and through enclosure joints.		
37.00.00	ERECTION / INSTALLATION OF SWITCHBOARDS AND OTHER EQUIPMENTS			
37.01.00	Each equipment shall be installed in a neat, workman-like manner so that it is leveled, plumbed, squared and properly aligned and oriented. Tolerances shall be as established in Contractor's drawings or as stipulated by owner. No equipment shall be permanently fixed down to foundations until the alignment has been checked and found acceptable by the owner.			
37.02.00	Contractor shall furnish all supervision, labour, tools, equipment, rigging materials, bolts, wedges, anchors, etc., in proper time, required to completely install, test and commission the equipment.			
37.03.00	Manufacturer's and owner's instructions and recommendations shall be correctly followed in handling, setting, testing and commissioning of all equipment.			
37.04.00	Contractor shall move all equipment into the respective rooms through the regular door or openings specifically provided for this purpose. No part of the structure shall be utilised to lift or erect any equipment without prior permission of Engineer.			
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
37.05.00	All switchboards shall be installed in accordance with Indian Standard, IS: 3072, and owner's instructions.			
37.06.00	Switchboard panels shall be installed on concrete floor or supported on steel channel / edge angle in concrete trenches. The Contractor shall provide steel insert plates in the concrete floor and / or steel channels / edge angle on the trenches as applicable. The base frame of switchboards shall be welded to the insert plates by the Contractor. The Contractor shall be required to install and align the panels using suitable metallic shims before welding the base frame. In joining shipping sections of switchboards together, adjacent housing of panel sections or flanged throat sections shall be bolted together after alignment has been completed.			
37.07.00	Contractor shall take utmost care in handling instruments, relays and other delicate mechanisms. Wherever the instruments and relays are supplied separately they shall be mounted only after the associated panels have been erected and aligned. the blocking materials employed for safe transit of instruments and relays shall be removed after ensuring that panels have been completely installed and no further movement of the same would be necessary. Any damage shall be immediately reported to Engineer.			
37.08.00	Equipment furnished with finished coats of paint shall be touched up by Contractor if their surface is spoiled or marred during erection / commissioning.			
37.09.00	The room and floor finishing work would be done after erection of the panels and the Contractor shall suitably cover up the panels to protect them from injury and marring of finish.			
38.00.00	COMMISSIONING CHECKS / TESTS			
38.01.00	After installation of panels, power and control wiring and connections, Contractor shall perform operational tests on all switchboards, to verify proper operation of switchboards / panels and correctness of all equipment in each and every respect.			
38.02.00	The Contractor shall carry out the following commissioning checks, in addition to other checks and tests recommended by the manufacturers.			
38.03.00	GENERAL (a.) Check name plate details according to the approved drawings. (b.) Check for physical damage. (c.) Check tightness of all bolted connections, by torque wrench. (d.) Check earth connections.			
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
38.04.00	(e.)	Check cleanliness.		
	(f.)	Check all moving parts for proper lubrication.		
	Circuit Breakers			
	(a.)	Check alignment of breaker truck for free movement.		
	(b.)	Check correct operation of shutters.		
	(c.)	Check control wiring for correctness of connections, continuity And IR values.		
	(d.)	Manual operation of breakers completely assembled.		
	(e.)	Closing /opening operation, manually and electrically.		
	(f.)	Trip free and anti-pumping operation.		
	(g.)	I.R. values of contacts.		
	(h.)	Contact resistance.		
	(i.)	Check on spring charging motor, correct operation of limit switches and time or charging.		
	(j.)	All functional checks		
	(k.)	Breaker closing and tripping time, if required.		
38.05.00	Current Transformers			
	(a.)	Visual inspection.		
	(b.)	IR Value		
	(c.)	Ratio check.		
	(d.)	Magnetising current.		
	(e.)	Wiring connection.		
	(f.)	Spare CT cores, if any, to be shorted and earthed		
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
38.06.00	Voltage Transformers			
	(a.) Visual inspection.			
	(b.) IR Value			
	(c.) Ratio check			
	(d.) Mangnetising current			
	(e.) Line connection as per connection diagram			
38.07.00	Cubicle Wiring			
	(a.) Check all switch developments			
	(b.) Each wire shall be traced by continuity tests and it shall be ensured that the wiring is as per relevant drawing. All inter-connections between panels / equipment shall be similarly checked.			
	(c.) All the wires shall be meggered to earth.			
	(d.) Functional checking of all control circuit e.g., closing, tripping, control, interlock, supervision and alarm circuit.			
38.08.00	Relays			
	1. Check connections and wiring.			
	2. Megger			
	a) Megger all terminals to body.			
	b) Megger AC to DC terminals.			
	3. Check operating characteristics by secondary injection.			
	4. Check minimum pick up voltage of DC coils.			
	5. Check operation of electrical / mechanical targets.			
	6. Relay settings.			
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38.09.00	7. Check CT and VT connections with particular reference to their polarities. Meters (a.) Visual inspection. (b.) Megger all insulated partitions. (c.) Check CT and VT connections with particular reference to their polarities for power type meters. (d.) Calibration.		
39.00.00	AC MODULES DESCRIPTION		
39.01.00	Module type DAE (Circuit Breaker Module) (a.) One (1) Triple-pole circuit breaker, complete with all accessories and power operated mechanism, as specified. (b.) Three (3) Current transformers for Protection and metering. (c.) One (1) DC isolating Switch (d.) Six (6) HRC Control fuses. (e.) Numerical relay for the following: - Short Circuit Protection - Earth Fault Protection - Over Load protection - Energy Metering - Current and Voltage metering - Trip Circuit Supervision - CB Monitoring - Synchronizing Check feature		
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
39.02.00	Module Type DAET (Circuit Breaker Incomer From Transformer) Similar to module type DAE; but with additional PS Class Current transformers for Restricted Earth Fault Protection. The Numerical relay shall have provision for REF protection in addition to the features listed against module type DAE.			
39.03.00	Module Type CC (Contactor Changeover Between Two In Coming Supplies) (Note: Main and Reserve incomers shall be housed in separate drawout modules, located in different panels.) The drawout modules shall be provided with service position limit switch having 2 NO+2NC contacts. Main Incomer One (1) Triple pole load break isolating switch . One (1) Triple pole contactor with coil suitable for 415 V AC. Two (2) Auxiliary contactors with coil suitable for 415 V AC. One (1) Indicating lamp with resistor and coloured lens suitable for 415 V AC. Three (3) HRC control fuses. Reserve Incomer One (1) Triple pole load break isolating switch One (1) Triple pole contactor with coil suitable for 415 V AC. One (1) Indicating lamp with resistor and coloured lens suitable for 415 V AC. Two (2) HRC control fuses.			
39.04.00	Module Type CS (AC Control Supply Module) (Note: Module type CS will be of non-drawout type) Two (2) 415/110 V control transformers. Four (4) 110V auxiliary relays. Two (2) Earth links. Eight (8) HRC Control fuses.			
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CLAUSE NO.	TECHNICAL REQUIREMENTS 		
39.05.00	Two (2) Selector switches Module Type DG (Circuit Breaker Incomer From DG Set)		
	(a.) One (1) Triple-pole circuit breaker, complete with all accessories and power operated mechanism, as specified. (b.) Three (3) Current transformers for protection & metering. (c.) One (1) DC isolating Switch (d.) Six (6) HRC control fuses (e.) Numerical relay for the following: • Differential protection • Over Load protection • Reverse Power Protection • DG Neutral displacement • Energy Metering • Current and Voltage metering • DG Monitoring		
39.06.00	Module Type E/E1/E2 (Switch Fuse Module/MCCB) (a) One (1) Triple pole switch-fuse unit with three pole isolating switch and three / one / two HRC fuses for E/E1/E2 modules, respectively. (b) One (1) Neutral link. (c) One (1) 3 pole MCCB (for rating 100A and above)		
39.07.00	Module Type G1 (VT Module with Under Voltage / No Volt Relay) (a.) Three (3) 415/ $\sqrt{3}$ / 110/ $\sqrt{3}$ V single phase voltage transformers, mounted on a common draw-out chassis (b.) Three (3) HRC fuses for VT primary.		
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CLAUSE NO.	TECHNICAL REQUIREMENTS		
39.08.00	(c.) Three (3)	HRC control fuses.	
	Module Type H (Isolating Switch Module)		
	(a) One (1)	Triple pole load break isolating switch	
	(b) One (1)	Neutral link	
39.09.00	Module type K1 (Non Reversible Motor Rated Below 30 kW Controlled from MCC)		
	(a) One (1)	Triple pole fuse switch unit with three pole load break isolating switch and three HRC fuses.	
	(b) One (1)	Triple pole contactor.	
	(a.) (c) One (1)	Bimetallic thermal overload relay with single phasing preventer. For motor with high starting time, heavy duty overload relay shall be provided.	
	(d) Two (2)	Push buttons.	
	(e) Three (3)	Indicating lamps with resistors and coloured lenses.	
	(f) One (1)	HRC control fuse.	
	(g) One (1)	Control link.	
39.10.00	Module Type K11 (Non reversible Motor Rated 30kW to 200kW Controlled from MCC)		
	Similar to module type K1 but with the following additions:		
	One (1) Current transformer for metering.		
	One (1) Ammeter		
	One (1) Single-pole switch and fuse for motor space heater.		
39.11.00	Module type DK2 (Non Reversible Motor rated below 30kW Controlled from DDCMIS)		
	(a) One (1)	Triple pole switch fuse unit with three pole load break	
		Isolating switch and three HRC fuses.	
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39.12.00	(b)	One (1)	Triple pole contactor.		
	(c)	One (1)	Bimetallic thermal overload relay with single phasing preventor. Modules marked with * (DK2* / PK2*) shall not have this relay. For motor with high starting time, heavy duty overload relay shall be provided.		
	(d)	Three (3)	Indicating lamps with resistors and coloured lenses.		
	(e)	One (1)	HRC control fuse.		
	(f)	One (1)	Control link		
	(g)	One (1)	Auxiliary contactor		
	(h)	Two (2)	Coupling relays suitable for 24V DC.		
	(i)	One (1)	digital energymeter with analog output of current (4-20 mA) for CHP dust suppression motors.		
	Module Type DK21 (Non Reversible Motor rated 30kW to up to 110KW (* See Remark) controlled from DDCMIS).				
	(*) Remark : For CHP Motors –upto 160 KW				
39.13.00	(a)	Similar to module type DK2 but with the following additions :			
	(b)	One (1)	Current transformer for metering.		
	(c)	One (1)	Ammeter (for motors of rating ≥ 30kW & < 110kW)		
	(d)	One (1)	Single-pole switch and fuse for motor space heater.		
	(e)	One (1)	Digital Energy Meter with Analog output of Current (4-20 mA) (for motors of rating ≥ 30kW & < 110kW and all dust suppression motors)		
	Module Type DN1 (Reversible Motor Controlled from DDCMIS)				
	(a.)	One (1)	Triple pole fuse switch unit with three pole load break solating switch and three HRC fuses.		
	(b.)	Two (2)	Triple pole mechanically interlocked, forward / reverse contactors.		
	(c.)	One (1)	Bimetallic thermal overload relay with single phasing preventor.		
	(d.)	One (1)	Indicating lamp with resistor and coloured lens.		
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2		SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT	
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CLAUSE NO.	TECHNICAL REQUIREMENTS			एनडीपीसी NTPC
39.14.00	(e.)	One (1)	HRC control fuse	
	(f.)	One (1)	Control link	
	(g.)	One (1)	Auxiliary contactor	
	(h.)	Two (2)	Coupling relays suitable for 240V DC.	
	Module Type VM (Voltmeter Module)			
39.15.00	(a.)	Three (3)	HRC fuses.	
	(b.)	One (1)	Voltmeter (0-500 V.)	
	(c.)	One (1)	Four position voltmeter selector switch	
	(d.)	One (1)	415 V auxiliary contactor with 2 NO + 2 NC contacts.	
	(e.)	One (1)	Voltage transducer with output of 4-20mA between R & Y phases	
	Module Type DM (Circuit Breaker (DDC /PLC Controlled) Motor Feeder for motor rated 110 KW & above (except for CHP motors).			
	(a.)	One (1)	Triple-pole circuit breaker, complete with all accessories and power operated mechanism, as specified.	
	(b.)	Three (3)	Current transformers for Protection and metering.	
	(c.)	One (1)	DC isolating Switch	
	(d.)	Six (6)	HRC Control fuses.	
	(e.)	One (1)	Single-pole switch and fuse for motor space heater	
(f)	Numerical relay for the following:			
	Short Circuit Protection (50)			
	Thermal Over Load protection(51I)			
	Earth fault Protection(50N)			
	Negative sequence Protection(46)			
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2		SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT
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CLAUSE NO.	TECHNICAL REQUIREMENTS			एनटीपीसी NTPC
	Restart inhibit protection(49) Locked Rotor Protection Energy Metering Current and Voltage metering Trip Circuit Supervision CB Monitoring			
40.00.00	DC MODULES DESCRIPTION			
40.01.00	Module Type -CH (Incomer from Charger)			
	(a)	One (1)	Double pole, 250 V DC fuse -switch unit	
40.02.00	Module Type -DB (Incomer from Battery)			
	(a)	Two (2)	HRC fuses with striker pins and Fuse monitoring relays with contacts for alarm. These fuses shall be mounted in a separate fiber glass / plastic enclosure and located in the battery room.	
	(b)	One (1)	DC ammeter with shunt and centre zero. This shall be mounted in the DCDB.	
40.03.00	Module Type - DC			
	(a)	One (1)	Double pole 250V DC switch / circuit breaker with 2NO+2NC auxiliary contacts.	
40.04.00	Module Type - HD (DC Isolating Switch / Circuit - Breaker Module)			
	(a)	One (1)	Double pole , 250 V DC switch isolator / circuit breaker	
40.05.00	Module Type-S (DC Metering and Protection Module)			
	(a)	One (1)	Voltmeter, 0-300V DC	
	(b)	One (1)	Three position voltmeter selector switch	
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2		SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT
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CLAUSE NO.	TECHNICAL REQUIREMENTS			
40.06.00	(c)	One (1)	Instantaneous under voltage relay (27) with a setting of 95% of 240V DC. The resetting ratio of relay should not be more than 1.05.	
	(d)	One (1)	Instantaneous over voltage relay (59) which shall operate at 110% of 240 V DC. The resetting ratio of relay should not be less than 0.95.	
	(e)	One (1)	Earth leakage relay having adjustable pick up range between 3 to 7mA. The relay shall be suitable for 240V / 50V DC and 240V AC auxiliary supply. The relay shall be Alstom type CAEM-21 or equivalent.	
	(f)	Two (2)	Indicating lamps with resistors & coloured lenses, one each for 'Earth fault' and 'DC supply failure ' indications.	
	(g)	Three (3)	HRC control fuses.	
	(h)	One (1)	Neutral link	
	Module Type -X (DC Isolating Switch Fuse Module)			
	(a)	One (1)	Double pole , 250 V DC fuse switch unit with two HRC fuses.	
	Module Type DW1 (DC Solenoid Valve Controlled from DDC)			
	(a)	One (1)	Double pole 250 V DC isolating switch	
40.07.00	(b)	Two (2)	HRC fuses	
	(c)	One (1)	Contactor with coil suitable for 240 V DC.	
	(d)	One (1)	Auxiliary contactor with coil suitable for 240 V DC	
	(e)	One (1)	Coupling relay	
	(f)	One (1)	Diode with peak inverse voltage of 440 V.	
	Module Type Q (Incomer to DC Lighting DB)			
40.08.00	(a)	One (1)	Double pole , 250 V DC switch isolator	
	(b)	One (1)	Power Contactor	
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2	SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT	PAGE 55 OF 71

CLAUSE NO.	TECHNICAL REQUIREMENTS एनटीपीसी NTPC																																																															
	(c) Two (2) Instantaneous under voltage relays (27) with a setting of 60% of 110V AC. (d) One (1) Timer having a delay of 0.5 to 3 sec. on pick-up with 2 self reset NO contacts, suitable for 240 Volts DC. (e) Two (2) Indicating lamps with resistors & coloured lenses, one each for 'On' and 'Off' indications. (f) Four (4) HRC control fuses (g) Two (2) Neutral links																																																															
41.00.00	SELECTION TABLES																																																															
41.01.00	Feeder Module, Other than Motor Selection Table (415 V AC) <table> <tr> <th>Sl. No.</th><th>Feeder Rating (Amp.)</th><th>Switch/MCCB Rating (Amp.)</th><th>Fuse Rating (Amp.)</th><th>Cable Size (sq. mm)</th></tr> <tr><td>1.</td><td>0-16</td><td>16</td><td>16</td><td>4CX6</td></tr> <tr><td>2.</td><td>17-32</td><td>32</td><td>32</td><td>4CX16</td></tr> <tr><td>3.</td><td>33-45</td><td>63</td><td>63</td><td>3¹/₂CX35</td></tr> <tr><td>4.</td><td>46-63</td><td>63</td><td>63</td><td>3¹/₂CX70</td></tr> <tr><td>5.</td><td>64-99</td><td>100</td><td>100</td><td>3¹/₂CX70</td></tr> <tr><td>6.</td><td>100</td><td>125A MCCB</td><td></td><td>3¹/₂CX70</td></tr> <tr><td>7.</td><td>101-160</td><td>250A MCCB</td><td></td><td>3CX150+1-1CX150</td></tr> <tr><td>8.</td><td>161-250</td><td>400A MCCB</td><td></td><td>**</td></tr> <tr><td>9.</td><td>251-400</td><td>400A MCCB</td><td></td><td>**</td></tr> <tr><td>10.</td><td>630-1120 (Breaker)</td><td></td><td></td><td>7-1CX630</td></tr> <tr><td>11.</td><td>1121-1680 (Breaker)</td><td></td><td></td><td>10-1CX630</td></tr> </table>				Sl. No.	Feeder Rating (Amp.)	Switch/MCCB Rating (Amp.)	Fuse Rating (Amp.)	Cable Size (sq. mm)	1.	0-16	16	16	4CX6	2.	17-32	32	32	4CX16	3.	33-45	63	63	3 ¹ / ₂ CX35	4.	46-63	63	63	3 ¹ / ₂ CX70	5.	64-99	100	100	3 ¹ / ₂ CX70	6.	100	125A MCCB		3 ¹ / ₂ CX70	7.	101-160	250A MCCB		3CX150+1-1CX150	8.	161-250	400A MCCB		**	9.	251-400	400A MCCB		**	10.	630-1120 (Breaker)			7-1CX630	11.	1121-1680 (Breaker)			10-1CX630
Sl. No.	Feeder Rating (Amp.)	Switch/MCCB Rating (Amp.)	Fuse Rating (Amp.)	Cable Size (sq. mm)																																																												
1.	0-16	16	16	4CX6																																																												
2.	17-32	32	32	4CX16																																																												
3.	33-45	63	63	3 ¹ / ₂ CX35																																																												
4.	46-63	63	63	3 ¹ / ₂ CX70																																																												
5.	64-99	100	100	3 ¹ / ₂ CX70																																																												
6.	100	125A MCCB		3 ¹ / ₂ CX70																																																												
7.	101-160	250A MCCB		3CX150+1-1CX150																																																												
8.	161-250	400A MCCB		**																																																												
9.	251-400	400A MCCB		**																																																												
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NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2		SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT																																																												
				PAGE 56 OF 71																																																												

CLAUSE NO.	TECHNICAL REQUIREMENTS						
41.02.00	Note	i) The cables of size below 150 sq. mm shall be PVC insulated and those of size 150 sq. mm and above shall be XLPE insulated ii) All cables shall be of aluminium conductor except for 2.5 sq. mm size which shall be copper conductor. iii) ** - Shall be finalized based on actual requirement during detailed engineering. iv) Termination arrangement suitable for the above cable sizes shall be provided in the switchgear / MCC panels.					
	Motor Module Selection table (Except CHP motors)						
	Sl. No.	Motor rating kW	Max. Motor Amp.	Switch rating Amp.	Fuse rating Amp.	Contactor rating Amp.	Cable size Sq. mm
	1.	1.1-1.5	3.5	16	6/16	16	3CX2.5
	2.	1.6-3.0	7	32	20	16	3CX2.5
	3.	3.1-5.5	11	32	32	16	3CX6
	4.	5.6-7.0	14.4	63	50	32	3CX6
	5.	7.1-13.0	27.3	63	63	32	3CX16
	6.	13.1-24.0	45	125	80/100	63	3CX35
	7.	24.1-37.0	70	125	125	70 (upto 30kW) 100 (above 30kW)	3CX70
8.	37.1-55.0	100	250	160	100(upto 40kW) 160 (upto 55kW)	3CX120	
9.	55.1-80.0	150	250	200	200	3CX150	
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2 SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT PAGE 57 OF 71							

CLAUSE NO.	TECHNICAL REQUIREMENTS						
41.03.00	10.	80.1-100	180	As per selected fuse	Suitable for type-II	225	3CX150 (upto 90kW) 3CX240 (above 90kW)
	12.	110.0-200.0	CIRCUIT BREAKER				3-1CX300
	Note i) The cables of size below 150 sq. mm shall be PVC insulated and those of size 150 sq. mm and above shall be XLPE insulated.						
	 ii) All cables shall be of aluminum conductor except for 2.5 sq. mm size which shall be copper conductor.						
	Switch Fuse Module Selection Table (220 V DC)						
	For all 220 V DC modules other than for motors, the ratings of switches fuses and cable termination shall be selected from the following table :						
	Sl. No.	Feeder rating Amp.	Switch rating Amp.	Fuse rating Amp.	Cable Size Sq.mm		
	1.	0-6	10	6	2CX2.5		
	2.	6-10	16	10	2CX2.5		
	3.	10-14	16	16	2CX2.5		
4.	14-19	32	32	2CX6			
5.	19-32	32	32	2CX16			
6.	32-53	63	63	2CX35			
7.	53-81	100	100	2CX70			
8.	81-114	125	125	2CX120			
9.	114-125	250	250	2-1CX150			
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2			SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT		PAGE 58 OF 71

CLAUSE NO.	TECHNICAL REQUIREMENTS				एनटीपीसी NTPC	
	10.	215-340	400	400	2-1CX300	
	11.	340-560	600	600	2-1CX630	
	12.	560-1000	Circuit Breaker		4-1CX630	
	13.	1000-1400	Circuit Breaker		6-1CX630	
	<i>Note i) The cables of size below 150 sq. mm shall be PVC insulated and those of size 150 sq. mm and above shall be XLPE insulated</i> <i>ii) All cables shall be of aluminum conductor except for 2.5 sq. mm size which shall be copper conductor.</i>					
NORTH KARANPURA STPP (3 X 660 MW) EPC PACKAGE		TECHNICAL SPECIFICATIONS SECTION VI, PART-B BID DOC. NO.:CS-4410-001-2		SUB SECTION B-06 LT SWITCHGEARS & LT BUSDUCT		PAGE 59 OF 71



**TITLE : TECHNICAL SPECIFICATION
FOR
SELF CLEANING STRAINERS (SCS)**

SPEC. NO. PE-TS-405-165-N003

VOLUME : IIB

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DATE :15.07.2014

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**SECTION C3
SELF CLEANING STRAINERS
C&I DETAILS**

		3x660MW North karanpura STPP
1.00	SYSTEM	SCS
2.00	COMMON / PER UNIT	PER UNIT
3.00	CONTROL SYSTEM	DCS
3.10	PROCESSOR CONFIGURATION FOR PLC SYSTEM	NA
4.00	LOCATION OF CONTROL SYSTEM	CCR
4.10	CONTROL SYSTEM SCOPE (BIDDER/ BHEL/ CUSTOMER)	BHEL
5.00	HARDWIRED INTERFACE WITH DCS (Y/N)	NA
5.10	PURPOSE OF HARDWIRED INTERFACE WITH DCS	
5.11	a) COMMAND FROM DCS (Y/N)	NA
5.12	b) STATUS FEEDBACK TO DCS (Y/N)	NA
5.13	c) GROUP FAULT ALARM TO DCS (Y/N)	NA
6.00	SOFTLINK TO DCS (Y/N)	NA
6.10	PURPOSE OF SOFTLINK TO DCS	
6.11	a) COMMAND INTERFACE WITH DCS (Y/N)	NA
6.12	b) STATUS MONITORING IN DCS (Y/N)	NA
7.00	PROTECTION CLASS FOR PLC / RIO PANEL	NA

8.00	CONTROL FROM PB's ON LCP/OWS ON LCP	NA
9.00	ANNUNCIATION ON LCP (Y/N) -- IF Y, MIN NO. OF HARDWIRED ALARMS / INDICATIONS	NA
9.10	MIMIC ON LCP (Y/N)	NA
10.00	CONTROL FROM DCS IN CCR (Y/N)	Y
11.00	TYPE OF SOFTLINK (TP/OFC)	NA
11.10	COMMUNICATION CABLE SCOPE (BIDDER/ PEM/ EDN/ CUSTOMER)	NA
11.20	REDUNDANT CABLE (Y/N)	NA
11.30	PROTOCOL	NA
12.00	RIO / RPU (Y/N)	NA
13.00	## NO. OF OWS / LAPTOP	NA
13.10	SIZE OF OWS/ CRT OR LCD	NA
14.00	NO. OF PRINTER	NA
14.10	PRINTER SIZE AND TYPE	NA
15.00	SS POWER SUPPLY AVAILABLE FOR BALL MONITOR (24V DC / 110 V AC UPS / 230 V AC UPS)	24V DC
15.10	&& POWER SUPPLY AVAILABLE FOR PLC PANEL (3PHASE, 415 V AC/ 1PHASE, 110 V UPS/ 1PHASE, 230 V UPS)	NA
15.20	REDUNDANT FEEDERS (R) / NON-REDUNDANT (NR) FEEDERS FOR POWER SUPPLY	NA
15.30	UPS BATTERY CONFIGURATION (1X100% / 2X100%)	NA

15.40	BATTERY TYPE (LEAD ACID/ Ni-Cd)	NA
15.50	BATTERY BACK-UP TIME (in minutes)	NA
16.00	ACTUATOR WITH INTEGRAL STARTER (Y/N)	Y
17.00	PG/ DPG/ PS/ DPS/ PT/ DPT per Self Cleaning Strainer	DPT = 2 no. DPG = 1 no.
18.00	REMARKS	
19.00	PROJECT SPECIFIC INFO	

19.00 NOTES:

1. **SS** THIS IS APPLICABLE FOR DCS CONTROLLED SYSTEMS ONLY.

2. **AA** THIS IS APPLICABLE FOR PLC CONTROLLED SYSTEMS. ALL POWER SUPPLY REQUIREMENTS FOR INDIVIDUAL SUB-SYSTEMS/ COMPONENTS EG. BALL MONITOR, SOL VALVES ETC SHALL BE DERIVED BY THE VENDOR FROM THIS POWER SUPPLY.

3. **AA** THE UPS FOR PLC SHALL BE IN BIDDER'S SCOPE. ITS CONFIGURATION SHALL BE 2X100% CHARGERS / INVERTERS.

4. IN CASE OF DCS CONTROLLED SYSTEMS, BIDDER TO TERMINATE ALL INSTRUMENTATION AND CONTROL ELEMENTS IN JUNCTION BOXES FOR FURTHER CABLING TO DCS BY BHEL/CUSTOMER. BIDDER TO PROVIDE INPUT/OUTPUT LIST, DRIVES LIST, JUNCTION BOX SCHEDULE AND TERMINATION DETAILS, RECOMMENDED CONTROL LOGICS / WRITE-UP ETC. DURING DETAILED ENGINEERING

5. IN CASE OF PLC CONTROLLED SYSTEMS, ALL CABLES & CABLE ENGINEERING SHALL BE IN BIDDER'S SCOPE.

6. **##** FOR PLC BASED CONTROL SYSTEM WHERE OWS IS PROVIDED, THE OWS SHALL HAVE PROGRAMMING & CONFIGURATION FACILITY.

7. OWS SHALL BE MOUNTED ON THE FRONT OF LCP.

8. COLOUR OF PLC PANEL SHALL BE AS PER IS-5 SHADE 631 OR EQUIVALENT.

9. INSTRUMENT RACK AND JUNCTION BOXES SHALL BE IN BIDDER'S SCOPE OF SUPPLY. NECESSARY STRUCTURAL STEEL FOR MOUNTING THE INSTRUMENTS(DPG,DPT,DPS),JUNCTION BOX, INSTRUMENT RACK,SWGR PANEL, ETC. SHALL BE IN BIDDER'S SCOPE.

10. BIDDER TO FURNISH ELECTRICAL LOAD DATA DURING DETAILED ENGINEERING.

11. ALARM FACIA SHALL BE UNDER BIDDER'S SCOPE. NO. OF FACIA SHALL BE DECIDED DURING DETAILED ENGINEERING.

LEGEND:

DCS- DISTRIBUTED CONTROL SYSTEM

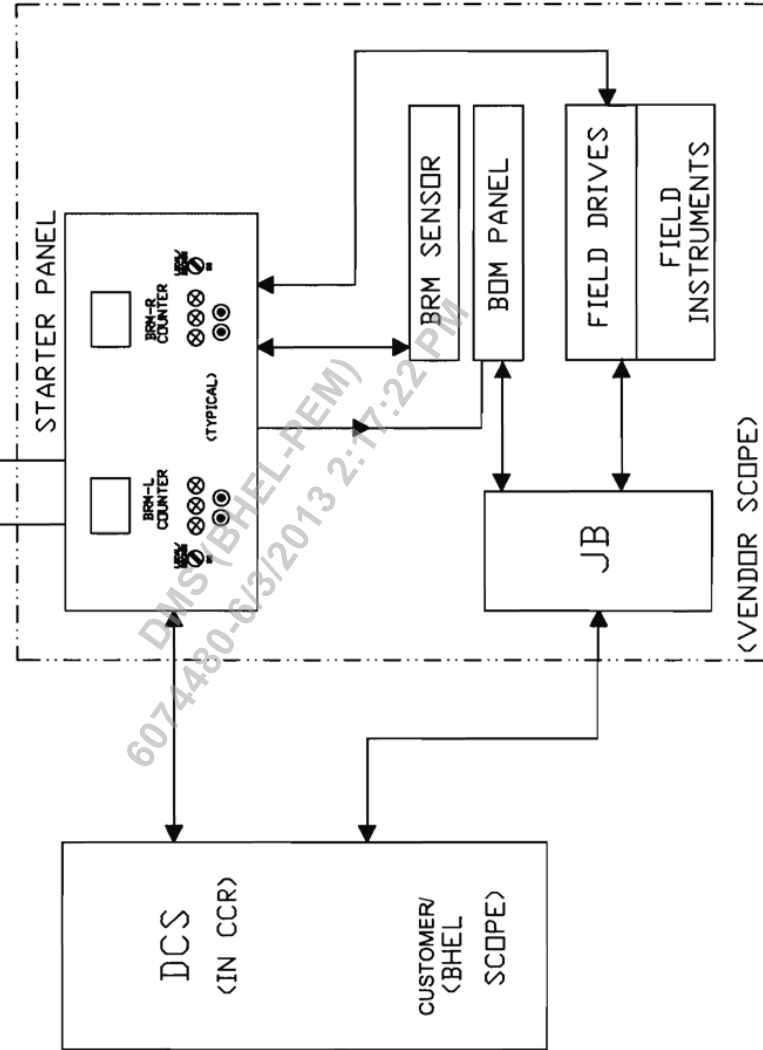
PLC- PROGRAMMABLE LOGIC CONTROLLER

RPU - REMOTE PROCESSING UNIT

STANDARD BLOCK DIAGRAM FOR SCS PACKAGE WITH DCS CONTROL

415V AC, 3P, 4WIRE
REDUNDANT FEEDER (BY CUSTOMER/BHEL)

CONFIGURATION A:
WITH STARTER PANEL IN VENDOR SCOPE



PE-DG-999-145-I274A(a)



**TITLE : TECHNICAL SPECIFICATION
FOR
SELF CLEANING STRAINERS (SCS)**

SPEC. NO. PE-TS-405-165-N003

VOLUME : IIB

SECTION : D

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SECTION – D

STANDARD TECHNICAL SPECIFICATION

SECTION D1 : SELF CLEANING STRAINERS

SECTION D2 : ELECTRICAL SYSTEMS

SECTION D3 : C&I SYSTEM



**TITLE : TECHNICAL SPECIFICATION
FOR
SELF CLEANING STRAINERS (SCS)**

SPEC. NO. PE-TS-405-165-N003

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SECTION D1

STANDARD TECHNICAL SPECIFICATION FOR SELF CLEANING STRAINERS



**TITLE : TECHNICAL SPECIFICATION
FOR MOU
SELF CLEANIGN STRAINER (SCS)**

SPEC. NO. PE-TS- XXX-165-N001

VOLUME : III

SECTION :

REV. NO. 0

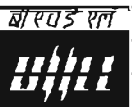
DATE : 12.06.2012

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SECTION D1

STANDARD TECHNICAL SPECIFICATION FOR SELF CLEANING STRAINER

DMS (BHEL-P&M),
6078516-2014/07/19

	TITLE :	SPEC. NO. PE-TS- 999-165-N002
	STANDARD TECHNICAL SPECIFICATION	VOLUME : II B
	SELF - CLEANING FILTERS	SECTION : D
		REV. NO. 0 DATE : 02.12.2009
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1.00.00 GENERAL

This specification covers the Design, Performance and Operational Requirements, Constructional Features, Manufacture, Assembly, Inspection and Testing at the Manufacturer's and/or his Sub-contractor's works and Painting for delivery of Self-cleaning filter (Backwash Type) complete with all accessories as specified hereinafter.

2.00.00 CODES AND STANDARDS

2.01.00 The design, materials manufacture, inspection and testing of the self-cleaning filter complete with all accessories, shall comply with the requirements of the latest revisions of the following appropriate codes and standards :

2.01.01 IS / BS / DIN / US Standards regarding pressure vessels, pipes, flanges and others as necessary.

2.01.02 IS / BS / DIN / ASTM Standards for materials specification and testing procedures.

2.01.03 IS / BS / DIN / AWWA Standards for valves and their testing.

2.02.00 In case of any conflict between the above codes / standards and this specification, the later shall prevail and in case of any further conflict in the matter, the interpretation of the specification by the Engineer shall be final and binding.

3.00.00 DESIGN AND CONSTRUCTION

3.01.00 General Requirements

3.01.01 Unless otherwise necessary manufacturer's standard and proven models of the self cleaning filter shall be supplied.

3.01.02 The self-cleaning filter shall be capable of safe, proper and continuous operation. Vibration, noise, mechanical stresses shall be kept within allowable limits specified by relevant codes / standards, In design due attention shall be given to ease of maintenance, repair and cleaning.

3.01.03 Suitable corrosion allowance shall be provided wherever necessary.

3.01.04 Unless otherwise specified in Data Sheet-A, the inlet and outlets of the filter shall be co-axial without any off set between the centre lines of inlet and outlet pipes.

3.02.00 Performance Requirements

The self-cleaning filter with all accessories shall be designed and guaranteed to meet the following requirements :-

3.02.01 The self - cleaning filter shall perform satisfactorily under the flow and pressure conditions specified in Data Sheet -A and shall be capable of housing the various forms of debris / sludge i.e., suspended particles / matter, mussels, grass, leaves,

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wood pieces etc. The performance of the filter shall be continuous with minimum number of flushing / backwashing operations.

3.02.02 The self-cleaning filter shall be designed such that the pressure drop across the filter (i.e., between inlet and outlet connections) under clean conditions and partially (50%) choked conditions shall not be more than those specified in Data Sheet -A.

3.02.03 Unless otherwise specified in Data Sheet -A, debris discharge / wash water flow rate during flushing/back washing operation shall be limited to 10% of the total flow rate and flushing / backwashing operation shall be completed within a period of maximum three (3) minutes. The pressure drop across the debris filter during flushing/backwashing operation shall not be more than the pressure drop under partially (50%) choked condition.

3.02.04 The coarse particles and floating matter accumulating at the filter section/screen are flushed out of the system by the debris flushing / backwash unit such that the pressure drop across the filter after flushing / backwashing, shall not be more than the pressure drop under clean conditions.

3.03.00 Operational Requirement

The self-cleaning filter and other accessories shall be designed for the following flushing/backwashing operation modes :

3.03.01 Complete automatic flushing/backwashing operation effected by the following :-

- ◆ differential pressure measuring system at a pre-determined differential pressure across the filter
- ◆ adjustable timer (0-24 hours)
- ◆ push button (for manual initiation of sequential flushing / backwashing)

3.03.02 Manual operation in the event of failure of control system.

3.04.00 Filter Housing / Body

3.04.01 The self-cleaning filter housing/body shall be designed and manufactured as per the applicable codes for pressure vessels. However in no case thickness of housing/ body shall not be less than connecting pipe thickness as specified in Data Sheet-A. It shall house the filter section / screen assembly and shall have flanged inlet, outlet, flushing / debris discharge openings and pressure measuring tappings etc.

3.04.02 In design of filter housing / body due attention shall be given for easy removal and replacement of filter section / screen assembly.

3.04.03 The filter shall be provided with inspection hole with bolted cover.

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3.04.04 The filter body / housing shall be provided with vent and drain connections with isolating valves. It shall be possible to drain unfiltered and filtered water.

3.04.05 If specified in Data Sheet-A, filter body/housing shall be epoxy painted.

3.05.00 **Filter Section / Screen assembly.**

3.05.01 The filter section/screen shall be designed for the maximum differential pressure across the filter and shall be securely positioned by a supporting cage and shall be securely mounted in the housing or body.

3.05.02 The perforation/mesh size of the filter section shall not be more than that specified in Data Sheet-A.

3.05.03 The arrangement of the filter section shall be such that there shall be no forced accumulation of debris.

3.06.00 **Differential Pressure Measuring System**

3.06.01 The self-cleaning filter shall be provided with a measuring system for differential pressure across the filter section/screen, to check debris accumulation and to initiate flushing / backwashing operation. This shall consist of a separate differential pressure transmitter for normal automatic flushing operation and separate DP Switch as a backup in the event of DPT failure, a differential pressure gauge for manual observation with adequate no. of tapplings with isolating valves and equalizing valves.

3.06.02 The contacts for differential pressure transmitter, differential pressure switch and for differential pressure gauge shall be independent so that in the event of failure of one, the other is available .

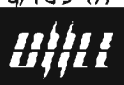
3.06.03 The differential pressure measuring system shall also be equiped with built in flushing arrangement consisting of flushing pump, valves and associated piping, to prevnet blockage of the system with any debris. Unless otherwise specified in Section C, water required for flushing the differential pressure measuring system shall be taken from downstream side of the strainer/ screen.

3.07.00 **Flushing / Backwash Unit :**

3.07.01 The self-cleaning filter shall be provided with suitable flushing/backwash unit (to be installed at ground floor) and debris discharge/backwash outlet valve with associated actuator to flush out the accumulated debris / sludge.

3.07.02 The flushing pump shall be provided with mechanical seals to the extent possible. If gland packing is provided it should be of good quality to prevent leakage of water bran pump glands.

3.07.3 The flushing backwash unit shall be either fixed type with actuator operated

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flushing valves or electric motor driven (through reduction gear) backwash rotor. In case of backwash rotor, it shall be fitted with removable shoes for smooth and close running contact with the filter section/screen and to prevent the unfiltered water from bypassing to waste.

3.07.04 If any water is to be injected for backwashing the filter section/screen, water shall be taken from down-stream side of the filter section/ screen with necessary pump, valves and piping for water injection supplied by the bidder.

3.07.05 View glass to be provided in debris outlet pipe to monitor the flushing of debris.

3.08.00 Valves

The flushing valves (if any,) the debris discharge/backwash outlet valve, isolation, vent and drain valves shall conform to appropriate codes / standards. The debris discharge/backwash outlet valve shall be larger than the debris discharge/back wash outlet pipe.

3.09.00 Instrumentation and Control System

3.09.01 Complete instrumentation and control system for automatic flushing / backwashing operation, protection, interlocking, indication/annunciation of high differential pressure and other malfunctions etc. shall be provided. This shall consist of adequate operational hardware, local control panel and interconnecting control and power cabling between the control panel and the self-cleaning filter and its associated electrical devices.

3.09.02 The control panel shall house all necessary instruments, indicating/ annunciation lamps, alarms, differential pressure indicator, timer, function selector switches, relays, protection and interlocking systems, start/stop push buttons, counter to register number of flushing operations etc., and shall be complete with internal wiring. In addition to the above, the control panel shall meet the requirements of the enclosed specification.

3.09.03 All instrumentation shall be of reputed make and shall meet the requirement of the enclosed specification.

3.10.00 Other Accessories.

3.10.01 Counter flanges, flat faced slip on type, complete with gaskets, bolts and nuts etc., shall be supplied for the filter inlet, outlet connections and all other terminal points. Fabrication, dimensions and drilling of the flanges shall conform to the codes/standards specified in Data Sheet-A.

3.10.02 Self-cleaning filter shall be provided with suitable lifting arrangement for handling during erection and maintenance.

3.10.03 Necessary supporting arrangement (wherever applicable) complete with foundation plates, bolts, nuts etc., shall be provided.

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3.11.00 Material of Construction

Material of self-cleaning filter and other accessories shall be corrosion resistant and consistent with the fluid handled. However material specification for various components shall be equal or superior to those specified in Data Sheet-A.

4.00.00 PAINTING

4.01.00 The surface preparation of the filter housing / body and other parts shall be done as per the standard mentioned in Data Sheet-A and shall include the following :

- a) Removal of oil, grease, dirt and swarf etc.
- b) Removal of rust and scale etc.
- c) Sand blasting/shot blasting.

4.02.00 All internal surfaces of the filter which are subject to immersion or water spray and which are not made of stainless steel or other corrosion resistant materials after surface preparation, shall be coated with adequate coats (minimum 200 to 250 microns thick) of epoxy paint of approved make and quality over a coat of zinc chromite primer, unless otherwise specified in Data sheet-A.

4.03.00 The external surfaces of the filter and other accessories after surface preparation, shall be coated with adequate coats (minimum 175 to 200 microns thick) of synthetic enamel paint of approved make and quality over two coats of red oxide primer, unless otherwise specified in Data Sheet-A.

5.00.00 SHOP INSPECTION AND TESTS

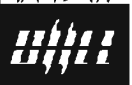
5.01.00 General :

5.01.01 Manufacturer shall conduct all tests and stage inspections as per the approved quality plan to ensure that the self-cleaning filter and other accessories shall conform to the requirements of this specification and of the applicable codes/ standards.

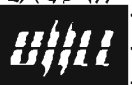
5.01.02 All materials used for manufacture/fabrication of the filter shall be of tested quality. Relevant test certificates for chemical analysis, mechanical tests and heat treatment shall be made available before the final shop inspection. In case the relevant test certificates are not available, the manufacturer shall arrange to carry out the necessary tests as per approved quality plan and applicable codes at his cost, for which samples shall be identified by BHEL's representative.

5.01.03 All shop tests shall be conducted in the presence of BHEL's representative and test certificates / reports for the same shall be furnished to BHEL for approval.

5.01.04 Qualification of welding procedures and welders shall be as per ASME B&PV

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- Code, Section-IX / applicable codes.
- 5.02.00 **Filter Housing / Body**
- 5.02.01 Chemical analysis, mechanical tests shall be carried out on housing/body material.
- 5.02.02 All butt welded joints shall be subjected to radiographic / ultrasonic testing as per applicable codes. However all welded joints shall be subjected to 100% magnetic particle / penetrant testing to ensure freedom from defects.
- 5.03.00 **Rubber Lining (as applicable)**
- Rubber lining shall be subjected to surface crack test, 100% spark and hardness tests and shall be checked for layer thickness, defects etc.
- 5.04.00 **Filter Section/Screen assembly**
- Supporting cage and filter section/screen materials shall be tested for chemical properties. Checks shall be carried out for perforation/mesh size, defects etc.
- 5.05.00 **Flushing / Backwash Unit**
- 5.05.01 Material of various components of the flushing/Backwash Unit shall be tested for chemical and mechanical properties.
- 5.05.02 Hollow shaft of backwash rotor shall be ultrasonically tested as per ASTM-A 388 for internal flaws. Penetrant test shall be carried out for surface flaws.
- 5.06.00 **Valves**
- Inspection and testing of valves including leakage test shall be carried out as per the requirements of the applicable standards. Correlating test certificates for materials of the valve components shall be furnished.
- 5.07.00 **Flanges**
- 5.07.01 In case of fabricated flanges, all the welds shall be subjected to 100% radiography as per ASME B&PV code, section VIII, Division-1.
- 5.07.02 In case of forged flanges, ultrasonic testing shall be carried out as per ASTM-E 388.
- 5.07.03 If the thickness of the plate used for flanged is 40mm or more the same shall be checked ultrasonically as per ASTM-A 435 to demonstrate the absence of lamination and lack of fusion etc.
- 5.07.04 Chemical and mechanical test certificates shall be furnished for flange materials.
- 5.07.05 Flanges shall be checked for edge preparation, fit up and satisfactory working with

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5.08.00 matching parts.
All materials for various nozzles, seals, pipes, gaskets, nuts bolts etc., shall be of tested quality and correlating test certificates for chemical and mechanical properties shall be furnished.

5.09.00 **Dimensional Checks**

Dimensional checks of various components of the filter shall be carried out as per the drawings approved by BHEL.

5.10.00 **Hydrostatic Test**

Hydrostatic test shall be conducted on the filter housing/body at a pressure of 2 times the design pressure. The duration of the test shall be minimum 30 minutes.

5.11.00 **Leakage Test**

Leakage test shall be conducted at the design pressure to demonstrate that the filter assembly is leak tight and no water seepage shall take place at various nozzle and valve connections.

5.12.00 **Functional Tests**

The self-cleaning filter assembly complete with valves, actuators and other accessories shall be subjected to functional tests and the following shall be checked :-

5.12.01 Smooth and free operation of all movable parts.

5.12.02 Interlocks and sequential operation.

5.12.03 Satisfactory operation of actuator torque switches, limit switches etc.

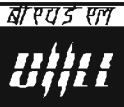
6.00.00 **TESTING AT SITE**

After completion of installation at site, the self cleaning filter with complete accessories, will be tested to check that the filter performance meets the requirements of its specification, Rectification of all defects shall have to be done by the supplier at no extra cost to the Owner / Purchaser. However the Owner / Purchaser reserves the right to reject the equipment / parts not meeting the requirement if the deficiency still persists.

7.00.00 **PERFORMANCE GUARANTEE**

7.00.00 **PERFORMANCE GUARANTEE & Bid evaluation criteria**

The Self cleaning strainer shall be guaranteed to meet the performance requirements specified in Section-D , Data Sheet A and Guarantee schedule and also for trouble free operation after commissioning. Schedule of performance guarantees (enclosed in

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Volume III) duly filled and signed shall be furnished with the bid.

The Performance guarantees of equipments shall stand valid till the satisfactory completion of performance testing & its acceptance by BHEL/ Customer. If the guarantee period specified in the Commercial Specification is higher, same shall prevail.

7.01.00 Performance Guarantee Parameters shall be as under :

- Pressure drop in Self cleaning strainer in clean condition viz. after backwashing.

7.02.01 Bidder to note that bids shall be evaluated on account of pressure drop across Self cleaning strainer (in clean condition) & liquidated damages on account of not meeting the same shall be in accordance with following :

A) Bid Evaluation Criteria and Liquidated Damages:

The bids received shall be evaluated for Pressure drop across Self cleaning strainer:

- The permissible limit of pressure drop across Self cleaning strainer in clean condition shall be 0.8 MWC.
- If the pressure drops quoted are higher than above limit, the bids shall be technically loaded @ Rate as mentioned in Data Sheet-A for respective projects per 1 MWC pressure drop (viz. per unit).
- However no advantage shall be given for pressure drops quoted less than above permissible limit.
- The maximum acceptable limit for pressure drop across self cleaning strainer (with technical loadings) shall be 1.0 MWC

The bids will be technically rejected for pressure drops quoted higher than above maximum limit.

- The guaranteed pressure drops shall be demonstrated at site by vendors and if found higher shall be subject to LD @ twice the bid evaluation factor as above.

8.00.00 QUALITY ASSURANCE & QUALITY PLAN

8.01.00 The self - cleaning filter and other accessories to be supplied shall have assured quality and workmanship.

8.02.00 Typical quality plans (Q.P. No. PEM-MSE-SQP-07) are enclosed herewith this specification for bidder's guidance. The bidder shall comply with these minimum requirements and shall furnishing own quality plan based on materials and components of the filter being offered.

9.00.00 NAME PLATE AND TAG NUMBERS

9.01.00 The filter shall be provided with a permanently attached brass or stainless steel plate indicating the following details:-

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- a) Design flow
- b) Design and test pressures
- c) Design temperature
- d) Filter section/screen mesh size
- e) Empty and operating weights
- f) Revolving speed of backwash rotor

9.02.00 Each valve shall be provided with a name plate indicating the following :-

- a) Service
- b) Design and test pressures
- c) Maximum flow and flow direction
- d) Size
- e) Engineer's Tag Number

Tag numbers will be indicated on the drawing submitted for approval during contract stage.

9.03.00 Each motor / actuator shall be provided with a name plate indicating the following details :

- a) Supply conditions.
- b) KW Rating
- c) Make

10.00.00 **DRAWINGS, DATA & INFORMATION TO BE SUBMITTED WITH THE BID**

The bidder shall furnish the following drawings, data and information alongwith the bid without which the offer will be deemed incomplete.

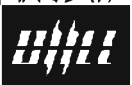
10.01.00 Data sheet-B with all particulars / data duly filled in.

10.02.00 General arrangement / installation drawings of the self-cleaning filter with all accessories, incorporating the principal dimensions and weights of equipment offered, size and location of various nozzle connections, supporting arrangement (if applicable) and scope of supply etc.

10.03.00 Cross-sectional / detailed drawings of filter housing / body, filter section / screen assemblies, flushing / backwashing unit, differential pressure measuring system, actuators, motors, control panel etc., indicating bill of quantities and materials of construction.

10.04.00 Flow and control logic diagrams for complete filter during normal and flushing / backwashing operations.

10.05.00 Performance evaluation procedure at site.

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- 10.06.00 Control panel layout and list of instruments provided on control panel.
- 10.07.00 List of annunciations, protections and interlocks provided.
- 10.08.00 Write-up on operation, control, monitoring, interlocks and protection of filter.
- 10.09.00 Manufacturer's descriptive and illustrative literature on the equipments / components being offered.
- 10.10.00 A detailed experience list about the successful installations of similar equipment of equal or higher inlet / outlet sizes and flow capacities for similar application.
- 10.11.00 A comprehensive write-up on the testing facilities, tests to be conducted inspection methods and QA system adopted by the manufacturer.
- 10.12.00 Quality plan for the self-cleaning filter and for all its accessories.
- 11.00.00 **DRAWINGS, DATA & INFORMATION TO BE SUBMITTED AFTER THE AWARD OF CONTRACT :**

The drawings, data and other documents as required in Data Sheet-C shall be furnished after the award of contract.

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	DATA SHEET - C	VOLUME : II - B	
	SELF - CLEANING FILTER	SECTION : D	
	(Backwash Type)	REV. NO. 02	DATE : 02.12.2009
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1.00.00 DRAWINGS, DATA AND INFORMATION TO BE SUBMITTED AFTER THE AWARD OF CONTRACT :

After the award of contract, the following drawings, data and information is to be submitted for review / approval of BHEL as per the distribution schedule given in Section -C.

1.01.00 Within 3 (three) weeks of the date of LOI, the following shall be submitted :

1.01.01 Data Sheet -B duly revised conforming to accepted bid.

1.01.02 Final versions of the following drawings to enable BHEL to finalise the layout and to design foundations and structures.

- a) General arrangement / Installation drawings of the self-cleaning filter with all accessories, indicating the principal dimensions and weights of equipment offered, size and location of various nozzle connections, withdrawal space and scope of supply etc.
- b) Foundation arrangement drawings (wherever applicable) showing load data on supports, size and location of anchor bolts etc.

1.02.00 **With in the stipulated time period as per vendor's drawing/document list, the following shall be submitted :**

1.02.01 Cross-sectional/detailed drawings of filter housing/body, filter screen/section assembly, flushing / backwash unit, differential pressure measuring system, actuators, motors, control panel etc. indicating bill of quantities and materials of construction.

1.02.02 Flow and control logic diagrams for complete filter during normal and flushing operation and system write-up covering all modes of operation.

1.02.03 Final version of performance evaluation procedures at site.

1.02.04 Detailed schedule of valves indicating tag numbers, type, make, size, pressure & temperature ratings, materials etc.

1.02.05 Detailed schedule of power & control cable.

1.02.06 Detailed schedule of piping and fittings indicating sizes, materials, maximum working pressure & temperatures etc.

1.02.07 Control panel layout and list of instruments provided on control panel and internal wiring diagrams.

1.02.08 List of annunciations, protections and interlocks provided.

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	DATA SHEET - C	VOLUME : II - B	
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- 1.02.09 Detailed drawings of flanges.
- 1.02.10 Quality Plan
- 1.02.11 Material test certificates.
- 1.02.12 Shop tests reports and certificates.
- 1.02.13 Write-up and instruction manuals for erection, operation and maintenance.
- 1.02.14 Storage instructions.
- 1.02.15 Vendor to send 3 sets of final documents (O&M Manual, GA drg, P&ID) direct to site under intimation to PEM.

DMS (BHEL-PEM)
6078516-2014/07/19

		TITLE : DATA SHEET – A2 FOR SELF CLEANING STRAINERS (SCS)		SPECIFICATION NO. SPEC. NO. PE-TS-405-165-N003	
				VOLUME : II B	
				SECTION : D	
				REV. NO. 00 DATE : 15.08.2015	
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S. No.	DESCRIPTION	UNITS	3x660MW NTPC NORTH KARANPURA STPP		
1.0	GENERAL				
1.1	Type of Strainers/ Filters	-	Self Cleaning Strainers		
1.2	No. of Strainers/ Filters required	Nos.	Total 6 Sets for 3 units viz. i.e.(1 Working + 1 Standby at ACW pumps discharge) per unit	Total 2 Sets for 3 units viz. i.e.(1 Working + 1 Standby at AHS cooling water pumps discharge).	
1.3	Inlet connection	mm Nb	800	400	
1.3	Outlet connection	mm Nb	800	400	
1.4	Filter type/ duty	-	On line / continuous		
1.5	Location	-	ACW Pump discharge Header (Outdoor)	AHS Pump discharge Header (Outdoor)	
1.6	Liquid handled	-	Clarified Water as per analysis attached in Project information in section-B		
2.0	DESIGN DATA				
2.1	Operating pressure	Bar (g)	3.5 to 4.5		
2.2	Design pressure	Kg/cm ²)	7.5		
2.3	Design temperature	Deg. C	60		
2.4	Flow rate through filter		3470 4164	820 984	
	a) Normal b) Maximum				

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S. No.	DESCRIPTION	UNITS	3x660MW NTPC NORTH KARANPURA STPP		
2.5	Design differential pressure for filter section/ screen	Bar (g)	1.5 (Min.)		
2.6	Type of suspended matter likely to enter the filter	-	Typical debris encountered in closed circuit CW system with Cooling Tower		
2.7	Differential pressure measuring system set pressure - For initiating flushing/ backwashing - For alarm/ annunciation	mbar	110		
		mbar	160		
2.8	Filter section/ screen perforation size	mm	2 mm (Max)		
2.9	Free flow area in the screen basket	-	At least 120 % of pipe inlet area		
3.0	GUARANTEED PERFORMANCE REQUIREMENT				
3.1	Pressure drop across the filter (i.e. between inlet and outlet connection) at normal flow	-			

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S. No.	DESCRIPTION	UNITS	3x660MW NTPC NORTH KARANPURA STPP		
	a) Clean condition	mbar	Refer Section – C of specification		
	b) Partially (50%) choked condition	mbar	Not to exceed 110		
3.2	Debris discharge flow during flushing period	Cub m/ Hr.	Not to exceed 2.5% of total flow rate		
4.0	MATERIALS OF CONSTRUCTION				
4.1	Filter body/ housing	-	IS:210 Gr. FG 260 or ASTM –A-515 Gr. 75/IS:2062 with epoxy painted inside		
4.2	Filter screen/ section	-	SS-316		
4.3	Shaft	-	SS-316		
4.4	Supporting cage	-	SS-316		
4.5	Differential measuring system	-	SS-316		
4.6	Flushing/ backwashing unit	-	SS-316		
4.7	Backwash rotor shoes	-	Neoprene		
4.8	Any other internal hardware /pipes etc.	-	SS-316 or eq.		

बीएसईएल BHEL		TITLE : DATA SHEET – A2 FOR SELF CLEANING STRAINERS (SCS)		SPECIFICATION NO. SPEC. NO. PE-TS-405-165-N003	
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S. No.	DESCRIPTION	UNITS	3x660MW NTPC NORTH KARANPURA STPP		

4.9	Valves	-	
4.9.1	Gate valves (65Nb and above)/Check Valves (all sizes)		
	a) Body & Bonnet	-	ASTM A 216 Gr. WCB/ASTM A105
	b) Disc for Check Valve	-	ASTM A 216 Gr. WCB/ASTM A105
	c) Trim	-	ASTM A 182 Gr. F6 or equivalent
4.9.2	Globe Valves 50 Nb & Below		
	Body, Bonnet & trim		ASTM A-105
	Stem		13% Chrome steel ASTM-A-182-Gr. F6a
4.9.3	<u>C) Ball valves</u>		
	i) Body		SA 351 CF8M
	ii) Ball		SA 351 CF8M
	iii) Stem		SS 316
4.10	Piping	-	By Bidder
	Material a) upto 150 Nb		Carbon steel ERW, IS:1239 (Heavy Grade)
	a) 200 Nb and above		carbon steel (IS:2062), Rolled & Welded confirming to IS:3589

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S. No.	DESCRIPTION	UNITS	3x660MW NTPC NORTH KARANPURA STPP		
5.0	COUNTER FLANGES		In Bidder's Scope		
5.1	Material				
	Flanges		IS 2062, Gr. B, epoxy painted		
5.2	Drilling Standard	-	BS 4504 or equivalent		
6.0	Connecting pipe size (OD & Thk)	mm	813 X 8	406.4 X 6.0	
7.0	PAINTING				
7.1	External Surface	-			
	a) Surface preparation	-	Power tool cleaning/Shot blasting/ abrasive blasting		
	b) Primer		Two coats of Zinc chrome primer (Alkyd base) by brush/spray to IS 104 OR Two coats of Red oxide Zinc Phosphate based primer (alkyd base)to IS 12744 with min. DFT per coat of 25 microns		
	Intermediate		One coat of Synthetic enamel (long oil alkyd) to IS 2932 with min. DFT of 30 microns		
	c) Final paint		Two coats of Synthetic enamel (long oil alkyd) to IS 2932 with min. DFT of 35 microns to achieve total min DFT of 150 microns.		
7.2	Internal Surface				
	a) Surface preparation		SA 2.5 of Swedish Specification SIS 05.5900.197		
	b) Primer		One coat of epoxy resin based primer		
	c) Final paint		Applicable no. Of coats of coal tar epoxy paint to achieve total DFT of 200 to 250 microns		
8.0	SHOP TEST				

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S. No.	DESCRIPTION	UNITS	3x660MW NTPC NORTH KARANPURA STPP	

8.1	Hydrostatic test		
	a) Test Pressure	bar (g)	1.5 times design pressure
	b) Test duration	min.	30
8.2	Leakage test		
	a) Test Pressure	bar (g)	Design Pressure
	b) Test duration	min.	30

	# Bidder to note that electrical power supply shall be provided by purchaser based on electrical load list of bidder furnished at tender stage and any changes or additional requirement of electrical load by bidder during contract stage shall be provided by BHEL(purchaser) with cost repercussions to the bidder
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9.0	Adequate provision for future installation of cathodic protection required		YES
10.0	Flow straightener for streamlining the ACW flow in SCS		If required as per bidder's design – the same to be incorporated by bidder in its constructional feature.
11.0	Performance Guarantee & Bid Evaluation		
11.1	Performance Parameters to be Guaranteed		
	❖ Pressure drop SCS		As per Guarantee schedule of bidder
11.2	Bid evaluation Criteria & Liquidated damages		As per clause no. 8.00.00 of section C1
11.3	Bid evaluation rate		@ Rs 3.0 Lacs per 0.1 MWC pr. Drop across each SCS
11.4	Liquidated damages		Twice the bid evaluation rate

		TITLE : DATA SHEET – A2 FOR SELF CLEANING STRAINERS (SCS)		SPECIFICATION NO. SPEC. NO. PE-TS-405-165-N003	
				VOLUME : II B	
				SECTION : D	
				REV. NO. 00 DATE : 15.08.2015	
				Page 7 of 7	
S. No.	DESCRIPTION	UNITS	3x660MW NTPC NORTH KARANPURA STPP		
12.0	Whether automatic flushing/ back- washing operation effected by the following : i. Differential pressure ii. Adjustable timer iii. Push button		YES YES YES		
13.0	Whether provision for manual flushing / backwashing operation is made in the event of control system failure.		YES		
14.0	Whether built in flushing arrangement complete with flushing pump, valves, and associated piping, is provided.		YES (if required)		
15.0	Mandatory Spare to be supplied under this specification				

ANNEX TO DATASHEET-A

PIPE SIZE TABLE (REFER CL. N. 6.2, SECTION C1, Vol.IIB)

PIPE SIZES

NB	O.D.(MM) MAX.	THK.(MM) MIN
15	21.8	3.2
25	34.2	4.0
50	60.8	4.5
100	115.0	5.4
150	166.5	5.4
200	219.1	6.0
250	273.0	6.0
300	323.9	6.0
350	355.6	6.0

PIPE SIZES

NB	O.D.(MM) MAX.	THK.(MM) MIN
400	406.4	6.0
450	457	6.0
500	508	6.0
600	610	6.0
700	711	7.0
800	813	8.0
900	914	8.0
1000	1016	9.0
1200	1219	10.0
1400	1422	12.5
1500	1524	14.2

		Manufacturer's Name & Address		STANDARD QUALITY PLAN				BHEL Doc No.: PE-QP-999-165-N005			
		P.O. No.		Item :		Vendor Q.P. NO.		PROJECT:			
				Self Cleaning Strainer		PACKAGE : SELF CLEANING STRAINER		CUSTOMER:			
						Date :		PURCHASER:			
						Page 01 of 12		CONSULTANT:			
		SL. NO.		DESCRIPTION				PAGE NOS.			
		1		SELF CLEANING STRAINER				2-4			
		2		BALL VALVES				5			
		3		BUTTERFLY VALVES				6			
		4		PRESSURE GAUGE, DP GAUGE, DP SWITCH DP TRANSMITTER				7			
		5		GEAR MOTOR DRIVE & WORM PLANETARY GEAR BOX				8			
		6		ACTUATORS				9			
		7		STARTER PANEL				10			
		8		FASTENERS				11			
		9		ALL COMPONENT / EQUIPMENT				12			
				ANNEXURES							
				DRY RUN TEST PROCEDURE				2			
				HYDRO TEST PROCEDURE				2			
				HYDRO STATIC LEAK TIGHTNESS TESTING PROCEDURE				2			
				PACKING PROCEDURE				1			
Note: Items not included in quality plan to be inspected as per Approved datasheet/drawings.											
				LEGEND							
				* Records identified with "STAR" shall be essentially included by contractor in QA Documentation.							
				** M : Manufacturer/ Sub-contractor							
Manufacturer / Sub-Contractor		Contractor		C : CONTRACTOR		O: OWNER					
Signature				Indicate : "P" - Perform, "W" - Witness and "V" - Verification						Name & Sign. Of approving authority & Seal	

		Manufacturer's Name & Address		STANDARD QUALITY PLAN				BHEL Doc No.: PE-QP-999-165-N005					
				Item :	Vendor Q.P. NO.		PROJECT:						
				Self Cleaning Strainer	PACKAGE : SELF CLEANING STRAINER		CUSTOMER:						
		P.O. No.			Date :		PURCHASER:						
				Page 02 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	
1	2	3	4	5	6	7	8	9	M	C	O	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/A609	ASME A 435/A609	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 * 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		Name & Sign. Of approving authority & Seal									
Signature													

		Manufacturer's Name & Address		STANDARD QUALITY PLAN					BHEL Doc No.: PE-QP-999-165-N005				
		P.O. No.		Item :		Vendor Q.P. NO.		PROJECT:					
				Self Cleaning Strainer		PACKAGE : SELF CLEANING STRAINER		CUSTOMER:					
				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	
1	2	3	4	5	6	7	8	9	M	C	O	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 Drawing	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 Drawing	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													

		Manufacturer's Name & Address		STANDARD QUALITY PLAN					BHEL Doc No.: PE-QP-999-165-N005				
		P.O. No.		Item :		Vendor Q.P. NO.		PROJECT:					
				Self Cleaning Strainer		PACKAGE : SELF CLEANING STRAINER		CUSTOMER:					
						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	
1	2	3	4	5	6	7	8	9	M	C	O	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 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		Contractor											
Signature													
Name & Sign. Of approving authority & Seal													

		Manufacturer's Name & Address		STANDARD QUALITY PLAN				BHEL Doc No.: PE-QP-999-165-N005				
		P.O. No.		Item :		Vendor Q.P. NO.		PROJECT:				
				Ball Valves		PACKAGE : SELF CLEANING STRAINER		CUSTOMER:				
						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
1	2	3	4	5	6	7	8	9	M	C	O	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 P.O. No.		STANDARD QUALITY PLAN					BHEL Doc No.: PE-QP-999-165-N005			
				Item : Self Cleaning Strainer		Vendor Q.P. NO. PACKAGE : SELF CLEANING STRAINER		PROJECT:		CUSTOMER:		
				Date : Page 06 of 12		PURCHASER:		CONSULTANT:				
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	Agency			Remarks
1	2	3	4	5	6	7	8	9	M	C	O	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 17292/Appd sheet	ISO 17292/Appd 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/API 598	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/API 598	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/API 598	EN 12266-1&2/API 598 & Appd. Data sheet	Manufacturer's T.C.	*	P	V	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-QP-999-165-N005				
		P.O. No.		Item : Pressure Gauge, DP Geuge, DP switch&DP Transmitter		Vendor Q.P. NO.		PACKAGE : SELF CLEANING STRAINER		PROJECT:		
						Date :				CUSTOMER:		
						Page 07 of 12				PURCHASER:		
										CONSULTANT:		
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	Agency			Remarks
1	2	3	4	5	6	7	8	9	M	C	O	11
4.0.0	In process quality control	Make, Range and Model	Critical	Visual	100%	Approved Sheet Data	Approved Data Sheet	Manufacturer test certificate	*	P	V	V
		Calibration	Critical	Calibration test	100%	Approved Sheet Data	Approved Data Sheet	Manufacturer test certificate	*	V	V	V
		Degree of protection	Critical	-	Type test certificate	Approved Sheet Data	Approved Data Sheet	Manufacturer test certificate	*	V	V	V
DMS (BHEL-PEN) 6078716-201407119												
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Manufacturer / Sub-Contractor		Contractor										
Signature				Name & Sign. Of approving authority & Seal								

		Manufacturer's Name & Address			Manufacturing Quality Plan				BHEL Doc No.: PE-QP-999-165-N005				
		P.O. No.			Item : Geared Motor drive & Worm planetary Gear box		Vendor Q.P. NO.		PROJECT:				
							PACKAGE : SELF CLEANING STRAINER		CUSTOMER:				
							Date : Page 08 of 12		PURCHASER:				
								CONSULTANT:					
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	Agency			Remarks	
1	2	3	4	5	6	7	8	9	M	C	O	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	
			LEGEND										
			* Records identified with "STAR" shall be essentially included by contractor in QA Documentation.										
			** M : Manufacturer/ Sub-contractor										
Manufacturer / Sub-Contractor			Contractor			C : CONTRACTOR			O: OWNER				
Signature						Indicate : "P" - Perform, "W" - Witness and "V" - Verification			Name & Sign. Of approving authority & Seal				



Manufacturer's Name & Address

Manufacturing Quality Plan

BHEL Doc No.: PE-QP-999-165-N005

Item : Actuators

Vendor Q.P. NO.

PROJECT:

P.O. No.

PACKAGE : SELF CLEANING STRAINER

CUSTOMER:

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			Remarks
									M	C	O	
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 / Auxillary Caontacts	Major	Visual	100%	Supplier catalogue	Supplier catalogue/Appd data sheet	Inspection Report	-	P	-	-

		Manufacturer's Name & Address P.O. No.		Manufacturing Quality Plan					BHEL Doc No.: PE-QP-999-165-N005				
				Item : Starter Panel		Vendor Q.P. NO.		PROJECT:					
						PACKAGE : SELF CLEANING STRAINER		CUSTOMER:					
						Date : Page 10 of 12		PURCHASER: CONSULTANT:					
Sl. No.	Component / Operation	Characteristics Checked	Class	Type of Check	Quantum of Check	Reference Documents	Acceptance Norms	Format of Record	Agency			Remarks	
1	2	3	4	5	6	7	8	9	M	C	O	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. Pcedure	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-QP-999-165-N005			
		P.O. No.		Item : Fasteners		Vendor Q.P. NO.		PROJECT:				
				PACKAGE : SELF CLEANING STRAINER		CUSTOMER:						
				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
1	2	3	4	5	6	7	8	9	M	C	O	11
8.1.0	Internal Fasteners - SS								**	10		
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 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										
		* Records identified with "STAR" shall be essentially included by contractor in QA Documentation.										
		** M : Manufacturer/ Sub-contractor										
Manufacturer / Sub-Contractor		Contractor		C : CONTRACTOR		O: OWNER						
Signature				Indicate : "P" - Perform, "W" - Witness and "V" - Verification								Name & Sign. Of approving authority & Seal

		Manufacturer's Name & Address			Manufacturing Quality Plan				BHEL Doc No.: PE-QP-999-165-N005			
		P.O. No.			Item : All components / Equipments		Vendor Q.P. NO.		PROJECT:		CUSTOMER:	
							PACKAGE : SELF CLEANING STRAINER		PURCHASER:			
							Date : 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			Remarks
1	2	3	4	5	6	7	8	9	M	C	O	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									



**TITLE : TECHNICAL SPECIFICATION
FOR
SELF CLEANING STRAINERS (SCS)**

SPEC. NO. PE-TS-405-165-N003

VOLUME : IIB

SECTION : D

REV. NO. 0

DATE :15.07.2014

SHEET 1 of 1

SECTION D2

STANDARD TECHNICAL SPECIFICATION FOR ELECTRICAL SYSTEMS

	TITLE : GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	SPECIFICATION NO. PE-SS-999-506-E101
		VOLUME NO. : II-B
		SECTION : D
		REV NO. : 00 DATE : 28.01.10
		SHEET : 1 OF 1

GENERAL TECHNICAL REQUIREMENTS

FOR

LV MOTORS

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

	TITLE : GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	SPECIFICATION NO. PE-SS-999-506-E101																														
		VOLUME NO. : II-B																														
		SECTION : D																														
		REV NO. : 00 DATE : 28.01.10																														
		SHEET : 1 OF 4																														
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: <table><tr><td>IS:325</td><td>Three phase Induction motors</td></tr><tr><td>IS : 900</td><td>Code of practice for installation and maintenance of induction motors</td></tr><tr><td>IS: 996</td><td>Single phase small AC and universal motors</td></tr><tr><td>IS: 4722</td><td>Rotating Electrical machines</td></tr><tr><td>IS: 4691</td><td>Degree of Protection provided by enclosures for rotating electrical machines</td></tr><tr><td>IS: 4728</td><td>Terminal marking and direction of rotation rotating electrical machines</td></tr><tr><td>IS: 1231</td><td>Dimensions of three phase foot mounted induction motors</td></tr><tr><td>IS: 8789</td><td>Values of performance characteristics for three phase induction motors</td></tr><tr><td>IS: 13555</td><td>Guide for selection and application of 3-phase A.C. induction motors for different types of driven equipment</td></tr><tr><td>IS: 2148</td><td>Flame proof enclosures for electrical appliance</td></tr><tr><td>IS: 5571</td><td>Guide for selection of electrical equipment for hazardous areas</td></tr><tr><td>IS: 12824</td><td>Type of duty and classes of rating assigned</td></tr><tr><td>IS: 12802</td><td>Temperature rise measurement of rotating electrical machines</td></tr><tr><td>IS: 12065</td><td>Permissible limits of noise level for rotating electrical machines</td></tr><tr><td>IS: 12075</td><td>Mechanical vibration of rotating electrical machines</td></tr></table> In case of imported motors, motors as per IEC-34 shall also be acceptable.			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 of rotating electrical machines	IS: 12065	Permissible limits of noise level for rotating electrical machines	IS: 12075	Mechanical vibration of rotating electrical machines
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IS: 12065	Permissible limits of noise level for rotating electrical machines																															
IS: 12075	Mechanical vibration of rotating electrical machines																															
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.																															

	TITLE : GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	SPECIFICATION NO. PE-SS-999-506-E101
		VOLUME NO. : II-B
		SECTION : D
		REV NO. : 00 DATE : 28.01.10
		SHEET : 2 OF 4
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 minimum 20,000 starts during the life time of the motor	
3.4	Running Requirements	
3.4.1	Motors shall run satisfactorily at a supply voltage of 75% of rated voltage for 5 minutes with full load without injurious heating to the motor.	
3.4.2	Motor shall not stall due to voltage dip in the system causing momentary drop in voltage upto 70% of the rated voltage for duration of 2 secs.	
3.5	Stress During bus Transfer	
3.5.1	Motors shall withstand the voltage, heavy inrush transient current, mechanical and torque stress developed due to the application of 150% of the rated voltage for at least 1 sec. caused due to vector difference between the motor residual voltage and the incoming supply voltage during occasional auto bus transfer.	
3.5.2	Motor and driven equipment shafts shall be adequately sized to satisfactorily withstand transient torque under above condition.	
3.6	Maximum noise level measured at distance of 1.0 metres from the outline of motor shall not exceed the values specified in IS 12065.	
3.7	The max. vibration velocity or double amplitude of motors vibration as measured at motor bearings shall be within the limits specified in IS: 12075.	
4.0	CONSTRUCTIONAL FEATURES	
4.1	Indoor motors shall conform to degree of protection IP: 54 as per IS: 4691. Outdoor or semi-indoor motors shall conform to degree of protection IP: 55 as per IS: 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.	

	TITLE : GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	SPECIFICATION NO. PE-SS-999-506-E101
		VOLUME NO. : II-B
		SECTION : D
		REV NO. : 00 DATE : 28.01.10
		SHEET : 3 OF 4
4.4.	Motors shall not be provided with any electric or pneumatic operated external fan for cooling the motors.	
4.5	Frames shall be designed to avoid collection of moisture and all enclosures shall be provided with facility for drainage at the lowest point.	
4.6	In case Class 'F' insulation is provided for LV motors, temperature rise shall be limited to the limits applicable to Class 'B' insulation. In case of continuous operation at extreme voltage limits the temperature limits specified in table-1 of IS:325 shall not exceed by more than 10°C.	
4.7	Terminals and Terminal Boxes	
4.7.1	Terminals, terminal leads, terminal boxes, windings tails and associated equipment shall be suitable for connection to a supply system having a short circuit level, specified in the Data Sheet-A. Unless otherwise stated in Data Sheet-A, motors of rating 110 kW and above will be controlled by circuit breaker and below 110 kW by switch fuse-contactor. The terminal box of motors shall be designed for the fault current mentioned in data sheet "A".	
4.7.2	Unless otherwise specified or approved, phase terminal boxes of horizontal motors shall be positioned on the left hand side of the motor when viewed from the non-driving end.	
4.7.3	Connections shall be such that when the supply leads R, Y & B are connected to motor terminals A B & C or U, V & W respectively, motor shall rotate in an anticlockwise direction when viewed from the non-driving end. Where such motors require clockwise rotation, the supply leads R, Y, B will be connected to motor terminals A, C, B or 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	

	TITLE : GENERAL TECHNICAL REQUIREMENTS FOR LV MOTORS	SPECIFICATION NO. PE-SS-999-506-E101
		VOLUME NO. : II-B
		SECTION : D
		REV NO. : 00 DATE : 28.01.10
		SHEET : 4 OF 4
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.		

MOTOR

TESTS/CHECKS TEMS/COMPONENTS	Visual	Dimensional	Make/Type/Rating /General Physical Inspection	Mech/Chem. Properties	NDT /DP/MPI/UT	Metallography	Electrical Characteristics	Welding/Brazing(WPS/PQR)	Heat Treatment
Plates for stator frame, end shield, spider etc.	Y Y		Y Y		Y				Y
Shaft	Y	Y Y		Y	Y Y				Y
Magnetic Material	Y	Y	Y	Y			Y		
Rotor Copper/Aluminium	Y Y		Y Y				Y		Y
Stator copper	Y Y		Y Y				Y		Y
SC Ring	Y Y		Y Y		Y		Y Y		Y
Insulating Material	Y		Y Y				Y		
Tubes, for Cooler	Y Y		Y Y		Y				Y
Sleeve Bearing	Y Y		Y Y		Y				Y
Stator/Rotor, Exciter Coils	Y Y		Y				Y	Y	
Castings, stator frame, terminal box and bearing housing etc.	Y Y		Y Y		Y			Y	
Fabrication & machining of stator, rotor, terminal box	Y	Y			Y			Y	Y
Wound stator	Y	Y					Y Y		
Wound Exciter	Y	Y					Y Y		
Rotor complete	Y	Y					Y		
Exciter, Stator, Rotor, Terminal Box assembly	Y	Y					Y		
Accessories, RTD, BTD, CT, Space heater, antifriction bearing, gaskets etc.	Y Y		Y						
Complete Motor	Y Y		Y						
Note: 1. This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating the practices & Procedure followed along with relevant supporting documents during QP finalization. However, No QP for LT motor upto 50KW. 2. Additional routine tests for Flame proof motors shall be applicable as per relevant standard 3. Makes of major bought out items for HT motors will be subject to NTPC approval. Y1 = for HT Motor / Machines only.									

MOTOR

ITEMS/COMPONENTS	TESTS/CHECKS									
	Magnetic Characteristics	Hydraulic/Leak/Pressure Test	Thermal Characteristics	Run out	Dynamic Balancing	Routine & Acceptance tests as per IS-325/IS-4722 /IS- 9283/IS 2148/IEC60034/IEC 60079-I	vibration	Over speed	Tan delta, shaft voltage & polarization index test	Paint shade, thickness & adhesion
Plates for stator frame, end shield, spider etc.										
Shaft										
Magnetic Material	Y	Y								
Rotor Copper/Aluminium										
Stator copper	Y									
SC Ring										
Insulating Material	Y									
Tubes for Cooler		Y								
Sleeve Bearing	Y									
Stator/Rotor, Exciter Coils										
Castings, stator frame, terminal box and bearing housing etc.										
Fabrication & machining of stator, rotor, terminal box										
Wound stator										
Wound Exciter										
Rotor complete				Y	Y					
Exciter, Stator, Rotor, Terminal Box assembly										
Accessories, RTD, BTD, CT, , Space heater, antifriction bearing, gaskets etc.										
Complete Motor						Y	Y	Y	Y1	Y

Note: 1. This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating the practices & Procedure followed along with relevant supporting documents during QP finalization. However, No QP for LT motor upto 50KW.

2. Additional routine tests for Flame proof motors shall be applicable as per relevant standard

3. Makes of major bought out items for HT motors will be subject to NTPC approval.

Y1 = for HT Motor / Machines only.

		QUALITY PLAN		CUSTOMER :		PROJECT		SPECIFICATION :				
				BIDDER/ :		TITLE		NUMBER :				
		SHEET 1 OF 2		VENDOR		QUALITY PLAN NUMBER PED-506-00-Q-006, REV-01		SPECIFICATION TITLE				
		SYSTEM		ITEM AC ELECT. MOTORS BELOW 55KW (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			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
1.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	MANUF'S SPEC	MANUF'S SPEC	-DO-	2	-	-	
		2.DIMENSIONS	MA	-DO-	-DO-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	-DO-	2	-	-	
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	MFG.SPEC./ RELEVANT IS	MFG.SPEC. RELEVANT IS	-DO-	2	-	-	
2.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	MANUFR'S SPEC/BHEL SPEC./RELEVANT STANDARD	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	NOTE -1 & NOTE-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	2	1		NOTE -1 & NOTE-3
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPN. REPORT	2	1	-	NOTE -1 & NOTE-3
BHEL			PARTICULARS		BIDDER/VENDOR							
			NAME									
			SIGNATURE									

		QUALITY PLAN		CUSTOMER :		PROJECT			SPECIFICATION :			
				BIDDER/ :		TITLE			NUMBER :			
		SHEET 2 OF 2		VENDOR		QUALITY PLAN			SPECIFICATION :			
		SYSTEM		NUMBER PED-506-00-Q-006, REV-01			TITLE :					
				ITEM AC ELECT. MOTORS BELOW 55KW (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			REMARKS
									P	W	V	
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	2	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. <u>Legends for Inspection agency</u> 1. BHEL/CUSTOMER 2. VENDOR (MOTOR MANUFACTURER) 3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER) P. PERFORM W. WITNESS V. VERIFY												
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-007, REV-03			SPECIFICATION : TITLE		
		SHEET 1 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION		VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
1.0	RAW MATERIAL & BOUGHT OUT CONTROL											
1.1	SHEET STEEL, PLATES, SECTION, EYEBOLTS	1.SURFACE CONDITION	MA	VISUAL	100%	-	FREE FROM BLINKS, CRACKS, WAVINESS ETC	LOG BOOK	3	-	-	PROPERTY CLASS MARKING SHALL BE CHECKED BY THE VENDOR
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	-DO-	3	-	-	
		3.PROOF LOAD TEST (EYE BOLT)	MA	MECH. TEST	-DO-	-DO-	-DO-	INSPEC. REPORT	3	-	2	
1.2	HARDWARES	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, UN-EVENNESS ETC.	-DO-	3	-	-	
		2.PROPERTY CLASS	MA	VISUAL	SAMPLES	MANFR'S DRG./SPEC BOOK	RELEVANT IS/SPEC.	SUPPLIERS TC & LOG	3	-	2	
1.3	CASTING	1.SURFACE CONDITION	MA	VISUAL	100%		FREE FROM CRACKS, BLOW HOLES ETC.	LOG BOOK	3	-	2	
		2.CHEM. & PHY. PROP.	MA	CHEM & MECH TEST	1/HEAT NO.	MANFR'S DRG./SPEC	RELEVANT IS/	SUPPLIER'S TC	3	-	2	HEAT NO. SHALL BE VERIFIED
		3.DIMENSIONS	MA	MEASUREMENT	100%	MANUFR'S M DRG.	ANUFR'S DRG.	LOG BOOK	3	-	2	
1.4	PAINT & VARNISH	1.MAKE, SHADE, SHELF LIFE & TYPE	MA	VISUAL	100% CONTINUOUS	MANFR'S DRG./SPEC	MANFR'S DRG./SPEC	LOG BOOK	3	-	2	
BHEL			PARTICULARS			BIDDER/VENDOR						
			NAME									
			SIGNATURE									
			DATE						BIDDER'S/VENDORS COMPANY SEAL			

		QUALITY PLAN		CUSTOMER :		PROJECT			SPECIFICATION :				
				BIDDER/ :		TITLE			NUMBER :				
				VENDOR		QUALITY PLAN			SPECIFICATION :				
SHEET 2 OF 9		SYSTEM		NUMBER PED-506-00-Q-007, REV-03			TITLE			SECTION			
ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)		VOLUME III											
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS	
									P	W	V		
1	2	3	4	5	6	7	8	9	10			11	
1.5	SHAFT (FORGED OR ROLLED)	1. SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED	
		2. CHEM. & PHYSICAL PROPERTIES	MA	CHEM. & PHYSICAL TESTS	1/HEAT NO. OR HEAT TREATMENT BATCH NO	MFG. DRG. SPEC.	RELEVANT IS	SUPPLIER'S TC	3	-	2		
		3. DIMENSIONS	MA	MEASUREMENT	100%	-DO-	MANUFR'S DRG.	LOG BOOK	3	-	2		
		4.INTERNAL FLAWS	CR	UT	-DO-	ASTM-A388	MANUFR'S SPEC. BHEL SPEC.	-DO-	3	2	1		
1.6	SPACE HEATERS, CONNEC- TORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S	1. MAKE & RATING	MA	VISUAL	-DO-	MANUFR'S DRG. SPEC.	MANUFR'S DRG. SPEC.	-DO-	3	-	2	FOR DIA OF 55 MM & ABOVE	
		2. PHYSICAL COND.	MA	-DO-	-DO-	-	NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY	-DO-	3	-	2		
		3.DIMENSIONS (WHEREVER APPLICABLE)	MA	MEASUREMENT	SAMPLE	MANUFR'S DRG./ SPEC.	MANUFR'S DRG. / SPEC.	-DO-	3	-	2		
		4.PERFORMANCE/ CALIBRATION	MA	TEST	100%	-DO-	-DO-	INSP. REPORT	3	-	2		
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-007, REV-03			SPECIFICATION : TITLE		
		SHEET 3 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION		VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
1.7	OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC.	1. SURFACE COND. ETC.	MA	VISUAL	100%	-	NO VISUAL DEFECTS	INSPT. REPORT	3	-	2	FOR MV MOTOR INSULATION/VARNISH THICKNESS SHALL BE MORE THAN THE BURS HEIGHT
		2. OTHER CHARACTERISTICS	MA	TEST	SAMPLE	MANUF'S SPEC.	MANUF'S SPEC.	LOG BOOK AND OR SUPPLIER'S TC	3	-	2	
1.8	SHEET STAMPING (PUNCHED)	1. SURFACE COND.	MA	VISUAL	100%	-	NO VISUAL DEFECTS (FREE FROM BURS)	LOG BOOK	3	-	-	
		2.DIMENSIONS INCLUDING BURS HEIGHT	MA	MEASUREMENT	SAMPLE	MANUFR'S DRG. .	MANUFR'S DRG.	-DO-	3	-	2	
		3. ACCEPTANCE TESTS	MA	ELECT. & MECH TESTS	-DO-	MANUF'S SPEC./ RELEVANT IS	RELEVANT IS	SUPPLIER'S TC	3	-	2	
1.9	CONDUCTORS	1. SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	LOG BOOK	3*	-	2*	* MOTOR MANUFACTURER TO CONDUCT VISUAL CHECK FOR SURFACE FINISH ON RANDOM BASIS (10% SAMPLE) AT HIS WORKS AND MAINTAIN RECORD FOR VERIFICATION BY BHEL/CUSTOMER.
		2.ELECT. PROP, & MECH. PROP	MA	ELECT. & MECH.TEST	SAMPLES	RELEVANT IS/ BS OR OTHER STANDARDS	RELEVANT IS/ BS OR OTHER STANDARDS	SUPPLIERS TC & VENDOR'S INSPN. REPORTS	3	-	2	
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-007, REV-03			SPECIFICATION : TITLE			
		SHEET 4 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION		VOLUME III	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.10	BEARINGS	3.DIMENSIONS	MA	MEASUREMENT	-DO-	-DO-	-DO-	Log Book	3	-	2	
		1.MAKE & TYPE	MA	VISUAL	100%	MANFR'S DRG./ APPROVED DATASHEET	MANFR'S DRG./ APPROVED DATASHEET	-DO-	3	-	2	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	BHEL DATA SHEET	BHEL DATA SHEET BEARING MANUF'S CATALOGUES	-DO-	3	-	2	
		3.SURFACE FINISH	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	2	
1.11	SLIP RING (WHEREVER APPLICABLE)	1.SURFACE COND.	MA	VISUAL	100%	-	-DO-	-DO-	3	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	
		3.TEMP.WITH-STAND CAPACITY	MA	ELECT.TEST	-DO-	MANUF'S SPEC./ BHEL SPEC.	MANUF'S SPEC./ BHEL SPEC.	-DO-	3	-	2	
		4.HV/IR	MA	-DO-	100%	-DO-	-DO-	-DO-	3	-	2	
1.12	OIL SEALS & GASKETS	1.MATERIAL OF GASKET	MA	VISUAL	100%	MANUF'S DRG/SPECS	MANUF'S DRG./ SPECS.	-DO-	3	-	-	
		2.SURFACE COND.	MA	VISUAL	100%	-	FREE FROM VISUAL DEFECTS	-DO-	3	-	-	
		3.DIMENSIONS	MA	MEASUREMENT	SAMPLE	MANUF'S DRG	MANUF'S DRG	-DO-	3	-	-	
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-007, REV-03			SPECIFICATION : TITLE			
		SHEET 5 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION		VOLUME III	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	
2.0	IN PROCESS											
2.1	STATOR FRAME WELDING (IN CASE OF FABRICATED STATOR)	1.WORKMANSHIP & CLEANNES	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	3/2	2	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-	
2.2	MACHINING	1.FINISH	MA	VISUAL	100%	-DO-	GOOD FINISH	LOG BOOK	2	-	-	
		2.DIMENSIONS	MA	MEASUREMENT	-DO-	MANUF'S DRG	MANUF'S DRG	-DO-	2	-	-	
		3.SHAFT SURFACE FLOWS	MA	PT	-DO-	RELEVANT SPEC./ ASTM-E165	MANUF'S SPEC./ BHEL SPEC./	-DO-	2	-	1	
2.3	PAINING	1.SURFACE PREPARATION	MA	VISUAL	100%	MANFR'S SPEC/BHEL SPEC./ RELEVANT STAND	BHEL SPEC. SAME AS COL.7	LOG BOOK	2	-	-	
		2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT)	MA	MEASUREMENT BY ELCOMETER	SAMPLE	-DO-	-DO-	-DO-	2	-	-	
		3.SHADE	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-	
		4.ADHESION	MA	CROSS CUTTING & TAPE TEST	-DO-	-DO-	-DO-	Log Book	2	-	-	
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-007, REV-03			SPECIFICATION : TITLE				
		SHEET 6 OF 9		SYSTEM		ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION		VOLUME III		
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS	
1	2	3	4	5	6	7	8	9	10	P	W	V	11
2.4	SHEET STACKING	1.COMPLETENESS	MA	MEASUREMENT	SAMPLE	MANUFR'S SPEC.	MANUFR'S SPEC.	Log Book	2	-	-		(FOR MOTORS OF 2MW AND ABOVE) * ON 10% RANDOM SAMPLE
		2.COMPRESSION & TIGHTENING	MA	MEASUREMENT	100%	-DO-	-DO-	Log Book	2	-	-		
		3.CORE LOSS & HOTSPOT	MA	ELECT.TEST	-DO-	-DO-	-DO-	Log Book	2	1*	1		
2.5	WINDING	1.COMPLETENESS	CR	VISUAL	100%	MANUFR'S SPEC./BHEL SPEC. SPEC. SPEC.	MANUFR'S SPEC. /BHEL	Log Book	2	-	-		
		2.CLEANLINESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-		
		3.IR-HV-IR	CR	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2	-	1		
		4.RESISTANCE	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1		
		5.INTERTURN INSULATION	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-		
		6.SURGE WITH STAND AND TAN. DELTA TEST	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1		
												FOR MV MOTOR	
2.6	IMPREGNATION	1.VISCOSCITY	MA	PHY. TEST	AT STARTING	-DO-	-DO-	Log Book	2	-	-		THREE DIPS TO BE GIVEN
		2.TEMP. PRESSURE VACCUM	MA	PROCESS CHECK	CONTINUOUS	-DO-	-DO-	Log Book	2	-	-		
		3.NO. OF DIPS	MA	-DO-	-DO-	-DO-	-DO-	Log Book	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-007, REV-03			SPECIFICATION : TITLE			
		SHEET 7 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION		VOLUME III	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS	
1	2	3	4	5	6	7	8	9	10	P	W	V	11
2.7	COMPLETE STATOR ASSEMBLY	4.DURATION	MA	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	1	VERIFICATION FOR MV MOTOR ONLY	
2.8	BRAZING/COMPRESSION JOINT	1.COMPACTNESS & CLEANLINESS	MA	VISUAL	100%	-DO-	-DO-	Log Book	2	-	-		
2.9	COMPLETE ROTOR ASSEMBLY	1.COMPLETENESS	CR	-DO-	-DO-	-DO-	-DO-	Log Book	2	-	-		
		2.SOUNDNESS	CR	MALLET TEST & UT	-DO-	-DO-	-DO-	Log Book	2		1		
		3.HV	MA	ELECT. TEST	-DO-	-DO-	-DO-	Log Book	2		1		
2.10	ASSEMBLY	1.RESIDUAL UNBALANCE	CR	DYN. BALANCE	-DO-	MFG SPEC./ ISO 1940	MFG. DWG.	Log Book	2		1		
		2.SOUNDNESS OF DIE CASTING	CR	ELECT. (GROWLER TEST)	-DO-	MFG. SPEC.	MFG. SPEC.	Log Book	2		1		
		1.ALIGNMENT	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	-		
		2.WORKMANSHIP	MA	VISUAL	-DO-	-DO-	-DO-	Log Book	2	-	-		
		3.AXIAL PLAY	MA	MEAS.	-DO-	-DO-	-DO-	Log Book	2	-	1		
		4.DIMENSIONS	MA	-DO-	-DO-	MFG.DRG./ MFG SPEC.	MFG. DRG/ RELEVANT IS	Log Book	2	-	-		
		5.CORRECTNESS, COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	2	-	-		
	6. RTD, BTD & SPACE HEATER MOUNTING.	MA	VISUAL	100%	MFG SPEC. RELEVANT IS	MFG SPEC. RELEVANT IS	Log Book	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-007, REV-03			SPECIFICATION : TITLE			
		SHEET 8 OF 9				SYSTEM				ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)				SECTION	
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS			
									P	W	V				
1	2	3	4	5	6	7	8	9	10			11			
3.0	TESTS	1.TYPE TESTS INCLUDING SPECIAL TESTS AS PER BHEL SPEC.	MA	ELECT.TEST	1/TYPE/SIZE	IS-325/ BHEL SPEC./ DATA SHEET	IS-325/ BHEL SPEC./ DATA SHEET	TEST REPORT	2	1*	1	* NOTE - 1			
		2.ROUTINE TESTS INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1\$	1	\$ NOTE - 2			
		3.VIBRATION & NOISE LEVEL	MA	-DO-	100%	IS-12075 & IS-12065	IS-12075 & IS-12065	-DO-	2	1\$	1	\$ NOTE - 2			
		4.OVERALL DIMENSIONS AND ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPC. REPORT	2	1	-				
		5.DEGREE OF PROTECTION	MA	ELECT. & MECH. TEST	1/TYPE/ SIZE	RELEVANT IS	BHEL SPEC. AND DATA SHEET	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3			
		6. MEASUREMENT OF RESISTANCE OF RTD & BTD	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1\$	1	\$ NOTE - 2			
		7. MEASUREMENT OF RESISTANCE, IR OF SPACE HEATER	MA	-DO-	100%	-DO-	-DO-	-DO-	2	1\$	1	\$ NOTE - 2			
		8. NAMEPLATE DETAILS	MA	VISUAL	100%	IS-325 & DATA SHEET	IS-325 & DATA SHEET	INSPC. REPORT	2	1\$	1	\$ NOTE - 2			
		9.EXPLOSION FLAME PROOF NESS (IF SPECIFIED)	MA	EXPLOSION FLAME PROOF TEST	1/TYPE	IS-3682 IS-8239 IS-8240	IS-3682 IS-8239 IS-8240	TC	2	-	1	TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3			
		10. PAINT SHADE, THICKNESS & FINISH	MA	VISUAL & MEASUREMENT BY ELKOMETER	SAMPLE	BHEL SPEC. & DATA SHEET	BHEL SPEC. & DATA SHEET	TC	2	1\$	1	SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY \$ NOTE - 2			
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-007, REV-03		SPECIFICATION : TITLE			
		SHEET 9 OF 9		SYSTEM			ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)			SECTION		VOLUME III
SL. NO.	COMPONENT/OPERATION	CHARACTERISTIC CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS
									P	W	V	
1	2	3	4	5	6	7	8	9	10			11
NOTES: 1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED. 2 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON. 3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE, THESE TEST MAY NOT BE REPEATED. 4 WHEREVER CUSTOMER IS INVOLVED IN INSPECTION, AGENCY (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER. <u>Legends for Inspection agency</u> 1. BHEL/CUSTOMER 2. VENDOR (MOTOR MANUFACTURER) 3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER) P. PERFORM W. WITNESS V. VERIFY												
BHEL			PARTICULARS		BIDDER/VENDOR				BIDDER'S/VENDORS COMPANY SEAL			
			NAME									
			SIGNATURE									
			DATE									



**TITLE : TECHNICAL SPECIFICATION
FOR
SELF CLEANING STRAINERS (SCS)**

SPEC. NO. PE-TS-405-165-N003

VOLUME : IIB

SECTION : D

REV. NO. 0

DATE :15.07.2014

SHEET 1of 1

SECTION D3

**STANDARD TECHNICAL SPECIFICATION
FOR
C&I SYSTEMS**



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-UP /CONFIRMED
BY BIDDER

(TO BE FILLED BY PURCHASER)

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 OPERATING PARAMETER	
	OVER RANGE PROTECTION	1.5 TIMES OF FSD	
	BLOW OUT DISC	REQUIRED	
	SWITCHING FACILITY (IF APPLICABLE) NOT TYPE	REQUIRED ☐ 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.



**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-999-145-1026-0

SL NO	TESTS/CHECKS	QUANTM OF CHECK	REFERENCE DOC. ACCEPTANCE NORMS	AGEN CY			REMARKS
				P	W	V	
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	ACCESSORIE S AS APPLICABLE	100% M			C	C	

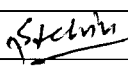
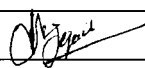
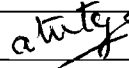
LEGEND:

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.

	DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER		SPECIFICATION NO.:	
			VOLUME	
			SECTION	
			REV. NO.	DATE:
			SHEET 1	OF 4
TAG No. Qty.....			Data Sheet No.: PES-145-01-DS1-001A REV 01	
DATA SHEET-A FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
GENERAL	MANUFACTURER	1/2 inch NPT(F) / 1",150#RF		
	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 / IP-65		
	OVER PRESSURE	150 % OF MAX OPERATING PRESSURE		
	CONNECTION (ELECTRICAL)	PLUG & SOCKET TYPE		
	PROCESS CONNECTION	½ INCH NPT / ¼ INCH NPT		
	ZERO DRIFT & SPAN DRIFT	+/- 0.015 PER DEG C AT AT MAX SPAN +/- 0.11 PER DEG C AT AT MAX SPAN		
	SPAN & ZERO	CONTINUOUS 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%			

	DATA SHEET FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER			SPECIFICATION NO.:	
				VOLUME	
				SECTION	
				REV. NO.	DATE:
				SHEET 2	OF 4
TAG No. Qty.....			Data Sheet No.: PES-145-01-DS1-001A REV 01		
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		
NAME SIGNATURE DATE	PREPARED BY	CHECKED BY	APPROVED BY	COMPANY SEAL NAME SIGNATURE DATE	
	SACHIN SRIVASTAVA	DILIP JEJURIKAR	ALKA TUTEJA		
					
	30.09.08	30.09.08	30.09.08		

	CHECK LIST FOR PRESSURE / DIFFERENTIAL PRESSURE TRANSMITTER (Mechanical Auxiliary Packages)		SPECIFICATION NO.:	
			VOLUME	
			SECTION	
			REV. NO.	DATE:
			SHEET 1 OF 1	
Data Sheet No.: PE-CL-999-145-1026-0				

SL NO	TESTS/CHECKS	QUANTM OF CHECK	REFERENCE DOC. ACCEPTANCE NORMS	AGENCY			REMARKS
				M	C	B	
1.0	CHECKS FOR VISUAL, 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
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	-do-		P	W	V	

		BELOW				
10.0	BURN IN TEST	ONE/TYPE		P	W	V
11.0	DEGREE OF PROTECTION	ONE/TYPE		P	W	V

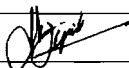
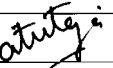
LEGEND:

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

NOTE:

- QUANTUM OF CHECK SHALL BE AS BELOW
100 % - BY MANUFACTURER
RANDOM FOR EACH TYPE – BY BHEL & CUSTOMER
- MANUFACTURER TO MAINTAIN CALIBRATED INSTRUMENT HAVING BETTER ACCURACY THAN THE ITEM UNDER TEST. INSPECTING ENGINEER SHALL CHECK THE SAME.
- 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.

	PREPARED BY	CHECKED BY	APPROVED BY
NAME	SACHIN SRIVASTAVA	DILIP JEJURIKAR	ALKA TUTEJA
SIGNATURE			
DATE	30.09.08	30.09.08	30.09.08

	TECHNICAL REQUIREMENTS		
	FIELD MOUNTED LOCAL JUNCTION BOXES (i) No. of ways 12/24/36/48/64/72/96/128 with 20% spares terminals. (ii) Material and Thickness 4mm thick Fiberglass Reinforced Polyester (FRP). (iii) Type Screwed at all four corners for door. Door gasket shall be of synthetic rubber. (iv) Mounting clamps and accessories Suitable for mounting on wall s, col umns, structures et c. Th e brackets, bolts, nuts, screws, glands required for erection shall be of SS, included in Bidders scope of supply. (v) Type of terminal blocks Rail mounted cage-clamp type suitable for conductor size upto 2.5 mm². A M6 earthing stud shall be provided. (vi) Protection Class IP: 55 mini mum for indoor & IP-65 minimum for outdoor applications. (vii) Grounding To be provided. (viii) Color RAL 7305.		
NORTH KARANPURA STPP (3X660 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS-4410-001-2	SUB-SECTION-IIIC-07 INSTRUMENTATION CABLES	PAGE 11 OF 12

Process Connection & Piping																	
TESTS	Visual ®	GA, BOM, Layout of component & construction feature®	Dimension ®	Paint Shade/thickness ®	Flattening,flaring,hydrotest,hardness check as per ASTM standard (A)	Component Ratings ®	Wiring ®	Make, Model, Type, Rating®	IR & HV ®	Review of TC for instrument/devices (R)	Accessibility of TBS/Devices ®	Illumination,grounding ®	Tubing ®	Leak/Hydro test(A)	Chemical/physical properties of material (A)	Proof pressure test,Dismantling & reassembly test,Hydraulic impulse and vibration test (R)	Tests as per standards & specification
ITEMS																	
Local Instrument enclosure	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y			
Local instruments racks	Y	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y			
Junction Box	Y	Y	Y	Y*		Y		Y	Y								
Gauge Board	Y	Y	Y	Y		Y		Y		Y			Y	Y			
Impulse pipes and tubes	Y		Y		Y			Y							Y		
Socket weld fittings ANSI B-16.11	Y		Y					Y							Y		Y
Compression fittings	Y		Y					Y						Y	Y	Y	
Instrument valves & Valve manifolds	Y		Y					Y						Y	Y		
Copper tubings ASTM B75	Y							Y									Y
*-applicable for painted junction boxes.																	
A- Acceptance Test																	
Y – Test applicable																	
Note: R-Routine Test																	
Note: This is an indicative list of tests/checks. The manufacturer is to furnish a detailed quality plan indicating the Practices and Procedure adopted alongwith relevant supporting documents.																	



SPECIFICATION FOR MOTORISED VALVE ACTUATOR

SPECIFICATION NO.: PE-SS-999-145-I007

VOLUME II B

SECTION D

REV. NO. 03

DATE: 20.06.14

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	3 X 660 MW STPP		
	OFFER REFERENCE			
	* TAG NO. SERVICE			
	* DUTY	☐ ON / OFF ☐ INCHING		
	* LINE SIZE (inlet/outlet): MATERIAL			
	* VALVE TYPE	☐ GLOBE ☐ GATE ☐ REG. GLOBE ☐ BUTTERFLY		
	* OPENING / CLOSING TIME			
	* WORKING PRESSURE			
	AMBIENT CONDITION	SHALL BE SUITABLE FOR CONTINUOUS OPERATION UNDER AN AMBIENT TEMP. OF 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 90% OF RATED VOLTAGE. FOR ISOLATING SERVICE THREE SUCCESSIVE OPEN-CLOSE OPERATIONS OR 15 MINS. WHICHEVER IS HIGHER. FOR INCHING /REGULATING SERVICE - 150 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) ENAMEL ☐		
	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 +/- 10 %, 3PH,3 W, AC 50 HZ. +/- 5 %		
	@ CONTROL VOLTAGE REQUIREMENT	TO BE DERIVED FROM THE POWER SUPPLY TO THE STARTER ☐ 230 V ☒ 110 V AC/24V DC		

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		SPECIFICATION NO.: PE-SS-999-145-I007		
			VOLUME II B		
			SECTION D		
			REV. NO.	03	DATE: 20.06.14
		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)	
	MOTOR BEARING WITH 2 EARTH TERMINALS	DOUBLE SHIELDED, GREASE LUBRICATED ANTI FRICTION			
	@ ENCLOSURE CLASS OF MOTOR	IP 67 FOR OUTDOOR & IP 55 FOR INDOOR(TOTALLY ENCLOSED SELF VENTILATED)			
	@ 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	(NOT APPLICABLE)			
	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) (\$\$)	MFR & MODEL NO.	BIDDER TO SPECIFY			
	OPEN : INT : CLOSE	☐ 1 No. ☒ 2 Nos.	☐ 1 No. ☒ 2Nos.		
	CONTACT TYPE	2 NO + 2 NC			

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR	SPECIFICATION NO.: PE-SS-999-145-I007	
		VOLUME II B	
		SECTION D	
		REV. NO. 03	DATE: 20.06.14
		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)	
Refer Notes)	RATING (AC / DC)	5A 240V AC AND 0.5A 220V DC	
Limit switches shall be silver plated with high conductivity and non-corrosive type. Contact rating shall be sufficient to meet the requirement of control system subject to a minimum of 60 V, 6 VA rating. Protection class shall be IP 55.			

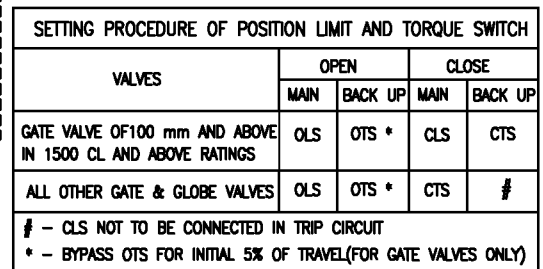
POSITION TRANSMITTER	POSITION TRANSMITTER (For inching duty applications)	☒ REQUIRED ☐ NOT REQUIRED	
	MFR & MODEL NO.	BIDDER TO SPECIFY	
	TYPE	☒ ELECTRONIC (2 WIRE) R/I CONVERTER ☐ ELECTRONIC (2 WIRE) CONTACTLESS	
	SUPPLY	☒ 24V DC ☐	
	OUTPUT	☒ 4-20mA	
	ACCURACY	$\pm$ 1% FS	
SPACE HEATER	@SPACE HEATER	REQUIRED	
	@ POWER SUPPLY (NON INTEGRAL)	230V AC,1 PH.,50 Hz	
	@ POWER SUPPLY (INTEGRAL)	POWER SUPPLY DERIVED FROM MAIN POWER SUPPLY AVAILABLE AT ACTUATOR END.	
	@ RATING		
TERMINAL BOX	ACTUATOR/MOTOR TERMINAL BOX	REQUIRED	
	ENCL CLASS ACTUATOR/MOTOR T.B.	☒ IP 67 @ ☐	
	@ 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 :-----	

	SPECIFICATION FOR MOTORISED VALVE ACTUATOR		SPECIFICATION NO.: PE-SS-999-145-I007	
			VOLUME II B	
			SECTION D	
			REV. NO. 03	DATE: 20.06.14
		SHEET 4 OF 3		
Data Sheet A & B				
DATA SHEET-A (TO BE FILLED BY PURCHASER)			DATA SHEET-B (TO BE FILLED-UP BY BIDDER)	
WEIGHT	TOTAL WEIGHT (ACTUATOR + ACCESSORIES)	BIDDER TO SPECIFY	_____ Kg.	
NOTES: SCOPE: DESIGN, MANUFACTURE, INSPECTION, TESTING AND DELIVERY TO SITE OF ELECTRIC ACTUATOR FOR INCHING OR OPEN / CLOSE DUTY. CODES & STANDARDS: DESIGN AND MATERIALS USED SHALL COMPLY WITH THE RELEVANT LATEST NATIONAL AND INTERNATIONAL STANDARD. AS A MINIMUM, THE FOLLOWING STANDARDS SHALL BE COMPLIED WITH: IS-9334, IS-2147, IS-2148, IS-325, IS-2959, IS-4691 AND IS-4722 - TEMPERATURE RISE SHALL BE RESTRICTED TO 70 DEG. C FOR AMBIENT TEMPERATURE OF 50 DEG C. - CABLE GLANDS OF DOUBLE COMPRESSION TYPE, BRASS MATERIAL SHALL BE PROVIDED. - 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. - 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%. - 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. - It shall be possible to operate the actuator locally. Lockable local/remote selection shall be provided on the actuator. - Position indicator shall be provided for 0 to 100 % travel - Wiring shall be suitable voltage grade copper wire.				
NAME SIGNATURE DATE	PREPARED BY	CHECKED BY	APPROVED BY	VENDOR COMPANY SEAL
	Madhav gupta	Mayank kesharwani	Bharat Singh	NAME
				SIGNATURE
	22.07.2014 22.	07.2014	22.07.2014	DATE
NOTES* = TO BE FILLED BY MPL (LEAD AGENCY). @ = TO BE FILLED BY ES				

CLAUSE NO.	TECHNICAL REQUIREMENTS एनटीपीसी NTPC
1.00.00	CONTROL DESK & PANELS
1.01.00	GENERAL
1.01.01	All control desk, panels, LVS panel etc. shall be furnished fully wired with necessary provision for convenience outlets, internal lighting, grounding, ventilation, space heating, anti-vibration pads, internal piping & accessories as required for completeness of the system.
1.01.02	All panels, desks, cabinets shall be free standing type & have bottom / top entry for cables to be finalised application wise during detailed engineering stage. The bottom of desk & cabinets shall be sealed with bottom plate, compression cable glands (double for field and single for inside rooms) and fire proof sealing material to prevent ingress of dust and propagation of fire. Sufficient number of power receptacles with disconnect switches shall be installed within all panels/desk.
1.01.03	Exterior steel surface shall be sand blasted, ground smooth, filled, primed, sanded and smooth enamel painted to give a good finish subject to minimum paint thickness of 65-75 microns for sheet thickness of 3 mm and 50 microns for sheet thickness of 2mm. The exact color shall be finalised during detailed engineering.
1.01.04	The design shall conform to the EN ISO 1106 4 (Ergonomical design of control room), Part-1,2 and 3.
2.00.00	CONTROL DESK & PANEL
2.01.00	GENERAL
2.01.01	The exact dimensions, material, construction details, grounding, general arrangement etc. of Control Desk etc. shall be as per the actual requirement and shall be finalised during detailed engineering and subjected to Employer's Approval.
NORTH KARANPURA STPP (3X660 MW) EPC PACKAGE	TECHNICAL SPECIFICATIONS SECTION – VI, PART-B BID DOC. NO.: CS-4410-001-2 SUB-SECTION-IIIC-12 CONTROL DESK & PANELS PAGE 1 OF 4

CONTROL DESK, LVS PANEL, PLC PANEL, SMOKE DETECTOR, FIRE ALARM & CONTROL SYSTEM

ITEMS	TESTS														
	Visual ®	GA, BOM ,Lay Out of components ®	Dimensions ®	Paint Shade/Thickness/Adhesion ®	Alignment of Section ®	Component Rating/ Make / Type ®	Wiring ®	IR & HV ®	Review of TC for instruments/ Devices/ Recorders, Indicators/ osaic Items/ Transducers ®	Accessability of TBS/ Devices ®	Illumination ®	Functional Check for Control Element ,	Mimic ®	Test as per IEC 1131 ® *	Test as per Std ® & (A)
1. Control Desk	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		
2. LVS Panel	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y
3. Annunciation, Control, PLC Panel	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
4.Smoke Detectors (UL-268,EN-54 PT-7), Heat Detectors(UL-521/EN 54 PT-5) Annunciation/ Control Panel (UL -864, EN-54, PT-2)															Y
Note: 1) Detailed procedure of Environmental Stress Screening test shall be as per Quality Assurance Programme in General Technical Conditions 2) This is an indicative list of test/ checks. The manufacturer is to furnish a detailed quality plan indicating the Practice and Procedure alongwith relevant supporting documents. • *Applicable for PLC • Y - Test Applicable , ® - Routine Test (A) - Acceptance Test															



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.		DRN CHD APPD	NAME N.P.ESWAR D.DINAKARAN K.ARUNACHALAM	SIGN N.P D.D K.A	DATE 17.03.05 17.03.05 17.03.05	NO.OF VAR. - - -
DEPT	VL	SCALE	WEIGHT (KG).	REFERENCE INFORMATION		NO. OF THICK
CODE	-		NTS	-		-
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



**TITLE : TECHNICAL SPECIFICATION
FOR
SELF CLEANING STRAINERS (SCS)**

SPEC. NO. PE-TS-405-165-N003

VOLUME : IIB

SECTION : D

REV. NO. 0

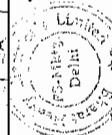
DATE :15.07.2014

SHEET 1of 1

LIST OF SUB-VENDORS

PROJECT : NORTH KARANPURA STPP (3 x 660 MW)											REF. NO. :	
PACKAGE : EPC PACKAGE											REVISION NO. : 00	
CONTRACTOR : BHEL - PEM, HYD, Trichy, PC, EDN											DATE : 20/12/2013	
CONTRACT NO : 4410-001												
No.	Major Equipment	Qp Inspec tion Cate gory	Qp No. 4410 001-QV1-Q	Qp Subm ission SCH	Qp Appr oval SCH	Proposed Sub Supplier	Country	SS Approv al Status	SS Detail Sub-SCH	SS Approva l SCH	Remark	
		III				M System	JAPAN	A				
		III				ABB	GERMANY/Farida bad	A				
		III				ENDRESS & HOUSER	Aurangabad	A				
		*				Kirone		DR				
		*				Tokyo Keliso	Japan	DR				
		*				INOR	Sweden	DR				
		*				P & F	India	DR				
		*				Siemens		DR				
		*				Yamatoka	JAPAN	DR				
		*				Yanari	JAPAN	DR				
		*				Foxboro		DR				
24	Conduits/Pipe(GI)					Refar Electrical List						
25	Electronic transmitters (pressure, DP)	III				EMERSON (Rosemount)	USA/ Pawane	A				
		III				FUJ: ELECTRIC	China	A				
		III				YOKOGAWA	JAPAN	A				
		I				ABB	FARIDABAD	A				
		III				ABB	GERMANY / Italy	A				
		III				Siemens	France / India	A				
		*				ENDRESS & HOUSER	Aurangabad/ Germany	DR				
26	Thermocouples, RTD & Thermowell	III				HERAUS SENSOR	GERMANY	A				
	Ruler Note - 2	III				WISE Control	Korea	A				
		II				Tampans	Udaipur	A				
		II				Pyroelectric	Goa	A				
		II				Deiviv Instrumentation & Electronics Ltd	Mumbai	A				
		III				Mitco	USA	A				
		III				OKAZAKI corporation	JAPAN	A				
		III				Yanari	JAPAN	A				

M/s BHEL will forward only two proposals after details review of NTPC Technical specification requirements



PROJECT : NORTH KARANPURA STPP (3 x 660 MW)				LIST OF ITEMS REQUIRING QP				REF. NO. :		
PACKAGE : EPC PACKAGE				APPROVAL & ACCEPTABLE				REVISION NO. : 00		
CONTRACTOR : BHEL - PEM, HYD, Trichy, PC, EDN				VENDOR AS APPROVED BY				DATE : 20/12/2013		
CONTRACT NO. : 4410-001										
No.	Major Equipment	Qp Inspection Category	Qp No. 4410 001-QV1-Q	Qp Approval SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub.SCH	SS Approval SCH	Remark
29	Pressure, DP Gauge	III			Pyroelectric	Mumbai	DR			
		III			BUDENBERG	UK	A			
		III			ASHCROFT	USA/Germany/ India	A			
		III			Wilka	GERMANY	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	Kolkatta	A			Not for MS & FW application
		III			Gauge Bourdon(GIC)	Parvel	A			Not for MS & FW application
		III			Goe Thermostatic	GOA	A			Not for MS & FW application
		III			Wilka	Pune	A			Not for MS & FW application
		III			Baumer	Vapi	A			Not for MS & FW application
		III			Ashcroft (Mass Brand)	Gandhinagar	A			Not for MS & FW application
		III			H.Guru	Rishra/Muzaffarpur	A			Not for MS & FW application
		*			US Gauge	USA	DR			
		*			Winiers	USA	DR			
		*			Forbes Marshall	Hyderabad	DR			
		*			Manometer	Mumbai	DR*			
		*			Waichandnagar Industries Ltd.	Mumbai	DR			
30	Level gauge (Transparent & Reflex, Tubular type)	*			Gauges Bourdon	Mumbai	DR			
		III			Nihon Klingage Co.,Ltd	UK	DR			
		III			Nihon Klingage Co.,Ltd	Japan	NOTED			
		III			Bunkabokei Kogyo Co., Ltd	Japan	NOTED			
		III			Iokyo keiso	Japan	NOTED			
		III			Samii industries Inc.	Korea	NOTED			
		III			HITROL	Korea	NOTED			
		III			Levcon	Kolkatta	NOTED			
		III			Sigma	Mumbai	NOTED			
		III			SBEM	Pune	NOTED			Up to 40 Kg/cm2
		III			Chemtrol	GOA	NOTED			Up to 40 Kg/cm3
		III			ASIAN INDUSTRIAL VALVES	CHENNAI	NOTED			Up to 40 Kg/cm4
		III			D.K. Instruments	Kolkotta	NOTED			Up to 40 Kg/cm5
		III			Flow Star	Fardabad	NOTED			Up to 40 Kg/cm2
		III			V-Automat	NewDelhi	NOTED			Up to 40 Kg/cm2
		III			DEMPEK KOGYO	JAPAN	NOTED			Up to 40 Kg/cm2

NTPC		PROJECT : NORTH KARANPURA STPP (3 x 660 MW)				LIST OF ITEMS REQUIRING OP				REF. NO.	
		PACKAGE : EPC PACKAGE				APPROVAL & ACCEPTABLE				REVISION NO : 00	
		CONTRACTOR : BHEL - PEM, HYD, Trichy, PC, EDN				VENDOR AS APPROVED BY				DATE : 20/12/2013	
		CONTRACT NO : 4410-001									
No.	Major Equipment	Qp	Inspection Category	Qp No. 4410 Submision SCH	Qp Approval SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub SCH	SS Approval SCH	Remark
		II				Thermo electra Bv	Netherlands	A			
		I				Universal Cable	Salna	A			PVC,FRLS type
		I				Thermocables	Hyderabad	A			
		I				Finolex Cable	Pune	DR*			
		I				Incab	Pune	DR*			
		*				Lappa cables	India	DR			
		*				Lion cable	Pune	DR			
		*				Gupla Cable	Orisa	DR			
		*				CM	Faridabad	DR			
47	Electrical actuator	III				Auma	Germany	A			
		III				Limitorg	USA	A			
		III				Rotorq	UK	A			
		II				Limitorque	Faridabad	A			
		II				Rotorq	Chennai/ Bangalore	A			
		III				Nippon gear	Japan	A			
		II				Auma	Bangalore	A			
		III				Harold Beck	USA	A			
		III				Drehmo	Germany	A			
		*				Lindco	USA	DR			
		*				Siemens	Germany	DR			
47A	Electrical actuator for ID/FD/FA Blade pitch and Guide vane control	III				Harold Beck	USA	A			
48	Flow nozzle assembly	II				SIPOS Aktorik GmbH	Germany	A			DR for P-91 Material
		II				Microprecision	Faridabad	A			
		II				SEIKO	Austria	A			
		II				TECHNOMATIC	Italy	A			
		II				Instrumentation Limited	Palghat	A			
		II				Starmech	Pune	A			
		II				WISE Control	Korea	A			DR for P-91 Material
		*				SAMIL	Korea	DR			
		*				MINCO	GOA	DR			
		*				Engg. Specialities	Kolkata	DR			
		*				Pyroelectric	Mumbai	DR			
49	HIGH Temp. cable (PTFE/FEP)	II				Halia cables	Sweden	DR			

PROJECT : NORTH KARANPURA STPP (3 x 660 MW)		LIST OF ITEMS REQUIRING QP APPROVAL & ACCEPTABLE				REF. NO. : PAGE 41 OF 84					
PACKAGE : EPC PACKAGE		REVISION NO. 01				DATE : 20/12/2013					
CONTRACTOR : BHEL - PEM, HYD, Trichy, PC, EDN		VENDOR AS APPROVED BY									
CONTRACT NO : 4410-001											
No.	Major Equipment	QP Inspection Category	QP No. 4410 001-QVI-Q	QP Submission SCH	QP Approval SCH	Proposed Sub Supplier	Country	SS Approval Status	SS Detail Sub.SCH	SS Approval SCH	Remark
125	AAQMS	I				Environment SA India Pvt. Ltd.	Bangalore	A			Analysers for Environment SA, France : Multipoint Calibrator from M/s L N Industrial, Switzerland and Metrological Sensors from M/s LSI Lassem SRL, Italy.
		I				Chemtrols	GOA	A			Analysers for Teledyne API, USA: Metrological Sensors & SPM from M/s Melone Instruments, USA.
		I				Thermo Electron LLS India Pvt. Ltd.	Mumbai	A			Analysers for M/s Thermoenvironmental Instruments Inc., USA & Metrological Sensors from M/s Melone Instruments, USA.
		*				Horiba	Japan	DR			M/s BHEL will forward only two proposals after details review of NTPC Technical specification requirements.
		*				Analysers Instrument Co. Ltd.	Kota	DR			
		*				SWAN Environmental Co. Pvt. Ltd.	Hyderabad	DR			
		*				Durag		DR			
		*				Land Combustion		DR			
126	CJC Box (If applicable)					Main Contractor will propose the vendors during detail Engineering.					
127	Operator Testing Simulator					Main Contractor will propose the vendors during detail Engineering.					

LEGENDS :

1.0 SYSTEM SUPPLIER / SUB SUPPLIER APPROVAL STATUS CATEGORY (SHALL BE FILLED BY NTPC)

A - For those items proposed vendor is acceptable to NTPC. To be indicated with letter "A" in the list alongwith the condition of approval, if any.

DR - For those items "Detailed Required" for NTPC review. To be identified with letter "DR" in the list.

DR* - For those items "Detail Required" for NTPC for record updation only

NOTED : For these items vendors are approved by Main Supplier and accepted by NTPC without specific vendor approval from NTPC. To be identified

2.0 QP INSPECTION CATEGORY :

CAT - I : For those items the Quality Plans are approved by NTPC and final acceptance will be on physical inspection witness by NTPC

CAT - II : For those items the Quality Plans are approved by NTPC. However no physical inspection shall be done by NTPC. The final acceptance by NTPC shall be on the basis of review

CAT - III : For those items Main supplier approves Quality Plans. The final acceptance by NTPC shall be on the basis of Certificate of Conformance by main supplier.

UNITS/WORKS : Place of manufacturing- Place of main supplier of multi units/works.

* - Inspection category will be decided during vendor evaluation.

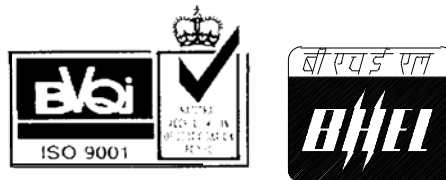


3 X 660 MW NTPC NORTH KARANPURA STPP

TECHNICAL SPECIFICATION FOR SELF CLEANING STRAINERS (SCS)

Specification No. : PE-TS- 405-165-N003(REV. 0).

VOLUME -III



**BHARAT HEAVY ELECTRICALS LIMITED
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
PPEI BLDG., SEC-16A, PLOT NO. 25
NOIDA – 201301 (UP)**

	TITLE : TECHNICAL SPECIFICATION FOR SELF CLEANING STRAINERS (SCS) PREAMBLE	SPEC. NO. PE-TS- 405-165-N003	
		VOLUME : III	
		REV. NO. 0	DATE : 15.07.2014
		SHEET 1 OF 1	

1.0

The tender document contains three (3) volumes. The bidder shall meet the requirements of all the three volumes.

1.1

Volume -I CONDITIONS OF CONTRACT

This consists of four parts as below :

Volume - I A

: This part contains instructions to bidders for making bids to BHEL.

Volume - I B

: This part contains general commercial conditions of the tender and include provision that vendor shall be responsible for the quality of item supplied by their sub-vendors.

Volume - I C

: This part contains special conditions of contract.

Volume - I D

: This part contains commercial conditions for erection and commissioning site work, as applicable.

1.2

Volume - II TECHNICAL SPECIFICATIONS

Technical requirements are stipulated in Volume II which comprises of :

Volume - II A

: General Technical Conditions

Volume - II B

: Technical specification including drawings, if any

1.2.1

Volume - II B :

This volume is sub-divided into following sections:

Section - A

: This section outlines the scope of enquiry.

Section - B

: This section provides "Project Information"

Section - C

: This section indicates technical requirements specific to the contract, not covered in Section-D.

Section - D

: This section comprises of standard technical specifications of equipments complete with data sheet A, B & C.
Data sheet-A specifies data and other requirements pertaining to the equipment.
Data sheet - B specifies data to be filled by the bidder
(Data Sheet B is contained in Volume - III)

	TITLE : TECHNICAL SPECIFICATION FOR SELF CLEANING STRAINERS (SCS) PREAMBLE	SPEC. NO. PE-TS- 405-165-N003	
		VOLUME : III	
		REV. NO. 0	DATE : 15.07.2014
		SHEET 1 OF 1	

1.2.2 Volume - III TECHNICAL SCHEDULES

This volume contains technical schedules and Data Sheets - B, which are to be duly filled by the bidder and the same shall be furnished with the technical bid as per instructions given in Document No.PES-100-901 in Volume-III.

2.0 The requirements mentioned in Section C/Data Sheets-A of Section-D shall prevail and govern in case of conflict between the same and the corresponding requirements mentioned in the descriptive portion in Section -D.

	TITLE : TECHNICAL SPECIFICATION FOR SELF CLEANING STRAINERS (SCS) PREAMBLE	SPEC. NO. PE-TS- 405-165-N003	
		VOLUME : III	
		REV. NO. 0	DATE : 15.07.2014
		SHEET 1 OF 1	

INDEX

SECTION	TITLE
A	DETAILS TO BE FURNISHED ALONGWITH BID
A1.	COMPLIANCE CERTIFICATE
A2.	PERFORMANCE GAURANTEE SCHEDULE
A3.	TECHNICAL DEVIATION SCHEDULE
A4.	ELECTRICAL LOAD DATA
A5.	GA DRAWING OF SCS
A6.	SCHEDULE OF PRICES
A7.	SCHEDULES OF UNIT PRICES
B	DOCUMENTS TO BE SUBMITTED ON PLACEMENT OF LOI
B1.	DATASHEET – B
B2.	SCHEDULES AS PER LIST.



TITLE :
TECHNICAL SPECIFICATION FOR
SCS

SPEC. NO. PE-TS- 405-165-N003

VOLUME III

SECTION

REV. NO. 0

DATE 15.07.2014

SHEET 1 OF 1

SECTION A

SHALL BE FURNISHED ALONGWITH BID

- **COMPLIANCE CERTIFICATE**
- **PERFORMANCE GUARANTEE SCHEDULE**
- **TECHNICAL DEVIATION SCHEDULE**
- **ELECTRICAL LOAD DATA**
- **GA DRG OF SCS**
- **SCHEDULE OF PRICES**
- **SCHEDULE OF UNIT PRICES**

	TITLE : COMPLIANCE CERTIFICATE FOR SELF CLEANING STRAINERS (SCS)	SPEC. NO.	PE-TS- 405-165-N003
	PROJECTS: 3x660MW NTPC NORTH KARANPURA	DATE:	15.07.2014
		SHEE	1 OF 2

COMPLIANCE CERTIFICATE

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

- a) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions with regard to same.
- b) There are no other deviations w.r.t. specification other than those furnished in the 'Schedule of Deviations'. Any other deviation, stated or implied, taken elsewhere in the offer stands withdrawn unless specifically brought out in the 'Schedule of Deviations'
- c) Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL/ Customer/Customer's Consultant approval and customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. Charges for 3rd party inspection (TUV/ equivalent) for imported components wherever required shall be included by bidder in the base price itself.
- d) Any drawing/ document/ data-sheet/ calculation/ Quality plan/ Instrumentation etc. submitted along with the offer shall be considered for reference only, same shall be subject to BHEL/ Customer/Customer's Consultant approval in the event of order.
- e) The offered materials shall be either equivalent or superior to those specified in the specification. For components where materials are not specified, same shall be suitable for intended duty, all materials shall be subject to approval in the event of order.
- f) The commissioning spares shall be supplied on 'As Required Basis' & prices for same included in the base price itself.
Prices for special tools & tackles, if any, shall also be included in the base price.
Recommended spares for 3 years shall be quoted separately with price indicated separately.
- g) Charges for Installation Checks, Commissioning of equipments, Trial runs and Performance Testing at site shall be included by bidder as per the price format.
- h) All Instruments shall be located in the Instrument Rack (as applicable) to be supplied by bidder.

The instrument rack shall be installed for SCS with impulse piping, root valves, fittings, accessories, valve manifolds mounted on gauge racks etc. supplied by bidder accordingly.
- i) The main flanges for SCS shall be suitable for the forces and moments as per the specification.
- j) All inter-connecting piping, valves, flanges, counter-flanges, fittings, fasteners, reducer/expander & accessories etc. shall be in bidder's scope of supply.
- k) Provision for future installation of Cathodic protection with sacrificial anodes.
- l) The hydrostatic test pressure shall be 1.5 times the design pressure.
- m) All sub - vendors shall be subject to BHEL/ Customer/Customer's Consultant approval in the event of order.
- n) The Performance guarantees of equipments shall stand valid till the satisfactory completion of performance testing & its acceptance by BHEL/ Customer/Customer's Consultant.
- o) The orientation of piping around SCS shall be finalised during detailed Engg.

	TITLE : COMPLIANCE CERTIFICATE FOR SELF CLEANING STRAINERS (SCS)		SPEC. NO.	PE-TS- 405-165-N003
	PROJECTS: 3x660MW NTPC NORTH KARANPURA		DATE:	15.07.2014
			SHEE	2 OF 2

p) Electrical/ C&I :

- All selected motor ratings have minimum 15 % margin over maximum continuous demand of the driven equipment including voltage and frequency variations, temperature rise and other factors.
- Supply of electrical viz. LT power cables, instrumentation and control cables, cable glands, lugs, cable trays etc. shall be as per specification. Their erection shall be done by BHEL
- The junction boxes for termination of DPT/ DPS/ Actuator LS/ solenoid valves are included in bidders scope. The instrumentation cable and cabling from instruments/ actuators to junction boxes is also included in bidders scope.
- Valve actuators and controls shall be provided as specified in Data Sheet-A and Project specific requirements as specified in Section C-2 & Section C-3
- Alarms/ annunciations/ instruments shall be finalised during detailed engineering in the event of order which shall be subject to BHEL/ Customer/Customer's Consultant approval and shall be without any commercial implications to BHEL.

	TITLE : SCHEDULE OF PERFORMANCE GUARANTEES FOR SELF CLEANING STRAINER (SCS)	SPEC. NO. PE-TS- 405-165-N003
		VOLUME : III
		Sheet 1 of 1

S.NO.	DESCRIPTION	UNITS	3x660MW NTPC NORTH KARANPURA	
			800 NB	400 NB
1.	Pressure drop across the SELF CLEANING STRAINER-SCS (i.e. between inlet & outlet nozzle) under clean condition and Normal flow condition	MWC		

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

LOAD TITLE	RATING (KW / A)		UNIT (U)/STN (S)	Nos.		VOLTAGE CODE*	FEEDER CODE**	EMER. LOAD (Y)	CONT.(C)/ INTT.(I)	STARTING TIME >5 SEC (Y)	LOCATION	BOARD NO.	CABLE		BLOCK CABLE DRG. No.	CONTROL CODE	REMARKS	LOAD No.
	NAME PLATE	MAX. CONT. DEMAND (MCR)		RUNNING	STANDBY								SIZE CODE	Nos				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
ANNEXURE-II																		
NOTES: 1. COLUMN 1 TO 12 & 18 SHALL BE FILLED BY THE REQUISITIONER (ORIGINATING AGENCY); REMAINING COLUMNS ARE TO BE FILLED UP BY PEM (ELECTRICAL)/ CUSTOMER 2. ABBREVIATIONS : * VOLTAGE CODE (7):- (ac) A=11 KV, B=6.6 KV, C=3.3 KV, D=415 V, E=240 V (1 PH), F=110 V (cc): G=220 V, H=110 V, J=48 V, K=+24V, L=-24 V : ** FEEDER CODE (8):- U=UNIDIRECTIONAL STARTER, B=BI-DIRECTIONAL STARTER, S=SUPPLY FEEDER, D=SUPPLY FEEDER (CONTACTER CONTROLLED)																		
	LOAD DATA (ELECTRICAL)	JOB NO.		405				ORIGINATING AGENCY				PEM (ELECTRICAL)						
		PROJECT TITLE		3x660MW NTPC NORTH KARANPURA				NAME				DATA FILLED UP ON						
		SYSTEM		COLTCS & SCS				SIGN.				DATA ENTERED ON						
		DEPTT. / SECTION		MSE				SHEET 1 OF 1		REV. 00		DE'S SIGN. & DATE						



TITLE :
TECHNICAL SPECIFICATION FOR
SCS

SPEC. NO. PE-TS- 405-165-N003

VOLUME III

SECTION

REV. NO. 0

DATE 15.07.2014

SHEET 1 OF 1

SECTION B

SHALL BE FURNISHED ON PLACEMENT OF LOI

- **DATASHEET B**
- **LIST OF SCHEDULES**



TITLE :
TECHNICAL SPECIFICATION FOR
SCS

SPEC. NO. PE-TS- 405-165-N003

VOLUME III

SECTION

REV. NO. 0

DATE 15.07.2014

SHEET 1 OF 1

SECTION B1

DATASHEET B

	TITLE :	SPECIFICATION NO.
	DATA SHEET - B	VOLUME : III - B
	SELF - CLEANING FILTER	SECTION : B
	(Backwash Type)	REV. NO. 00 DATE :
		SHEET 1 OF 3

SL.NO.	DESCRIPTION	UNIT	DATA/ PARTICULARS
1.0	GENERAL		
1.1	No. of filters required	Nos.	
1.2	Inlet connection	mm Nb	
1.3	Outlet connection	mm Nb	
1.4	Filter type/ duty		
1.5	Location		
1.6	Liquid handled		
2.0	DESIGN DATA		
2.1	Operating pressure	Bar (g)	
2.2	Design pressure	Bar (g)	
2.3	Design temperature	Deg. C	
2.4	Flow rate through filter		
	a) Normal		
	b) Maximum		
2.5	Design differential pressure for filter section/ screen	Bar (g)	
2.6	Max. Size of solid particle likely to enter the filter	mm	
2.7	Type of suspended matter likely to enter the filter		
2.8	Differential pressure measuring system set pressure		
	• For initiating flushing/ backwashing	mbar	
		mbar	
	• For alarm/ annunciation		
2.9	Filter section/ screen perforation size	mm	
3.0	GUARANTEED PERFORMANCE REQUIREMENT		

	TITLE :	SPECIFICATION NO.
	DATA SHEET - B	VOLUME : III - B
	SELF - CLEANING FILTER	SECTION : B
	(Backwash Type)	REV. NO. 00 DATE :
		SHEET 2 OF 3

SL.NO.	DESCRIPTION	UNIT	DATA/ PARTICULARS
--------	-------------	------	-------------------

3.1	Pressure drop across the filter (i.e. between inlet and outlet connection)	mbar	
-----	--	------	--

a) Clean condition

b) Partially (50%) choked condition

c) During flushing operation

d) After flushing operation

3.2	Debris discharge flow during flushing period		
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3.3	Flushing period	Minutes	
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3.4	Debris/ sludge removal capacity	m ³ /hr	
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4.0	MATERIALS OF CONSTRUCTION		
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4.1	Filter body/ housing		
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4.2	Filter screen/ section		
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4.3	Supporting cage		
-----	-----------------	--	--

4.4	Differential measuring system		
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4.5	Flushing/ backwashing unit		
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4.6	Backwash rotor shoes		
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4.7	Internal hardware		
-----	-------------------	--	--

4.8	Pipes		
-----	-------	--	--

4.9	Shaft		
-----	-------	--	--

5.0	COUNTER FLANGES		
-----	------------------------	--	--

5.1	Materials :		
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a) Flanges

b) Bolts & Nuts

c) Gaskets

5.2	Drilling Standard		
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	TITLE :	SPECIFICATION NO.
	DATA SHEET - B	VOLUME : III - B
	SELF - CLEANING FILTER	SECTION : B
	(Backwash Type)	REV. NO. 00 DATE :
		SHEET 3 OF 3

SL.NO.	DESCRIPTION	UNIT	DATA/ PARTICULARS
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6.0 PAINTING

6.1 External Surface

1. Surface preparation
2. Primer
3. Final paint

6.2 Internal Surface

- a) Surface preparation
- a) Primer
- b) Final paint

7.0 SHOP TEST

7.1 Hydrostatic test

- a) Test Pressure bar (g)
- b) Test duration min.

7.2 Leakage test

- a) Test Pressure bar (g)
- b) Test duration min.

	TITLE	SPECIFICATION NO.	
		VOLUME	III
		SECTION	D
		REV NO. 00	DATE 07.01.14
		SHEET	1 OF 2

MOTOR
DATA SHEET - C

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.
	MOTOR DATA SHEET - C	VOLUME III
		SECTION D
		REV NO.00 DATE 07.01.14
		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 $\geq 55\text{KW}$)	
	a) Torque speed characteristic	
	b) Thermal withstand characteristic	
	c) Current vs time	
	d) Speed vs time	

NAME OF VENDOR			SEAL	REV.	
NAME	SIGNATURE	DATE			



TITLE :
TECHNICAL SPECIFICATION FOR
SCS

SPEC. NO. PE-TS- 405-165-N003

VOLUME III

SECTION

REV. NO. 0

DATE 15.07.2014

SHEET 1 OF 1

SECTION B2
LIST OF SCHEDULES

CHECKLIST - LIST OF SCHEDULES

Sl. No.	Form No.	Description	Tick Applicable Forms
1.	PEM-6024	Schedule of Drawings/Catalogues submitted with Bid.	✓
2.	PEM-6025@	Schedule of Occurrence of Key Events of Delivery, Erection & Commissioning	
3.	PEM-6026	Schedule of Equipment Manufacture. Despatch and Shipment to Site.	✓
4.	PEM-6027	Schedule of Weights & Dimensions.	
5.	PEM-6028@	Schedule of Performance Guarantee	
6.	PEM-6030	Inspection Schedule	✓
7.	PEM-6031	Schedule of Cement and Steel and Quarterly Cement Requirement.	
8.	PEM-6032	Schedule of Quarterly Requirement of Reinforcing Bars and Structural Steel.	
9.	PEM-6033@	Bill of Quantities (Civil Works)	
10.	PEM-6035	Schedule of Bidder's Proposed Construction/ Site Fabrication Facilities.	
11.	PEM-6036	Schedule of Deviations.	✓
12.	PEM-6040	Schedule of Declaration	✓
13.	PEM-6041	Quality Plan	✓
14.	PEM-6042	Vendor's Drawings/ Documents Schedule	✓
15.	PEM-6043@	Schedule of Occurrence of Key Events for Civil/Structural Works	
16.	PEM-6046	Inspection Request.	✓
17.	PEM-6051@	Schedule of Prices.	✓
18.	PEM-6052@	Schedule of Unit prices	✓
19.	PEM-6053	Schedule of Prices for Commissioning & Mandatory Spares.	✓
20.	PEM-6054	Schedule of Prices for Recommended Spares.	✓
21.	PEM-6055	Schedule Prices for Erection and Maintenance Tools & Tackles.	✓
22.	PEM-6057	Schedule of Daily & Overtime Rates.	
23.	PEM-6058	Schedule of Hire charges for Construction/ Site Fabrication Facilities.	

For Forms marked with @ certain information to be filled by DEs before issuing to bidder.

	SCHEDULE OF DRAWINGS/CATALOGUES SUBMITTED WITH BID		SPECIFICATION NO:	
			VOL III	
			SHEET..... OF.....	
Section C/D enclosed with the specification indicate the drawings / catalogues to be furnished with the bid. The bidder in addition to furnishing the same, can also include any other drawings / catalogues which he may desire to submit with the bid. This schedule duly lists out such drawings as enclosed by the bidder with the bid.				
DRAWING/ CATALOGUE NUMBER	DESCRIPTION			NUMBER OF SHEETS

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

	SCHEDULE OF EQUIPMENT, MANUFACTURE, DESPATCH AND SHIPMENT TO SITE			SPECIFICATION NO:
				VOL III
				SHEET..... OF.....
Equipment/Major Bought-out items	Time for Manufacture/ Procurement from Date of issues of Letter of intent (Weeks)	Time for Test Dismantling Packing & Ready for Despatch (Weeks)	Time required from Shipment to Site (Weeks)	Total Time from Date of Issue of Letter of intent to Shipment to Site (Weeks)
We, the undersigned hereby undertake to meet the schedule in weeks from manufacture, dispatch and shipment of each equipment and procurement of major boughtout items as listed above.				

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

	SCHEDULE OF WEIGHTS & DIMENSIONS		SPECIFICATION NO:
			VOL III
			SHEET..... OF.....
The bidder shall state below the weights and dimensions of various packages for shipment covering the complete scope.			
Description of Package(S)		Dimension (in meters)	Weight (in tones)

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

		INSPECTION SCHEDULE		SPECIFICATION NO	
				VOL III	
				SHEET..... OF.....	
S No.	ITEM/COMPONENT	PLACE & ADDRESS OF TEST / INSPECTION	SCHEDULE D DATE OF INSPECTION	DURATION OF TEST / INSPECTION (IN DAYS)	
This schedule shall be in the line with specification and quality plan requirements. The information in this form shall be furnished after receipt of LOI/PO.					

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

	TITLE * SCHEDULE OF DEVIATIONS () From Conditions of Contract (Volume – 1) () From General Technical Conditions (Volume – II A) () From Technical Specifications (Volume –II B)	SPECIFICATION NO
		VOL III
		SHEET..... OF.....
We the undersigned hereby certify that the above mentioned are the only deviations.		

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

	TITLE * SCHEDULE OF DECLARATIONS	SPECIFICATION NO
		VOL III
		SHEET..... OF.....

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

DECLARATION

Icertify that all the technical data and information pertaining to this specification are correct and are true representation of the equipment/system covered by our format proposal number Dated and there is no deviation to the specification.

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

Biders Company Name

Authorised representative's
Signature

Name

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

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

6: 150 folios / P 410 10000

Bid FORM No. PEM — 6041-0

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		QUALITY PLAN		CUSTOMER		PROJECT		SPECIFICATION							
				BIDDER / VENDOR	SYSTEM	TITLE	NUMBER	TITLE	NUMBER						
SHEET		OF		SYSTEM		ITEM		SECTION		VOLUME III					
S. NO.	COMPONENT / OPERATION :	CHARACTERISTIC CHECK	CAT.	TYPE / METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS			
									P	W	V				
1	2	3	4	5	6	7	8	9	10			11			
BHEL NAME SIGNATURE DATE													BIDDER'S / VENDOR'S COMPANY SEAL		

(Form No. PEM-6042 7)

Column 1- Serial Number

Column 2- - Component/Operation- The component and/or operation being checked shall be given here.

Column 3- Characteristics check- The characteristics being checked shall be given here, e.g., chemical composition, mechanical properties, leak tightness, surface defects etc.:

Column 4- Category - 'CR' stands for critical characteristic - affecting safety of equipment and personnel

'MA' stands for major Characteristic - affecting safety of equipment and personnel

MI' stands for minor characteristic - affecting appearance etc.

Column 5- Type/Method of check e.g. chemical analysis tensile testing, hydraulic test, visual examination radiography etc.

Column 6- Extent of check, such as, 100, 10, 1 per heat etc.

Column 7- Reference Documents - Documents, such as technical specification, drawings, standard specifications (IS, BS ETC.) procedure, etc. according to which check is done.

Column 8- Acceptance Norms - Standards etc. according to which acceptability or otherwise of the characteristics being checked is decided.

Column 9- Format of Record - Formats, log sheets, reports, etc. in which the observations are recorded. Standard log sheets, reports, formats etc. of the Vendors shall be numbered and such reference numbers shall be included here

Column 10- Agency - The agency which performs the test/instruction shall be written in sub-column 'W'

The agency which verifies test certificates/inspection records and carries out audit check of the components/operation shall be written in sub-column 'V'

The agencies are codified '1' stands for (BHEL)

as 1,2 & 3

'1' * means the operation shall be cleared by BHEL before the start of the next operation.

'2' Stands for Vendor

'3' stands for sub-Vendor of the Vendor and so on.

Example :

Entry '3' in column 'P' means test/inspection to be performed by sub-Vendor's QC

Entry '2' in column 'W' means test/inspection to be witnessed by Vendor's QC

Entry '1' in column 'V' means verification shall be done by BHEL and next stage to be started only after the hold point is cleared by BHEL.

Column II- Remarks - Any special remarks shall be given here.

NOTES

1. In absence of correlation with the test certificate(s) (e.g. material identification) samples shall be drawn by BHEL and all tests as per relevant specifications shall be carried out in their presence or in recognized Government Laboratory
2. When materials and components are initially identified and stamped by BHEL QS engineer, the identification marks shall be preserved till despatch. Wherever this is not possible, the identification mark shall be transferred to the components in the presence of BHEL QS Engineer unless otherwise agreed.
3. For castings and forgings integral test specimens shall be provided. When this is not possible for casting, they shall be poured in the presence of BHEL QS Engineer unless otherwise, if witnessing of test by BHEL is called for.
4. When welders qualified by reputed inspection agencies or statutory bodies are not available, qualification tests shall be conducted in the presence of BHEL QS Engineer.
5. This Quality Plan is liable to be modified as per the requirements of approved drawings and changes in technical specifications/drawings. If there are contradictions in respect of column 7 & 8 between this Quality Plan and the approved drawings specifications, the latter shall prevail.
6. Wherever inspection by BHEL's Purchaser/Third Party/Statutory authorities are mandatory, this shall be complied with.
7. Inspection reports, log sheets, test reports/certificate, etc. shall be furnished to BHEL at the appropriate stages or at the time of final inspection, as required.
8. This Quality Plan is also applicable to spares, if any, under scope of supply of Vendor.
9. The quality plan shall be submitted in septuplicate (7 Copies).

	*SCHEDULE OF PRICES FOR COMMISSIONING AND MANDATORY SPARES						SPECIFICATION NO		
							VOL III		
							SHEET..... OF.....		
*Unpriced schedule shall also be furnished along with Part A- Schedule in technical bid The bidder shall indicate here the quantity required for erection / commissioning and mandatory spares for equipment as listed in Section C / Section – D. If the listed spares are not adequate then the bidder shall indicate those and additional spares considered necessary by him.									
Type	Manufacturer's Drawing No / Part of spare	Description	Material	Quantity per Unit / Equipment	Quantity Recommended	If Set, Nos. Per Set	Delivery Period (Weeks)	Unit Price (Rs.)	Total Price (Rs.)
Erection & Commissioning									
Mandatory Spares									
Additional Spares Mandatory Erection / Commissioning									

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

	*SCHEDULE OF PRICES FOR RECOMMENDED SPARES						SPECIFICATION NO		
							VOL III		
							SHEET..... OF.....		
*Unpriced schedule shall also be furnished along with Part A- Schedule in technical bid The bidder shall give below a list of spares recommended for three years (or as otherwise specified in section – C) for trouble free performance of the equipment / system offered.									
S. No.	Manufacturer's Drawing No / Part of spare	Description	Material	Quantity per Unit / Equipment	Quantity Recommended	If Set, Nos. Per Set	Delivery Period (Weeks)	Unit Price (Rs.)	Total Price (Rs.)

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

	TITLE * SCHEDULE OF PRICE FOR ERECTION AND MAINTENANCE TOOLS & TACKLES	SPECIFICATION NO
		VOL III
		SHEET..... OF.....

***Unpriced schedule shall also be furnished along with Part A- Schedule in technical bid**

The bidder shall be given below the list of erection and maintenance tools and tackles as offered by him. This shall also include the customer's list of maintenance tools. If specified in Section – C / Section - D

S. No	DESCRIPTION OF TOOLS & TACKLES	QUANTITY OFFERED	UNIT PRICE (Rs.)	TOTAL PRICE (Rs.)

NOTE : The hire charges for vendors equipment called for in this schedule shall include the cost of consumables, operation services, descriptions, wear and tear as well as vendor's over head and profit (These rates will be payable by customer to the vendor, only if the customer's requires the use of this equipment for carrying out his own work out side the scope of this contract).

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