			SOR INC	USA	Approved
			SWITZER INSTRUMENT LTD	CHENNAI	Approved
			TRAFAG CONTROLS INDIA PVT LTD	GURGAON.	Approved
			WIKA ALEXANDER WIEGAND GMBH & CO.	GERMANY.	Approved
11	81SFI	SIGHT FLOW INDICATOR	CHEMTROLS SAMIL (INDIA) P.LTD.	MUMBAI	Approved
			D.K.INSTRUMENTS PVT. LTD.	KOLKATA	Approved
			LEVCON INSTRUMENTS PVT.LIMITED	KOLKATTA	Approved
			SIGMA INSTRUMENTS COMPANY	MUMBAI	Approved
			V.AUTOMAT & INSTRUMENTS P.LTD.	NEW DELHI	Approved
12	81TEG	TEMPERATURE GAUGE	A.N.INSTRUMENTS PVT. LIMITED,	KOLKATA	Approved
			ASHCROFT INDIA PVT. LTD,	GUJARAT	Approved
			BUDENBERG GAUGE CO LTD.,	United Kingdom	Approved
			FORBES MARSHALL PRIVATE LIMITED	PUNE. MAHARASTRA	Approved
			GENERAL INSTRUMENTS CONSORTIUM,	CHENNAI	Approved
			GOA INSTRUMENT INDUSTRIES PVT LTD.	GOA	Approved
			GOA THERMOSTATIC INSTRUMENTS PVT. L	GOA	Approved
			H GURU INSTRUMENTS(SI) P.LTD.,	BANGALORE	Approved
			PYRO ELECTRIC INSTRUMENTS GOA P LTD	GOA	Approved
13	81THW	THERMOWELL	DETRIV INSTRUMENTATION &	MUMBAI	Approved
			GENERAL INSTRUMENTS CONSORTIUM,	CHENNAI	Approved
			GOA INSTRUMENT INDUSTRIES PVT LTD.	GOA	Approved
			PYRO ELECTRIC INSTRUMENTS GOA P LTD	GOA	Approved
14	FLEFN	FLOW NOZZLE ASSEMBLY	ASIAN INDUSTRIAL VALVES AND INSTRUM	CHENNAI	Approved
			BOPP & REUTHER HEINRICHS MESSTECHNI	Germany	Approved
			HYDRO PNEUMATICS PVT LTD	GOA.	Approved
			INSTRUMENTATION LTD.,	KERALA	Approved
			MICRO PRECISION PRODUCTS (P) LTD,	FARIDABAD	Approved
			TECHNOMATIC	Italy	Approved
15	PCASH	ALUMINIUM SHEET :PLA	BHARAT ALUMINIUM CO.LTD.,	BANGALORE	Approved
			HINDALCO INDUSTRIES LTD.,	CHENNAI	Approved
			JINDAL ALUMINIUM LIMITED	BANGALORE.	Approved
			NATIONAL ALUMINIUM CO. LTD.,	CHENNAI	Approved

BHEL TRICHY

TSGENCO-1x800 MW Kothagudem TPS

Approved Vendor List for Bought-Out Items

Sl No	Ite	Vendor	Place/ Country	Remarks
1	BLOCK VALVE	AVCON CONTROLS PVT.LTD.,	India	Approved
		DRESSER VALVE INDIA PRIVATE LTD.,	India	Approved
		INSTRUMENTATION LTD.,	India	Approved
		MIL CONTROLS LIMITED	India	Approved
		SAMSON CONTROLS PRIVATE LIMITED	India	Approved
2	CONTROL VALVE	CONTROL COMPONENTS INC	USA	Approved
		DRESSER PRODUITS INDUSTRIELS S.A.S	France	Approved
		DRESSER VALVE INDIA PRIVATE LTD.,	India	Approved
		Fisher Sanmar Limited	India	Approved
		FLOWSERVE INDIA CONTROLS PVT.LTD.,	India	Approved
		INSTRUMENTATION LTD.,	India	Approved
		KOSO INDIA PRIVATE LIMITED.	India	Approved
		KOSO INDIA PVT LTD	India	Approved
		MIL CONTROLS LIMITED	India	Approved
3	INSULATION: CASTABLE REFRACTORY	ABS REFRACTORIES PVT.LTD.,	India	Approved
		BHASKAR REFRACTORIES&SW PIPES P LTD	India	Approved
		CALDERYS INDIA REFRACTORIES LTD.,	India	Approved
		CASTWEL INDUSTRIES	India	Approved
		DALMIA REFRACTORIES LIMITED	India	Approved
		INDUSTRIAL ASSOCIATES,	India	Approved
		MAHAKOSHAL REFRACTORIES PVT. LTD,	India	Approved
		SHARADAA CERAMICS PVT.LTD	India	Approved
		SOUVENIOR CERAMICS	India	Approved
		VISHVA VISHAL ENGINEERING LTD.,	India	Approved
		VISHWAKARMA REFRACTORIS PRIVATE	India	Approved
4	INSULATION: WOOL MATTRESS	LLOYD ROCKFIBRES LTD,	India	Approved
		ROCKWOOL (INDIA) LTD.,	India	Approved
		ROCKWOOL INDUSTRIES	India	Approved
5	INSULATION: POURABLE	BHASKAR REFRACTORIES&SW PIPES P LTD	India	Approved
		DALMIA REFRACTORIES LIMITED	India	Approved
6	HEA IGNITOR ASSY	DURAG INDIA INSTRUMENTATION PVT. L	India	Approved
		FIVES COMBUSTION SYSTEMS PVT. LTD	India	Approved
		HAMWORTHY COMBUSTION ENGINEERING LT	United Kingdom	Approved
		UNISON INDUSTRIES,	USA	Approved
7	SCANNER AIR FAN	AIR CONTROL & CHEMICAL ENGG.CO.LTD.	India	Approved
		AIROCHEM ENGINEERING COMPANY,	India	Approved
		C.DOCTOR INDIA PVT. LTD.,	India	Approved
		CB DOCTOR VENTILATORS PVT LTD.	India	Approved
		PATELS AIRFLOW LIMITED,	India	Approved
8	BOILER STARTUP CIRCULATION PUMP	HAYWARD TYLER LTD	United Kingdom	Approved
		KSB AKTIENGESELLSCHAFT	Germany	Approved
		METALKEM RESOURCES,	India	Approved
		TORISHIMA PUMP MFG CO.LTD	Japan	Approved
		V-FLO PUMPS & SYSTEMS,	China	Approved
9	HANDLING EQUIPMENT:	GRIP ENGINEERS PVT LTD,	India	Approved
		UNIVERSAL HOIST-O-FABRIK,	India	Approved

Chief Engineer/TPC

BHEL TRICHY

TSGENCO-1x800 MW Kothagudem TPS

Approved Vendor List for Bought-Out

Sl No	Item	Vendor Name	Country	TSGENCO Remarks
1	ACTUATOR: ELECTRICAL REGULATOR	AUMA (INDIA) PRIVATE LIMITED,	India	Approved
		LIMITORQUE INDIA LTD.,	India	Approved
		ROTORK CONTROLS LIMITED	United Kingdom	Approved
		ROCKWELL AUTOMATION		Approved
2	ACTUATOR: PNEUMATIC	INSTRUMENTATION LTD.,	India	Approved
		KELTRON CONTROLS,	India	Approved
		ROCKWELL AUTOMATION		Approved
3	LT-PVC CONTROL CABLE	CORDS CABLE INDUSTRIES LIMITED.,	India	Approved
		DELTON CABLES LIMITED,	India	Approved
		KEC INTERNATIONAL LIMITED,	India	Approved
		KEI INDUSTRIES LIMITED,	India	Approved
		POLYCAB WIRE PVT. LTD,	India	Approved
4	LT-XLPE POWER CABLE	CORDS CABLE INDUSTRIES LIMITED.,	India	Approved
		DELTON CABLES LIMITED,	India	Approved
		KEI INDUSTRIES LIMITED	India	Approved
		POLYCAB WIRE PVT. LTD,	India	Approved
5	INSTRUMENTATION/ SCREENED/ SHIELDED/ COMPENSATING/ EXTENSION CABLES	CORDS CABLE INDUSTRIES LIMITED.	India	Approved
		DELTON CABLES LIMITED,	India	Approved
		POLYCAB WIRE PVT. LTD,	India	Approved
6	AIR FILTER REGULATOR	Already given in BHEL-TRICHY-VALVES List		
7	PANELS: R.LOGIC/AC CONTROL SUPPLY PANEL	C & S ELECTRIC LTD.,	India	Approved
		CONTROLS & SCHEMATICS LIMITED,	India	Approved
8	PANELS: MCC/PCC	C & S ELECTRIC LTD.,	India	Approved
		LARSEN & TOUBRO LTD.(CTRL & AUTOMN.	India	Approved
9	ORIFICE PLATE ASSY	ASIAN INDUSTRIAL VALVES AND INSTRUM	India	Approved
		GENERAL INSTRUMENTS CONSORTIUM,	India	Approved
		INSTRUMENTATION LTD.,	India	Approved
		MICRO PRECISION PRODUCTS (P) LTD,	India	Approved
10	CCTV SYSTEM	Already given in BHEL EDN-List	Sweden	
11	FLOW NOZZLES	ASIAN INDUSTRIAL VALVES AND INSTRUM	India	Approved
		GENERAL INSTRUMENTS CONSORTIUM,	India	Approved
		INSTRUMENTATION LTD.,	India	Approved
		MICRO PRECISION PRODUCTS (P) LTD,	India	Approved
12	DP GAUGES	Already Given in BHEL-EDN List		
13	PRESSURE GAUGES	Already given in BHEL-EDN List		
14	CABLE TRAY	INDIANA GRATINGS PVT.LTD.,	India	Approved
		JAMNA METAL COMPANY	India	Approved
		PATNY SYSTEMS PVT LTD	India	Approved

Chief Engineer/TPC

BHEL TRICHY

TSGENCO-1x800 MW Kothagudem TPS

Approved Vendor List for Bought-Out

15	REFERENCE JUNCTION	ABB LIMITED,	India	Approved
17	TEMPERATURE GAUGES	Already given in BHEL-EDN List		
18	LOCAL INSTRUMENT ENCLOSURE	CHEMIN CONTROLS AND	India	Approved
		INSTRUMENTATION LTD.	India	Approved
		PRAMMEN INDUSTRIES,	India	Approved
		PYROTECH ELECTRONICS P.LTD(UNIT II	India	Approved
19	LOCAL INSTRUMENT RACK	CHEMIN CONTROLS AND	India	Approved
		INSTRUMENTATION LTD.	India	Approved
		PRAMMEN INDUSTRIES,	India	Approved
		PYROTECH ELECTRONICS P.LTD(UNIT II	India	Approved
20	LEVEL SWITCH	Already given in BHEL-EDN List		
21	MASS FLOW METER	ABB LIMITED,	India	Approved
		EMERSON PROCESS MANAGEMENT (INDIA)	India	Approved
		ENDRESS + HAUSER (INDIA) PVT.LTD.,	India	Approved
		ENDRESS + HAUSER GMBH + CO	Germany	Approved
		GE INDIA INDUSTRIAL PVT. LTD.,	India	Approved
		YOKOGAWA INDIA LIMITED,	India	Approved
22	ERV CONTROLLER	PRAMMEN INDUSTRIES,	India	Approved
		SAJAS ELECTRICALS, INDIA	India	Approved
		VEEVEE CONTROLS PVT LTD	India	Approved
23	SB FLOW SWITCH	CAMERON MEASUREMENT SYSTEMS,	United Kingdom	Approved
		SWITZER PROCESS INSTRUMENTS	India	Approved
24	L.T.MOTORS	BHARAT BIJLEE LIMITED,	India	Approved
		CROMPTON GREAVES LIMITED,	India	Approved
		KIRLOSKAR ELECTRIC CO.LTD.	India	Approved
25	PR & DP SWITCH	DELTA CONTROLS LIMITED	United Kingdom	Approved
		GENERAL INSTRUMENTS CONSORTIUM	India	Approved
		SWITZER PROCESS INSTRUMENTS	India	Approved
26	FLAME SCANNER CABLE	DELTON CABLES LIMITED,	India	Approved
		NICCO CORPORATION LTD.,	India	Approved
27	FRP JUNCTION BOX	K.S.INSTRUMENTS PVT. LTD,	India	Approved
		MANISHA COMPOSITEKS PVT LTD	India	Approved
		SUCHITRA INDUSTRIES	India	Approved
28	SOLENOID VALVES	Already Given in BHEL-TRICHY-VALVES List		

9/4/15

Chief Engineer/TPC

BHEL TRICHY

TSGENCO-1x800 MW Kothagudem TPS

Approved Vendor List for Bought-Out

Sl No	Item	Vendor Name	Country	TSGENCO Remarks
1	ACTUATOR: ELECTRICAL REGULATOR	AUMA (INDIA) PRIVATE LIMITED,	India	Approved
		LIMITORQUE INDIA LTD.,	India	Approved
		ROTORK CONTROLS LIMITED	United Kingdom	Approved
		ROCKWELL AUTOMATION		Approved
2	ACTUATOR: PNEUMATIC	INSTRUMENTATION LTD.,	India	Approved
		KELTRON CONTROLS,	India	Approved
		ROCKWELL AUTOMATION		Approved
3	LT-PVC CONTROL CABLE	CORDS CABLE INDUSTRIES LIMITED.,	India	Approved
		DELTON CABLES LIMITED,	India	Approved
		KEC INTERNATIONAL LIMITED,	India	Approved
		KEI INDUSTRIES LIMITED,	India	Approved
		POLYCAB WIRE PVT. LTD,	India	Approved
4	LT-XLPE POWER CABLE	CORDS CABLE INDUSTRIES LIMITED.,	India	Approved
		DELTON CABLES LIMITED,	India	Approved
		KEI INDUSTRIES LIMITED	India	Approved
		POLYCAB WIRE PVT. LTD,	India	Approved
5	INSTRUMENTATION/ SCREENED/ SHIELDED/ COMPENSATING/ EXTENSION CABLES	CORDS CABLE INDUSTRIES LIMITED.	India	Approved
		DELTON CABLES LIMITED,	India	Approved
		POLYCAB WIRE PVT. LTD,	India	Approved
6	AIR FILTER REGULATOR	Already given in BHEL-TRICHY-VALVES List		
7	PANELS: R.LOGIC/AC CONTROL SUPPLY PANEL	C & S ELECTRIC LTD.,	India	Approved
		CONTROLS & SCHEMATICS LIMITED,	India	Approved
8	PANELS: MCC/PCC	C & S ELECTRIC LTD.,	India	Approved
		LARSEN & TOUBRO LTD.(CTRL & AUTOMN.	India	Approved
9	ORIFICE PLATE ASSY	ASIAN INDUSTRIAL VALVES AND INSTRUM	India	Approved
		GENERAL INSTRUMENTS CONSORTIUM,	India	Approved
		INSTRUMENTATION LTD.,	India	Approved
		MICRO PRECISION PRODUCTS (P) LTD,	India	Approved
10	CCTV SYSTEM	Already given in BHEL EDN-List	Sweden	
11	FLOW NOZZLES	ASIAN INDUSTRIAL VALVES AND INSTRUM	India	Approved
		GENERAL INSTRUMENTS CONSORTIUM,	India	Approved
		INSTRUMENTATION LTD.,	India	Approved
		MICRO PRECISION PRODUCTS (P) LTD,	India	Approved
12	DP GAUGES	Already Given in BHEL-EDN List		
13	PRESSURE GAUGES	Already given in BHEL-EDN List		
14	CABLE TRAY	INDIANA GRATINGS PVT.LTD.,	India	Approved
		JAMNA METAL COMPANY	India	Approved
		PATNY SYSTEMS PVT LTD	India	Approved

BHEL TRICHY

TSGENCO-1x800 MW Kothagudem TPS

Approved Vendor List for Bought-Out

15	REFERENCE JUNCTION	ABB LIMITED,	India	Approved
17	TEMPERATURE GAUGES	Already given in BHEL-EDN List		
18	LOCAL INSTRUMENT ENCLOSURE	CHEMIN CONTROLS AND	India	Approved
		INSTRUMENTATION LTD.	India	Approved
		PRAMMEN INDUSTRIES,	India	Approved
		PYROTECH ELECTRONICS P.LTD(UNIT II	India	Approved
19	LOCAL INSTRUMENT RACK	CHEMIN CONTROLS AND	India	Approved
		INSTRUMENTATION LTD.	India	Approved
		PRAMMEN INDUSTRIES,	India	Approved
		PYROTECH ELECTRONICS P.LTD(UNIT II	India	Approved
20	LEVEL SWITCH	Already given in BHEL-EDN List		
21	MASS FLOW METER	ABB LIMITED,	India	Approved
		EMERSON PROCESS MANAGEMENT (INDIA)	India	Approved
		ENDRESS + HAUSER (INDIA) PVT.LTD.,	India	Approved
		ENDRESS + HAUSER GMBH + CO	Germany	Approved
		GE INDIA INDUSTRIAL PVT. LTD.,	India	Approved
		YOKOGAWA INDIA LIMITED,	India	Approved
22	ERV CONTROLLER	PRAMMEN INDUSTRIES,	India	Approved
		SAJAS ELECTRICALS, INDIA	India	Approved
		VEEVEE CONTROLS PVT LTD	India	Approved
23	SB FLOW SWITCH	CAMERON MEASUREMENT SYSTEMS,	United Kingdom	Approved
		SWITZER PROCESS INSTRUMENTS	India	Approved
24	L.T.MOTORS	BHARAT BIJLEE LIMITED,	India	Approved
		CROMPTON GREAVES LIMITED,	India	Approved
		KIRLOSKAR ELECTRIC CO.LTD.	India	Approved
25	PR & DP SWITCH	DELTA CONTROLS LIMITED	United Kingdom	Approved
		GENERAL INSTRUMENTS CONSORTIUM	India	Approved
		SWITZER PROCESS INSTRUMENTS	India	Approved
26	FLAME SCANNER CABLE	DELTON CABLES LIMITED,	India	Approved
		NICCO CORPORATION LTD.,	India	Approved
27	FRP JUNCTION BOX	K.S.INSTRUMENTS PVT. LTD,	India	Approved
		MANISHA COMPOSITEKS PVT LTD	India	Approved
		SUCHITRA INDUSTRIES	India	Approved
28	SOLENOID VALVES	Already Given in BHEL-TRICHY-VALVES List		

BHEL TRICHY

TSGENCO-1x800 MW Kothagudem TPS

Approved Vendor List for Bought-Out Items

Sl No	Ite	Vendor	Place/ Country	Remarks
1	BLOCK VALVE	AVCON CONTROLS PVT.LTD.,	India	Approved
		DRESSER VALVE INDIA PRIVATE LTD.,	India	Approved
		INSTRUMENTATION LTD.,	India	Approved
		MIL CONTROLS LIMITED	India	Approved
		SAMSON CONTROLS PRIVATE LIMITED	India	Approved
2	CONTROL VALVE	CONTROL COMPONENTS INC	USA	Approved
		DRESSER PRODUITS INDUSTRIELS S.A.S	France	Approved
		DRESSER VALVE INDIA PRIVATE LTD.,	India	Approved
		Fisher Sanmar Limited	India	Approved
		FLOWSERVE INDIA CONTROLS PVT.LTD.,	India	Approved
		INSTRUMENTATION LTD.,	India	Approved
		KOSO INDIA PRIVATE LIMITED.	India	Approved
		KOSO INDIA PVT LTD	India	Approved
		MIL CONTROLS LIMITED	India	Approved
3	INSULATION: CASTABLE REFRACTORY	ABS REFRACTORIES PVT.LTD.,	India	Approved
		BHASKAR REFRACTORIES&SW PIPES P LTD	India	Approved
		CALDERYS INDIA REFRACTORIES LTD.,	India	Approved
		CASTWEL INDUSTRIES	India	Approved
		DALMIA REFRACTORIES LIMITED	India	Approved
		INDUSTRIAL ASSOCIATES,	India	Approved
		MAHAKOSHAL REFRACTORIES PVT. LTD,	India	Approved
		SHARADAA CERAMICS PVT.LTD	India	Approved
		SOUVENIOR CERAMICS	India	Approved
		VISHVA VISHAL ENGINEERING LTD.,	India	Approved
		VISHWAKARMA REFRACTORIS PRIVATE	India	Approved
4	INSULATION: WOOL MATTRESS	LLOYD ROCKFIBRES LTD,	India	Approved
		ROCKWOOL (INDIA) LTD.,	India	Approved
		ROCKWOOL INDUSTRIES	India	Approved
5	INSULATION: POURABLE	BHASKAR REFRACTORIES&SW PIPES P LTD	India	Approved
		DALMIA REFRACTORIES LIMITED	India	Approved
6	HEA IGNITOR ASSY	DURAG INDIA INSTRUMENTATION PVT. L	India	Approved
		FIVES COMBUSTION SYSTEMS PVT. LTD	India	Approved
		HAMWORTHY COMBUSTION ENGINEERING LT	United Kingdom	Approved
		UNISON INDUSTRIES,	USA	Approved
7	SCANNER AIR FAN	AIR CONTROL & CHEMICAL ENGG.CO.LTD.	India	Approved
		AIROCHEM ENGINEERING COMPANY,	India	Approved
		C.DOCTOR INDIA PVT. LTD.,	India	Approved
		CB DOCTOR VENTILATORS PVT LTD.	India	Approved
		PATELS AIRFLOW LIMITED,	India	Approved
8	BOILER STARTUP CIRCULATION PUMP	HAYWARD TYLER LTD	United Kingdom	Approved
		KSB AKTIENGESELLSCHAFT	Germany	Approved
		METALKEM RESOURCES,	India	Approved
		TORISHIMA PUMP MFG CO.LTD	Japan	Approved
		V-FLO PUMPS & SYSTEMS,	China	Approved
9	HANDLING EQUIPMENT:	GRIP ENGINEERS PVT LTD,	India	Approved
		UNIVERSAL HOIST-O-FABRIK,	India	Approved

1X800MW TSGENCO KOTHAGUDEM TPS

APPROVED PEM VENDOR LIST

				Deviations
17	GCB	1	ABB SWITZERLAND LTD.,	Approved
		2	ALSTOM GRID SAS	Approved
18	PA SYSTEM	1	BYTE COMMUNICATIONS PVT.LTD	Credentials to be submitted
		2	CHASHMITA ENGINEERS PVT.LTD	Credentials shall be submitted
19	LT HR PVC CONTROL CABLE	1	CORDS CABLE INDUSTRIES LTD.	Approved
		2	DELTON CABLES LTD.	Approved
		3	Diamond Power Infrastructure Ltd	Approved
		4	GEMSCAB INDUSTRIES LTD.	Approved
		6	Havells India Limited	Approved
		7	KEI INDUSTRIES LTD.	Approved
		8	NICCO CORPORATION LTD.	Approved
		9	POLYCAB WIRES PVT. LTD.	Approved
		10	TORRENT CABLES LTD.	Approved
		11	THERMO CABLES LTD.	Approved
		12	UNIVERSAL CABLES LTD.	Approved

PACKAGE CATEGORY = Control & Instrumentation

S.NO	Package Name	S.NO	Vendor Name	TSGENCO REMARKS
1	FLOW ELEMENT-ORIFICE	1	INSTRUMENTATION LTD.	Approved
		2	MICRO PRECISION PRODUCTS PVT. LTD.	Approved
2	FLOW ELEMENT-NOZZLE	1	HYDROPNEUMATICS PVT. LTD.	Approved
3	CONTROL VALVE	1	INSTRUMENTATION LTD.	Approved
		2	MIL CONTROLS LTD.	Approved
4	ROTAMETER	1	EUREKA INDUSTRIAL EQUIPMENTS PVT.LTD.	Approved

7/4/11
Chief Engineer/TPC

1X800MW TSGENCO KOTHAGUDEM TPS

APPROVED PEM VENDOR LIST

		2	FLOWTECH INSTRUMENTS SERVICRS	Approved
		3	INSTRUMENTATION ENGINEERS PVT LTD	Approved
		4	SCIENTIFIC DEVICES (BOMBAY) PVT LTD,	Approved
5	ANNUBAR (DELTA TUBE) clarification raised on vendor	1	SWITZER INSTRUMENT LTD.	Approved
		2	STAR-MECH CONTROLS (I) PVT.LTD.	Approved
		3	TM TECNOMATIC SPA	Approved

Note: For the items which are not covered in this list, BHEL shall furnish the vendors to TSGENCO for Approval.

Chief Engineer/TPC

ANNEXURE III

FUNCTIONAL / PERFORMANCE / DEMONSTRATION GUARANTEE

The Bidder shall guarantee that the equipment offered shall meet the rating and performance requirements stipulated for various equipment covered in this specifications.
The guaranteed performance parameters furnished by the bidder in his offer, shall be without any tolerance values and all margins required for instrument inaccuracies and other uncertainties shall be deemed to have been included in the guaranteed figures.
The bidder shall demonstrate all the guarantees covered herein during demonstration test / PG test.
The various tests which are to be carried out during demonstration tests are listed in the specification. The guarantee tests shall be conducted by the bidder at site in presence of BHEL/ CUSTOMER. All costs associated with the tests shall be included in the bid price.
In case during demonstration test /PG test, it is found that the equipment/system has failed to meet the guarantees, the bidder shall carry out all necessary modifications and/or replacements to make the equipment/system comply with the guaranteed requirements at no extra cost to the BHEL/ CUSTOMER and re-conduct the demonstration test(s) / PG test with BHEL/ CUSTOMER's consent.

I. TECHNICAL GUARANTEES

SEWAGE TREATMENT PLANT

Out let quality to be demonstrated by bidder should meet the latest environmental norms by state government / MOEF / PCB or below mentioned desired quality whichever is stringent.

- BOD_5 : 20 mg/l
- COD : 100 mg/l
- TSS : 30 mg/l
- pH : 7 – 8
- Temperature : Ambient

In addition to the above all equipments / items shall be demonstrated by bidder for its rated capacity at site.

ANNEXURE IV

DRAWING DOCUMENTS DISTRIBUTION PROCEDURE

DISTRIBUTION SCHEDULE

S. No	Description	TSGENCO							CONSULTANT			Equipment Vendor	Remarks
		Director Projects	Director Technical	CE/Civil Thermal Projects Hyd.	CE/ TPC-1, Hyd	CE/ O&M/ KTPS	SE/ Civil KTPS	SE/E&M / KTPS	DE Constr. KTPS	Kolkata	HYD	KTPS		
A	**Letter Of Intent or Contract Documents**	1	1	1	S	1	2	2	1	1	1	1	2	
B	**Vendor Drawings**													
1.	Preliminary	1	1	1	2	1	1	2	2	12	1	-	S	
2.	Return preliminary with comments	-	-	1	2	1	1	1	1	S	1	-	1	
3.	Final and any revision thereof													
	a. Civil	1	1	6+1T	1	1	6+1T	1	-	2+1T	1	1	S	
	b. E&M	1	1	1	6+1T	1	1	6+1T	1	2+1T	1	1	S	
C.	**Design Drawings**													
1.	Preliminary													
	a. Civil	1	1	2	1	1	2	1	1	4	1	1	S	
	b. E&M	1	1	1	2	1	1	2	1	4	1	1	S	
2.	Released for construction													
	a. Civil	1	1	2	1	1	6	1	1	1	1	2	S	
	b. E&M	1	1	1	1	2	1	6	1	1	1	2	S	
3.	Return marked 'As built'													
	a. Civil	-	-	1	-	-	1	-	-	1	1	S	1	
	b. E&M	-	-	-	1	-	-	1	1	1	1	S	1	
4.	As built drawings													
	a. Civil	-	-	1+1T	-	2+1T	5+1T	-	1	1+1T	-	1	S	
	b. E&M	-	-	1	2+1T	2+1T	-	5+1T	1+1T	1+1T	-	1	S	

S. No	Description	TSGENCO								CONSULTANT			Equipment Vendor	Remarks
		Director Projects	Director Technical	CE/Civil Thermal Projects Hyd.	CE/ TPC-I, Hyd	CE/ O&M/ KTPS	SE/ Civil KTPS	SE/E&M / KTPS	DE Constr. KTPS	Kolkata	HYD	KTPS		
D	Progress Report Monthly													
1.	Equipment vendor	1	1	1	2	1	1	2	1	1	1	1	S	
2.	M/s DCPL, Kolkata	1	1	2	2	1	1	2	1	S	1	1	Nil	
E	Test & Inspection Reports													
1.	Equipment manufacturer													
	a. Civil	1	1	1	2	1	1	1	-	11	1	1	S	
s	b. E&M	1	1	-	2	1	-	1	1	11	1	1	S	
2.	M/s DCPL, Kolkata	1	1	-	2	1	-	1	1	S	-	1	-	
F	Instruction Manuals/Data Books													
1.	Equipment manufacturer													
	a. Civil	1	1	1+1T	1	1	6+1T	1	1	2+1T	1	1	S	
	b. E&M	1	1	-	3+1T	1	-	6+1T	2	3+1T	1	1	S	
2.	M/s DCPL, Kolkata	1	1	-	10+1T	1	-	15+1T	-	S	1	1	Nil	
G	M/s DCPL, Kolkata Criteria	1	1	1	8+1T	1	1	2	1	1	1	1	S	
H	Design Calculations	1	1	1	8+1T	1	1	2	1	1	1	1	S	
I	Final consulting Engineering Report	1	1	1	10	1	1	2	1	S	1	1	Nil	

S – Source, T – Transparency & Soft Copy on CD,

ANNEXURE V

PAINTING SPECIFICATION

TECHNICAL SPECIFICATION

FOR

PROTECTIVE LINING AND PAINTING

1.00.00 INTENT OF SPECIFICATION

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

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

2.00.00 CODES & STANDARDS

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

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

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

3.00.00 GENERAL REQUIREMENTS

3.01.00 The steel surface preparation prior to actual commencement of coating shall conform to SSPC SP 10 / NACE 2 / Sa2½ (near white metal) with sand blasting.

3.02.00 The contractor shall submit a detailed written description in the form of a manual covering coating equipment, procedures, materials inspection test, and repair etc. to Owner/Consultant for approval.

3.03.00 The contractor shall also provide copies of test reports from NABL approved laboratory (like National Test House, Kolkata) in support of the paint/primer materials to be used shall conform to the specification requirement.

3.04.00 The contractor shall also provide certificates from paint/primer manufacturer mentioning the batch numbers, date of manufacture and shelf life etc. of the materials to be used. In addition to that Manufacturing Quality Plan (MQP) and Field Quality Plan (FQP) shall also be submitted prior to commencement of supply of material and field application.

3.05.00 Paint/coating application work at site shall be done either by paint manufacturer or by their authorized applicator. The authorized applicator shall have proper training & certification from manufacturer. Applicator shall possess all the necessary specialized equipment and manpower experienced in similar job.

3.06.00 Applied coating shall be tested for dry film thickness, holiday (electrical inspection for continuity) and adhesion as per relevant standard such as SSPC PA 2, NACE RP 0274 and ASTM D 4541.

3.07.00 If necessary, the material may be heated and applied by airless spray / plural component spray system.

3.08.00 Manufacturer's specific recommendation, if any, shall be followed during application of lining / paints.

3.09.00 In areas where there is danger of spotting automobiles or other finally finished equipment or building by wind borne particles from paint spraying, a Purchaser approved method shall be adopted.

3.10.00 The colour scheme of the entire Plant, covered under this specification shall be approved by the Purchaser in advance before application.

3.11.00 All indoor and outdoor piping, insulated as well as uninsulated will have approved colour bands painted on the pipes at conspicuous places throughout the system, as approved by Purchaser.

3.12.00 Inside surfaces of vessels / tanks shall be protected by anticorrosive paints or rubber lining as required / specified elsewhere in the specification. External surfaces of all vessels / tanks shall be protected by anti corrosive painting.

3.13.00 For vessels / tanks requiring lining and epoxy painting all inside surface shall be blast cleaned using non-siliceous abrasive after usual wire brushing.

3.14.00 Natural rubber lining shall be provided on the inside of vessels / tanks as required / specified elsewhere in the specification, in three layers resulting in a total thickness not less than 4.5 mm.

3.15.00 Surface hardness of rubber lining shall be 65 +/- 5 deg. A (shore).

3.16.00 After the lining is completed, the vessels / tanks shall not be subjected to any prolonged exposure to direct sunlight in course of its transportation, erection etc. They shall not be stored in direct sunlight. No further lining or burning shall be carried out on the vessel, after application of the lining.

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

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

3.19.00 All insulated piping shall have aluminium sheet jacketing.

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

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

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

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

4.02.00 Surface Preparation

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

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

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

4.03.00 Painting

4.03.01 Specification for application of paints for external surfaces protection of vessels / tanks / equipment / piping / fittings / valves etc. to be installed indoor shall be as follows :

a) Surface preparation shall be done either manually or by any other approved method.

b) Primer Coat shall consist of one coat (minimum DFT of 50 microns) of chlorinated rubber based zinc phosphate.

c) Intermediate Coat (or Under Coat) shall consist of one coat (minimum DFT of 50 microns) of chlorinated rubber based paint pigmented with Titanium Dioxide.

d) Top Coat shall consist of one coat (minimum DFT of 50 microns) of chlorinated rubber paint of approved shade and colour with glossy finish.

e) Total DFT of paint system shall not be less than 150 microns.

4.03.02 Specification for application of paints for external surfaces protection of vessels / tanks / equipment / piping / fittings / valves etc to be installed **outdoor** shall be as follows :

a) Surface preparation shall be done by means of sand blasting, which shall conform to Sa 2-1/2 Swiss Standard.

b) Primer Coat shall consist of one coat (minimum DFT of 100 microns) of epoxy resin based zinc phosphate primer.

c) Intermediate Coat (or Under Coat) shall consist of one coat (minimum DFT of 100 microns) epoxy resin based paint pigmented with Titanium Dioxide.

d) Top Coat shall consist of one coat (minimum DFT of 75 microns) of epoxy paint of approved shade and colour with glossy finish. Additional one coat (minimum DFT of 25 microns) of Finish Coat of polyurethane shall be provided.

e) Total DFT of paint system shall not be less than 300 microns.

4.03.03 Specification for application of paints for external surfaces protection of steel pipes and fittings which are **buried underground / laid inside a hume pipe & or submerged Under Water and laid under Pipe Trenches** (in road/rail/pipe or trench crossings) shall be as follows :

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

4.03.04 Specification for application of paints for **internal surface protection of large diameter pipes** (sizes above 600 mm NB and above) if any, shall be as follows :

a) All Internal surfaces of steel pipes, fittings, specialties etc. buried underground or located within pipe trenches shall be given epoxy coating to protect them from (except for drinking water service, where the compatible painting shall be so selected to meet relevant quality standards) corrosion.

b) Internal surface of the pipe should be coated with one coat of two part epoxy primer with not less than 50 micron DFT (dry film thickness) followed by two part polyamide cured solvent less epoxy.

c) The minimum dry film thickness (DFT) of internal lining shall be 600 micron.

4.03.05 Specification for application of paints for protection of **internal surfaces of DM Water Storage Tank(s)** shall be as follows :

a) Primer - One coat of epoxy primer containing high level of Zinc Phosphate anticorrosive pigment. Total Dry Film Thickness (DFT) of primer shall not be less than 125 microns.

b) Finish Paint - Three (3) coats Polyamine HB Epoxy Paint. Total Dry Film Thickness (DFT) of finish paint shall not be less than 125 microns per coat.

c) Total thickness of primer and paint should not be less than 500 microns.

4.03.06 All motors, local push button stations, cable racks, structures used for supports etc. are to be painted with acid proof paint.

4.03.07 The following surfaces shall not be painted - stainless steel, galvanized steel, aluminum, copper, brass, bronze and other nonferrous materials.

4.03.08 No painting or filler shall be applied until all repairs, hydrostatic tests and final shop inspection are completed.

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

5.00.00 COATING PROCEDURE AND APPLICATION

5.01.00 Surface Preparation :

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

a) The blast pattern or profile depth shall be 40 to 100 micron and shall be measured by dial micrometer.

b) Before sand blasting is started or during blasting or coating, temperature of the pipe surface should be more than 3°C above dew point temperature. Blast cleaned surface should be primed within 4 hours and shall be protected from rainfall or surface moisture and shall not be allowed to flash rust. If the rust occurs, the surface again to be prepared by sand blasting or wire brushing.

5.02.00 Application of Epoxy Coating

a) Coating shall be applied when

i) When the pipe surface temperature shall be atleast 3°C above dew point temperature.
ii) The temperature of mixed coating material and the pipe at the time of application shall not be lower than 10°C or greater that 50°C.

b) Material preparation shall be in accordance with manufacturer's recommendations.

c) Application of epoxy coating system :

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

5.03.00 Application of PU Coating

a) PU coating shall be applied when the pipe surface temperature atleast 3°C above dew point temperature (when R.H is more than 85%).

b) Material preparation and application shall be done as per manufacturer recommendation.

6.00.00 TEST REQUIREMENTS :

6.01.00 Measurement of dry film thickness

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

6.01.01 Apparatus / Instrument:-

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

6.01.02 Procedures:-

a) Number of measurements:
For 100 square feet (9.29 square meters), five (5) spots per test area (each spot is 3.8 cm) in diameter. Three gauge readings per spot (average becomes the spot measurement).

b) If the structure is less than 300 square feet, each 100 square feet should be measured.

c) If the structure is between 300 and 1000 sq ft, select 3 random 100 square feet test areas and measure.

d) For structure exceeding 1000 square feet, select 3 random 100 square feet testing areas for the first 1000 sq ft and select 1 random 100 square feet testing area for each additional 1000 square feet

e) Coating thickness Tolerance: Individual reading taken to get a representative measurement for the spot are unrestricted (usually low or high readings are discarded). Spot measurements (the average of 3 gauge readings) must be within 80% of the minimum thickness and 120% of the maximum thickness. Area measurement must be within specified range.

6.02.00 Electrical Inspection (Holiday) Test

6.02.01 All the coated / lined pipes shall be tested with an approved high voltage holiday detector preferably equipped with an audio visual signaling device to indicate any faults, holes, breaks or conductive particles in the protective coating.

6.02.02 The applied output voltage of holiday detector shall have a spark discharge of thickness equal to at least twice the thickness of the coating to assure adequate inspection voltage and compensate for any variation in coating thickness. The electrode shall be passed over the coated surface at approximately half the spark discharge distance from the coated surface only one time at the rate of approximately 10 to 20m/min. The edge effect shall be ignored. Excessive voltage shall be avoided as it tends to induce holiday in the coated surface thereby giving erroneous readings.

6.02.03 While selecting test voltages, consideration should be given to the tolerance on coating thickness and voltage should be selected on the basis of maximum coating thickness likely to be encountered during testing of a particular pipe.

The testing voltage shall be calculated by using following formula. (as per NACE 0274 : 2004)

Testing Voltage V = 7900 $\sqrt{T}$ ± 10 percent where T is the average coating thickness in mm.

6.02.04 Any audio visual sound or spark leads to indicate pinhole, break or conductive particle.

6.03.00 Adhesion Pull off Test :

After holiday the coated surface is subjected to adhesion pull off test as per ASTMD 4541.

6.03.01 Apparatus / Instrument: Adhesion tester consists of three basic components:

A hand wheel, a black column containing a dragging indicator pin and scale in the middle and a base containing three legs and a pulling “Jaw” at the bottom and also dollies.

6.03.02 Prepare the test surface :

Once test area is selected, test area shall be free of grease, oil, dirt, water. The area should be flat surfaces and large enough to accommodate the specified number of replicate test.

6.03.03 Prepare Dolly (Test Pull Stub) :

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

6.03.04 Select an adhesive:

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

6.03.05 Attach the dolly to the surface.

a) Using a wooden stick, apply an even layer of adhesive to the entire contact surface area of the dolly.

b) Carefully remove the excessive adhesive by using a cotton swab. Allow the adhesive to fully cure before performing the adhesion test.

c) Attach the dolly to the coated surface and gently push downward to displace any excessive adhesive.

d) Push the dolly inward against the surface, then apply tape across the head of the dolly.

6.03.06 Adhesion Test Procedure

a) Attach the adhesion tester to the dolly by rotating the hand wheel counter clockwise to lower the jaw of the device.

b) Slide the jaw completely under the head of the dolly. Position the three legs of the instruments so that they are sitting flat on the coated surface.

c) Slide the dragging indicator pin on the black column to zero by pushing it downward.

d) Firmly hold the base of the instrument in one hand and rotate the handwheel clockwise to raise the jaw of the device that is attached to the head of the dolly. The dragging indicator pin will move upward on the black column as the force is increased and will hold the reading. Apply the tension using a moderate speed. Continue to increase the tension on the head of the dolly until (a) the minimum PSI/MPa/Kg/cm² required by project specification is exceeded and the test is discontinued, (b) the maximum PSI/MPa/Kg/cm² of adhesion tester has been achieved and dolly is still attached, (c) The force applied by the adhesion tester causes the dolly to dislodge.

e) Read the scale and record the adhesion value.

6.04.00 Coating Repair

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

6.04.01 Surface Preparation:

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

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

6.04.03 Coating Application :

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

6.04.04 Repair Inspection :

Repaired portion shall be electrically inspected using a holiday detector.

6.05.00 Welded Field Joints

6.05.01 Preparation :

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

6.05.02 Electrical Inspection :

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

7.00.00 INFORMATION/DATA REQUIRED

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

8.00.00 Bidder shall provide one final coat additionally of same DFT as specified in this painting specification of tender specification at site after completion of erection of each equipment / item.

ANNEXURE VI

MANDATORY SPARES LIST

1. VERTICAL SUMP PUMPS – (FOR EACH TYPE AND SIZE)

Sl. No.	Name of Items	Unit	QUANTITY
i.	Complete Casing including suction (if applicable) bell	Set	1
ii.	Impeller	Set	1
iii.	Impeller key	Number	1
iv.	Wearing rings (Impeller & Casing ; as applicable)	Set	2
v.	Impeller Shaft, line shaft and head shaft	Set	1
vi.	Shaft Sleeves	Set	2
vii.	Stuffing box	Set	1
viii.	Coupling between Pump & motor, bushes, pins with all fasteners & coupling Guards.	Set	1
ix.	Line Shaft Couplings (if applicable)	Set	1
x.	Impeller, Line and Head shaft bearings (as applicable)	Set	1
xi.	Gland Packing & Gland Assembly	Set	1
xii.	Mechanical seal as applicable	Set	1

2. HORIZONTAL CENTRIFUGAL PUMPS (FOR EACH TYPE AND SIZE)

Sl. No.	Name of Items	Unit	QUANTITY
i.	Impeller for each type	Set	1
ii.	Wearing rings – Impeller for each type (if applicable)	Set	1
iii.	Wearing rings – Casing for each type (if applicable)	Set	1
iv.	Shaft for each type	Set	1
v.	Shaft Sleeves for each type	Set	1
vi.	Stuffing box for each type	Set	1
vii.	Coupling between Pump & motor, bushes, pins with all fasteners & coupling Guards	Set	1
viii.	Pump bearings for each type	Set	1
ix.	Gland Packing & Gland Assembly for each type	Set	1
x.	Mechanical seal as applicable	Set	1
xi.	Impeller key	Number	1

3. AGITATORS (FOR EACH TANK AS APPLICABLE)

Sl. No.	Name of Items	Unit	QUANTITY
i.	Agitator Assembly with Gear Box	Set	1

4. MOTOR

Sl. No.	Name of Items	Unit	QUANTITY
i.	Motor bearing for each type of pump	Set	1

5. VALVES AND PIPING

Sl. No.	Name of Items	QUANTITY
i.	Piping valves & traps - Complete assembly	5% or min. 1 no. (whichever is more) for each size, type & rating for total population

6. MANDATORY SPARES FOR CONTROL SYSTEM AND MEASURING INSTRUMENTS

Sl. No.	Name of Items	QUANTITY
6.1	**Mandatory Spares for Temperature Elements and Thermowells**	
6.1.1	Thermocouple / RTD elements (10% of each type and length of elements, or a minimum of one number, whichever is more.)	2 Lot
6.1.2	Thermowells for each type of temperature sensors (10% or a minimum of one for each type, whichever is more.)	2 Lot
6.2	**Mandatory Spares for Electronic Transmitters (for pressure, DP, Flow, level, Temperature) and Electrical Transducers.**	
6.2.1	Transmitters and Electrical Transducers (10% of total number of offered for each model and type for the project or a minimum of one number, whichever is more)	2 Lot
6.3	**Mandatory spares for local gauges/switch (for Pressure, DP, Temperature, Flow, level, etc.)**	
6.3.1	Local gauges/ Switch (for Pressure, DP, Temperature, Flow, level, etc.) (10% of total number of instruments offered for each model and type for the project or a minimum of one number, whichever is more.)	2 Lot
6.4	**Programmable Logical Control (PLC)**	
6.4.1	Function controller and control modules (10% of number for each type or minimum of 4 number for each type whichever is high.)	2 Lot
6.4.2	Process I/O cards and drive modules (10% of the number of cards offered for the project from each category.)	2 Lot
6.4.3	All other type of electronic modules like CPU of workstation, Power supply modules, communication modules, modules for Data highway / modules for LAN, controllers not covered above (10% of each type or minimum of 2 nos. of each type whichever is more).	2 Lot
6.4.4	All cards, controllers, lamp and other	2 Lot (10%)

	components used in LVS.	
6.4.5	Control logic power supply fuses at each current rating (Three times the one hundred percent spare replacement).	2 Lot
6.4.6	Electric to pneumatic converters (10% of each type utilized with automatic control system using pneumatic drives or a minimum of one of each type, whichever is more.)	2 Lot
6.4.7	Plug-in type keyboard	2 No. of each type
6.4.8	Dot matrix Printer	2 No.
6.4.9	CRT	2 No.
6.4.10	DVDs	40 Nos.
6.4.11	Printer ribbons /inking mechanism for colour printer.	20 Nos.
6.4.12	Ribbons for dot matrix printer.	60 Nos.
6.4.13	Data highway cable with adequate connectors.	500 meters
6.4.14	Hard disc drive unit as offered for system complete with accessories.	2 No.
6.4.15	Interface cables for each type	4 Sets
6.4.16	Power supply modules of each type and rating	2 Lot (10%)
6.4.17	Interposing / coupling relays of each type.	2 Lot (5% of total quantity)
6.5	**MANDATORY SPARES FOR UN-INTERRUPTIBLE POWER SUPPLY SYSTEM**	
6.5.1	Fuses (3 times, the one hundred percent spare replacement fuses shall be furnished with each panel board.)	2 Lot
6.5.2	Electronic modules for UPS , Charger, static switch & stabilzer and DC power supply system with each set consisting of at least one number of each type of electronic module for inverters, chargers, static switch, stabiliser etc.	2 Set
6.5.3	Battery cells	2 Lot (10%)
6.5.4	Thyrister without heat sink	2 Lot (10%)
6.5.5	Semiconductor fuse	2 Lot (10%)
6.6	**Mandatory Spares for Control Panels / Desks**	
6.6.1	Crimping Pins	2 Rolls
6.6.2	Bulbs for indicating lights (Three times the one hundred percent spare replacement)	2 Lot
6.6.3	control circuit fuses of each current rating (Three times, the one hundred percent spare replacement)	2 Lot
6.6.4	Push buttons, electrical control switches and Illuminated push buttons etc	Lot (20%)

7. HORIZONTAL SCREW PUMPS (FOR EACH TYPE AND SIZE)

Sl. No.	Name of Items	Unit	QUANTITY
i.	Shaft for each type	Set	1
ii.	Shaft Sleeves for each type	Set	1
iii.	Coupling between Pump & motor, bushes, pins with all fasteners & coupling Guards	Set	1

iv.	Pump bearings for each type	Set	1
v.	Gland Packing & Gland Assembly for each type	Set	1

8. AIR BLOWER (FOR EACH TYPE AND SIZE)

Sl. No.	Name of Items	Unit	QUANTITY
i.	V Belt	Set	1
ii.	Oil seal	Set	1
iii.	Filter	Set	1
iv.	Bearings for Blower	Set	1

9. LIST OF MANDATORY SPARES FOR HOIST AND CHAIN PULLEY BLOCK

Sl. No.	Name of Items	QUANTITY
ELECTRIC HOIST (for each type and rating, hoists)		
1.	**Mechanical Items**	
1.1	Bearings for long travel wheels	2 sets
1.2	Bearings for gear boxes for each type of hoist	2 sets
1.3	Break liners for all the brakes	100% of total population of each type & size
1.4	Oil seals	100% of total population of each type, size rating
1.5	Brake springs for all brakes	-do-
1.6	Wire ropes for hooks	100% installed on each crane and hoist
1.7	Solenoid coils for brakes	2 sets
1.8	Overload relay for motors	2 Nos.
1.9	Limit switches for hoists and travel mechanisms	2 sets
1.10	Spare motors for hoists	2 Nos.
1.11	Long travel machinery	
1.12	i. Gear wheel	1 set
1.13	ii. Internal clip	2 Nos.
1.14	iii. Pinion	1 No.
2.	**Electrical Items**	
2.1	415 Volt Motor (Upto 30 KW Rating)	
2.2	Driving End & Non-Driving End Bearing	3 Set for each type and rating of Motor
2.3	Cooling Fan	2 Nos. for each type and rating of Motor
2.4	Motor Terminal Block	5 Nos. for each type and rating of Motor
2.5	Complete Set of Coupling	1 Set of each application
3.	**C&I Items**	
3.1	Back-up panel mounted devices (Selector switches/ Push buttons/ Indicators etc.	5% of installed capacity

3.2	Lamps/ LEDs	10% of the total quantity
3.3	Blank Tiles	10% of installed capacity
3.4	MCBs	10% of each type & rating
3.5	Fuses/ Fuse holder	10% of each type & rating
Chain pulley block (for each capacity and type of chain pulley blocks)		
i	Load chain wheel	1 No.
ii	Load chain stripping fork	5 Nos.
iii	Hand chain wheel	2 Nos.
iv	Ratchet pawl	1 No.
v	Locking ratchet wheel	2 Nos.
vi	Guide roller	2 Nos.
vii	Brake disc	2 Nos.

NOTES FOR ELECTRIC HOIST AND CHAIN PULLEY BLOCK

1. "One (1) Set" and "One (1) set of each type & size" is defined as 100% requirement for one crane/hoist for the entire hoists of similar size & capacity. If two (2) cranes/hoist are of same capacity, the total quantity for both cranes/hoist shall be 100% quantity required for one hoist.
2. 100% of total population of each type, size and rating is defined as 100% requirement for one crane/hoist.
3. Applicable spares from the above list shall be provided as per specific design of the hoist supplier.

Notes:

i) Unless stated otherwise, a "set" or "Lot" means items required for complete replacement in one equipment of each type / size/ range.

ii) Wherever quantity has been specified as percentage (%), it shall mean percentage (%) of the population of the item required for one unit of 270 MW in the station (project), unless specified otherwise.

iii) The Mandatory spares for the equipment under the contract provided by the vendor will strictly conform to the specifications and documents and will be identical to the corresponding main equipment/components supplied under the contract.

iv) The quality plan and the inspection requirement finalized for the main equipment will also be applicable to the corresponding mandatory spares.

v) In case, mandatory spares are not applicable as per equipment / item selected, bidder has to provide equivalent mandatory spare as per for selected equipment / item in line with list of mandatory spares.

The vendor warrants:

1. That all spares supplied will be new and in accordance with the contract document and will be free from defects in design, material and workmanship and shall further guarantee as under:

2. In case of any failure in the original component/equipments due to faulty designs, materials and workmanship, the corresponding spare parts if any, supplied will be replaced without any extra cost to the BHEL and customer unless a joint examination and analysis by BHEL and/or customer of such spare parts prove that the defect found in the original part that failed can safely be assured not to be present in spare parts.

3. The long term availability of spares to the BHEL and the customer for the full life of the equipment covered under the contract and that before going out of production of spare parts of the equipment covered under the contract, vendor and his sub-vendors shall give the BHEL and the customer at least 24 (Twenty-Four) months advance notice so that the latter may order his bulk requirements of spares, if he so desires. The same provision will also be applicable to the sub-vendors. Further, in case of discontinuance of manufacture of any spares by the vendors or his sub-vendors the vendors and his sub-vendors, will provide the BHEL and the customer, 2 (two) years in advance, with full manufacturing drawings, material specifications and technical information required by the BHEL and the customer for the purpose of manufacture of such items and also the right to manufacture such spares for their own requirements.

4. Further in case of discontinuance of supply of spares by the vendors or his sub-vendors, the vendor will provide the BHEL and the customer with full information for replacement of such spares with other equivalent makes, if so required by the BHEL and the customer.

5. Notwithstanding the above, the vendor shall be responsible for supply of spares for the lifetime of the package at reasonable prices. The prices of all future requirements of spares shall be derived from the corresponding ex-works price at which the orders for such spares have been placed by the BHEL and the customer as a part of the mandatory or long term or any other kind of spares. The base indices for calculating ex-works price shall be commissioning of last equipment under main contract.

vi) The vendor will indicate the delivery period of the spares, which the BHEL and the customer may procure in accordance with this clause.

vii) In case of emergency requirements of spares, the vendor would make every effort to expedite the manufacture and delivery of such spares on the basis of mutually agreed time schedule.

viii) In case the vendor fails to supply the mandatory or long term or any other kind of spares on the terms stipulated above, the BHEL and the customer shall be entitled to purchase the same from the alternate sources at the risk and the cost of the vendor and recover from the vendor, the excess amount paid by the BHEL and the customer over the rates as per the contract. In the event of such risk purchase by the BHEL or the customer, the purchases will be as per the works and procurement policy of the BHEL and the customer prevalent at the time of such purchases and BHEL & the customer at his option may include a representative from the vendor in finalizing the purchases.

ix) It is expressly understood that the final settlement between the parties in terms of relevant clauses of the tender document shall not relieve the vendor of any of his obligations under the provision of long term availability of spares and such provisions shall continue to be enforced till the expiry of 30 (thirty) years period reckoned from the scheduled date of completion of trial operation of the last equipment unless otherwise discharged expressly in writing by the BHEL or the customer.

ANNEXURE VII

DRAWING/DOCUMENTS SUBMISSION SCHEDULE

Sl No	DOCUMENT / DRAWING NO.	DRAWING / DOCUMENT TITLE	SCHEDULE OF SUBMISSION FROM LOI (IN WEEKS)	SIZE
1	PE-V0-411-673A-A017	INSTRUMENT SCHEDULE SEWAGE TREATMENT PLANT	12	A4
2	PE-V0-411-673A-A016	DATA SHEET OF AGITATOR FOR SEWAGE TREATMENT PLANT	10	A4
3	PE-V0-411-673A-A005	MECH. GA DRAWINGS OF ALL SEWAGE SUMPS AND TANKS FOR SEWAGE TREATMENT PLANT	10	A1
4	PE-V0-411-673A-A040	QAP FOR CONTROL CABLE & SCREENED CONTROL CABLES	10	A4
5	PE-V0-411-673A-A021	VALVE SCHEDULE SEWAGE TREATMENT PLANT	12	A4
6	PE-V0-411-673A-A019	ELECTRICAL LOAD DATA SEWAGE TREATMENT PLANT	8	A4
7	PE-V0-411-673A-A020	OPERATION & CONTROL PHILOSOPHY SEWAGE TREATMENT PLANT*	6	A4
8	PE-V0-411-673A-A022	O & M MANUAL FOR SEWAGE TREATMENT PLANT	24	A4
9	PE-V0-411-673A-A039	DATA SHEET CONTROL CABLE & SCREENED CONTROL CABLES	10	A4
11	PE-V0-411-673A-A015	TECHNICAL DATA SHEET FOR METERING PUMPS FOR SEWAGE TREATMENT PLANT	10	A4
12	PE-V0-411-673A-A034	MECH. GA OF CLARIFIER FOR SEWAGE TREATMENT PLANT	10	A1
13	PE-V0-411-673A-A013	TECHNICAL DATA SHEET- INSTRUMENTS SEWAGE TREATMENT PLANT	10	A4
14	PE-V0-411-673A-A004	YARD PIPING LAYOUT OF STP	16	A1
15	PE-V0-411-673A-A001	P&I DIAGRAM FOR SEWAGE TREATMENT PLANT*	4	A1
16	PE-V0-411-673A-A010	DATA SHEET OF VALVES SEWAGE TREATMENT PLANT	10	A4
17	PE-V0-411-673A-A027	QAP FOR METERING PUMPS WITH MOTOR FOR SEWAGE TREATMENT PLANT	10	A4
18	PE-V0-411-673A-A038	PLC DOCUMENTS FOR STP -PLC CONFIGURATION DIAGRAM, DATA SHEET FOR PLC, GA & WIRING DETAILS FOR PLC PANEL, I/O LIST, BOM, MIMIC DIAGRAM, SCADA SCREEN , LIST FOR SIGNALS EXCHANGE WITH DDCMIS (BOTH HARDWIRED & SERIAL INTERFACE IN BHEL	12	A4
19	PE-V0-411-673A-A032	ENGINEERING BOQ FOR SEWAGE TREATMENT PLANT	20	A4
21	PE-V0-411-673A-A018	CABLE SCHEDULE FOR SEWAGE TREATMENT PLANT	16	A4
22	PE-V0-411-673A-A008	PROCESS DESIGN AND SIZING CALCULATION INCLUDING PRESSURE DROP CALCULATIONS (STP)*	4	A4

23	PE-V0-411-673A-A036	TECHNICAL DATA SHEET OF MOTOR FOR SEWAGE TREATMENT PLANT	10	A4
24	PE-V0-411-673A-A023	PAINTING SCHEDULE FOR SEWAGE TREATMENT PLANT	10	A4
25	PE-V0-411-673A-A025	SUB VENDOR LIST & INSPECTION CRITERIA FOR SEWAGE TREATMENT PLANT*	4	A4
26	PE-V0-411-673A-A026	QAP FOR SUBMERSIBLE WITH MOTOR SEWAGE TREATMENT PLANT	10	A4
27	PE-V0-411-673A-A011	TECHNICAL DATA SHEET OF SUBMERSIBLE PUMPS SEWAGE TREATMENT PLANT	10	A4
28	PE-V0-411-673A-A035	QAP FOR VALVES SEWAGE TREATMENT PLANT	10	A4
29	PE-V0-411-673A-A037	CABLE TRAY/ TRENCH & CONDUIT ROUTING DIAGRAM OF STP	12	A1
30	PE-V0-411-673A-A003	PIPING LAYOUT OF STP (INSIDE AREA)	10	A1
31	PE-V0-411-673A-A012	TECHNICAL DATA SHEET OF SCREW AND HORIZONTAL CENTRIFUGAL PUMPS FORSEWAGE TREATMENT PLANT	10	A4
32	PE-V0-411-673A-A028	QAP FOR BLOWERS WITH MOTOR FOR SEWAGE TREATMENT PLANT	10	A4
33	PE-V0-411-673A-A002	EQUIPMENT LAYOUT OF SEWAGE TREATMENT PLANT*	4	A1
34	PE-V0-411-673A-A029	QAP FOR PLC SEWAGE TREATMENT PLANT	12	A4
35	PE-V0-411-673A-A014	TECHNICAL DATA SHEET OF BLOWERS SEWAGE TREATMENT PLANT	10	A4
36	PE-V0-411-673A-A031	PG TEST FOR SEWAGE TREATMENT PLANT	20	A4
37	PE-V0-411-673A-A033	QAP FOR LAMELLA CLARIFIER TUBE SETTLER FOR SEWAGE TREATMENT PLANT	10	A4

*Basic Engineering documents

Notes:

1. The above drawing list is tentative and shall be finalized with the successful bidder after placement of order. While some of the drawings indicated above may not be applicable, some additional drawings may also be required based on scope of work.
2. Drawings shall be prepared in Auto-Cad latest edition. Required no. of hard and soft copies (editable) of the drawings shall be furnished as per requirement specified elsewhere in the specification.
3. Only manual calculation with authentic supporting literature (e.g. extracts of hand Book/ standard/codes) shall be acceptable. All design calculations and drawings shall be in SI system only.
4. All the drawings and documents including general arrangement drawing, data sheet, calculation etc. to be furnished to the customer during detailed engineering stage shall include / indicate the following details for clarity w.r.t. Inspection, construction, erection and maintenance etc.: -

    a) All drawings and documents shall indicate the list of all reference drawings including general arrangement.

    b) All drawings shall include / show plan, elevation, side view, cross - section, skin section, blow - up view; all major self-manufactured and bought out items shall be labeled and included in BOQ / BOM in tabular form.

    c) Painting schedule shall also be made as a part of general arrangement drawing of each equipment / items indicating at least 3 trade names.

d) All the drawings required to be furnished to customer during detailed engineering stage shall include technical parameters, details of paints and lubrication, hardness and BOQ / BOM in tabular form indicating all major components including bought out items and their quantity, material of construction indicating its applicable code / standard, weight, make etc.

e) Drawings/ documents to be submitted for purchasers review/ approval shall be under Revision A, B, C… etc. while drawings /documents to be submitted thereafter for customer's approval after purchaser's approval shall be under R-0, 1, 2, 3 ….etc.

f) Drawings and documents not covered above but required to check safety of machines/ system, shall be submitted during detailed engineering stage without any commercial implication.

g) All drawings shall include "B.O.M" and indicate quantity, material of construction, make along with IS/BS No., Technical parameters, dimensions, hardness, machining symbol and tolerance, requirement of radiography and hydraulic tests, painting details, elevation, side view, plan, skin section and blow-up view for clarity.

h) All drawings shall be prepared as per BHEL's title block and shall bear BHEL's drawing No.

i) Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL's/ Customer's/ Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.

j) Bidder to follow the following the drawing submission schedule:

k) 1st submission of drawings from date of LOI as per the submission schedule.

l) Every revised submission incorporating comments – within 7 days.

m) Bidder to submit revised drawings complete in all respects incorporating all comments. Any incomplete drawing submitted shall be treated as non-submission with delays attributable to bidder's account. For any clarification/ discussion required to complete the drawings, the bidder shall himself depute his personal to BHEL for across the table discussions/ finalizations/ submissions of drawings.

5. Bidder to note that the successful bidder, during detail engineering, will submit the drg/doc through web based Document Management System in addition to hard copies to be submitted as per the Annexure III of this specification. Bidder would be provided access to the DMS for drg/doc approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end:

   - Internet explorer version – Minimum Internet Explorer 7
   - Internet speed – 2 mbps (Minimum preferred)
   - Pop ups from our external DMS IP (124.124.36.198) should not be blocked
   - Vendor's Internal proxy setting should not block DMS application's link (http://124.124.36.198/wrenchwebaccess/login.aspx)"
   - DMS user manuals to be used by BHEL PEM vendors for uploading, viewing, revising, commenting and tracking documents on PEM's DMS have been uploaded on PEM internet website (www.bhelpem.com) under the Vendor session.
   - For quick access bidder may refer the link http://bhelpem.com/DMSManuals/DMSManuals.html

ANNEXURE VIII

LIST OF TOOLS & TACKLES (AS APPLICABLE)

Bidder to consider necessary tools and tackles for mechanical, electrical and control & instrument as per their system requirement. In addition, bidder to adhere relevant clauses of tender specification also.

ANNEXURE IX

FORMAT FOR OPERATION AND MAINTENANCE MANUAL

Bidder to submit operation and Maintenance manual with minimum information as listed in below check list during contract stage.

Check List for Operation & Maintenance Manual

Project name :
Project number :
Package Name :
PO reference :
Document number :
Revision number :

Sl.no. & Sections	Description	Tick (√)if included in Manual			Remarks
		Yes	No	Not Applicable	
1.	Cover page				
1.1	Project Name				
1.2	Customer/consultant Name				
1.3	Name of Package				
1.4	Supplier details with phone, FAX ,email address , Emergency Contact number				
1.5	Name and sign of prepared by , checked by & approved by				
1.6	Revision history with approval Details				
2.0	Index				
2.1	showing the sections & related page nos All the pages should be numbered section wise				
3.0	Description of Plant/System				
3.1	Description /write up of operating principle of system equipment/ associated sub-systems & accessories/controls system , operating conditions, performance parameters under normal , start up and special cases				
3.2	Equipment list and basic parameter with Tag numbers				
3.3	Data sheets approved by Customer/for information and catalogues provided by original manufacturer				
3.4	Associated other packages and Interface /terminal points				
3.5	P&ID & Process Diagrams				
3.6	GA Layout drawings, As-built drawings , Actual photograph of items/system (Drawings of A2 & bigger sizes are to be attached in the last)				
3.7	Single line/wiring diagrams				
3.8	Control philosophy /control write-ups				
4.0	Commissioning Activities (if not covered in separate document i.e. erection manual, commissioning manual)				
4.1	Pre-Commissioning Checks				
4.2	handling of items at site				
4.3	Storage at site				

4.4	Unpacking & Installation procedure				
5.0	Operation Guidelines for plant personal/ user/ operator				
5. 1	Interlock & Protection logic along with the limiting values of protection settings for the equipment along with brief philosophy behind the logic, drawings etc. to be provided.				
5. 2	Start up, normal operation and shut down procedure for equipments along with the associated systems in step by step mode. Valve sequence chart, step list, interlocks etc. with Equipment isolating procedures to be mentioned.				
5. 3	Do's & Don't of the equipments.				
5. 4	Safety precautions to be taken during normal operation. Safety symbols, Emergency instructions on total power failure condition/lubrication failure/any other condition				
5. 5	Parameters to be monitored with normal values and limiting values				
5. 6	Trouble shooting with causes and remedial measures				
5. 7	Routine operational checks, recommended logs & records				
5. 8	Changeover schedule if more than one auxiliary for the same purpose is given				
5. 9	Painting requirement and schedule				
5. 10	Inspection, repair , Testing and calibration procedures				
6.0	Maintenance guidelines for plant personal				
6.1	List of Special Tools and Tackles required for Overhaul/Trouble shooting including special testing equipment required for calibration etc.				
6.2	Stepwise dismantling and re-assembly procedure clearly specifying the tools to be used, checks to be made, records to be maintained, clearances etc. to be mentioned. Tolerances for fitment of various components to be given.				
6.3	Preventive Maintenance & Overhauling schedules linked with running hours/calendar period along with checks to be given				
6.4	Long term maintenance schedules especially for structural, foundations etc.				
6.5	Consumable list along with the estimated quantity required during commissioning, normal running and during maintenance like Preventive Maintenances and Overhaul. Storage/handling requirement of consumables/self-life.				
6.6	List of lubricants with their Indian equivalent, Lubrication Schedule, Quantity required for each equipment for complete replacement is to be given				
6.7	List of vendors & Sub-vendors with their latest addresses, service centers ,Telephone Nos.,				

	Fax Nos., Mobile Nos., e-mail IDs etc.				
6.8	List of mandatory and recommended spare parts list				
6.9	Tentative Lead time required for ordering of spares from the equipment supplier				
6.10	Guarantee and warranty clauses				
7.0	**Statutory and other specific requirements considerations.**				
8.0	**List of reference documents**				
9.0	**Binding as per requirement**				

ANNEXURE X

SITE STORAGE AND PRESERVATION

CONTENT

1. SCOPE OF THE DOCUMENT

This guideline is prepared in intent to provide proper site storage and preservation of the Mechanical, Electrical and C & I items / equipment supplied under various bought out packages/items. This storage procedure shall be followed at different power plant sites by concerned agency for storage and preservation from the date of equipment received at site until the same are erected and handed over to the customer.

2. PURPOSE OF STORAGE & PRESERVATION

Many of the items may be required to be kept in stores for long period. It shall therefore be essential that proper methods of storage and preservation be applied so that items do not deteriorate, loose some of their properties and become unusable due to atmospheric conditions and biological elements.

3. MEASURES TO BE TAKEN FOR STORAGE, HANDLING & PRESERVATION

a) GENERAL STORAGE REQUIREMENTS

1. To the extent feasible, materials should be stored near the point of erection. The storage areas should have adequate unloading and handling facilities with adequate passage space for movement of material handling equipment such as cranes, fork lift trucks, etc. The storage of materials shall be properly planned to minimise time loss during retrieval of items required for erection.
2. The outdoor storage areas as well as semi-closed stores shall be provided with adequate drainage facilities to prevent water logging. Adequacy of these facilities shall be checked prior to monsoon.
3. The storage sheds shall be built in conformity with fire safety requirements. The stores shall be provided with adequate lights and fire extinguishers. 'No smoking' signs shall be placed at strategic locations. Safety precautions shall be strictly enforced.
4. Adequate lighting facility shall be provided in storage areas and storage sheds and security personnel positioned to ensure enforcement of security measures to prevent theft and loss of materials.
5. Adequate number of competent stores personnel and security staff shall be deployed to efficiently store and maintain the equipment / material.
7. The equipment shall be stored in an orderly manner, preserving their identification slips, tags and instruction booklets, etc., required during erection. The storage of materials shall be equipment-wise. Loose parts shall be stored in sheds on racks,

preserving the identification marks and tags in good condition. The group codes shall be displayed on the racks

6. At no time shall any materials be stored directly on ground. All materials shall be stored minimum 200 mm above the ground preferably on wooden sleepers

b) GENERAL PRESERVATION REQUIREMENTS

1. All special measures to prevent corrosion shall be taken like keeping material in dry condition, avoiding the equipment coming in contact with corrosive fluid like water, acid etc.
2. Materials which carry protective coating shall not be wrapped in paper, cloth, etc., as these are liable to absorb and retain moisture. The material shall be inspected and in case of signs of wear or damages to protective coating, that portion shall be cleaned with approved solution and coated with an approved protective paint. Complete record of all such observations and protective measures taken shall be maintained.
3. Generally equipment supplied at site are properly greased or rust protective oil is applied on machined/ fabricated components. However periodic inspection shall be carried out to ensure that protection offered is intact.
4. While handling the equipment, no dragging on the ground is permitted. Avoid using wire rope for lifting coated components. Use polyester slings (if possible) otherwise protective material (e.g. clothes, wood block etc.) should be used while handling the components with rope / slings
5. For Equipment supplied with finished paint, touch paint shall be done in case any surface paint gets peeled off during handling. Otherwise such surfaces shall necessarily be wrapped with polythene to avoid any corrosion. Further for equipment wherein finish coat is to be applied at site, site to ensure that equipment is received with primer coat applied.
6. It shall be ensured by periodic inspection that plastic inserts are intact in tapped holes, wherever applicable.
7. Pipes shall be blown with air periodically and it shall be ensured that there is no obstruction.
8. Silica gel or approved equivalent moisture absorbing material in small cotton bags shall be placed and tied at various points on the equipment, wherever necessary.
9. Heavy rotating parts in assembled conditions shall be periodically rotated to prevent corrosion/jamming due to prolonged storage.

10. All the electrical equipment such as motors, generators, etc. shall be tested for insulation resistance at least once in three months and a record of such measured insulation values shall be maintained.

11. Following preservatives/preservation methods can be used depending upon type of equipment

    a. Rust preventive fluid (RPF)

    b. Rust protective paints

    c. Tarpaulin covers, in case of outdoor storage

    d. De-oxy aluminate for weld-ments

c) GENERAL INSPECTION REQUIREMENTS

1. Period inspection of materials with specific reference to –

   - Ingress of moisture and corrosion damages.
   - Damage to protective coating.
   - Open ends in pipes, vessels and equipment -
     - In case any open ends are noticed, same shall be capped.

2. Any damages to equipment / materials.

   - In case of any damages, these shall be promptly notified and in all cases, the repairs / rectification shall be carried out.
   - Any items found damaged or not suitable as per project requirements shall be removed from site. If required to store temporarily, they shall be clearly marked and stored separately to prevent any inadvertent use.

4. TYPE OF STORAGE FOR VARIOUS EQUIPMENT

The types of storage are broadly classified under the following heads:

i **Closed storage with dry and dust free atmosphere**. (C)

The closed shed can be constructed by using cold-rolled / tubular components for structure and corrugated asbestos sheets / galvanised iron sheets for roofing. Brick walls / asbestos sheets can be used to cover all the sides. The floor of the shed can be finished with plain cement concrete suitably glazed. The shed shall be provided with proper ventilation and illumination.

ii **Semi-closed storage**. (S)

The semi closed shed can be constructed by using cold-rolled / tubular components for structure and corrugated / asbestos sheets for roofing. The floor shall be brick paved. If required a small portion of sides can be covered to protect components from rainwater splashing onto the components.

iii Open storage (O)

The open yard shall be levelled, well consolidated to achieve raised ground with the provision of feeder roads for crane approach along with access roads running all sides. One part of the open yard shall be stone pitched, levelled and consolidated with raised ground suitable for storing / stacking heavier and critical components with due space to handle them by cranes etc . Adequate number of sleepers, concrete block etc. to be provided to make raised platforms to stack critical materials.

A separate yard to be identified as "scrap yard" slightly away from main open yard to store wooden/steel scraps, which are to be disposed off. This is required to avoid mix up with regular components as well as to avoid fire hazard.

Some of the components, which are having both machined & un-machined surfaces and are bulky, shall be stored in open storage area on a raised ground and suitably covered with water proof / fire retardant tarpaulin.

The equipment listed below shall be stored and inspected as per requirement mentioned in the table below.

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
Raw material /mechanical items like pipes, plates, structure sections etc.)				
1.	Steel pipes (lined/unlined)	S	Damage , paint, corrosion, rubber lining peeling	Provide end cap
2.	MS Plates	S	Damage, paint, corrosion	
3.	SS Plates	S	Damage	
4.	Non-metallic pipes	S	Damage, cracks	Provide end cap
5.	Stainless steel pipes	S	Damage ,	Provide end cap
6.	MS sections, beams	S	Damage, paint, corrosion	
7.	Cable trays	S	Damage, condition of preservations	
8.	Insulation sheets	S	Damage	
9.	Insulation	C	Damage, packing	
10.	Hangers Rods	S	Damage, paint, packing	
11.	Tubes	S	Damage, paint , packing	Provide end cap
12.	Hume pipes	O	Damage	
13.	Castings	O	Damage, paint, corrosion	
Fabricated mechanical items (pressure vessels, tanks etc.)				
14.	Pressure vessels (unlined)	O	Damage, paint, corrosion,	Covered nozzles
15.	Atmospheric storage tanks (unlined)	O	Damage, paint, corrosion	Covered nozzles

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
16.	Pressure vessels (lined)	S	Damage, paint, corrosion, rubber lining	
17.	Atmospheric storage tanks(lined)	S	Damage, paint, corrosion, rubber lining	
18.	Support structures	O	Damage , paint, corrosion	
19.	Flanges	C	Damage , paint, corrosion	
20.	Fabricated pipes	S	Damage , paint, corrosion	Provide end cap
21.	Vessels internals	C	Damage , paint, corrosion ,packing	
22.	Grills	S	Damage , paint, corrosion	
23.	Angles	S	Damage , paint, corrosion	
24.	Bridge mechanism/clarifier mechanism	O	Damage , paint, corrosion	
25.	Cranes, rails	S	Damage , paint, corrosion	
26.	Stair cases	O	Damage , paint, corrosion	
27.	Ladders/handrails	O	Damage , paint, corrosion	
28.	Fabricated ducts	S	Damage , paint, corrosion	
29.	Isolation Gates	O	Damage , paint, corrosion	
30.	Fabricated boxes/panels	S	Damage , paint, corrosion	
Mechanical components like valves, fittings, cables glands, spares etc.)				
31.	Valves	S	Damage , packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
32.	Fittings	S	Damage , packing	Provide end cap
33.	Cable glands	C	Damage , packing	
34.	Tools & tackles	C	Damage , packing	
35.	Nut , bolts, washers,	C	Damage , packing	
36.	Gasket & Packings	C	Damage , packing	
37.	Copper tubes	C	Damage , packing, corrosion	Provide end cap
38.	SS tubing	C	Damage , packing	Provide end cap
Rotating assemblies (pumps, blowers, stirrers, fans, compressors etc.)				
39.	Pumps	S	Damage , packing, corrosion	Shaft rotation
40.	Blowers/Compressors	S	Damage , packing, corrosion	Shaft rotation
41.	Agitators/stirrers/radial launders	C	Damage , packing, corrosion	Shaft rotation
42.	Rollers for chlorine tonner mounting	C	Damage , packing, corrosion	
43.	Centrifuge	S	Damage , packing,	
44.	Gear box	C	Damage , packing, corrosion	
45.	Bearings	C	Damage , packing, corrosion	
46.	Fans	S	Damage , packing, corrosion	
47.	Dosing skids	S	Damage , packing, corrosion	
48.	Pump assemblies	S	Damage , packing, corrosion	
49.	Air washers(INTERNALS)	S	Damage , packing	
50.	Air conditioners (split)	C	Damage , packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
51.	Elevators(CONTAINERIZED)	O	Damage , packing, corrosion	
52.	Chillers/VA machines	S	Damage , packing	
53.	Air handling Unit/Package unit	S	Damage , packing	
54.	Chlorinators & Evaporators	C	Damage , packing	
55.	Ejectors	C	Damage , packing	
56.	Electrolyser	C	Damage , packing	
Miscellaneous items like chain pulley blocks, hoists etc.				
57.	Chain pulley blocks	S	Damage, Packing	
58.	Electric hoists	S	Damage, Packing	
59.	Fire extinguishers	C	Damage, expiry date	
60.	Fork Lift Truck	S	Damage, Packing	
61.	Hydraulic Mobile Crane	O	Damage, Packing	
62.	Mobile Pick Up & Carry Crane	O	Damage, Packing	
63.	Motor boats	O	Damage, Packing	
64.	Safety showers	S	Damage, Packing	
65.	Diffusers/dampers	S	Damage, Packing	
Chemicals and consumables (acid, alkali, paints, oils, reagents and special chemicals)				
66.	Hydro Chloric Acid (HCl)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical
67.	Sulphuric acid (H_2SO_4)	Store in canes/ storage tank in dyke area	Date of production/ leakage/fumes	hazardous chemical

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
68.	Sodium hydroxide (NaOH)	Store in canes/ storage tank in dyke area	Date of production/ leakage/ fumes/ breather	hazardous chemical ,breather to be checked for air ingress
69.	Sodium hypo chlorite	To be stored under shed	Date of production/ leakage/ fumes	hazardous chemical ,self-life normally 15-30 days after which strength of chemical decays
70.	Ammonia	S	Date of production/ leakage/ fumes	Store in closed storage tanks, hazardous chemical
71.	CW treatment chemicals	S	Date of production , Self-life	Store in closed canes
72.	RO/UF cleaning chemicals	S	Date of production , Self-life	Store in closed canes
73.	Lime	C	Damage to packing , seepage	Prevent moisture, rain
74.	Alum bricks	C	Damage to packing	Prevent moisture, rain
75.	Poly electrolyte	S		Store in closed storage tanks
76.	Laboratory chemicals(powder)	C	Damage, Packing self-life	
77.	Laboratory chemicals(liquid)	C	Damage, Packing self-life	
78.	Lubrication oils	C	Leakage	
79.	Paints	S	Leakage ,air tightness	
80.	Sand	O	Damage of packing	No hooks
81.	Salt (NaCl)	C	Damage of packing, water ingress	Prevent moisture, rain
82.	Anthracite	S	Damage of packing	
83.	Activated carbon	S	Damage of packing	

Sl. No.	Description of the equipment	Type of Storage	Check for	Remarks
84.	Thermal insulation	S	Damage of packing	
85.	Cement	C	Damage of packing	Prevent moisture, rain
86.	Gravels	O	Damage of packing	
87.	ION exchange resins	C	Damage , packing	Refer manufacturer guidelines
88.	RO membranes	C	Damage , packing	Refer manufacturer guidelines
89.	UF membranes	C	Damage , packing	Refer manufacturer guidelines
90.	Cleaning chemicals	C	Damage , packing	Refer manufacturer guidelines
91.	Chemicals for analysers/calibration	C	Damage , packing	Refer manufacturer guidelines
Electrical and C & I items (motors, cables etc.)				
92.	Motors	C	Damage , packing	
93.	Cable drums	O	Damage	
94.	Control Panel /control desk, UPS ,JB	S	Damage, Packing	
95.	Instruments(gauges/analysers)	C	Damage	
Special items		As per Manufacturer's item, like Hydrogen cylinders, Ozonator, Analyser, Chlorine dioxide generators etc.		

5. CONCLUSION

Concerned storage agency at site should make sure that loss in equipment performance and wear & tear are minimised through proper storage and preservation. The above are broad guidelines and cover major equipment / materials. However specific storage practices shall be followed as per manufacturer recommendation. All the necessary measures even in addition to the ones mentioned above, if found necessary, should be taken to achieve the objective.

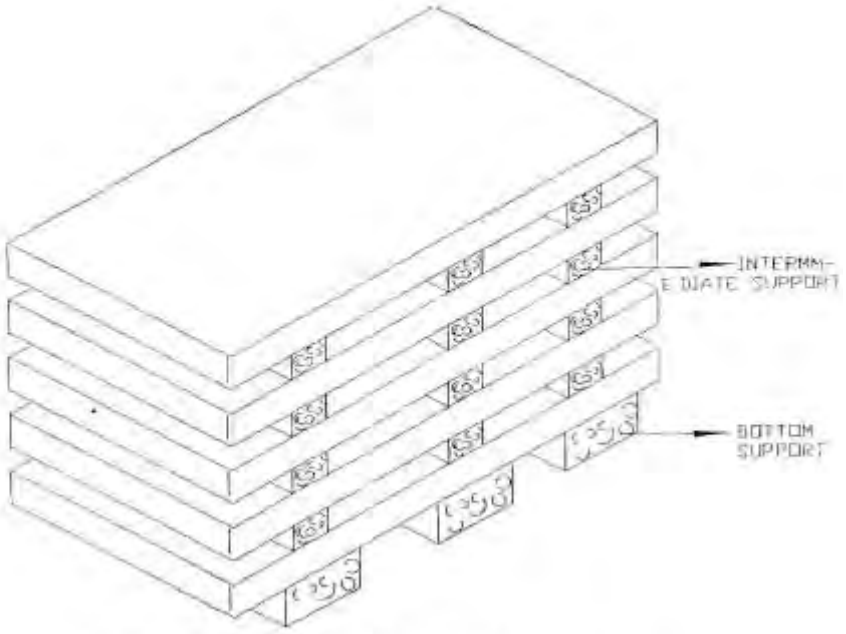

Figure – 1 – PLATE STACKING ARRANGEMENT

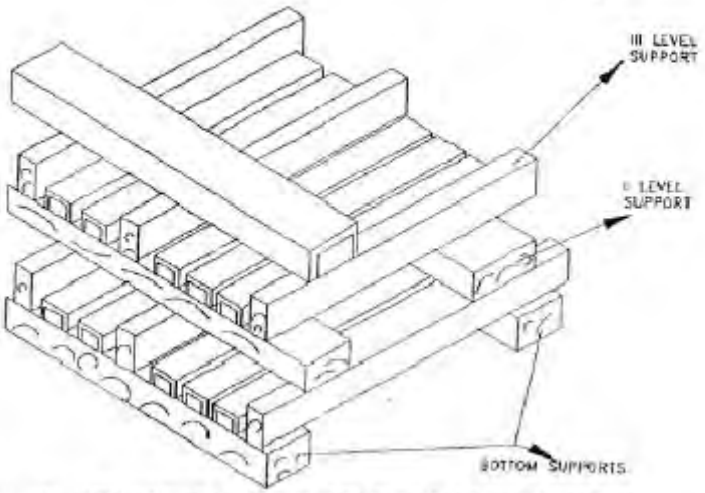

Figure – 2 – STRUCTURAL STEEL STACKING ARRANGEMENT