

to conduct certain type test specifically for this contract (and witnessed by employer or his authorized representative). Even if the same have been conducted earlier as clearly indicated subsequently such tests.

- B. For the rest, submission of type test, results, and certificates shall be acceptable provided following points
 - i. The same have been carried out by the bidder/ subvendor on exactly the same model/rating of equipment. (For control valves this shall be same size, type & design).
 - ii. There has been no change in the components from the offered equipments and tested equipments.
 - iii. The test has been carried out as per the latest standards along with amendments as on the date of bid opening.
- C. In case the approved equipment is different from the one on which the type test had been conducted earlier or any of the above grounds, then the tests have to be repeated and the cost of such tests shall be borne by the bidder/sub-vendor within the quoted price and no extra cost will be payable by the owner on this account.

17.02.05.1 As mentioned against certain items, the test certificates for some of the items shall be reviewed and approved by the main bidder or his authorized representative and balanced have to be approved by the employer.

The schedule of conduction of type test/submission of reports shall be submitted and finalized during pre award discussion.

17.02.05.2 For the type test to be conducted, bidder shall submit detailed test procedure for approval by owner. This shall clearly specify test setup, instruments to be used, procedure, acceptance norms (wherever applicable), recording of different parameters, intervals of recording precaution to be taken etc. for the test to be carried out.

17.02.05.3 SPECIAL REQUIREMENTS FOR SOLID STATE EQUIPEMNTS /SYSTEMS

The minimum type test report, over and above the requirements of above clause which are to be submitted for each of the major C&I systems like DDCMIS, DCS, PLC etc shall be as indicated below:

- i. Surge Withstand Capability (SWC) for solid state equipments/equipments

All solid state systems/equipments shall be able to withstand the electrical noise and the surges as encountered in actual service conditions and inherent in the power plant. All the solid states systems /equipments shall be provided with all required protection that needs the surge withstand capability as defined in ANSI 37.90.1/IEEE 472. Hence, all front end cards which receive external signals like analog input and output modules, Binary input and output modules etc including power supply, data highway, data links shall be provided with protection that meets the surge withstand capability as

defined in ANSI 37.90.1/IEEE 472. Complete details of the features incorporated in the electronic system to meet this requirement the relevant test carried out, the test certificates, etc shall be submitted along with the proposal. As an alternative to the above, suitable class of EN 61000-4-12 which is equivalent to ANSI 37.90.1/IEEE 472 may also be adapted for SWC test.

- ii. The dry heat test as per IEC-68-2-2 or equivalent
- iii. Damp heat test as per IEC 68-2-3 or equivalent
- iv. Vibration test as per IEC 68-2-6 or equivalent
- v. Electrostatic Discharge test as per EN 61000-4-2 or equivalent
- vi. Radio frequency immunity test as per EN 61000-4-6 or equivalent
- vii. Electromagnetic Field Immunity test as per EN 61000-4-3 or equivalent

Test listed at Item no v, vi, vii above are applicable for electronic cards only as defined under item no. (i) above

17.02.05.4 **TYPE TEST REQUIREMENTS FOR C&I SYSTEMS**

S.No.	Item	Test requirement	Standard	Test to be specifically conducted	Owner's Approval required on Test Certificate
1	Electrical metering instruments	As per standards	IS 1248	No	Yes
2	Thermocouple	Degree of Protection Test	IS - 13947	No	No.
3	Junction Box	Degree of Protection Test	IS - 13947	Yes	Yes
4	RTD	As per standards	IEC-60751	No	No
5	Electronic Transmitter	As per standards	BS 6447/ IEC 60770	No	Yes
6	E/P convertor	As per standards	Manufacturing standard	No	Yes
7	Instrumentation cable (Twisted and shielded) (Refer Vol. V, Chapter 9)				
8	Battery	As per standard	IS 10918	Yes	YES
9.	Voltage stabiliser	Over load test	Approved procedure	No	YES
		Temp. rise test without redundant fans	Approved procedure	No	YES
		Input voltage variation test	Approved procedure	No	YES
10	DDCMIS				
	CLCS	Model Test	Approved	No	No

	system		procedure		
	BMS & MFT	Safety requirement	VDE 0116, SEC 8.7	No	YES
11	Conductivity type level switch	Degree of protection test	IS 13947	No	No
12	Local gauges	Degree of protection test	IS 13947	No	No
13	Process actuated switches	Degree of protection test	IS 13947	No	No
14	Control valves	CV test	ISA 75.02	No	YES
15	PLCs	As per Standard	IEC 1131	No	YES
16	LIE/LIR	Degree of protection test	IS 13947	YES	YES
17	Flue gas O2 analyser, other Flue gas Analysers	Degree of protection test	IS 13947	No	YES
18	Flow nozzles & Orifice plates	calibration	ASME PT C BS 1042	YES	YES

Note:

Type test are to be conducted only for the items, which are being supplied as part of this package.

- A. For batteries with electric power supply system of main plant C&I, the bidder shall submit for owner's approval the reports of all the type tests as per IS-10918 carried out within last 5 years from the date of bid opening and the test should have been either conducted at an independent laboratory or should have been witnessed by a owner/client. The complete type test report shall be for any rating of battery in a particular group, based on plate dimensions being manufactured by supplier.

For batteries with electric power system of auxiliary plants, type test reports for batteries shall be as per standard –practice of manufacturer.

14.02.06 Testing at Site [Prior to commercial operation]

- a. All equipment shall be checked thoroughly in respect of the following:
 - i. Visual and mechanical testing
 - ii. Complete system configuration loading functions; system diagnostics; system proper operation specified power supply specifications.



STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)

CHECK LIST FOR TEMPERATURE GAUGE

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	W	V	
	DIAL SIZE						
	MODEL NO./TAG NO./TYPE						
	RANGE/SCALE						
	END CONNECTION						
2	CALIBRATION	1 OF TYPE	APPROVED SPEC./ DATA SHEETS	P	W	V	
	ACCURACY						
	REPEATABILITY						
	HYSTERESIS						
3	OVER TEMP. TEST	FOR LOT	APPROVED SPEC./ DATA SHEETS	P	W	V	
4	AMBIENT TEMP. COMPENSATION CHECK			P	V	V	
5	REVIEW OF TC FOR MATERIALS OF			V	V	V	
	SENSOR						
	MOVEMENT						
	PROCESS CONNECTION						
	THERMOWELL						
6	HOUSING	TYPE TEST	AS PER APPD DWG	V	V	V	
	REVIEW OF TC FOR DEGREE OF PROTECTION						
7	THERMOWELL	SEE NOTE-1 BELOW	AS PER APPD DWG		V	V	
	MATERIAL TC & DIMN. CHECK						
	HYD.TEST						
	OVER RANGE TEST						

Legend :

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL,
P = Perform, W = Witness, V = Verification

Note :

- Quantum of check shall be as below :
100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- Manufacturer to carry out ROUTINE TEST on 100 %.
- IBR certificate to be provided if called for in specn.
- Contractor to provide compliance certificate for tests/checks verified by contractor and submit the same alongwith test certificates to be verified by BHEL.



STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)

CHECK LIST FOR PRESSURE & DP GAUGE

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks	
				M	C	B		
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	W	V		
	SENSOR TYPE							
	DIAL SIZE							
	MODEL NO/TAG NO							
	RANGE/SCALE							
	SWITCH CONTACT RATING & NOS.							
	END CONNECTION							
2	CALIBRATION				P	W	V	
	ACCURACY							
	REPEATABILITY							
	SET POINT ADJUSTMENT							
3	OVER PRESSURE & LEAK TEST		P	W	V			
4	OPERATION OF PRESSURE. RELIEF DEVICE	ONE		P	W	V		
5	REVIEW OF TC FOR	FOR LOT		V	V	V		
	MATERIALS OF SENSOR							
	MOVEMENT							
	PROCESS CONNECTION							
	HOUSING							
6	REVIEW OF TC FOR DEGREE OF PROTECTION	TYPE TEST		V	V	V		
7	ACCESSORIES AS APPLICABLE	SEE NOTE-1 BELOW		V	V	V		

Legend :

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL, P = Perform, W = Witness, V = Verification

Note :

- Quantum of check shall be as below :
100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- Manufacturer to carry out ROUTINE TEST on 100 %.
- When material correlation is not available, MFR's compliance to be provided
- Contractor to provide compliance certificate for tests/checks verified by contractor and submit the same alongwith test certificates to be verified by BHEL.



STANDARD CHECK LIST FOR C&I INSTRUMENTS (for Maux Pkgs)

CHECK LIST FOR FLOAT OPERATED LEVEL SWITCH

Sl. No.	Test / Checks	Quantum of check	Reference Doc. / Acceptance Norms	Agency **			Remarks
				M	C	B	
1	CHECK FOR	SEE NOTE-1 BELOW	APPROVED SPEC./ DATA SHEETS	P	V	V	
	MODEL NO/TAG NO						
	TYPE						
	END CONNECTION						
2	ON/OFF DIFFL	SEE NOTE-5	---	P	W	V	
3	REPEATABILITY			P	W	V	
4	IR TEST			P	W	V	
5	HV TEST			P	V	V	
6	PR. TEST ON CHAMBER			P	V	V	
7	MATL. TC FOR CHAMBER & FLOAT	FOR LOT	---	V	V	V	
8	CONTACT CONFIG. & RATING FOR MICROSWITCH	FOR LOT	---	V	V	V	
9	TC FOR DEGREE OF PROTECTION	TYPE TEST	---	V	V	V	
10	MANUFACTURER TO ENSURE WELDING PROCEDURE, WELDERS & NDT AS PER ASME FOR PR >40 KG/CM2	SEE NOTE-1 BELOW	---	P	V	V	
11	CHECK FOR TEMP. SUITABILITY FOR MICROSWITCH AND LEAD WIRE		---	V	V	V	
12	ACCESSORIES AS APPLICABLE		APPROVED SPEC./ DATA SHEETS	V	V	V	

Legend :

** M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL, P = Perform, W = Witness, V = Verification

Note :

- Quantum of check shall be as below :
100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- Manufacturer to carry out ROUTINE TEST on 100 %.
- When material correlation is not available, MFR's compliance to be provided
- IBR certificates shall be provided wherever required.
- Contractor to provide compliance certificate for tests/checks verified by contractor and the same alongwith test certificates to be verified by BHEL

STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL														STD QUALITY PLAN NO.: PE-QP-999-145-1056					
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														SECTION		D			
														REV. NO.		01		DATE: 22-02-2008	
														SHEET		1		OF 7	
Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks							
									P	W	V								
1.0	INCOMING Sheet Steel (CRCA & HR)	1. Chemical Composition	MA	Chemical analysis	Sample	IS:1079 IS:513	IS:1079 IS:513	Test Certificate	3	---	2								
		2. Bend Test	CR	Mech. test	Sample	IS:1079 IS:513	IS:1079 IS:513	Log Book	2	---	---								
		3. Surface finish	MA	Visual	100%	Factory Standard / Sample	Factory Standard / Sample	Log Book	2	---	---								
		4. Waviness	MA	Visual	100%	Factory Standard	No Waviness	Log Book	2	---	---								
		5. Thickness	MA	Measurement	100%	BHEL Spec.	BHEL Spec.	Log Book	2	---	---								
		6. Mill marking	MA	Visual	100%	Factory Standard	Factory Standard	Log Book	2	---	---	1							
2.0	Flats / Angles / Channels	1. Dimensions	MA	Measurement	Sample	IS:2062	IS:2062	Log Book	2	---	---								
		2. Surface Defects	MA	Visual	100%	Factory Standard / Sample	Factory Standard / Sample	Log Book	2	---	---								
		3. Straightness	MA	Measurement	100%	Factory Std.	Factory Std.	Log Book	2	---	---								
		4. Mill marking	MA	Visual	100%	IS:2062	IS:2062	Log Book	2	---	---	1							
3.0	Cables / Wires	1. Visual / Surface defects	MA	Visual	100%	BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694	Log Book	2	---	---								
		2. IR and HV	MA	Electrical	100%	BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694	Log Book	2	---	---								
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics														1 - BHEL 2 - Vendor 3 - Sub-vendor					

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									P	W	V					
		3. Conductor a) Resistance b) Size c) Sheet colour	MA MA MA	Electrical Measurement Visual	100% 100% 100%	BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694	Log Book	2	---	---					
		4. Type / Routine Test Certificates	MA	Verification	100%	BHEL Spec. and IS:1554 or IS:694	BHEL Spec. and IS:1554 or IS:694	Log Book	3	---	2					
4.0	Electrical Components like Annunciator Transformers Lamps Switches PBs Contactors Relays Timers Space Heaters Thermostat Indicating meters etc.	1. Verification at make and Type Certificates 2. Verification of Test Certificates 3. Operation / Functional check 4. I.R. 5. H.V. 6. Calibration 7. Pick up / Drop off Voltage	CR CR CR MA MA MA MA	Visual Scrutiny of Type / Routine T.Cs. Electrical Electrical Electrical Electrical	Sample 100% Sample+ 100% 100% 100% 100% 100%	BHEL Spec. and BOM Relevant IS Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue	BHEL Spec. and BOM Relevant IS Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue Relevant Indian Std & Catalogue	Log Book Log Book Log Book Log Book Log Book Log Book Log Book Log Book	2 2 2 2 2 2 2 2	---	---	---	---	---	---	+ for relay & contactors only @ for all components except relays & contactors.
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics																
\$ P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test.																
1 - BHEL 2 - Vendor 3 - Sub-vendor																

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Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks					
									P	W	V						
5.0	Misc. Components like Gaskets, Terminal Blocks etc.	1. Verification of Type / Make 2. Surface defects 3. IR / HV on Terminal Blocks	MA	Visual	Sample	BHEL Spec. & Mfrs. Catalogue	BHEL Spec. & Mfrs. Catalogue	Log Book	2	---	---	---					
6.0	IN PROCESS Blanking / Bending / Forming	1. Dimensions	MI	Measurement	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	2	---	---	---					
		2. Surface defects after bending	MA	Visual	100%	Factory Standard	Factory Standard	Log Book	2	---	---	---					
7.0	Nibbling / Punching	1. Cutout Sizes	MI	Measurement	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	2	---	---	---					
		2. Deburring	MA	Visual	100%	Approved Mfr. drgs.	Approved Mfr. drgs.	Log Book	2	---	---	---					
8.0	ASSEMBLY Frame Assembly & Sheet fixing	1. Dimensions	MA	Measurement	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	---	2					
		2. Alignment	MA	Measurement	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	---	2					
		3. Welding Quality	MA	Visual	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	---	2					
		4. Surface defects	MA	Visual	100%	Approved drg. / Mfr. Standards	Approved drg. / Mfr. Standards	Log Book	2	---	---	2					
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics												\$	P	1 - BHEL	2 - Vendor	3 - Sub-vendor	

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Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks		
									P	W	V			
9.0	Pre-treatment and Painting	1. Pretreatment Process 2. Process parameters like bath temp. concentration etc. 3. Dipping / Removal Time 4. Surface quality after every dip 5. Primer after phosphating 6. Putty Application & Rubbing after primer 7. Paint first coat 8. Putty Application and Rubbing after first coat of paint 9. Paint second coat	MA MA MA MA MA MA MA	Visual Measurement Measurement Visual Visual, Thickness Visual Visual, Thickness Visual Visual, Thickness, Scratch test Colour adhesion	100% Periodic 100% 100% 100% 100% 100%	Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005	Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005 Factory Standard & IS: 6005	Log Book Log Book Log Book Log Book Log Book Log Book Log Book	2 2 2 2 2 2 2	--- --- --- --- --- --- ---	1 1 1 1 1 1 1			
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics												\$	P	1 - BHEL 2 - Vendor 3 - Sub-vendor
												W		
												V		

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Sl. No.	Component / operation	Characteristics Checked	* Cate gory	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks					
									P	W	V						
10.	Panel Wiring	1. Wiring Layout 2. Wiring Termination (Crimped Lugs) 3. Ferrule numbers 4. Colour of wiring 5. Size of Conductor	MA MA MA MA MA	Visual Visual Visual Visual Measurement	100% 100% 100% 100% 100%	Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs.	Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs. Approved drgs. & Specs.	Log Book Log Book Log Book Log Book Log Book	2 2 2 2 2	--- --- --- --- ---	--- --- --- 1 1						
11.	Component Mounting	1. Correct components 2. Fixing	MA MA	Visual Visual	100% 100%	Approved drgs., Specs. & BOM Approved drgs., Specs. & BOM	Approved drgs., Specs. & BOM Approved drgs., Specs. & BOM	Log Book Log Book	2 2	--- ---	--- ---						
12.	FINAL Final Inspection	1. Workmanship 2. Component layout (neatness, accessibility & safety) Mounting / Proper fixing of all components 3. Components identification Marking / Name plates	MA MA MA	Visual Visual Visual	100% 100% 100%	Factory Standard BHEL approved drg. / Spec. BHEL approved drg. / Spec.	Factory Standard BHEL approved drg. / Spec. BHEL approved drg. / Spec.	Inspection Report Inspection Report Inspection Report	2 2 2	1 1 1	1 1 1	At Random by BHEL, based on 100 % internal test reports by Mfr.					
LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics																	
\$ P W V - Agency Performing the Test. - Agency Witnessing the Test. - Agency Verifying the Test.																	
1 - BHEL 2 - Vendor 3 - Sub-vendor																	

LEGEND: * CR - Critical characteristics
 MA - Major characteristics
 MI - Minor characteristics

\$ P - Agency Performing the Test.
 W - Agency Witnessing the Test.
 V - Agency Verifying the Test.

1 - BHEL
 2 - Vendor
 3 - Sub-vendor

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Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks			
									P	W	V				
		5. Dimensions	MA	Measurement	100%	BHEL approved drg. / Spec., BOM	BHEL approved drg. / Spec., BOM	Inspection Report	2	1	1	At Random by BHEL, based on 100 % internal test reports by Mfr.			
		6. Door functioning	MA	Functional	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1				
		7. Paint Shade	CR	Visual	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1				
		8. Paint Thickness	CR	Measurement	100%	BHEL approved drg. / Spec.	BHEL approved drg. / Spec.	Inspection Report	2	1	1				
		9. Workmanship of Gaskets	MA	Visual	100%	Factory Standard	Factory Standard	Inspection Report	2	1	1				
		10. Wiring Layout	MA	Visual	100%	BHEL approved drg.	BHEL approved drg.	Inspection Report	2	1	1				
		11. Wire Termination	MA	Pulling manually	Sample	-----	Firm termination	Inspection Report	2	1	1				
		12. Continuity	MA	Electrical	100%	-----	Continuity OK	Inspection Report	2	1	1				

LEGEND: * CR - Critical characteristics
MA - Major characteristics
MI - Minor characteristics

\$ P - Agency Performing the Test.
W - Agency Witnessing the Test.
V - Agency Verifying the Test.

1 - BHEL
2 - Vendor
3 - Sub-vendor

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Sl. No.	Component / operation	Characteristics Checked	* Category	Type/Method of Check	Extent of Check	Reference documents	Acceptance Norms	Format of Records	Agency \$			Remarks			
									P	W	V				
13.	TYPE TEST	Degree of Protection	CR	Mech. Protection	Sample	BHEL approved spec., drg relevant IS-13947 Part-1, IS-2148.	BHEL approved spec., drg relevant IS-13947 Part-1, IS-2148.	Type Test Certificate	3	--	1				
14	ROUTINE TEST	IR before & after HV Test	CR	Electrical	100%	BHEL approved spec., drg., BOM & relevant IS.	BHEL approved spec., drg., BOM & relevant IS.	Test Report	2	1	1				
15	FUNCTIONAL TEST	1. Control Logic Operation	CR	Electrical	100%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1				
		2. Instrument Calibration	CR	Electrical	10%	BHEL approved spec. / drg.	BHEL approved spec. / drg.	Inspection Report	2	1	1				
		3. Temperature rise	CR	Electrical	100%	BHEL approved spec/drg. & relevant IS.	BHEL approved spec/drg & relevant IS.	Inspection Report	2	1	1				

LEGEND: * CR - Critical characteristics MA - Major characteristics MI - Minor characteristics										\$ P - Agency Performing the Test. W - Agency Witnessing the Test. V - Agency Verifying the Test.										1 - BHEL 2 - Vendor 3 - Sub-vendor			
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K.LIST OF MANDATORY SPARES

NOTE :-

Please note that these spares shall be considered as unit wise except for any item/equipment supplied as common for both units.

2x660 MW ENNORE SEZ PROJECT OF TANGEDCO					
MANDATORY SPARES					
III.	CONTROL & INSTRUMENTATION PACKAGES		TANGEDCO		*Remarks
			Total Ex-Works price		
SI no	Name of spares	Unit	Qty	in INR	
1.0.0	INSTRUMENTATION				
(i)	Each type of lamps, PBs, ILPBs, fuse, MCB, MCCB used in the equipment/system.	Nos.	20 % of Installed of each type.		
1.00.01	Measuring Instruments				
1.00.01.01	Indicators, Recorders, Electrical Metering and Skid Mounted Instruments				
(i)	Indicators, recorders and meters offered from each model for the project. These instruments shall be supplied with three sets of blank scales.	Nos.	10 % of Installed of each type/Model or a minimum of one number for each model and type, whichever is more		
(ii)	For skid mounted instruments	Nos.	10% of total number of instruments for each Type and model or a minimum of one number for each model and type, whichever is more		
1.00.01.02	Temperature Elements and Thermowells				

C&I Mandatory spares are indicated in above list. These spares shall be considered as per the applicable items in main supply of respective packages.

TANGEDCO					Total Ex-Works price	*Remarks
Sl no	Name of spares	Unit	Qty		in INR	
(i)	Thermocouple/RTD elements	Nos.	10% spare for each type and length of element furnished with thermocouple/RTD assemblies, or a minimum of one number of each type & length, whichever is more.			
(ii)	Thermowells	Nos.	10% for each type of temperature sensors or a minimum of one for each type, whichever is more.			
1.00.01.03	Temperature, Transmitters and Electronic Transmitters (For Pressure, DP, Temp, Flow, Level), Temperature, Pressure, Flow & Level Switch, safety switches, Gauges, meters, Transducer or any other instrument etc.	Nos.	10% of total number of Instruments/transducers offered for each model and type for the project or a minimum of one number, whichever is more.			ct
1.00.01.04	Flue Gas Analyzers & CEMS (Spareparts shall be furnished in accordance with manufacturer's recommendations for five years continuous operation or minimum quantities indicated as below (whichever is more)					se t

C&I Mandatory spares are indicated in above list. These spares shall be considered as per the applicable items in main supply of respective packages.

TANGEDCO						Total Ex-Works price	*Remarks
Sl no	Name of spares	Unit	Qty	in INR			
a)	Electronic Module/Mother Board	Nos.	10% of installed or at least one number of each type of module for each analyser type.			price included at s.no. 1.00.01 above	
b)	Cooling and purging air blower unit	Nos.	One No. for each analyser type			price included at s.no. 1.00.01 above	
c)	Light source and detector unit for smoke density analyser.	Set	One set for each analyser type			price included at s.no. 1.00.01 above	
d)	Infrared source and detector unit for CO analyser	set	One set for each analyser type			price included at s.no. 1.00.01 above	
e)	Zirconia Cell, ceramic filters, heater & thermocouple assembly for flue gas oxygen analyzer.	Nos.	Two Nos. of each type			price included at s.no. 1.00.01 above	
f)	of chopper motor, two nos. protection window, one no. of heater cartridge for CO analyser	Nos.	Two No. of each type			price included at s.no. 1.00.01 above	
g)	Power supply module	Nos.	1 no. of each type for each analyser type.			price included at s.no. 1.00.01 above	
h)	UV Lamp with adapter with SO2 analyser	Nos.	2 no. of each type.			price included at s.no. 1.00.01 above	
i)	Light source and detector unit for SPM, and NOX/SOX analyser.	Nos.	1 no. of each type for each analyser type.			price included at s.no. 1.00.01 above	
j)	Set of filters	Nos.	1 No. of each type for each analyser type.			price included at s.no. 1.00.01 above	
k)	Analysers spares like transmitter lens and receiver lens, protection windows for transmitter & receiver, integral pressure and temperature sensors, signal processing unit, electronic modules	Nos.	1 No. of each type for each type of flue gas analyser.			price included at s.no. 1.00.01 above	
1.00.02	DDCMIS/PLC system, Master slave clock system, Hart Management System, Vibration Monitoring system, CAAQMS, ERP/MIS/LAN/Simulator/ WAN, CCTV, Microprocessor based control system, and other Control System/Sub-systems/electronic system listed in NIT.						

TANGEDCO					Total Ex-Works price	*Remarks
Sl no	Name of spares	Unit	Qty		in INR	
1.00.02.01	I/O cards					
a.	Analog Input module	Nos.	10% of qty Installed of each category/model or at least 2 No. of each type/model (Whichever is more)			
b.	Analog output module	Nos.	10% of qty Installed of each category/ model or at least 2 No. of each type/model (Whichever is more)			
c.	RTD/TC cards/modules	Nos.	10% of qty Installed of each category/model or at least 2 No. of each type/model (Whichever is more)			
d.	Digital input module	Nos.	10% of qty Installed of each category/model or at least 2 No. of each type/model (Whichever is more)			
e.	Digital output module	Nos.	10% of qty Installed of each category/model or at least 2 No. of each type/model (Whichever is more)			
1.00.02.02	All types of electronic modules, controllers, function modules, cards, terminal boards, relay boards, power supply cards etc for above mentioned system and other Control System/Sub- systems and any other type of PCB not covered above	Nos.	10% of qty Installed of each category/model or at least 2 No. of each type/model (Whichever is more)			

C&I Mandatory spares are indicated in above list. These spares shall be considered as per the applicable items in main supply of respective packages.

TANGEDCO					Total Ex-Works price	*Remarks
Sl no	Name of spares	Unit	Qty		in INR	
1.00.02.03	Electronic Cards/modules	Nos.	10% of number for each type or minimum of 2 number for each type whichever is high.			
1.00.02.04	Auto/Manual stations, set-point/bias stations etc	Nos.	10% of the number of stations offered for the project from each type or a minimum of 2 number from each model, whichever is more.			
1.00.02.05	Control logic power supply fuses, MCB/MCCB, at each current rating required for the project.	Nos.	20% spare for each type/Model			
1.00.02.06	Electronic cards of each type used for each type of Servers supplied with any control system	Nos.	Ten (10) percent or 2 no. (Whichever is more)			
1.00.02.07	Electric to pneumatic converters of each type utilized with automatic control system using pneumatic drives	Nos.	Ten (10) percent of each type or a minimum of one of each type, whichever is more.			
1.00.02.08	Plug-in type keyboard	Nos.	Not Applicable for this package			
1.00.02.09	Control OWS	Nos.				
1.00.02.10	Utility/Engineering OWS	Nos.				
1.00.02.11	DVD/CD	Nos.	200 mts. each			
1.00.02.12	Data highway cable with adequate connectors of each type	set.	Not Applicable for this package			
1.00.02.13	Hard disc drive unit	Nos.				
1.00.02.14	Prefab cable connectors	Nos.	10% or 5 nos (whichever is more) of each type of Installed			
1.00.02.15	Cubicle power supply power supply modules	Nos.	Ten (10) percent or 5 nos (whichever is more) of Installed of each type and rating			
1.00.02.16	Interposing/coupling relays.	Nos.	Ten (10) percent Installed of each type and rating			

C&I Mandatory spares are indicated in above list. These spares shall be considered as per the applicable items in main supply of respective packages.

TANGEDCO						Total Ex-Works price	*Remarks
Sl no	Name of spares	Unit	Qty	in INR			
1.00.02.17	Ethernet Switches, Routers & other communication hardware	Nos.	10% of qty installed of each type or a minimum of 2 numbers from each model, whichever is more.				
1.00.02.18	Sensors with special cables, Power supply modules, Relay, Interface Module, and electronic modules used for vibration monitoring system.	Nos.	10% of qty installed or Five no. (Whichever is more) of each type)				
1.00.02.19	Printer toners for all printers	Nos.	Not Applicable for this package				
1.00.02.20	DMP printer head of the total quantity	Nos.	Not Applicable. OWS shall be supplied as per applicability.				
1.00.02.21	Drum for A3 sized scanner cum copies, printer	Nos.					
1.00.02.22	24" LED monitor,	Nos.					
1.00.02.23	29" LED monitor	Nos.					
1.00.02.24	22" LED monitors.	Nos.	Twenty (20) percent or 2 no. (Whichever is more)				
1.00.02.25	RJ 45 connector with box of each type	Nos.					
1.00.02.26	Hooters, Buzzers, Cooling fans of each type.	Nos.	Ten (10) percent or 2 no. (Whichever is more)				
1.00.02.27	Interface cables	Set	2 sets of each type/model				
1.00.02.28	Power supply modules (AC to DC converters)	Nos.	10% or Five no. (Whichever is more) of each type/model				
1.00.02.29	DVD/CD drive unit of each type	Nos.	Not Applicable for this package				

C&I Mandatory spares are indicated in above list. These spares shall be considered as per the applicable items in main supply of respective packages.

TANGEDCO					Total Ex-Works price	*Remarks
SI no	Name of spares	Unit	Qty	in INR		
1.00.02.30	Mouse	Nos.	Not Applicable for this package			
1.00.03	Steam and Water Analysis System (SWAS)			50,56,170	Lot price has been given for items under SI no. 10,00,03	
1.00.03.01	High pressure reducing elements for sample flow.	Nos.	10% spare of qty installed.			
1.00.03.02	Ion exchange columns with resin as utilized with cation conductivity analysers	Nos.	Four No			
1.00.03.03	Conductivity cells as utilised with conductivity monitors	Nos.	Two nos of each type			
1.00.03.04	pH flow-through type cells used with pH monitors	Nos.	Two nos. of each type			
1.00.03.05	Chemical reagents for all analysers	Set	12 months continuous operation of all analysers from date of taking over.			
1.00.03.06	Chemical reagents for colorimetric silica analysers	Set	12 months continuous operation of all analysers from date of taking over.			
1.00.03.07	Electronic Modules	Nos.	One (1) no. for each type of Analyser.			
1.00.03.08	Pressure gauge, solenoid valves, temperature gauge, Back Pressure regulating valves, 3 way grab valves, needle valves, isolation valves, PRV, flow switch, flow indicator and temperature switch, erection hardware's, valves in SWAS.	Nos.	Two (2) no. of each type			
1.00.03.09	Primary coolers/secondary coolers.	Nos.	Three (3) No of each type			
1.00.04	Relay based Control Panels					
1.00.04.01	LEDs for indicating lights	Nos.	10% of qty installed.			
1.00.04.02	Control circuit fuses/MCB/MCCB/ Semiconductor Fuses	Nos.	300% of installed of each type, current rating.			
1.00.04.03	Relays modules & contactors.	Nos.	20% spare of qty Installed of each type & rating.			

C&I Mandatory spares are indicated in above list. These spares shall be considered as per the applicable items in main supply of respective packages.

TANGEDCO					Total Ex-Works price	*Remarks
Sl no	Name of spares	Unit	Qty		in INR	
1.00.05	Alarm Annunciation System					
1.00.05.01	Logic modules, group card modules, power supply modules, Hooters and any other electronic module.	Nos.	20% spares of each type installed			
1.00.05.02	un-engraved window boxes complete with LED etc.	Nos.	5% spares of each size installed			
1.00.05.03	LEDs for annunciation facia windows and LEDs box assemblies offered for the project	Nos.	20% of qty installed			
1.00.05.04	Annunciator hooter	Nos.	One (1) No. of each type			
1.00.06	Un-interrupted Power Supply System and DC Control Power Supply System					
1.00.06.01	As per Manufacturer's Recommendation for Three Years Continuous Operation or minimum quantities indicated as below (whichever is more)					
1.00.06.02	Fuses/Semiconductor Fuses	Nos.	300% of installed of each type, current rating with each panel /board			
1.00.06.03	Miscellaneous parts for the power supplies such as SCRS, transistors, resistors, diodes, light bulbs, static switches , blocking diodes etc.	Nos.	Minimum of 10% or atleast two (which ever is more) of each type			
1.00.06.04	Battery cells complete with contactor,cover plates etc	Nos.	10% of qty installed			
1.00.06.05	Electronic Modules like Rectifier control card, inverter control card, Driver card, IGBT Module, DC-DC converter card or any other card as listed in approved BOM for UPS, AC supply & 24 V DC supply etc.	Set	1 Set of each type & rating			

C&I Mandatory spares are indicated in above list. These spares shall be considered as per the applicable items in main supply of respective packages.

TANGEDCO					Total Ex-Works price	*Remarks
Sl no	Name of spares	Unit	Qty		in INR	
1.00.06.06	Miniature Circuit breakers for AC and DC supply.	Nos.	20 % of installed or 10 Nos of each type (which ever is more) for ACDB and DCDB.			
1.00.06.07	Digital/analog panel meters/indicators	Nos.	5% or 2 no. of each type (whichever is more)			
1.00.06.08	CT's, CVT's VT's chokes, AC/DC isolators, contactors, timers, relays.	Nos.	10% or 2 nos. of each type and rating, (whichever is more)			
1.00.06.09	Cooling Fans in UPS & 24 V DC charger panels	Nos.	10% or 2 nos. of each type and rating, (whichever is more)			
1.00.06.10	following accessory equipment for the battery shall be furnished : a) Cell lifting facilities b) Assembly wrenches c) Vent plug hydrometer d) Vent plug thermometer e) Supply of corrosion-preventive grease. f) 10% spare cells.	Set	Two sets			
1.00.06.11	Electronic modules of each type & rating for UPS and DC control power supply system.	Set	One set of with each set consisting of at least one number of each type of electronic module for inverters, chargers, static switch, stabiliser etc. as per approved BOM.			
1.00.06.12	MCCB for UPS & 24 V DC charger panels, ACDB, DCDB.	Nos.	20 % of installed or 5 Nos of each type (which ever is more)			
1.00.07	Erection hardware					
1.00.07.01	Instrument valves	Nos.	Ten (10) percent of each type & Size installed			

C&I Mandatory spares are indicated in above list. These spares shall be considered as per the applicable items in main supply of respective packages.

TANGEDCO						Total Ex-Works price	*Remarks
SI no	Name of spares	Unit	Qty	in INR			
1.00.07.02	Condensate pots of each type & Size installed	Nos.	Ten (10) percent of total number of Installed or four numbers whichever is higher.				
1.00.07.03	Manifold	Nos.	Ten (10) percent of each type & Size installed				
1.00.07.04	Fittings	Nos.	Ten (10) percent of each type & Size installed				
1.00.08	LVS			8,58,305		EDN-Lot price has been given for items SI no 1.00.08	
1.00.08.01	LEDs	Nos.	20% (Installed) spares of each type & size.				
1.00.08.02	LVS Filters	Nos.	50% spare or min 6 nos.				
1.00.08.03	Electronic cards of each type for LVS	Nos.	3 nos. or 20% whichever is more				
1.00.08.04	Interfacing cables	Set	Two Set of each type & size.				
1.00.08.05	Power supply modules of each type for LVS	Nos.	3 nos. or 20% whichever is more				
1.00.08.06	Cooling modules of each type for LVS	Nos.	3 nos. or 20% whichever is more				
1.00.08.07	LVS Controller of each type for LVS	Nos.	2 nos.				
1.00.09	Master Slave Clock system			1,45,950		EDN-Lot price has been given for items SI no 1.00.09	
(i)	As per Manufacturer's Recommendation for Three Years Continuous Operation or minimum quantities indicated as below (whichever is more)	Set					
(ii)	Electronic cards	Nos.	One No. of each type & model				
(iii)	Signal Conditioner cards	Nos.	One No. of each type & model				
(iv)	Slave clocks of each type used for Master slave clock system	Nos.	Two No. of each type & model				
(v)	Cubicle power supply power supply modules	Nos.	Ten (10) percent or 2 nos (whichever is more) of Installed of each type and rating				
1.00.10	Plant Security and surveillance system			5,10,020		EDN-Lot price has been given for items SI no 1.00.10	

C&I Mandatory spares are indicated in above list. These spares shall be considered as per the applicable items in main supply of respective packages.

TANGEDCO						Total Ex-Works price	*Remarks
Sl no	Name of spares	Unit	Qty	in INR			
1.00.10.01	As per Manufacturer's Recommendation for Three Years Continuous Operation or minimum quantities indicated as below (whichever is more)	Nos.					
1.00.10.02	Electronic cards	Nos.	One No. of each type				
1.00.10.03	PTZ controller	Nos.	One No. of each type				
1.00.10.04	Electronic modules used for server system	Nos.	10% or Two No. of each type (whichever is more)				
1.00.10.05	Special cables & connector	Set	(5 sets) of each type				
1.00.10.06	Cartridges for air filter	Nos.	Two No. of each type				
1.00.10.07	Relay	Nos.	5 nos. of each type				
1.00.10.08	Power supply modules of each type	Nos.	5 nos. of each type				
1.00.10.09	Camera of each type used for Plant Security and surveillance system.	Nos.	Two no. of each type				
1.00.10.10	Automatic door sensors	Nos.	10% or 2 nos. min whichever is more				
1.00.10.11	Card reader.	Nos.	10% or 2 nos. min whichever is more				
1.00.11	AAQMS					27,12,500	Lot price for applicable items
1.00.11.01	As per Manufacturer's Recommendation for Three Years Continuous Operation or minimum quantities indicated as below (whichever is more)						
1.00.11.02	Electronic cards/Module/Mother Board /Signal Processing Unit for each type of Analyzer	Nos.	One no. of each type				
1.00.11.03	Power supply module	Nos.	One no. of each type for each analyser				
1.00.11.04	UV Lamp with adopter with SO2 analyser.	Nos.	One no. of each type				
1.00.11.05	Light source and detector unit for SPM, and NOX/SOX analyser.	Nos.	One no. of each type for each analyser				
1.00.11.06	Pump for SPM Analyser	Nos.	One no. of each type				
1.00.11.07	Conference hall mic.	Nos.	Two no. of each type				
1.00.11.08	Conference hall speakers.	Nos.	Two no. of each type				
1.00.12	HMS					90,475	
1.00.12.01	As per Manufacturer's Recommendation for Three Years Continuous Operation	Set					
1.00.12.02	Electronic cards	Nos.	One no. of each type				

TANGEDCO						Total Ex-Works price	*Remarks
Sl no	Name of spares	Unit	Qty	in INR			
1.00.13	Mandatory Spares for Control valves, Power Cylinder, Control Dampers, Actuators and Accessories						
(A)	Following spares shall be furnished for control valves, Power Cylinder, Control Dampers as applicable.						
	One set of spare control valve stem packing for each control valve.						
	Two moulded rubber diaphragms for each control valve.						
	One sets of each of O-rings and rubber gaskets for each control valve.						
d)	100 percent qty. of lubricants for gaskets for each control valve on one year consumption basis.						

C&I Mandatory spares are indicated in above list. These spares shall be considered as per the applicable items in main supply of respective packages.

TANGEDCO					Total Ex-Works price	*Remarks
Sl no	Name of spares	Unit	Qty	in INR		
	2 sets of limit switches and 1 set of valve positioner for each control valve.					
f)	20 percent of position transmitter (4-20mA) for total qty. of control valve.					
g)	One (1) set of valve trims (such as plug, stem, seat ring /cage, guide bushing, stem lock pin, packing retaining ring, etc) for each control valve.					
h)	One completes actuator of each type or min 10% for each type and size whichever is more.					
i)	20 percent of Solenoid valves or min 2 no. of each type for total qty. of control valves.					
j)	20% of I to P converters, Pressure regulators.					
B)	Mandatory spares for each critical applications special control valves as specified in HT			1,17,72,635	PEM-For APRDS AND For Fuel Oil Unloading System, included under clause Fuel oil system of Mech. List of mandatory spares AND For Air Conditioning system, price included under clause Air Conditioning system of Mech. List of mandatory spares	
C)						

C&I Mandatory spares are indicated in above list. These spares shall be considered as per the applicable items in main supply of respective packages.

TANGEDCO						Total Ex-Works price	*Remarks
Sl no	Name of spares	Unit	Qty	in INR			
a.	Soft Goods Kit Valve	1 set			65,16,048		PEM-For Fuel Oil Unloading System, included under clause Fuel oil system of Mech. List of mandatory spares AND For Air Conditioning system, price included under clause Air Conditioning system of Mech. List of mandatory spares HYD-Lot price has been given for items under SL no.1.00.13 (C) Items applicable for Pumps shall be supplied.
b.	Metal seat	1 set					For C&I control valves included above under clause no A1 -1.0013 of C&I list AND For Fuel Oil Unloading System, included under clause Fuel oil system of Mech. List of mandatory spares AND For Air Conditioning system, price included under clause Air Conditioning system of Mech. List of mandatory spares
c.	Seat Ring	1 set					
d.	Spindle	1 set					
e.	Actuator Soft Goods kit	1 set					
i.	Feed back transmitter unit	2 Nos.					
ii.	Electronic Position Transmitter	2 Nos.					
iii.	Solenoid valves	2 Nos.					
iv.	Air filter regulators	2 Nos.					
v.	Air Lock Relay	2 Nos.					
vi.	Complete Actuator for each type and model	1 set					
C)	Following spares shall be supplied for each of the HP/LP By Pass & Spray control valves						TRY-V: Price already Quoted in Mechanical section under HP BYPASS SYSTEM
i)	Stem	1 NO.					
ii)	Jet Cage	1 NO.					
iii)	Nozzle Body	1 NO.					
iv)	Seat	1 NO.					
v)	Guide bushing	1 NO					
vi)	Valve Packing	1 Set					
vii)	Valve Gaskets	1Set					
viii)	Actuator seal set	1 Set					
D)	Common spares for HP/LP By Pass & Spray control valves:						TRY-V: Price already Quoted in Mechanical section

TANGEDCO

TANGEDCO					Total Ex-Works price	*Remarks
Sl no	Name of spares	Unit	Qty		in INR	
i)	Feedback transmitter	2 NOS.				
ii)	Electronic positioner	2 NOS.				
iii)	Proportional Valve	2 NOS.				
iv)	Quick opening device	2 NOS.				
v)	Seal sets	4 Sets				
vi)	Solenoid Valves	2 NOS.				
vii)	Filters for Oil Units	1 set				
viii)	Supply manifold for oil units	1 No				
ix)	Hose for each service	1 each				
x)	Seal set for oil unit	1 Set				
	Complete actuator for each type and model	1 set				
E)	1 NO of Nozzle for each PRDS De Super heater & Spray water desuperheater and orifice plate for CEP flow.					1 No. Nozzle for Spray water Desuperheater is included in our price. Rest of the flow nozzles not included in our offer as 'Mandatory spares' are provided for items or components that require replacement during plant operation. Flow nozzles and orifice plates do not require replacement and hence are not provided as mandatory spares. We have never supplied nozzles and orifice plate as mandatory spares in any of the existing as well as previous projects.
1.00.14	Mandatory Spares for Boiler Tube leak Detection System				17,81,920	LOT PRICE FOR THE APPLICABLE ITEMS UNDER THIS SERIAL NO 1.00.14
	Following mandatory spares along with their individual price required for maintaining boiler tube leak detection system to supply along with the package.					
1)	2nos. acoustic transducer with rear connector sealed to IP-65					
2)	2 nos. flexible high temperatures lead, 3metre long for acoustic transducer.					
3)	2 nos. acoustic s field amplifier / processor mounted in a die cast aluminum or polycarbonate box sealed to IP-65 with mounting brackets, pairs.					
4)	1 no. A/D Converter cards/field signal interface module for 32 or more channels.					
5)	1 no. Alarm relay output card.					

TANGEDCO						Total Ex-Works price	*Remarks
Sl no	Name of spares	Unit	Qty	in INR			
6)	Consumables like batteries, fuses etc. for two years operation of boiler tube leak detection system.						
1.00.15	Mandatory spares not covered above						
	Bidder to supply 10% or 1 no. (whichever is more) of each type of sensor/instrument, instrumentation/mechanical fittings etc for any other electronic system, feeder control cabinets, hydra-step (EWLI), Vibration Monitoring System, CCTV, C&I Lab Instruments, On line Carbon in Ash analyser system, On line Coal mass flow/speed measurement system, On line secondary air flow measurement system Mass Flow meter, Solid flow meter, 3 D Acoustic type level transmitters, Nucleonic & non nucleonic density transmitter etc.						
1.00.16	OTHER RELATED CONTROL AND INSTRUMENTATION SYSTEMS/EQUIPMENTS						
1.00.16.01	Other SG related sub-systems						
	1 Flame Monitoring System						
(i)	Complete Flame Scanner Assembly including scanner head assembly, scanner housing, and fibre optic cables.	20% or 4 nos. whichever is more.			39,05,356		
(ii)	Flame Scanner Lens.	100%			1,08,570		
(iii)	Electronic cards for scanners	10% or 2 nos. of each type whichever is more.			17,69,852		
(iv)	Power Supply Modules	10% or 2 nos. of each type whichever is more.					INCLUDED IN SL NO (iii) ABOVE
	2 Coal Feeders						
(i)	Calibration Motor	10% or 2 nos. whichever is more.					NOT APPLICABLE
(ii)	Correction Motor	10% or 2 nos. whichever is more.					NOT APPLICABLE

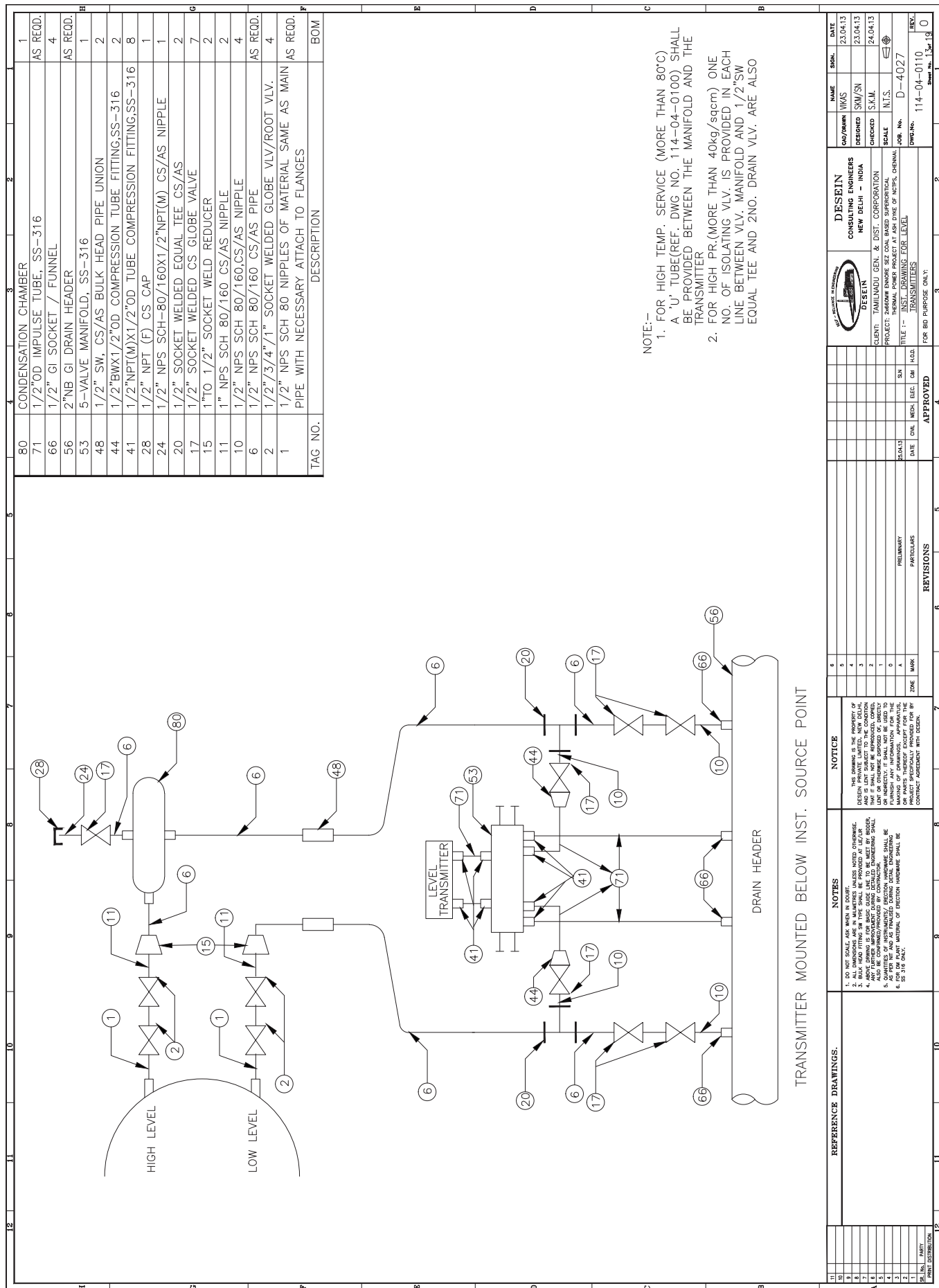
C&I Mandatory spares are indicated in above list. These spares shall be considered as per the applicable items in main supply of respective packages.

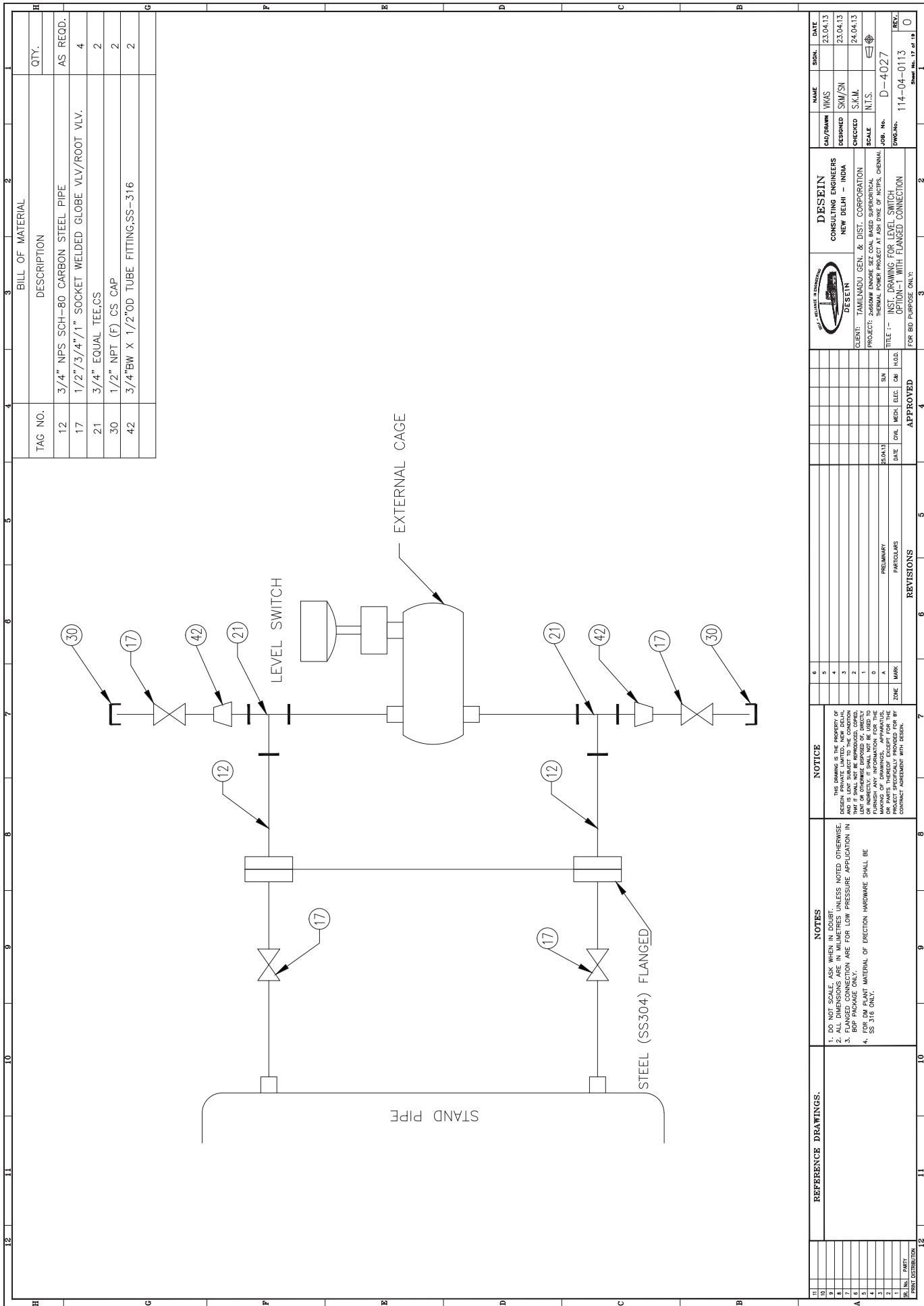
TANGEDCO						Total Ex-Works price	*Remarks
Sl no	Name of spares	Unit	Qty	in INR			
(iii)	Motion monitor	10% or 2 nos. whichever is more.		8,14,275			
(iv)	Speed pick-up	10% or 2 nos. whichever is more.		5,69,989			
(v)	Torque switch	10% or 2 nos. whichever is more.		15,30,746			
(vi)	Load Cell	10% or 2 nos. whichever is more.		62,19,969			
(vii)	Electronic cards & Power Supply cards	10% or 2 nos. whichever is more.		12,15,725			
(viii)	Clutch (if applicable)	10% or 2 nos. whichever is more.		8,14,275			
(ix)	Local indication lamps	200% .		4,14,316			
(x)	Panel meters	10% or 2 nos. whichever is more.					NOT APPLICABLE
(xi)	Limit switch assembly for coal-on-belt, no coal flow, shear pin failure, etc.	10% or 2 nos. whichever is more.		3,79,995			
(xii)	Coupling (eddy current type etc., if applicable)	10% or 2 nos. whichever is more.		3,79,995			
	3 Electromatic Safety Valves						
(a)	Pressure switches, local PB stations and solenoid Valves.	10% or 2 nos. of each type whichever is more.		4,07,498			
	4 Furnace Temperature Probes						
(a)	Thermocouple	2 Nos. of each type		67,900			
	5 Acoustic Pyrometers						
(a)	Signal Processor and interface modules	10% or 2 nos. of each type and model whichever is more					NOT APPLICABLE
(b)	Sensors and Transceivers	20% or 2 nos. of each type and model which is more.					NOT APPLICABLE
	6 Furnace and Flame Viewing System			40,25,000			LOT PRICE FOR THE APPLICABLE ITEMS UNDER THIS SL NO
(a)	Flame Cameras	10% or 2 nos. of each type whichever is more.					
(b)	Electronic Modules	10% or 2 nos. of each type whichever is more.					
	7 Coal Bunker Level Indicating System			1,69,680			EDN -lot price has been given for the itmes under SI no 7 to 8
(i)	Sensors of each type	20% or 2 nos. of each type whichever is more.					

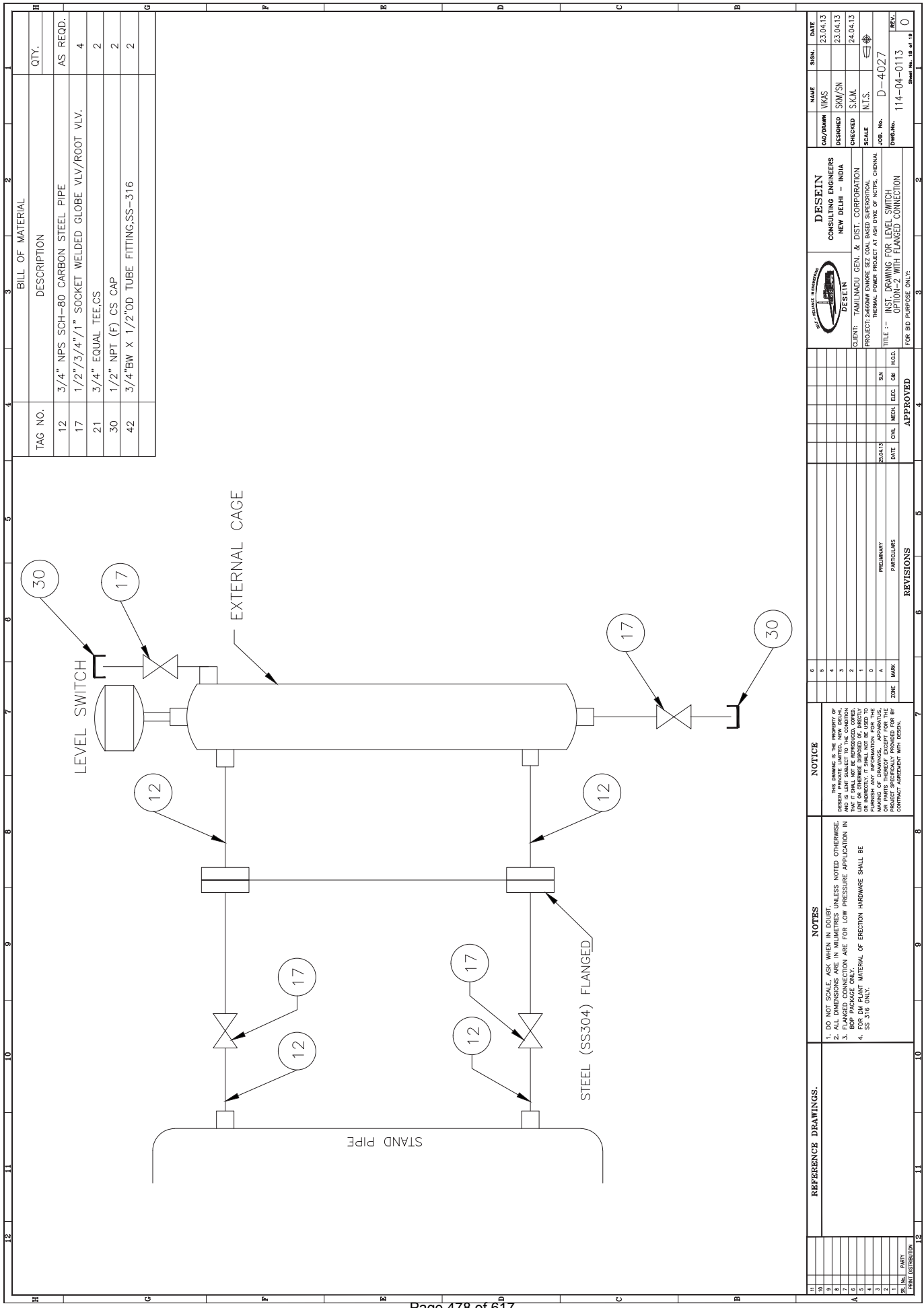
TANGEDCO						Total Ex-Works price	*Remarks
SI no	Name of spares	Unit	Qty	in INR			
(ii)	Electronic Cards of each types, model	10% or 2 nos. of each type and model whichever is more.					
(iii)	Panel indicators/displays for Bunker Level	20% or 2 nos. of each type whichever is more.					
8 (i)	Solenoids for SG pneumatic drives/valves.	20% or 2 nos. of each type whichever is more.					
(ii)	Solenoid valves.	20% or 2 nos. of each type whichever is more.					
(iii)	Diaphragms	20% or 2 nos. of each type whichever is more.					
9	Conductivity type level monitoring system						NOT APPLICABLE
(i)	Electrodes	50% of population of each type and model.					NOT APPLICABLE
(ii)	Electronic Cards	20% or 2 nos. of each type and model whichever is more.					NOT APPLICABLE
(iii)	Lamps/LEDs of display units	100%					NOT APPLICABLE
10	Mill and Air heater Fire detection system.				63,672		Included in SI No 1.00.01 & 1.00.02 for EDN scope of supply and lot price indicated here is for Trichy's scope of supply.
(a)	Thermocouple	10% or 2 nos. whichever is more			-		
(b)	Process actuated switches	10% or 1 no. whichever is more					NOT APPLICABLE
(c)	Electronic cards	20% or 2 nos. whichever is more					NOT APPLICABLE
1.00.16.02	Other TG Related Sub-Systems						
	Turbine Supervisory System/EHTC/ITSC/ATT/ATRS/GSPC/IDBFP etc.						EDN portion is Included in SI No 1.00.01 & 1.00.0
(i)	Power Supply assemblies of all types	10% or 2 nos. of each type whichever is more				11,81,034 (viii)	HYD- Lot price for items under for the SI no (i) to (viii)
	Temperature Sensing elements	10% or 2 nos. of each type whichever is more					Already covered under S.No.1.00.01.02 (i) above, Hence,not offered again.
(iii)	CJC assemblies of all types	10% or 2 nos. of each type whichever is more					
(iv)	Local gauges/transmitters of all types, range, model no. etc. For Temperature, pressure, DP, differential expansion, axial shift etc.	5% or 1 no. of each type whichever is more					Already covered under S.No.1.00.01.03 above. Hence,not offered again.

TANGEDCO						Total Ex-Works price	*Remarks
Sl no	Name of spares	Unit	Qty	in INR			
(v)	Process Actuated Switch Devices of all types, range, model no. etc. for pressure, DP, temperature, flow, level, proximity/speed etc.	5% or 1 no. of each type, whichever is more					Already covered under S.No.1.00.01.03 above. Hence, not offered again.
(vi)	Electronic Cards/PCB's/interface units/special cables etc. of each type of measurement used in TSI.	10% or 2 nos. of each type whichever is more.					
(vii)	Instrument valves of all types like isolating, 2/3/5 way valve manifolds, hi pressure reducing, safety relief, each type of solenoid valves etc.	5% or 2 nos. of each type, whichever is more.		1,74,230			
(viii)	Sensors of all types, range, model etc. for vibration, eccentricity, proximity, differential expansion, axial shift, EHC position, Stop/Control valve position and any other measurements etc.	10% or 2 nos. of each type, whichever is more.					Sensors for Stop/ control valve position are already covered above under C&I spares. Hence, same are not offered again. For rest of measurements, the sensors are "Not applicable".
(ix)	Electro Hydraulic Converter.	1 complete unit of each type.		5,74,276			
			C&I TOTAL	26,12,61,835			

L.DRAWINGS

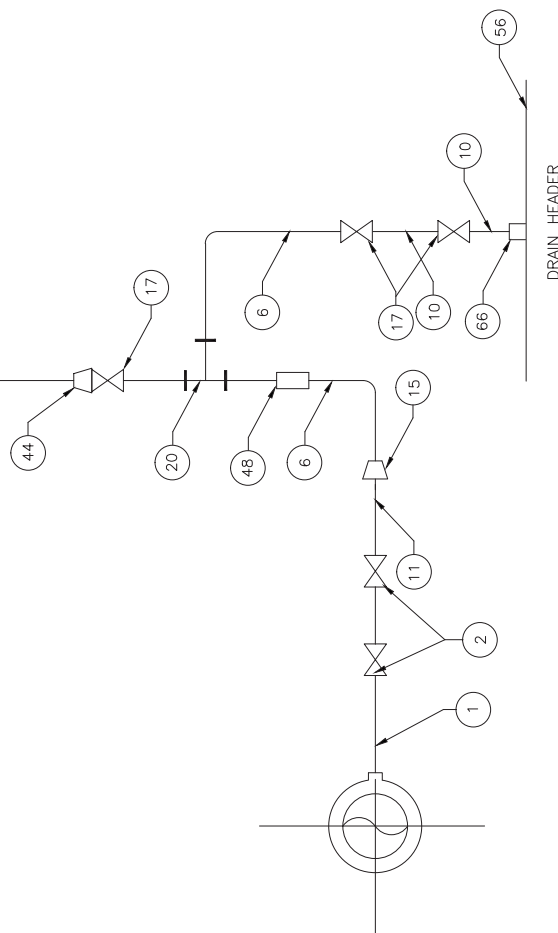
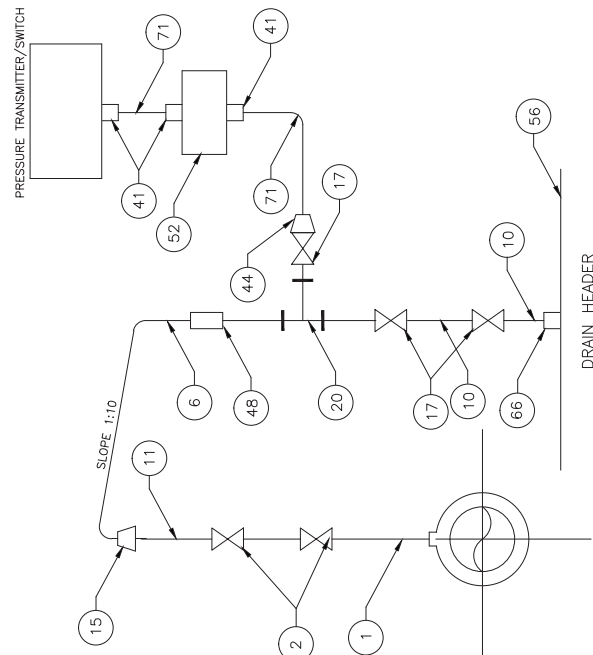






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BILL OF MATERIAL			QTY.
TAG NO.	DESCRIPTION		
12	3/4" NPS SCH-80 CARBON STEEL PIPE		AS REQD.
17	1/2"/3/4"/1" SOCKET WELDED GLOBE VLV/ROOT VLV.		
21	3/4" EQUAL TEE,CS		2
30	1/2" NPT (F) CS CAP		2
42	3/4"BW X 1/2"OD TUBE FITTING,SS-316		2
			G

REFERENCE DRAWINGS: 1. DO NOT SCALE ANY WHEN IN DOUBT 2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE. 3. FLANGED CONNECTION ARE FOR LOW PRESSURE APPLICATION IN BOP PACKAGE ONLY. 4. SS 316 ONLY.		NOTES THE DRAWING IS THE PROPERTY OF DESEIN CONSULTING ENGINEERS AND IS LEFT SUBJECT TO THE CONDITION THAT IT SHALL NOT BE REPRODUCED, COPIED, OR INDIRECTLY, IT SHALL NOT BE USED TO MAKE ANY CLAIM OF INFRINGEMENT OF PATENT OR MAKING OF DUBIOUS, APPROPRIATE, OR PARTS THEREOF EXCEPT FOR THE CONTRACT AGREEMENT WITH DESEIN.		NOTICE THE DRAWING IS THE PROPERTY OF DESEIN CONSULTING ENGINEERS AND IS LEFT SUBJECT TO THE CONDITION THAT IT SHALL NOT BE REPRODUCED, COPIED, OR INDIRECTLY, IT SHALL NOT BE USED TO MAKE ANY CLAIM OF INFRINGEMENT OF PATENT OR MAKING OF DUBIOUS, APPROPRIATE, OR PARTS THEREOF EXCEPT FOR THE CONTRACT AGREEMENT WITH DESEIN.		REVISIONS DATE: 23.04.13 PRELIMINARY PARTIALS		APPROVED DATE: 23.04.13 ONE: MECH. ELEC. CSE. PAGE: 2		DESEIN CONSULTING ENGINEERS NEW DELHI - INDIA CLIENT: TAMILNADU GEN. & DIST. CORPORATION PROJECT: 2460MW ENCORE SZL COAL BASED SUPERCRITICAL THERMAL POWER PROJECT AT ASH DYE OF NCTPS, CHENNAI TITLE: - INST. DRAWING FOR LEVEL SWITCH OPTION-2 WITH FLANGED CONNECTION FOR BID PURPOSE ONLY.		NAME: WKAS DESIGNED: SKM/SN CHECKED: S.K.M. SCALE: N.T.S. JOB. No.: D-4027 ENG.No.: 114-04-0113 SHEET No. 18 of 19	
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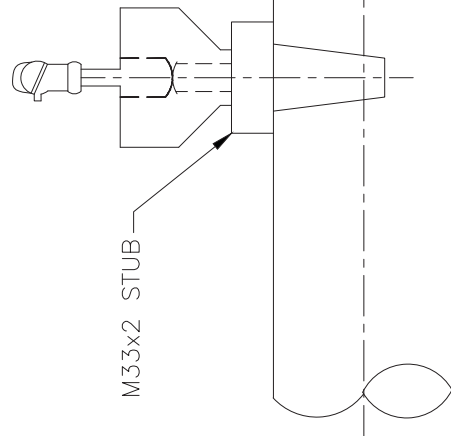
TRANSMITTER MOUNTED ABOVE
INSTRUMENT SOURCE POINT

FIG-C

TRANSMITTER MOUNTED ABOVE
INSTRUMENT SOURCE POINT
FIG-D

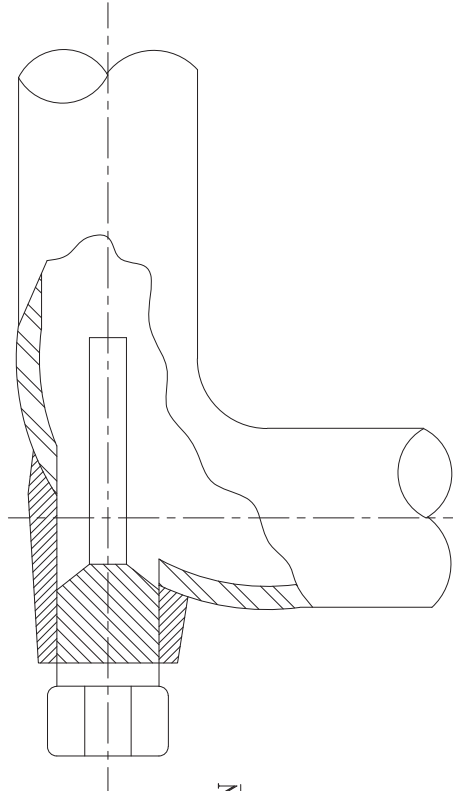
71	1/2"OD IMPULSE TUBE,SS-316	AS RECD.
66	1/2" GI SOCKET	1
56	2"NB GI DRAIN HEADER	
52	5/3/2-VALVE MANIFOLDS,SS-316	1
48	1/2"SW,CS/AS BULK HEAD PIPE UNION	1
44	1/2"BW X 1/2"OD COMPRESSION TUBE FITTING,SS-316	1
41	1/2"NPT(M) X 1/2"OD TUBE COMPRESSION FITTING,SS-316	3
20	1/2"SW,ALUM. TEE,CS	1
17	1/2" SW,CS GLOBE VALVE / NEEDLE VALVE	3
15	1" TO 1/2" SW REDUCER	1
11	1" NPS SCH-80 CS/AS NIPPLE	1
10	1/2" NPS,SCH 80/160, CS/AS NIPPLE	2
6	1/2" NPS. SCH 80/160 CS/ AS PIPE	AS RECD.
2	1/2"3/4"x1" ROOT VALVE	2
1	1/2"3/4"x1" CARBON/ALLOY STEEL NIPPLE OF MTL. SAME AS THAT OF MAIN PIPE(AS PER PROCESS RECD.)	AS RECD.
TAG NO.	DESCRIPTION	C D
		QTY.

REFERENCE DRAWINGS:			NOTES			NOTICE			BILL OF MATERIAL																				
11			NOTES 1. DO NOT SCALE. WORK WHEN IN DOUBT. 2. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE. 3. DIMENSIONS IN PARENTHESES ARE FOR INFORMATION ONLY. 4. ABOVE DIMENSIONS ARE FOR BASIC. GUSE LINE TO BE MET BY BENDER. 5. DIMENSIONS IN PARENTHESES ARE FOR INFORMATION ONLY. 6. DIMENSIONS IN PARENTHESES ARE FOR INFORMATION ONLY. 7. DIMENSIONS IN PARENTHESES ARE FOR INFORMATION ONLY. 8. DIMENSIONS IN PARENTHESES ARE FOR INFORMATION ONLY. 9. DIMENSIONS IN PARENTHESES ARE FOR INFORMATION ONLY. 10. DIMENSIONS IN PARENTHESES ARE FOR INFORMATION ONLY.			NOTICE THIS DRAWING IS THE PROPERTY OF THE COMPANY. IT IS TO BE KEPT IN THE OFFICE OF THE COMPANY AND IS NOT TO BE LOANED, REPRODUCED, COPIED, OR IN ANY MANNER USED FOR THE PURPOSE OF REPRODUCING OR TRANSMITTING INFORMATION IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPYING, RECORDING, OR BY ANY INFORMATION STORAGE AND RETRIEVAL SYSTEM, WITHOUT THE WRITTEN PERMISSION OF THE COMPANY. THE COMPANY ASSUMES NO LIABILITY FOR ANY LOSS OR DAMAGE TO THE DRAWING OR FOR ANY LOSS OF PROFITS OR REVENUE, OR FOR ANY OTHER CONSEQUENCES OF ANY SUCH USE. THE COMPANY ASSUMES NO LIABILITY FOR ANY LOSS OF PROFITS OR REVENUE, OR FOR ANY OTHER CONSEQUENCES OF ANY SUCH USE.			 DESEIN CONSULTING ENGINEERS NEW DELHI - INDIA DESEIN CLIENT: TAMILNADU GEN. & DIST. CORPORATION PROJECT: THIRUVANANTHAPURAM 322 COAT BASED SUPERIOR PRELIMINARY TITLE: INST. DRAWING FOR PRESS. & OFF PRESS. SCALE: N.T.S. CHECKED: S.K.M. DESIGNED: S.M./S.N. NAME: VIKAS CAD/THIN: 23.04.13 DATE: 23.04.13																				
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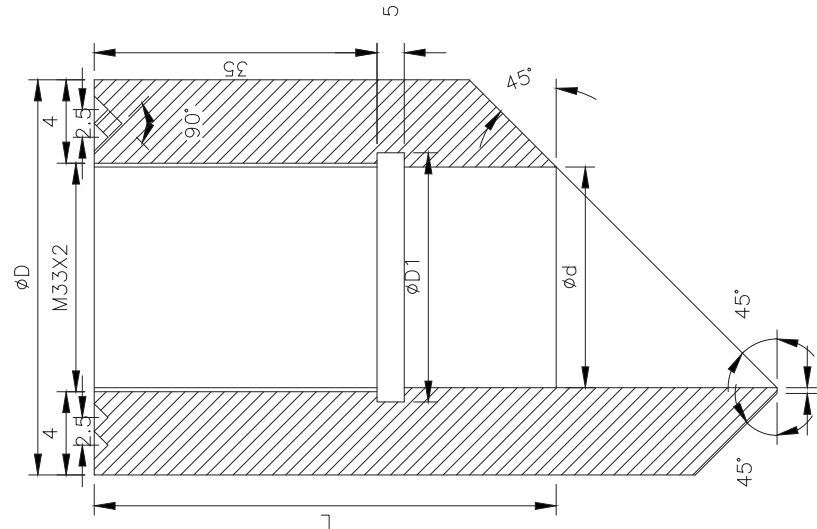
1. MATERIAL OF THE BOSS SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED.
2. LENGTH OF THE STUB (L) SHALL BE 65/45 mm DEPENDING UPON PIPE SIZE.
AS PER CORPORATE STD. AA 7326102.(FOR PIPE OD 88.9mm TO 159mm
STUB HEIGHT SHALL BE=65mm & FOR PIPE OD >191.1mm STUB HEIGHT SHALL BE=159mm)
3. STRAIGHT IMMERSION STUBS SHALL BE USED FOR PIPE OD'S 168.3mm & ABOVE.
THE STUB HEIGHT FOR PIPE OD, 168.3mm TO <191.1mm SHALL BE 65mm.
4. SLANT IMMERSION STUBS SHALL BE USED FOR PIPE OD'S 88.9mm TO 159mm.
5. FOR MAIN PIPE OD'S 88.9mm & below SUITABLE EXPANDER SHALL BE USED.

(FOR MAIN PIPE OD 168.3mm & ABOVE)



(FOR MAIN PIPE OD 88.9mm & BELOW)

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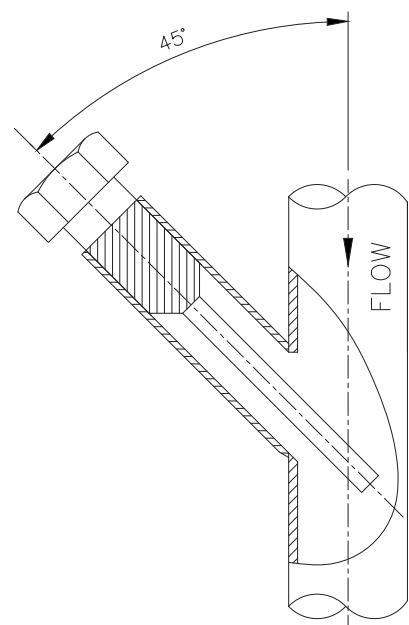


TEMPERATURE STUB FOR SLANT IMMERSION

FOR PIPE OD BELOW 219.1mm	29	55	33.5	1.5	65
FOR PIPE OD 219.1mm & ABOVE	29	55	33.5	1.5	45
MAIN PIPE SIZES	d	D	D1	S	L

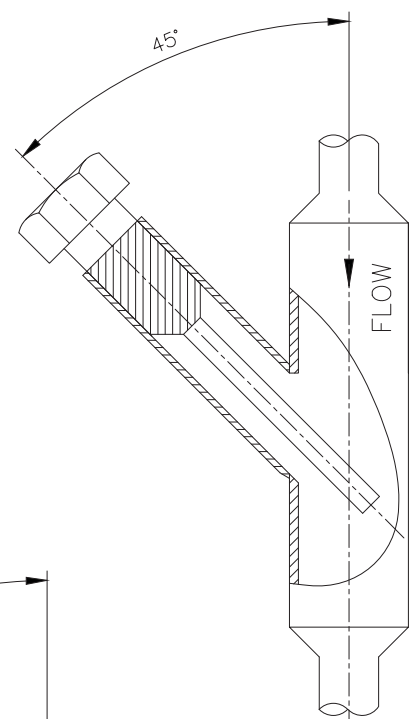
NOTE :-

1. MATERIAL OF THE BOSS SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED.
2. LENGTH OF THE STUB (L) SHALL BE 65/45 mm DEPENDING UPON PIPE SIZE, AS PER CORPORATE STD. AA 7326102.(FOR PIPE OD 88.9mm TO 159mm STUB HEIGHT SHALL BE=65mm & FOR PIPE OD >219.1mm STUB HEIGHT SHALL BE=45mm)
3. STRAIGHT IMMERSION STUBS SHALL BE USED FOR PIPE OD'S 168.3mm & ABOVE. THE STUB HEIGHT FOR PIPE OD, 168.3mm TO <219.1mm SHALL BE 65mm.
4. SLANT IMMERSION STUBS SHALL BE USED FOR PIPE OD'S 88.9mm TO 159mm.
5. FOR MAIN PIPE OD'S 88.9mm & BELOW SUITABLE EXPANDER SHALL BE USED.



INSTALLATION TYPE-3

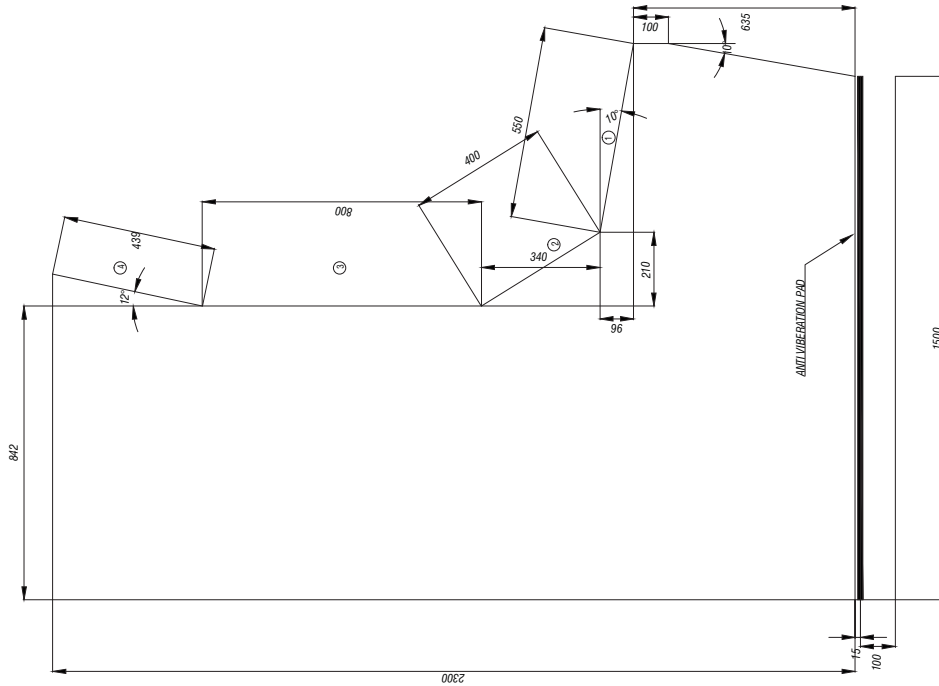
(FOR MAIN PIPE OD 88.9mm TO 159mm)



INSTALLATION TYPE-4

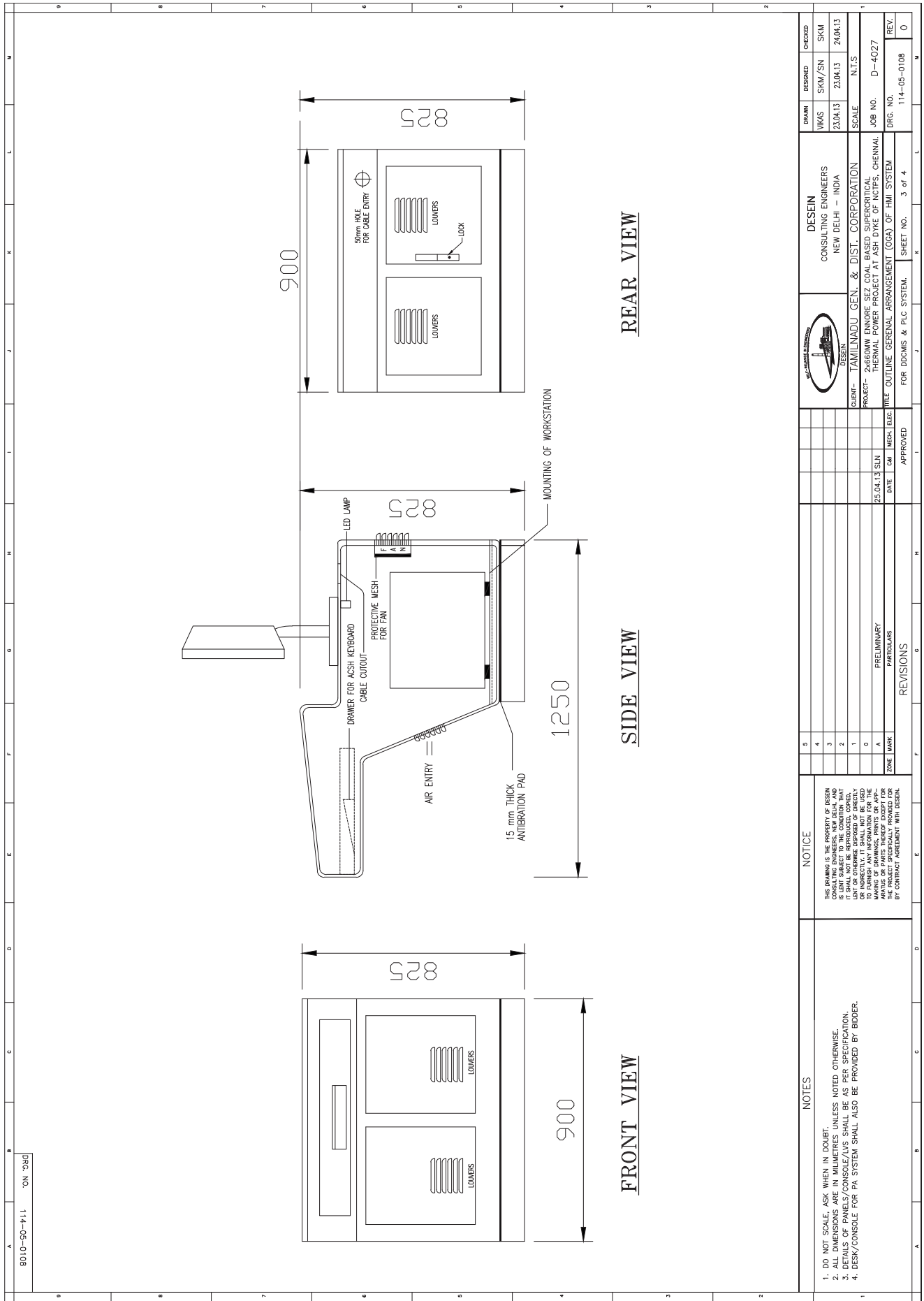
(FOR MAIN PIPE OD 88.9mm & BELOW)

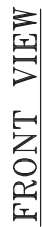
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12		11		10		9		8		7											



- NOTE:-**
- 1 : Panel for Mounting announcement P.B.
Desk release P.B, Emergency Trip P.B.
 - 2 : Panel for Mounting ILPB for OLCS / Sequential Operation.
 - 3 : Sheet metal panel for mounting MIMC , Ammeters, Indicator, Totalizer, recorder etc.
 4. Inclined Sheet metal panel for mounting Announcement Facia windows.

NOTES		NOTICE		5		4		3		2		1		0		A		P		REVISIONS		SHEET NO.		1 of 1		FOR BID PURPOSE		DRG NO.		114-05-0105		REV.		0	
1. DO NOT SCALE, ASK WHEN IN DOUBT.		THIS DRAWING IS THE PROPERTY OF DESEN CONSULTING ENGINEERS. IT SHALL NOT BE REPRODUCED, COPIED, OR IN ANY MANNER, OR INDIRECTLY, IT SHALL NOT BE USED TO FURNISH ANY INFORMATION FOR THE PROJECT SPECIFICALLY PROVIDED FOR BY CONTRACT, AGREEMENT WITH DESEN.																																	
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.																																			
3. DETAILS OF PANELS/ DESK SHALL BE AS PER SPECIFICATION.																																			



REVISIONS



**2X660 MW ENNORE SEZ
COMPRESSED AIR SYSTEM
STANDARD TECHNICAL SPECIFICATION**

SPECIFICATION No: PE-TS-412-555-A001

VOLUME: II B

SECTION : D

REV. 00

DATE: 15.12.2016

SHEET: 1 OF 1

**SECTION: D
STANDARD TECHNICAL SPECIFICATIONS**

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		VOLUME II B	
		SECTION D	SUB-SECTION A8
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1. GENERAL			
1.1	This specification covers the design, manufacture, testing at Manufacturer's works, delivery to site, handling at site, installation, commissioning and carrying out acceptance tests and final painting at site of various equipment of the compressed air system, as specified hereinafter.		
2. SYSTEM DESCRIPTION			
2.1	The compressed air system shall consist of instrument air compressors & air drying plant (ADP), plant air compressors, air receivers, control panels interconnecting compressed air piping, cooling water piping, instrumentation and control.		
2.2	The compressors shall be arranged such that all the plant air compressors shall supply air to the upstream (header of instrumentation air of each ADP through an isolation and a non-return valve so that in the event of failure of instrument air compressor, the instrument are in ensured at all time continuously.		
3. DESIGN CRITERIA			
3.1	The instrument air compressor will be designed to meet the instrument air requirements of all the equipments /plants/systems as specified elsewhere in the specification (excluding the compressed air requirement of Ash Handling Plant).		
3.2	The Plant/Service air compressor will be designed to meet the plant/service air requirements of all the equipments / plants / systems as specified elsewhere in the specification (excluding the plant air requirement of Ash Handling Plant) or capacity be identical as that of the instrument air compressors whichever is higher.		
3.3	Design margin of 25% is to be considered for IA & PA/SA requirement for sizing of the Instrument Air Compressor & Plant/Service Air Compressor.		
3.4	Each compressor will be designed to deliver the nominal capacity at the required delivery pressure.		
3.5	The compressors' capacity will be designed for 45 ⁰ C DBT and 75% RH		
3.6	For Instrument Air, Delivery pressure will be 7.5 Kg/cm ² (g) at ADP outlet.		
3.7	For Plant / Service Air, Delivery pressure will be 8.0 Kg/cm ² (g) at Compressor outlet.		
3.8	Air compressors will be designed for continuous operation with high efficiency to satisfy the performance requirement.		
3.9	The continuous motor rating (at 50 ⁰ C ambient) will be at least ten percent (10%) above the maximum load demand of the driven equipment under the entire operating range. When the driver is not directly coupled to the compressor, due consideration will be made for losses in power transmission, in addition to the above margin.		
3.10	Velocity of air in the air piping shall be limited from 6 to 9 m/sec.		
3.11	Velocity of water flow shall be limited to 2.5 m/sec and for gravity flow the same shall be limited to 1.5 m/sec.		
3.12	For calculating friction loss in piping system: WILLIAM & HAZEN formula shall be used with C value as 100.		

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3.13	Noise level of compressors not to exceed 85 dBA to a reference of 0.0002 microbar when measured at a distance of 1.5 m above the floor in elevation and at a distance of 1 m horizontally from the nearest surface of compressor.		
3.14	Compressors to be designed for Continuous, Load-Unload and On-Off mode operation.		
3.15	Satisfactory operation in parallel shall be ensured without any uneven load sharing, undue vibration, noise etc.		
4.	OIL FREE MULTISTAGE SCREW TYPE COMPRESSORS		
4.1	AIR COMPRESSOR SHALL COMPLY WITH THE FOLLOWING REQUIREMENTS.		
4.1.1	Design / Construction		
	i) Compression chamber Wall thickness to withstand maximum design pressure.		
	ii) Casing with a large inlet port for fast filling and low air velocity.		
	iii) To provide suitable arrangement for cleaning of the cooling water jackets during maintenance of compressor.		
	iv) Dynamically balanced, one piece Rotors with asymmetric profile, to keep leakage losses to a minimum and ensure high efficiency.		
	v) Rotor shaft mounted, oil lubricated, highly precise timing gear shall be designed to counter act the axial forces incurred in compression.		
	vi) Life of Oil lubricated anti-friction type bearing be at least 8000 running hours.		
	vii) Shaft Seals of floating restrictive ring type design.		
	viii) The shaft seal rings and retainers shall be free for radial self-adjustment on the rotor shafts.		
	ix) Minimum design service factor for the integral, oil lubricated type, step-up Gear Box shall be of 1.5.		
	x) To provide safety valves on low pressure and high pressure stages.		
	xi) A direct driven positive displacement type oil pump connection to the main drive shaft is preferred. Alternatively a separate motor driven oil pump be provided.		
	xii) The lubrication system to include oil pump, oil filter, oil cooler and oil tank / sump.		
	xiii) Cooling shall be by closed circuit Demineralised water.		
	xiv) Compressor shall be directly coupled with constant speed squirrel cage induction motor conforming to the technical specification attached elsewhere.		
4.1.2	Material of construction		
	The materials of various components shall conform to the applicable BIS / BS / ASTM / DIN standard or any other reputed standards.		
	i) Compressor chamber: Cast iron coated with corrosion resistant material.		
	ii) Rotors: Forged carbon steel coated with corrosion resistant material		

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iii) Timing Gear: Low, Alloy Steel. iv) Inlet throttle valve & Housing: Aluminium v) Shaft Seals: High, Alloy Steel. vi) Safety valves: Brass vii) Water separator: Cast Iron viii) Non-return valves: Stainless steel spring loaded type. ix) Blow off valve: Stainless steel. x) Unloading Cylinder header: Aluminium xi) Tube of Blow off cooler / oil cooler: SS 304 xii) Outer casing of coolers: Carbon Steel xiii) Gear box: Cast Iron xiv) Gears: Alloy Steel. However, Material of Construction of components of Screw Compressor of reputed manufacturer shall also be acceptable subject to BHEL/Customer's approval. 4.1.3 Accessories Each compressor skid to include Suction filter, silencer, intercooler & After cooler with moisture separators, automatic drain traps, instruments, control panel Base plate, coupling guard. Foundation bolt, nuts, anti vibration pads, Eye bolts and operation and maintenance tools. 4.1.4 Control Philosophy i. Each compressor be operatable under continuous, auto, "Load-Unload" or "On-Off" mode (i.e.) "Dual control modes". ii. Any of the compressors shall be selectable at control panel to operate either for Base duty (Auto Load-Unload) or Standby duty (Auto On-Off) operation. iii. In "Base duty" mode, whenever air supply from compressors exceeds the demand, control system shall: a) Operate the load-unload circuit at a predetermined set pressure. b) Throttle the inlet valve. c) Open the blow off valve. Unloaded compressors to run in idling mode and when system pressure drops due to more demand, the load-unload circuit shall operate again to bring the compressor to 100% load after closing the blow-off valve. iv. In "Stand-by" duty the compressor shall automatically assist base load compressors during periods of peak air demand. When air pressure in the system reaches a pre-set lower limit, compressor shall be started to unloaded condition. After a suitable time delay, the compressor shall be fully loaded. v. When the pressure in the system rises to pre-set high value, the compressor shall be unloaded and shall run in idling mode for a specific period, (set by a timer), the compressor may be loaded to; full load in case of drop in system			

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pressure or compressor may be stopped in case the system pressure does not drop and compressor continues to idle for more than a pre-set time.

vi.

The pressure and duration of time to be set shall be adjustable at site from the panel.

vii.

Further all interlocks for safe and proper operation of the compressors shall be provided by the Bidder.

viii.

All pressure and temperature conditions used for tripping the compressor shall be provided with pre-trip annunciation in the control panel.

ix.

Independent switches shall be used for alarms (annunciations) and tripping or interlock as far as possible.

x.

An electrically operated automatic valve shall be provided on cooling water supply line of each compressor which will automatically shut off the cooling water supply, in case compressor is not running for more than set time duration. Suitable interlock shall also be provided for opening the valve before starting of the compressor.

4.2

Intake Filter and Silencer

Intake Air Filter and Silencer shall be comply with the following requirements:

4.2.1

Performance

i.

Filtering efficiency minimum 99% down to 10 microns.

ii.

Maximum pressure drop across filter at design flow rate in new condition be 250 mm of water column.

iii.

Design Airflow rate corresponding to compressor airflow.

4.2.2

Quantity: One per compressor

4.2.3

Design air data

i.

Dust concentration:30 mg / M³

ii.

Particle size in microns: Up to 10 microns

4.2.4

Type/Design: Heavy duty type

4.2.5

Construction

i.

To provide densely packed, replaceable type paper as filtering media.

ii.

Filter to be designed to have sound suppressing characteristics.

iii.

Preferably Filter and silencer be combined type.

iv.

Filter to take suction from outside not from compressor room.

4.3

Inter Cooler & After Cooler

Inter cooler and After cooler shall comply with the following requirements:

4.3.1

Performance

i.

Outlet temperature of air from intercooler to suit the equipment offered.

ii.

Outlet temperature of air After cooler to be limited to 10 Deg.C of inlet cooling water temperature.

4.3.2

Type: Shell and tube type

4.3.3

Construction

i.

Design code: TEMA class “C” or equivalent.

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	ii. With removable tube bundle type. iii. With internal baffling. iv. Design pressure in airside: 2 Kg / Cm² more than air inlet pressure. v. Design pressure in waterside: Not less than shut off head of DM cooling water pump.		
4.3.4	Material i. Tube : Admiralty brass or Aluminium brass or SS 304. ii. Shell : SA 285 Gr.C or equivalent iii. Tube sheet: SA 285 Gr.C or equivalent iv. Baffle : Carbon steel v. Flanges : Steel IS 2862.		
4.3.5	Accessories i. To provide necessary vent & drain connections. ii. Moisture separation units with level gauge. iii. Automatic drain trap stations with bypass & isolating valves for moisture separators. iv. Safety valves v. Lifting eye bolts, tools & tackles if any.		
4.3.6	Additional Data After coolers are not to be fitted with instrument air compressors if bidder offers "Heat of compression" type air drying plants and the same shall be provided at down stream of ADP.		
5.	RECIPROCATING OIL FREE COMPRESSOR		
5.1	Each of the Compressors shall comprise but not be limited to the following:		
5.1.1	LP and HP cylinders as required to meet the compressor rating, intercoolers, automatic drain trap station, relief valves and other accessories.		
5.1.2	Drive machinery including drive motor and accessories.		
5.1.3	Frame lubrication system, complete with protective devices and instruments.		
5.1.4	After cooler and moisture separator both complete with automatic trap station, relief valves and other accessories and instruments .		
5.1.5	Air intake filter and silencer unit		
5.1.6	Set of local instruments as applicable		
5.1.7	Set of cooling water control valves.		
5.1.8	Set of foundation bolts, nuts etc. for compressors, motors, after coolers, suction filters etc.		
5.1.9	Control panel comprising of all relays, contactors, solenoid valves, pressure switches, instruments, pneumatic impulse air tubing annunciation window selector switches etc.		
5.1.10	Flow indicator of jacket cooling water after the inter and after coolers		
5.1.11	Relief valves on the instrument and service air headers and also after the interconnection header between SA and IA headers.		

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5.1.12	Instruments like pressure / temperature gauges and switches as required for the following:- i. Pressure switches a) Compressor lube oil pressure low alarm b) Compressor lube oil pressure very low trip c) To load the compressor d) To unload the compressor e) To start the compressor f) To stop the compressor g) Low water pressure alarm on common water inlet heater of the Compressor. h) Very low water pressure trip on common water inlet heater of the Compressor. ii. Temperature switches a) Air after after-cooler high alarm b) Air after after-cooler very high trip c) Compressor cylinder water outlet temperature high alarm d) Compressor cylinder water outlet temperature very high trip. iii. Pressure gauges a) After compressor inter-cooler b) After compressor after-cooler c) At water inlet common header of the compressors iv. Temperature gauges a) After cooler water outlet b) After cooler air outlet c) Inter cooler water inlet d) Inter cooler air outlet e) After air compressor cylinder jacket
5.1.13	Flow indicator of jacket cooling water after the inter and after coolers
5.1.14	Relief valves on the after coolers, intercoolers, instrument and service air headers and also after the inter connection headers between SA & IA headers, moisture separators etc.
5.1.15	Counter flanges, bolts, nuts and gaskets at all equipment/piping terminating points.
5.1.16	Base plate/plates, support plates, anchor bolts and nuts, inserts, lifting lugs, eye bolts, etc. as required.
5.1.17	Set of special tools and tackles including tools boxes.
5.1.18	Cleaning, protection and painting
5.1.19	Initial fill of lubricating oil for compressors and filtering media for all filters.

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5.2

5.2.1

CONSTRUCTION FEATURES

Air Compressors

i.

Each compressor shall be multi stage, reciprocating, water cooled type. Compressor cylinder shall be closed grained cost Iron conforming to IS:210 FG 260 or equivalent. The cylinder shall be provided with renewable liners or recording allowance as per API-015, 1974. The crankshaft and connecting rods shall be of forged steel conforming to IS:1875 or equivalent and statically and dynamically balanced,. The service air compressors shall be lubricated / non lubricated type (as required in the data sheet A) whereas the instrument air compressors shall essentially be non lubricated type and the air delivered by these instrument air compressors shall be completely free of any oil, grease and other impurities. To ensure, this the piston rings shall be of Teflon and no lubricating oil shall be used in the cylinder. Special care shall be taken to prevent any oil from finding its way into the cylinders from the crank case.

ii.

The piston rod packing shall also be of oil less self lubricating type. Any oil adhering to the piston rod shall be wiped off by suitable water rings. Suitable collar may also be fixed in the piston rod so that any trickling oil flow can be stopped from movement towards the cylinder.

iii.

The intake filters with built in silencers shall be of dry reusable type located at the air intake connection to low pressure cylinder to remove any carried solid particles in air.

iv.

Crank case shall be of rugged construction and shall have openings for access to all crank case machinery. A level indicator shall be provided for all crank case oil sump.

v.

Each compressor shall be driven preferably by direct coupeled electric motors or otherwise through 'V' belt drives. The drive shall be provided with a safety guard.

vi.

Flywheels shall be provided, if required, and shall be of adequate size to smoothen the effect of fluctuation of turning moment load during crank revolution.

vii.

Compressor valves shall have large effective areas permitting low velocities. In case of on lubricating type compressors, valves disc. Shall be either of stainless steel to AISI 316 or 15% chrome steel heat treated, tempered and ground. The valve seats and guards shall be case hardens and valve spring shall be of stainless steel. Self lubricating valve guides and wear strips shall be used for noiseless operation and long life. The tenderer shall offer his standard materials of construction for the valve for lubricated type of compressor.

viii.

To shut off cooling water flow through intercooler, compressor jacket and after coolers, operate lockable type gate valve (lockable in open position) shall be provided. These valves are to be shut off manually when required.

ix.

The crankshaft bearings shall be of antifricition type. A crankshaft driven positive displacement pump shall draw lubricating oil from the crankcase sump though a strained and shall provide for forced lubrication to all the bearings.

x.

The compressor lube oil pressure shall be built up with in a predetermined time (adjusted by a timer) failing which the compressor shall automatically trip.

xi.

Provision shall be made for lubricating the parts where ever necessary to ensure smooth operation and freedom from undue wear.

xii.

Gear boxes and oil bath shall be provided with filling and drain plug of adequate size and shall also be provided with visual level indicators. Provision shall be made for efficient lubrication of all bearings, including ball and roller bearings by the use of separate grease cups, self sealing nipples of oil baths. Housing of

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ball and roller bearings shall be packed at the time of assembly. Necessary provision shall be made for preventing dust ingress into lubricated parts. A drawing showing all lubricant points and recommended lubrications to be used shall be supplied. The first fill of oil lubricant of correct grade shall be provided.

xiii. All lubrication systems fittings on all equipment supplied shall wherever possible be standardised. The grease nipples shall be of button head type or approved equal and shall conform to IS:4009.

xiv. The power ratings of the driver shall be selected such that the minimum margin of 15% is available over the power requirement to deliver rated capacity at rated pressure. When the drive is not directly coupled to the compressor, due account should be made for losses in power transmission in addition to the above margin. In case belt driven compressors, 5% belt loss should be considered over and above 15% spare margin in selecting the driven motor.

5.2.2 Inter Cooler, After Cooler and Moisture Separator

i. The intercooler shall be provided between the low and high pressure stages of the compressor. The after coolers and moisture separator shall be located between the compressor discharge and air receiver. Volume bottles shall be provided at LP cylinder discharge end and HP cylinder suction and discharge ends to take care of the pulsation or air flow. Both intercooler and after cooler shall be water cooled complete with standard accessories, such as safety valves moisture separator and automatic drain trap, bypass arrangement for automatic drain trap. The equipment shall be complete with the instrument mentioned elsewhere in this specification included in the scope of work. The inter cooler and after cooler shall be designed with adequate margin in heat transfer area. For design purpose a cleanliness factor of 0.85 shall be used in both cases.

ii. The after cooler shall be designed such that the temperature of air leaving is not more than 80 deg. C above the cooling water inlet temperature.

iii. Following material of construction shall be used.

a) Shell: ASTM A-285 Gr. C or approved / Equal

b) Tubes: Copper as per BS-378 or admiralty brass to ASTM B-111 type B.

c) Moisture separator: Galvanised, to prevent corrosion Internal.

iv. The lower portion of moisture separator shall be provided with the gauge glass. Pressure drop in intercooler, after-cooler & moisture separator, shall be kept to a minimum. Pressure parts shall be designed as per IS:2825 or as per ASME section VIII Div. 1 Design of coolers shall be as per TEMA class C.

v. Both intercooler and after cooler shall preferably be standardised in regard to tube material, tube outside diameter & tube length.

5.2.3 Oil Separator

i. In case compressed air is to be fed from the lubricated compressors to the pneumatic/control valves, then it would be desirable that the air is made oil free before it is fed to the pneumatic valves bypassing it through and air separator. (Please refer to data sheet A).

ii. The oil separator shall be constructed from carbon steel in accordance with pressure vessel codes like ASME Section VIII Div. I or IS 2525. The design pressure of this same shall be indicated in Data Sheet A. The oil separator shall be able to remove the oil in the condensed form by impingement on a cartridge of synthetic wool to a degree as specified in Data Sheet A.

iii. The design of the oil separator shall be such as to facilitate easy removal of the synthetic wool cartridge for cleaning. A drain valve shall also be provided.

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iv. The frequency at which the oil separator is to be drained and the time after which the synthetic wool should be either washed with a solvent or replaced shall be clearly indicated.

5.3 Control and Interlock Equipment

5.3.1 Compressor Capacity Control

i. Control system for each compressor shall be to maintain receiver pressure within the specified limits by load unload Control" or on-off control" (i.e. dual control as per data sheet 'A' which are briefly described below:-

ii. The loading/unloading of the compressor is to be actuated through pressure switches located on the outlet header of each compressor. The compressor(s), in this mode of control would run continuously at constant speed but would be loaded and unloaded in steps of 100, 50% and 0% by closing and opening of the respective suction valves. This is to be achieved by means of a selector switch, having two position viz "Auto" and 'Mechanical'.

iii. In the auto position the control will be through electro pneumatic means i.e. pressure switches while in the mechanical position, the control shall be through adjustable spring loaded mechanical governors.

iv. Normally the selector switch for control for all the compressors will be in the 'Auto' position and the mechanical position is only a standby arrangement.

v. Another selector switch is to be provided for selecting the duty of the compressor viz. 'Main' or 'Standby' Duty. Depending upon the position selected in this selector switch, the compressor will run as a main compressor or be a standby.

vi. In the ON-OFF mode of capacity control the compressor will always be loaded except during starting. The compressor is started automatically when the discharge header pressure falls below the set value by the pressure switch. The compressor is stopped when the discharge header pressure reaches upper set limit on another pressure switch. The first start of compressor will however, be manual. In the event of tripping of compressor on fault or manually, the compressor will not start automatically until the fault is reset and started manually.

5.3.2 COMPRESSOR PROTECTION

The control panel shall house an audio visual alarm system for each compressor in order to ensure safe operation of the compressors and to bring their abnormal operation to the notice of the operator. The items to be annunciated for IA & SA compressors shall include but not be limited to the following:-

a) Receiver pressure high alarm

b) Receiver pressure very high trip

c) Receiver pressure low alarm

d) Compressor lube oil pressure low alarm

e) Compressor lube oil pressure very low trip

f) Air temperature after aftercooler high alarm

g) Air temperature after after-cooler very high trip

h) Compressor cylinder water outlet temperature high alarm

i) Compressor cylinder water outlet temperature very high trip.

6. AIR RECEIVERS

Air receivers shall comply with the following requirements.

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6.1.1	Design	i. Design pressure & temperature : 10 Kg/cm² & 50 Deg.C. ii. Outdoor located, vertical cylindrical vessel. iii. Design code : ASME Sec. VIII Div 1 or IS:2825 & IS 7938. iv. Welded Construction : Longitudinal seam in adjacent sections shall not be in same line. v. To provide gasketted inspection manhole of minimum 500 diameter. Opening shall not pierce any seam & shall be as far as possible away from any welded seam.	
6.1.2	Fabrication	i. Welding as per relevant codes. ii. Filler material to have composition & structure as that of material welded. iii. Welding electrodes to be approved by Owner. iv. Electrodes to be dried before use.	
6.1.3	Accessories	i. To provide Relief valves to suit compressor capacity and set pressure of the same at least 10% above working pressure. ii. The spring in relief valve shall not reset for any pressure more than 10% above or below the design set pressure. iii. Drain connection with automatic trap stations.	
6.1.4	Material	Shell End plates & flanges --- IS:2002 or Equivalent.	
7.	AIR DRYING PLANTS	Air Drying plants shall comply with the following requirements:	
7.1	Performance Requirements		
7.1.1	Normal flow rate:	To match compressor capacity.	
7.1.2		To be designed for continuous duty for dew point of outlet air at minus (-) 40 Deg.C at atmospheric pressure.	
7.1.3		Quality of dry outlet air to conform to Instrument society of American standard S7.3 "Quality Standard for Instrument Air".	
7.1.4		ADP to be placed upstream of the air receiver.	
7.2	Quantity		
7.2.1		One ADP for each Instrument air compressor.	
7.3	Type / Design		
7.3.1		"Heat of Compression type ADP" either "Conventional Type" or "Rotary Drum type".	
7.3.2		Drying by absorption method.	

	TECHNICAL SPECIFICATION COMPRESSED AIR SYSTEM	SPECIFICATION NO.PE-SS-EPC-555-A-001	
		VOLUME II B	
		SECTION D	SUB-SECTION A8
		REV. 0	
		SHEET 12 OF 14	

7.4	Construction of Conventional heat of Compression type ADP
7.4.1	Reactivation shall be by “Heat of Compression” method without any air purge loss. Hot unsaturated compressed air shall be used for regeneration of exhausted dessicant in case of “Heat of compression type ADP”.
7.4.2	With two absorber tower per ADP for conventional type (One for drying while the other is under regeneration / standby modes).
7.4.3	Design drying cycle: 8 Hours.
7.4.4	Design regeneration cycle: Less than 8 hours including cooling period.
7.4.5	Indoor located.
7.4.6	With (minimum) 3 steps de-pressurisation.
7.4.7	To provide automatic tower change over control with provision for manual take over.
7.4.8	All pressure vessels to be designed as per IS:2825 or equivalent code.
7.4.9	All vessels to include required manholes / harid holes.
7.4.10	All hot vessels & pipelines to be insulated to restrict the outside temperature within 60 Deg.C with mineral wool (or equivalent), GI wire netting and aluminium cladding / over.
7.4.11	Quantity of dessicant to be calculated taking into account residual moisture content at the end of regeneration cycle. Design calculation with curves shall be submitted for approval of Owner.
7.4.12	Absorption capacity and density to be considered for silica gel shall not be more than 10% and 550 Kg/M ³ respectively. In case of activated alumina the same shall be 8% (max) and 900 Kg/M ³ (max.) respectively.
7.4.13	Minimum 20% of dessicant depth shall be provided as free board in adsorber vessels.
7.4.14	Adsorber vessels to be provided with suitable number of inspection / sight windows of peresplex for observation of adsorbent condition.
7.4.15	Dessicant filling and removal connection shall be provided.
7.4.16	Non-lubricated two way three way / four way valves ball valves with pneumatic actuators be provided.
7.4.17	In case of Heat of compression type adsorbers shall be sized so that even when the compressor is operating at 50% capacity, complete regeneration shall be achieved within the cycle time.
7.4.18	Complete ADP equipments shall be preferably mounted on a skid.
7.4.19	Required sample connections in piping be provided for sampling of air at desired locations.
7.5	Accessories
7.5.1	Prefilters and After filters: 2x100% with automatic drain trap filter arrangement & with ceramic candle type elements.
7.5.2	Electric Heaters : 2x100% with thermostatic control for heater & facility for easy replacement of element.
7.5.3	To provide suitable solenoid valves for depressurisation and re pressurisation of towers.
7.6	Material
7.6.1	Absorber vessels & its internals: MS Vessels as per IS; 2062 & Internals SS 304

	TECHNICAL SPECIFICATION COMPRESSED AIR SYSTEM		SPECIFICATION NO.PE-SS-EPC-555-A-001	
			VOLUME II B	
			SECTION D	SUB-SECTION A8
			REV. 0	
			SHEET 13 OF 14	
7.6.2	Regeneration air cooler shell tube(if applicable): SA-285 Gr.C or equivalent			
7.6.3	Blower casing:	Carbon steel		
7.6.4	Blower blades & shaft:	Stainless steel		
7.6.5	Relief valves:	Brass or SS		
7.6.6	Tube of heat exchangers and Dehumidifier:	Aluminium brass or SS		
7.6.7	Shell & tube sheet for the above:	SA 285 Gr.C.		
7.6.8	Baffle:	Carbon steel		
7.6.9	Dessicant:	Silica gel / Activated Aluminium or as per manufacture's standard.		
7.7	Control philosophy			
7.7.1	Sequential operation of the adsorber towers be controlled automatically with a provision for manual take over.			
7.7.2	Automatic operation of adsorber tower under drying, operation of the other tower under regeneration, change over of towers, starting and stopping of blowers, slow depressurisation & re pressurisation of towers etc. shall be timer controlled. During the process, in case, operation is taken over manually from the panel through push button or selector switch, the sequential operation shall start with the manual initiation for each of the steps.			
8.	INTER CONNECTING PIPING, FITTING AND VALVES			
	Inter connecting piping, fittings and valves shall confirm to the following requirements.			

	TECHNICAL SPECIFICATION COMPRESSED AIR SYSTEM	SPECIFICATION NO. PE-SS-EPC-555-A-001	
		VOLUME II B	
		SECTION D	SUB-SECTION A8
		REV. 0	
		SHEET 14 OF 14	
8.1	All interconnecting compressed air piping shall conform to IS: 1239 (Heavy Grade) or IS: 3589 Gr. 410 and galvanised as per IS : 4736.		
8.2	Fittings for air piping shall be conforming to IS: 1239/IS:1879 and Grade equivalent that of parent pipe Grade.		
8.3	Compressed air piping from air compressor to after cooler and other lines handling hot air will be suitably insulated so as to restrict surface temperature to 60deg.C. The pipe joints will be screwed coupling type for sizes upto 50 NB and above 50 NB the same will be flanged.		
8.4	All cooling water piping will be M.S. conforming to IS: 1239 (Part-I) (Heavy Grade).		
8.5	For Air line Ball Valves with Stainless Steel internals with Teflon seat shall be provided. Ball valves upto 50 NB shall be of Forged Carbon Steel Body with screwed connections. Ball valves above 50 NB shall be of Cast Carbon Steel Body with flanged connections.		
8.6	The check valves shall conform to IS: 3412.		
8.7	For water line Gate valves shall be provided. For size 50 NB and smaller carrying water the same shall conform to IS:778 with gun metal body and trim and for above 50 NB with carbon steel body and internals.		
9.	INSTRUMENTATION (GENERAL)		
9.1	Detailed specification for the Instrumentation shall be referred in the control and instrumentation section of this volume.		
9.2	The bidder shall include instruments / controls to facilitate safe, reliable and efficient operation for the system offered. The instrumentation control system offered by the bidder shall be subjected to approval of the Employer during detailed engineering.		
9.3	All Instrumentation and Control equipments required for Compressed air system such as primary and secondary instruments, control panels / cabinets, cable etc. shall meet the requirements specified in control and instrumentation section of the Volume.		
9.4	The protection and interlock system shall be subject to the approval of the Employer.		
9.5	All pressure and temperature conditions used for tripping the compressor shall e provided with pre-trip annunciation in the control panel.		
9.6	Following general philosophy shall be followed regarding instrumentation.		
9.6.1	Pressure Indicators / Vacuum gauge:		
	i. At inlet outlet of each compression stage (air line).		
	ii. At inlet and outlet of cooling water header.		
	iii. At inlet and outlet of (air line) each heat exchangers of compressors & air drying plant (in air side).		
	iv. At inlet and outlet of each adsorber vessel.		
	v. At each air receiver and at outlet header of compressor & air drying plant.		
	vi. At inlet of each of the filters of compressors assembly and ADP system.		

	TECHNICAL SPECIFICATION COMPRESSED AIR SYSTEM	SPECIFICATION NO.PE-SS-EPC-555-A-001	
		VOLUME II B	
		SECTION D	SUB-SECTION A8
		REV. 0	
		SHEET 15 OF 14	
9.6.2	Pressure Switches (Individual for each function).		
	i. At inlet/outlet of each compressor stage of the compressor (for annunciation / interlock).		
	ii. At each air receiver for:		
	a) High/Low pressure alarm, for start/stop control.		
	b) For load/unload control.		
	c) At common discharge outlet of compressor & air drying plant (for alarm)		
	iii. At discharge of each compressor.		
9.6.3	Temperature Indicators		
	i. At inlet and outlet of each heat exchangers / coolers of compressor and air-drying plant in the lube oil, air & cooling water circuits.		
	ii. At inlet and outlet of electric heaters & exhaust (atmosphere) of regeneration air (for open through type ADP).		
	iii. At inlet and outlet of each adsorber vessel.		
	iv. At common discharge outlet of compressor & ADP.		
9.6.4	Temperature Switches / Temperature Controllers		
	i. At inlet and outlet of each heat exchangers / coolers of compressor and air drying plant in the air & cooling water and lube oil circuits for low & high alarms, trip & interlock.		
	ii. At outlet of electric heaters & exhaust of regeneration air (open through type ADP) for alarm & interlock.		
	iii. At discharge of each compressors (before air receiver).		
	iv. At common discharge outlet of air compressors & air-drying plant.		

MANUFACTURE'S NAME & ADDRESS										MANUFACTURING QUALITY PLAN										
ITEM : CHECK VALVE										CONTRACT NO.										
P.O. NO. : REV. NO. : DATE :										END USER :										
P.O. DATE :										CONTRACTOR : BHARAT HEAVY ELECTRICAL LIMITED										
PAGE : 1 OF 1																				
QUANTUM OF CHECK										REFERENCE DOCUMENTS										
M										C/N										
TYPE OF CHECK										ACCEPTANCE NORMS										
CLASS										FORMATS OF RECORDS										
CHARACTERISTICS										AGENCY										
COMPONENTS & OPERATION										REMARKS										
1.0	MATERIALS																			
1.1	BODY, COVER, DISC, SEATRING & FASTNERS																			
1.2	HINGE PIN (BAR STOCK)																			
2.0	INPROCESS INSPECTION																			
2.1	MACHINING OF BODY, COVER, DISC																			
2.2	DISC & SEATRING																			
3.0	ASSEMBLY																			
4.0	TESTING																			
4.1	SHELL																			
4.2	HYDRO SEAT																			
5.0	FINAL INSPECTION																			
5.1	PAINTING																			
6.0	PROVISION OF NAME PLATE																			
NOTE:- SS PARTS SHALL BE CHECKED AT 10% POSITIVE MATERIAL IDENTIFICATION (PMI) GRADE ANALYSER																				
LEGEND:										DOC. NO. :										
*RECORDS IDENTIFIED WITH TICK(✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.																				
M : MANUFACTURER / SUB-SUPPLIER																				
C : MAIN SUPPLIER N : END USER & BHEL																				
P : PERFORMANCE W : WITNESS V : VERIFICATION AS APPROPRIATE																				
MANUFACTURER/SUB-SUPPLIER										APPROVED BY										
SIGNATURE										APPROVAL SEAL										

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

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

REFERENCE QUALITY PLAN												
MANUFACTURE'S NAME & ADDRESS			ITEM : AIR DRYER		QIP NO. Rev : Date : Page :		Sign of MGR		QIP No : Rev No : Date : Page :		Reviewed By	
SR NO.	COMPONENTS AND OPERATORS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENTS	ACCEPTANCE	FORMAT OF RECORD	AGENCY	REMARKS		
1	2	3	4	5	6	7	8	9	M	C	N	
A MATERIAL INSPECTION												
1.1	ROTOR DRUM	CHEMICAL	MAJOR	CHEMICAL ANALYSIS	100%	APPROVED DATASHEET	APPROVED DATASHEET	COC	V	V	V	
1.2	DRYER VESSEL COMPLETE	DIMENSIONS MECHANICAL	MAJOR	DIMENSIONS MECH PROPERTIES	100%	MFG DRG APPROVED DATASHEET	MFG DRG	COC	V	V	V	
1.3	REGEN COOLERS	MECHANICAL CHEMICAL	MAJOR	CHEMICAL & MECH.	100%	APPROVED DATASHEET	APPROVED DATASHEET	COC	V	V	V	
B INPROCESS INSPECTION												
2.1	REGEN COOLERS	TIGHTNESS	MAJOR	HYDROSTATIC	100%	1.5 X DESIGN PRESSURE FOR NO LEAKAGE 5 MIN.		COC [SEE NOTE 1]	V	P	V	
2.2	DRYER VESSEL WATER SEPARATOR	TIGHTNESS	MAJOR	HYDROSTATIC	100%	1.5 X DESIGN PRESSURE FOR NO LEAKAGE 5 MIN.		COC [SEE NOTE 1]	V	P	V	
2.3	WATER SEPARATOR GEAR BOX DRAIN VALVES MOTOR	FUNCTIONAL	MAJOR	FUNCTIONAL	100%	MFG DRAWING	MFG DRAWING	COC	V	P	V	
C FINAL INSPECTION												
AT ATLAS COPCO AIRPOWER BELGIUM												
3.1	ASSEMBLY AND TESTING	DIMENSIONAL APPEARANCE & COMPLETENESS	MAJOR	MEASUREMENT VISUAL	100%	APPROVED DRAWING	APPROVED DRAWING	INSP REPORT	V	P	V	
		MECH RUN TEST TIGHTNESS	MAJOR	FUNCTIONAL TEST HYDROSTATIC		APPROVED DRAWING 1.5 X DESIGN PRESSURE	APPROVED DRAWING NO LEAKAGE	COC [SEE NOTE 1]	V	P	V	

LEGEND : * Records identified with "Tick" (✓) shall be essentially included by supplier in QA documentation.
 ** M : Manufacturer / Sub Supplier C : Supplier nominated inspection agency P : Perform, W : Witness and V : Verification.
 N : END USER & BHEL

MANUFACTURING QUALITY PLAN

[illegible]

MANUFACTURER'S NAME AND ADDRESS		MANUFACTURING QUALITY PLAN										OWNER :			
		ITEM		HEAT OF COMPRESSION AIR DRYER		QP NO		CONSULTANT :							
				REV		PROJECT :									
		SUB SYSTEM		COMPRESSED AIR SYSTEM.		DATE		PACKAGE VENDOR :							
PAGE				BHEL DOC NO		:									
SLNO	COMPONENT & OPERATIONS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK		REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY			REMARKS		
					M	C/N				M	C	N			
1.	2.	3.	4.	5.	6.		7.	8.	9.	10.			11.		
1.0 RAW MATERIAL INSPECTION															
1.1	MS PLATE FOR SHELL & DISHED END.	CHEMICAL PROPERTIES	B	CHEMICAL ANALYSIS	1 SAMPLE / HEAT		RELEVANT MATERIAL SPECIFICATION AS PER APPROVED DATA SHEET / APPROVED DRAWING							REFER NOTE 1	
		MECHANICAL PROPERTIES	B	MECHANICAL TESTS	1 SAMPLE / HEAT										
		INTERNAL DEFECTS	B	U.T. (32 MM & ABOVE THICK	100 %		ASME SEC. V / ASTM A 435		ASTM A 435		U.T. REPORT				
1.2	PIPES	CHEMICAL PROPERTIES	B	CHEMICAL ANALYSIS	1 SAMPLE / HEAT		RELEVANT MATERIAL SPECIFICATION AS PER APPROVED DATA SHEET / APPROVED DRAWING							REFER NOTE 2	
		MECHANICAL PROPERTIES	B	MECHANICAL TESTS	1 SAMPLE / HEAT										
1.3	BOUGHT OUT ITEMS	VISUAL, DIMENSIONAL	B	ITEM, MAKE, RANGE, DIMENSIONAL	100%		APPROVED DATA SHEET / APPROVED DRAWING							REFER NOTE - 6	
2.0 IN PROCESS INSPECTION															
2.1	DISHED END	CORRECT DIMENSIONS	B	MEASURE	100%		MANUFACTURING DRAWING							IN CASE OF JOINT IN DISH END, 100% RT ON JOINT TO BE DONE.	
		RT ON DISHED ENDS (IF APPLICABLE)	B	RT AFTER FINAL WELDING	100%		ASME SEC. V		ASME SEC. VIII DIV.1-UW-51		RT FILM, RT REPORT				
		DPT ON KNUCKLE	B	DP TEST	100%		ASME SEC. V		ASME SEC. V		DPT REPORT				
		THICKNESS THINNING	B	MEASURE	100%		APPROVED DRAWING/MANUFACTURING DRAWING / TECHNICAL SPECIFICATION								
		CUTTING OF PLATES	B	VISUAL & MEASURE	100%		CUTTING PLAN / MANUFACTURING DRAWINGS		REGISTER		REGISTER				
2.2	FABRICATION OF AIR DRYER	EDGE PREPARATION AND FIT UP	B	VISUAL & MEASURE	100 %		APPROVED WPS / FABRICATION DRAWING								
		WPS / WELDER QUALIFICATION	B	VISUAL & MECHANICAL TEST	100 %		ASME SEC. IX		ASME SEC. IX		QW 482, 483, 484				
		NDT ON BUTT WELDS (LONGITUDINAL & CIRCUMFERENTIAL WELD JOINT FOR ADSORPTION TOWERS) AFTER BACK GOUGING & FINAL WELDING	B	DPT AFTER BACK GOUGING	100 %		ASME SEC. V		ASME SEC. VIII DIV. 1 APPENDIX 8		NDT REPORT				
		NDT ON BUTT WELDS & FILLET JOINTS IN SHELL & DISH AFTER FINAL WELDING	B	RT AFTER FINAL WELDING	10 % ON BUTT JOINT INCLUDING 100% CROSS JOINT		ASME SEC. V		ASME SEC. VIII DIV.1-UW-52		RT REPORT				
			B	DPT	100 %		ASME SECTION V		ASME SEC. VIII DIV. 1 APPENDIX 8		NDT REPORT				
LEGEND : () Records, indentified with "Tick" () shall be essentially included by SUPPLIER in QA documentation.															
MANUFACTURERS / SUB-SUPPLIER		M: MANUFACTURER/SUB-SUPPLIER, C: NOMINATED INSPECTION AGENCY N: CUSTOMER , P: PERFORM, W: WITNESS AND V: VERIFICATION. ND:NDT LAB R:TEST / DIMENTIONAL REPORT													
		* RECORDS, IDENTIFIED WITH "TICK" (✓) SHALL BE ESSENTIALLY INCLUDED BY SUPPLIER IN QA DOCUMENTATION.													
SIGNATURE		REVISED BY : APPROVED BY : APPROVAL SEAL													

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

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

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

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

	2x660 MW ENNORE SEZ COMPRESSED AIR SYSTEM LIST OF MAKES OF SUB-VENDOR ITEMS	SPECIFICATION NO. PE-TS-412-555-A001	
		VOLUME : II B	
		SECTION : E / ANNEXURE-I	
		REV 00	DATE: 15.12.2016
		SHEET: 1 OF 1	

ANNEXURE-I **LIST OF MAKES OF SUB-VENDOR ITEMS**

SR. NO.	DETAILS OF EQUIPMENT/SYSTEM	FINAL APPROVED VENDOR
	MECHANICAL	
1	GATE/GLOBE/ CHECK VALVES	
	(A) CAST STEEL VALVES	FOURESS, L&T, LEADER, SAKHI,MACNEILL, MAGORE, CRESENT, GEETA , KBL, AV VALVE BOSS, AUDCO,WEIR BDK VALVES, WALTECH INDUSTRIE VALVES PVT. LTD., NSSL LIMITED, FLUIDLINE VALVES COMPANY PVT. LTD,INTERVALVE (LTD.,STEEL STRONG VALVES (i) PVT.LTD., M/S GM ENGINEERING, VENUS PUMPS AND ENG WORKS, NITON VALVE INDUSTRIES PVT LTD,
	(B) FORGED STEEL VALVES	AUDCO, FOURESS, LEADER , KSB, BDK,HI -TECH, L&T,WEIR BDK VALVES, WALTECH INDUS V.K VALVES PVT. LTD., NSSL LIMITED, FLUIDLINE VALVES COMPANY PVT. LTD,INTERVALV INDIA) LTD.,STEEL STRONG VALVES (i) PVT.LTD., M/S GM ENGINEERING, VENUS PUMPS A ENGG. WORKS, NITON VALVE INDUSTRIES PVT LTD,
	(C) CAST IRON VALVES	FOURESS/ L&T/KIRLOSKAR/BDK/LEADER/AV ENGG./VAAS/GALAXY/HAWA VALVES/LEVCON/BANKIM/I.M.ENGINEERS/H.SARKAR/AUDCO/SHIVA DURGA/UPADHYAY VA CRESCENT / OSCAR / AV VALVES/ SELTTEC/ GEETA/ IMET/ BOSS/LEADER VALVE
	(D) G. M.VALVES	LEADER / BOMBAY METAL / SANT / A.V. VALVES / GG / BDK/ AUDCO/ VAAS/ ILK / MIL/ FOURESS / JASH SCHUTTE, VALTECH INDUSTRIES, ATAM VALVES PVT LTD
	(E) SLEWING RING BEARING	FAG/SKF/ROTHERDE
	(F) BRONZE	LEADER, IMET, AV ENGG., BOSS
	(G) DUAL PLATE CHECK VALVE	ADVANCE, AUDCO, UPADHYAY, C&R, L&T
	(H) GENERAL (AS ABOVE)	SHANCO,BDK,H SARKAR,GALAXY, L&T
2	BALL VALVES	AKSONS, AKAY, CRESENT, BDK, FLUID LINE, AUDCO,KIRLOSKAR,LEADER VALVES,KSB PUM L&T,MICROFINISH VALVES PVT LTD.,WEIR BDK VALVES-AUNIT OF WEIR INDIA PVT LTD.,A VALVES LTD, M/S GM ENGINEERING. ATAM VALVES PVT. LTD.
3	BUTTERFLY VALVE	FOURESS,GEETA,FLOVEL,L&T,CRESCENT,IL(PALGHAT),BARODA FLOWTECH,AUDCO,ADVANCE,KIRLOSKAR,TYCO,KEYSTONE,MIL,FISHER SAN MAR,ISTRUMENTATION LTD,SUB VENDER --CRANE PROCESS,BDK,AUTAEM ,S.L, NEDFA WI TIELLING VALVES JOINT-STOCK CO. LTD.
4	SOLENOID VALVES	AVCON,ROTEX,ASCO,HERION,SIETZ,ADVANCE,BLUE STAR,NUCON,VELJAN HYDRAIR,SMC PNEUMATIC
5	MS PIPES / ERW(BLACK AND GALVANIZED)	ITC, SURYA ROSHNI, ZENITH, INDUS ,MAHARASHTRA TUBES, JINDAL, SAIL, AJANTA, HSL,GST,BST, JAIN TUBES, TATA, MAN INDUSTRIES,RATNAMANI
6	FORGE STEEL PIPES AND FITTINGS.	NITIN,TRUTEFORGE,TUBE PRODUCTS
7	STAINLESS STEEL PIPES	JINDAL, RATNAMANI, REMI
8	SITE FLOW INDICATOR	GREAVES COTTON , LEADER , MACMEIL , AV ENGG., LEVCON, AUTOMAT , ROTA INSTRUMENTS, EUREKA, FORBES MARSHALL, TRAC
9	PAINTING MATERIALS	BERGER ,SHALIMAR , ASIAN PAINTS, NEROLAC, JHONSON AND NICHOLSON,AKZO NOBEL
10	AIR DRYING PLANT	PACE, SABROE, ULTRATROC, INDCON, DHIR PNEUMATIC, MELLCON,ELGI / INGESOLL RAND /KG KHOSLA/ CONSOLIDATED PNEUMATIC/ CHICAGO/DELAIR,TRIDENT,ACIL(MAKE SUBJECT TO CUSTOMER APPROVAL)
11	PRESSURE VESSELS, TANKS, AIR RECEIVERS.	SV ENGG. , PRAGATI ENGG., TEXMACO, ANUP , KANARA, VISHWAKARMA , SATGURU , VIRAT TRANS , HEAT TRANSFER,VIJAY FAB, BINNY ENG. LTD; TECHNOFAB, GMW, RAUNAQ
12	AUTO DRAIN VALVE IN AIR CIRCUIT	ULTRAFILTER,GREAVES
13	SB PR. REDUCING VALVE & CONTROL VALVE : HP	INSTRUMENTATION LTD; MIL CONTROLS LIMITED, FISHER SANMAR LIMITED, DRESSER VALVE INDIA PRIVATE LTD
	ELECTRICAL	
14	HT AC MOTORS	BHEL, CGL, GEC, ALSTOM,KIRLOSKAR ELECTRIC CO; NGEF, SIEMENS, ABB, GE, HITACHI, TOSHIBA, LG,JYOTI LIMITED, MARATHON ELECTRICAL, ANSALOD (ITALY), MELCO (JAPAN)
15	LT AC MOTORS	ABB, CROMPTON GREAVES, ALSTOM INDUSTRIAL, GEC, KIRLOSKAR ELECTRIC CO;NGEF, J' SIEMENS, BHARAT BIJLEE LTD; LG , TOSHIBA, ANSALDO, GE, MELCO, MARATHON , BHEL
16	CABLE LUGS	DOWELLS,CHETNA ENGG,3D

17	CABLE GLAND	BRACO, COMET, CONTRACT, HARDWARE INDUSTRIES, ELECT ENG; LAPP
18	CABLE TRAYS	AV ENGINEERS, BARODA GALVANISERS, INDIANA, NIRMAL ENGG; PAREKH ENGINEERS, V. SADHNA, JAMNA METAL, RUKMANI ELECTRICAL & COMPONENTS PVT LTD, PATNY SYSTEMS LTD, PREMIER POWER PRODUCTS (CAL) PVT. LTD., RABI ENGINEERING WORKS PVT. LTD., UNITECH FABRICATORS and ENGINEERS PVT LTD, RATAN PROJECTS & ENGINEERING PVT. LTD., MAHESHWARI ELECTRICAL MFCS. PVT. LTD., INDIA ELECTRICALS SYNDICATE.
19	UPS	IL-JAIPUR, HI-REL-GANDHINAGAR, TATA, LIEBERT, DB ELECTRONICS, EMERSON, SOCOM GUTUR, FUJI / SIEMENS / APCARE, MERLIN GERIN, PTE/CHLORIDE-UK/GOUTOR/KELTRON
20	220 VOLT DC BATTERY	EMCO, EXIDE, SABMIFE, HBL-SABNIFE, FUJI LEAD AID -PLANTE BATTERY- EXCIDE. HOPPECKE BATTERIEN GMBH & CO.KG, NI-CD BATTERY, AMAR RAJA/HBL KNIFE/SAB KNIFE/FUJI/AMCO/SAFTSEALED MAINTENANCE FREE BATTERY, VRLA BATTERY.-EXCIDE./AMAR RAJA/HBL KNIFE/SAB KNIFE/FUJI/AMCO/SAFT
21	220 VOLT DC BATTERY CHARGER	CHHABI, MASS-TECH, AMARA RAJA POWER SYSTEM LTD., STATCON, SABNIFE, CALDYNE, KAYBEE, HBL, DUBAS, SABNIFE POWER SYSTEM, DB POWER ELECTRONICS, AUTOMATIC ELECTRIC LTD./ HBL-NIFE/ HIND RECTIFIES/ DUBAS ENGG. CHLORIDE POWER SYSTEM AND SOLUTION LTD, KOLKATA. JEMA ENERGY, LASARTE-ORIYA
22	MARSHALLING KIOSKS/JB	CONTROLS & SWITCHGEAR; ANDREW YULESPACEAGE SWITCHGEAR; BCH; ENTERPRISING ENGINEERS; MIKA ELECTROCONTROLS;
23	ACDB/DCDB/MLDB	L N T, HAVELLS/PYROTECH, MDS/INDU. SWGR./C&S/, SIEMENS/ALSTOM/GE POWER/CONTROL & SWITCHGEAR
CONTROL & INSTRUMENTATION		
24	PRESSURE SWITCHES	SWITZER, INDOFOSS, DELTA, UK, DRESSER, USA., VASUTECH, DANFOSS, PYRO ELECTRIC, CHEMTROL, ASHCROFT, DWYER, SOR, E&H, GIC(MUMBAI), PRECISION (AHMEDABAD), TRAFAG(RANIPET), TRAFAG(RANIPET)
25	LEVEL INDICATOR	ENDRESS AND HAUSER- GERMANY, E.I.P BULK CONTROLS, KISTLEMORSE, TROLEX, EIP ENVIROLEVEL CONTROLS LTD DELHI, SB ELECTRIC MECHANICAL PVT. LTD PUNE, NIVO CONTROLS INDORE EIP ENVIROLEVEL CONTROLS LTD I SB ELECTRO MECHANICAL PVT. LTD PUNE, NIVO CONTROLS INDORE.
26	FLOW SWITCHES	SWITZER, INDOFOSS, V. AUTOMAT, GENERAL INSTRUMENT /DELTA UK/ DRESSER USA/ E&H, KROHNE MARSHALL (PUNE)-CHEMTROLS INDUSTRIES LTD., MUMBAI / KROHNE MAR (PUNE)
27	PRESSURE GAUGES	BELLS CONTROLS, H.GURU, GENERAL INSTRUMENTS GIC, PYRO ELECTRIC, AN INSTRUMENTS, WIKA, INDOFOSS, GLUCK(INDIA), WAAREE, MANOMETER(I), BUDENBERG, KONICS/KOREA, ASCHOFT, FORBES MARSHALL (HYD), GIC (MUMBAI), ODIN (AHMEDABAD), KROHNE MARSHALL PVT LTD., PUNE / HIRLEKAR PRECISION ENGG. PVT. LTD.-FORBES MARSHALL PVT. LTD., PUNE FORBES MARSHALL (HYD), GIC (MUMBAI), ODIN (AHMEDABAD), KROHNE MARSHALL PVT LTD., PUNE / HIRLEKAR PRECISION ENGG. PVT. LTD.)
28	LEVEL GAUGES	LEVCON, TECHNOMATIC, TOSHNIWAL, MAGNETROL, KROHNE, E&H, V AUTOMAT, CHEMTROLS, DK INST(KOLKATA), SBEM(PUNE), SIGMA INST (MUMBAI)
29	TEMPERATURE GAUGES.	BELLS CONTROLS, H.GURU, GENERAL INSTRUMENTS GIC, PYRO ELECTRIC, AN INSTRUMENTS, WIKA-GERMANY, DRESSER, INDOFOSS, WAAREE, ASCHOFT, FORBES MARSHALL (HYD), GOA THERMOSTATIC INST(GOA), WIKA(INDIA)
30	TEMPERATURE SENSOR	PYRO ELECTRIC, DETRIV
31	MASS FLOW METER	MICROMOTION, KROHNE MARSHALL, ROSEMOUNT, ULTRA FILTER, ABB, YBL, DIELEN, E&H
32	ROTAMETER	INSTRUMENT ENGR. HYD. TRANSDUCER AND CONTROL, HYD., V. AUTOMAT, EUREKA (PUNE), FLUIDYNE INS(MUMBAI), PLACKA (CHENNAI), CHEMTROLS SAMIL (INDIA) PVT.LTD.
33	DEW POINT APPARATUS	ADP MANUFACTURER, WALKER (UK), ULTRAFILTER (GERMANY)

34	INSTRUMENT FITTINGS	AURA INCORPORATED,Arya Crafts & Engineering Pvt. Ltd.,Astec Valves & Fittings Pvt. Ltd,Cr Valve Pvt. Ltd.,FLUIDFIT ENGINEERS PVT. LTD.,Fluid Controls Pvt. Ltd.,HP VALVES & FITTING INDIA PVT. LTD.,PRECISION ENGINEERING INDUSTRIES,Panam Engineers,Perfect Instrument Control (India) Pvt. Ltd.,VIKAS INDUSTRIAL PRODUCTS,
35	FIBRE OPTIC CABLE	BIRLA ERICSSON,FINOLEX,AKSH FIBRE
36	TRANSDUCER	AE, SOUTHERN , MECO, SIEMENS, ABB,ADEPT(PUNE), ELSTER(MUMBAI), LECTROTEK (PUNE), MASIBUS(GANDHINAGAR), MECO(MUMBAI), PYROTECH(UDAIPUR), ADEPT(PUNE), ELSTER(MUMBAI), LECTROTEK (PUNE), MASIBUS(GANDHINAGAR), MECO(MUMBAI), PYROTECH(UDAIPUR)
37	ELECTRONIC TRANSMITTER	H&B, ROSEMOUNT, IL, FUJI MAKE,ABB, EMERSON, HONEYWELL, YOKOGAWAABB, EMERSON
38	LT XLPE POWER CABLES AND PVC CONTROL CABLES	HAVELLS, TORRENT, NICCO, FINOLAX, RAVIN, GOVIND , LAPP, INDUSTRIAL CABLES, KRISHI ELECTRIC, FINE CAB., SPL CABLES, RADIANT, SUYOG, PARAMOUNT, VIKAS CABLES, CORDS ALPHA, GEMS CAB. , TCL, ROLLEX, KEI, CRYSTAL, POLYCAB, DELTON, RELIANCE ENGINEERING RPG, ASSOCIATE CABLES, ELKAY TELELINKS, UNIVERSAL, FGI CCI/UNIVERSAL
39	PLC	ROCKWELL, GEFANUC, ABB, SIEMENS, HONEYWELL, GROUP SCHNEIDER, ALLEN BRADLEY, YOKOGAWA
40	PCS	HP / IBM/ DELL/ACER ,IBM,LENOVO
41	TFT MONITOR	HP / IBM/ DELL,NEC, Samsung, IBM,LENOVO,DIMOND,TLT,MIRCON TEK,TIPL
42	PRINTERS (LASER/INKJET)	HP,CANON,WIPRO,SAMSUNG
43	PLC CUM ENGINEERING STATION	PLC CUM ENGINEERING STATION SHALL BE SUPPLIED WITH RELIANT MAKE PLC

PEM REGISTERED VENDOR

SLNO	Package Code	Package Name	Vendor Code	Vendor Name	Reg Status	Grade	Vendor Address	Remarks
1	145-07000-A	ANALYTICAL INSTS.SAMPLE COOLER	J001	FORBES MARSHAL PVT. LTD.	REGULAR	NA	A-33/34, MIDC ESTATE, H-BLOCK, PIMPRI, PUNE-MAHARASHTRA-INDIA Phone- 27470171,27477472 Pincode : 411018 Email : nkaushal@forbesmarshall.com	, ,
2	145-07000-A	ANALYTICAL INSTS.SAMPLE COOLER	R002	EMERSON PROCESS MANAGEMENT (INDIA) PVT.LTD.	REGULAR	NA	Mr. Amit Paithankar/Vikram Raj Singh 206-210,BALARAMA BUILDING 2ND FLR. BANDRA EAST MUMBAI-MAHARASHTRA-INDIA Phone- 9619121500 Pincode : 400051 Email : vikramraj.singh@emerson.com	, ,
3	145-07000-A	ANALYTICAL INSTS.SAMPLE COOLER	S001	SIEMENS LIMITED	REGULAR	NA	Dr. Armin Bruck/Sandeep Mathur 130, Pandurang Budhkar Marg Worli Mumbai-Maharashtra-INDIA Phone- 0124 383 7377 Pincode : 400018 Email : ankit.varshney@siemens.com	, ,
4	145-23000-A	ANUBAR (DELTA TUBE)	S009	SWITZER PROCESS INSTRUMENTS PVT. LTD.	REGULAR	NA	B Kannan/V S Jayaprakash 9, SOUTH BOAG ROAD, II FLOOR, PB NO-1423, T.NAGAR, CHENNAI-TAMIL NADU-INDIA Phone- 044-24340999 / 24344 Pincode : 600017 Email : marketing@switzerinstrument.com	Name changed from "M/s Switzer Instrument Ltd." to "M/s Switzer Process Instruments Pvt. Ltd." w.e.f. 27.07.2016; , ,
5	145-23000-A	ANUBAR (DELTA TUBE)	S044	STAR-MECH CONTROLS (I) PVT.LTD.	REGULAR	B	SUSHILLOTAM, SUSHILLOTAM, 29/3A/3, SASANE NAGAR, HADAPSAR, PUNE-MAHARASHTRA-INDIA Phone- 02026970450 Pincode : 411028 Email : marketing@star-mech.net	, ,
6	145-23000-A	ANUBAR (DELTA TUBE)	M009	MICRO PRECISION PRODUCTS PVT. LTD.	REGULAR	NA	K.P. CHANDHOK/ATUL CHANDHOK 4, LINK ROAD, FARIDABAD-HARYANA-INDIA Phone- 9810265688 Pincode : 121002 Email : nal@microa1.com	, ,
7	145-23000-A	ANUBAR (DELTA TUBE)	D212	DYNAFLUID VALVES AND FLOW CONTROLS (P) LTD.	REGULAR	NA	Mr. Yogish M. Kulkarni Plot # 23, Udyambag, Belgaum-karnataka-India Phone- 0831-4210386 Pincode : 590008 Email : yogish@dynafluid.com	, ,
8	145-23000-A	ANUBAR (DELTA TUBE)	T108	TM TECNOMATIC SPA	REGULAR	NA	MR. ANTONIO NOVIELLO/Mrs. Enrica Bazzoc VIA DELLE INDUSTRIE, 36 CREMONA-ITALY Phone- 39037221574 Pincode : 26100 Email : info@tmtcnomatic.com	, ,
9	145-31000-A	Cold Junction Compensation Box (CJCB)	C048	CREATIVE INSTRUMENTS & CONTROLS	REGULAR	B	NO-17/1, 1ST FLOOR, 11TH CROSS 1ST K BLOCK, RAJAJINAGAR, BANGALORE-560010 -- Phone- Pincode : Email : crinstruments@gmail.com	, ,

10	145-04000-A	CONTROL VALVE	C010	SPX Flow Technology (I) Pvt. Ltd.	REGULAR	NA	Survey No 275, Odhav Road, Odhav Ahmedabad-Gujarat-India Phone- +91 (0) 8939963099 Pincode : 382415 Email : siva.prakash@spx.com	Name changed from M/s DeZURIK-Copes Vulcan Ltd. to M/s SPX Corporation, USA as per 25th MISCC-Electrical and C&I dtd. 20.02.2014; Put on HOLD for 6 months w.e.f. 18.05.2012 & uplifted on 19.03.2014.; , POs to be placed on Indian subs.M/s SPX Flow Technology (I) Pvt. Ltd., Ahmedabad, India and the material will be supplied as per scope matrix[Available at CMM-->VD DOCUMENTS-->SCOPE
11	145-04000-A	CONTROL VALVE	D027	DRESSER VALVE INDIA PVT. LTD	REGULAR	NA	Mr. Raj Raman/Mr. Rajkumar Moria S.F. No: 608,Chettipalayam Road, Echanari Post, Coimbatore-Tamilnadu-INDIA Phone- +91-98451 19085 Pincode : 641021 Email : Anoop.Ramachandran@ge.c	, ,
12	145-04000-A	CONTROL VALVE	D057	Daume Regelarmaturen GmbH,	REGULAR	NA	Mr. Björn Carstensen Am Springbrunnen 23, Barleben--Germany, Phone- 9820805424, Pincode : 39179 Email : madhu@aumvn.com, info@daume-regelarmaturen.de,	GCC R.5 accepted by vendor. , Reviewed in MISCC dt. 21.07.2015 for non-response in 4 consecutive tender enquiry;
13	145-04000-A	CONTROL VALVE	F015	EMERSON PROCESS MANAGEMENT CHENNAI LIMITED	REGULAR	C	147, KARAPAKKAM VILLAGE, CHENNAI-TAMIL NADU-INDIA Phone- 23722184, 23716242 Pincode : 600096 Email : jatinder.singh@emerson.com	Vendor's name changed from "Fisher Sanmar Limited" to "Emerson Process Management Chennai Limited" w.e.f. 22.09.2011 , ,
14	145-04000-A	CONTROL VALVE	F030	FORBES MARSHALL ARCA PVT.LTD.	REGULAR	NA	A-34/35 , MIDC ESTATE, H-BLOCK, PIMPRI, PUNE,- MAHARASTRA-INDIA, Phone- 020-27442020, Pincode : 411018 Email : mnadgaundi@forbesmarshall.com	, Technical limit reviewed on 30.04.2014 and further revised on 29.12.2015; , Reviewed in MISCC dt. 21.07.2015 for non-response in 4 consecutive tender enquiry;
15	145-04000-A	CONTROL VALVE	H057	HOLTER REGELARMATUREN GmbH & Co.KG	REGULAR	NA	HOLTER REGELARMATUREN GmbH & Co.KG , Helleforthstrasse 58-60, D 33758 Schloss Holte-Stukenbrock Germany-- Phone- 0049-05207/88037 Pincode : Email : mail@hora.de	, HOLD due to non-responsse /non-participation w.e.f. 31.01.2013; Hold removed w.e.f. 16.10.2014.

16	145-04000-A	CONTROL VALVE	K048	Koso India Private Limited,	REGULAR	A	H 33 & 34, MIDC, Ambad, Nashik,-Maharashtra,-India, Phone- 91 944 744 3198 Pincode : 422010, Email : seemaanand_sa@koso.co.in	, The name has been changed from M/s KOSO FLUID CONTROLS (PVT) LTD to M/s Koso India Private Limited as per 11th MISCC Elect and C&I dated 30.07.2013. , Approved works at Control Valve Division, H-33&34, Ambad, Nashik w.e.f. 12.10.2015; Additional works at "J"-1,MIDC,Ambad, nashik-422010" approved w.e.f. 17.06.2016;
17	145-04000-A	CONTROL VALVE	M005	MIL CONTROLS LTD.	REGULAR	B	Mr.Jacob Cherian/Mr.Geo Jolly Meladoor, Annamanada P.O. MALA, Thrissur-KERALA INDIA Phone- 0480-2695700 Pincode : 680741 Email : biju.simon@ksb.com	, ,
18	145-04000-A	CONTROL VALVE	I006	INSTRUMENTATION LTD.	REGULAR	B	KANJIKODE WEST, PALAKKAD, PALAKKAD-KERALA-INDIA Phone- 2566127-130,2567128 Pincode : 678623 Email : icvldil@gmail.com;fa2@ilpgt.com	SICK PSU. BIFR CASE. , ,
19	145-04000-A	CONTROL VALVE	P203	PARCOL S.p.A	REGULAR	NA	Mr. Erminio Campanelli, Via Isonzo, 2, Canegrate MI--Italy Phone- 0349-7417774 Pincode : 200010 Email : mazurizio.para@parcol.com	Indian Representative-M/s Astrotech, 35, MV Compound, Bridge Way Colony, Tiruppur - 641607, Tamil Nadu, India, Ph. No.-+91 975 199 4989; Email- mani@astrotech india.in , ,
20	145-04000-A	CONTROL VALVE	R001	R.K.CONTROL INSTRUMENTS PVT. LTD.	REGULAR	NA	PLOT NO.A-250, OPP.POLICE STATION, WAGLE INDUSTRIAL ESTATE, THANE-MAHARASHTRA-INDIA Phone- 25820943/2331 Pincode : 400604 Email : rkcipl@vsnl.com ; rkcinpvt@bol.net.in	HOLD due to non-responsse /non-participation w.e.f. 10.01.2013.HOLD due to non-responsse /non-participation w.e.f. 01.02.2013.Hold is lifted w.e.f. 21.09.2013. , Reassessed on 26.02.2016; Technical limit added w.e.f. 26.02.2016; ,
21	145-04000-A	CONTROL VALVE	S237	SUZHOU DELAN ENERGY SCIENCE & TECHNOLOGY CO., LTD.	REGULAR	NA	No 566 Fangqiao Road Caohu Industrial Park, Xiangcheng Economic Development Zone, Suzhou-Jiangsu-China Phone- 008618012776062 Pincode : 215143 Email : huanlele@delan-valve.com	, ,

22	145-04000-A	CONTROL VALVE	V051	Valvitalia S.P.A. ,	REGULAR	NA	Mr. Salvatore Ruggeri Via Tortona 69, Rivanazzano (Pavia) --Italy, Phone- +39-03839459875 Pincode : 27055 Email : gianluca.angeleri@valvitalia.com	One Time Code accorded for "Control Valves" package for "1x500 MW Vindhayachal STPP Stage-V" project. , Supplier registered in permanent category as per 28th MISCC-Electrical and C&I dtd. 31.03.2014 , Deleted due to non-response in 4 consecutive tenders w.e.f. 27.07.2016; Decision revoked as per MISCC dt. 05.08.2016;
23	145-04000-A	CONTROL VALVE	W202	WALDEMAR PRUSS ARMATURENFABRIK GMBH	REGULAR	NA	Mr. Winfried Dremhel Schulenburgelandstrasse 261, Hannover--Germany Phone- +49-511279260 Pincode : 30419 Email : dremhel@pruss.de; vogel@pruss.de	Indian Representative- M/s H S Engineering & Marketing Services, B2/73C Safdarjung Enclave, New Delhi - 110029, Ph No.-011-26193156/9313 007463; Email- joy@hsgroupdelhi.com , ,
24	145-47000-A	ELECTROMAGNETIC FLOW METER	E211	Electronet Equipments Pvt Ltd.	REGULAR	NA	Plot No. 84, 85 & 86, Tiny Industrial Estate Kondhwa Budruk, Pune-Maharashtra-India Phone- 020-2026932039 Pincode : 411048 Email : ho@eenindia.com	, ,
25	145-47000-A	ELECTROMAGNETIC FLOW METER	A216	Adept Fluidyne Pvt. Ltd.	REGULAR	NA	Vinayak Gadre Plot No 4,S.No.17/1-B Kothrud Industrial Estate Pune-Maharashtra-India Phone- 020 25464551 Pincode : 411038 Email : info@adeptfluidyne.com	, ,
26	145-12000-A	FLOW ELEMENT	S044	STAR-MECH CONTROLS (I) PVT.LTD.	REGULAR	C	SUSHILLOTAM, SUSHILLOTAM, 29/3A/3, SASANE NAGAR, HADAPSAR, PUNE-MAHARASHTRA-INDIA Phone- 02026970450 Pincode : 411028 Email : modulation@star-mech.net	, ,
27	145-12000-A	FLOW ELEMENT	I006	INSTRUMENTATION LTD.	REGULAR	C	KANJIKODE WEST, PALAKKAD, PALAKKAD-KERALA-INDIA Phone- 2566127-130,2567128 Pincode : 678623 Email : icvdlil@gmail.com;fa2@ilpgt.com	SICK PSU. BIFR CASE. , ,
28	145-12000-A	FLOW ELEMENT	M009	MICRO PRECISION PRODUCTS PVT. LTD.	REGULAR	C	K.P. CHANDHOK/ATUL CHANDHOK 4, LINK ROAD, FARIDABAD-HARYANA-INDIA Phone- 9810265688 Pincode : 121002 Email : nal@micro1.com	REGISTERED AS MSME VENDOR W.E.F.15.11.2011 FOR FY 2011-12. , ,
29	145-12000-A	FLOW ELEMENT	T108	TM TECNOMATIC SPA	REGULAR	NA	MR. ANTONIO NOVIELLO/Mrs. Enrica Bazzoc VIA DELLE INDUSTRIE, 36 CREMONA-ITALY Phone- 39037221574 Pincode : 26100 Email : info@tmtecnomatic.com	, ,

30	145-44000-A	FLOW ELEMENT - NOZZLE	S165	SEIKO FLOW CONTROL GMBH	REGULAR	NA	Mr. Friedrich Rupprecht/ Mr. S. Subhash Zur Schleuse 5, 2000 Stockerau, Stockerau--Austria Phone- 9811047972 Pincode : Email : office@seiko-flowcontrol.com	Indian Representative: M/s Menon Associates, 118, Aurobindo Commercial Complex, New Delhi-110016 ,
31	145-44000-A	FLOW ELEMENT - NOZZLE	I006	INSTRUMENTATION LTD.	REGULAR	B	KANJIKODE WEST, PALAKKAD, PALAKKAD-KERALA-INDIA Phone- 2566127-130,2567128 Pincode : 678623 Email : icvidil@gmail.com;fa2@ilpgt.com	SICK PSU. BIFR CASE. , ,
32	145-44000-A	FLOW ELEMENT - NOZZLE	M009	MICRO PRECISION PRODUCTS PVT. LTD.	REGULAR	B	K.P. CHANDHOK/ATUL CHANDHOK 4, LINK ROAD, FARIDABAD-HARYANA-INDIA Phone- 9810265688 Pincode : 121002 Email : pal@microa1.com	REGISTERED AS MSMD VENDOR W.E.F.15.11.20 11 FOR FY 2011-12. , ,
33	145-44000-A	FLOW ELEMENT - NOZZLE	M201	MINCO (INDIA) FLOW ELEMENTS PVT. LTD.	REGULAR	NA	Mr. Raghavendra M. Kulkarni D2-49/50, Tivim Industrial Estate, Karaswada Mapusa-Goa-India Phone- 0832-2257059 Pincode : 403526 Email : gicflowelement@giconindia.com	, ,
34	145-44000-A	FLOW ELEMENT - NOZZLE	S044	STAR-MECH CONTROLS (I) PVT.LTD.	REGULAR	B	SUSHILLOTAM, SUSHILLOTAM, 29/3A/3, SASANE NAGAR, HADAPSAR, PUNE-MAHARASHTRA-INDIA Phone- 02026970450 Pincode : 411028 Email : madkoting@star-mech.net	, ,
35	145-44000-A	FLOW ELEMENT - NOZZLE	D212	DYNAFLUID VALVES AND FLOW CONTROLS (P) LTD.	REGULAR	NA	Mr. Yogish M. Kulkarni Plot # 23, Udyambag, Belgaum-karnataka-India Phone- 0831-4210386 Pincode : 590008 Email : yogish@dyna-fluid.com	, ,
36	145-44000-A	FLOW ELEMENT - NOZZLE	H066	HYDROPNEUMATICS PVT. LTD.	REGULAR	NA	Mr. DM Bichu G/B, Hill Crown Apts., College Road Mapusa-Goa-India Phone- 0832-2360364 Pincode : 403507 Email : ajayrc@hydropneumatics.co.in	, ,
37	145-43000-A	FLOW ELEMENT - ORIFICE	H066	HYDROPNEUMATICS PVT. LTD.	REGULAR	NA	Mr. DM Bichu G/B, Hill Crown Apts., College Road Mapusa-Goa-India Phone- 0832-2360364 Pincode : 403507 Email : ajayrc@hydropneumatics.co.in	, ,
38	145-43000-A	FLOW ELEMENT - ORIFICE	F033	Flow Star Engineering Pvt. Ltd.,	REGULAR	A1	MR. KHALID AKHTAR/MR. TAPAN KUMAR JANA Plot No- 7 F/2, Northern India Industrial 20/3, Mathura Road FARIDABAD-HARYANA-INDIA Phone- 9818176380 Pincode : 121005 Email : khalid@flowstar.co.in	, ,
39	145-43000-A	FLOW ELEMENT - ORIFICE	D212	DYNAFLUID VALVES AND FLOW CONTROLS (P) LTD.	REGULAR	NA	Mr. Yogish M. Kulkarni Plot # 23, Udyambag, Belgaum-karnataka-India Phone- 0831-4210386 Pincode : 590008 Email : yogish@dyna-fluid.com	, ,
40	145-43000-A	FLOW ELEMENT - ORIFICE	S044	STAR-MECH CONTROLS (I) PVT.LTD.	REGULAR	B	SUSHILLOTAM, SUSHILLOTAM, 29/3A/3, SASANE NAGAR, HADAPSAR, PUNE-MAHARASHTRA-INDIA Phone- 02026970450 Pincode : 411028 Email : madkoting@star-mech.net	, ,
41	145-43000-A	FLOW ELEMENT - ORIFICE	M009	MICRO PRECISION PRODUCTS PVT. LTD.	REGULAR	B	K.P. CHANDHOK/ATUL CHANDHOK 4, LINK ROAD, FARIDABAD-HARYANA-INDIA Phone- 9810265688 Pincode : 121002 Email : pal@microa1.com	REGISTERED AS MSMD VENDOR W.E.F.15.11.20 11 FOR FY 2011-12. , ,

42	145-43000-A	FLOW ELEMENT - ORIFICE	I006	INSTRUMENTATION LTD.	REGULAR	NA	KANJIKODE WEST, PALAKKAD, PALAKKAD-KERALA-INDIA Phone- 2566127-130,2567128 Pincode : 678623 Email : icvdlil@gmail.com;fa2@ilpgt.com	SICK PSU. BIFR CASE. , ,
43	145-43000-A	FLOW ELEMENT - ORIFICE	I030	INSTRUMENTATION ENGINEERS PVT LTD	REGULAR	B	SH.N.V.RAM GOPAL/MS. N.NIHARIKA PLOTS 1,2,3, PHASE-III, IDA, JEEDIMETLA HYDERABAD-TELANGANA-INDIA Phone- 9848407365 Pincode : 500055 Email : jeedimetla@jeedimetla.com	, ,
44	145-45000-A	INSTRUMENT FITTINGS	P046	PRECISION ENGINEERING INDUSTRIES	REGULAR	NA	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI-MAHARASHTRA-INDIA Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com	, ,
45	145-45000-A	INSTRUMENT FITTINGS	P082	PANAM ENGINEERS	REGULAR	NA	Mr. Santosh Shukla 203, Jaisingh Business,Parsiwada, Sahar road,Andheri(East), Mumbai,-Maharashtra,-India, Phone- 9892179529, Pincode : 400099, Email : santosh@panamengineers.com,	, ,
46	145-45000-A	INSTRUMENT FITTINGS	P81	Perfect Instrumentation Control (India) Pvt. Ltd.	REGULAR	NA	MD Hussain Shaikh/Shahanawaz Khan Gala No. 168, Loheki Chwal,216/ 218, Maulana Azad Rd. Nagpada Junction Mumbai-Maharashtra-INDIA Phone- 91-9324383121 Pincode : 400008 Email : shahanawaz.khan@perfectinstrumentation.com	, ,
47	145-45000-A	INSTRUMENT FITTINGS	C067	Comfit & Valve Pvt. Ltd.	REGULAR	NA	Mr. Jeetu Jain/Mr. Vinay Sosa Survey No. 23/1, Part 2, Ahmedabad-Mehsana Highway Laxmipura, Nandasan-Gujarat-INDIA Phone- 02764-267036/37 Pincode : 382705 Email : jeetukojia@com-fit.com	, ,
48	145-45000-A	INSTRUMENT FITTINGS	A079	AURA INCORPORATED	REGULAR	NA	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI-DELHI-INDIA Phone- 9810182430 Pincode : 110048 Email : niraj@aurainc.com	, ,
49	145-45000-A	INSTRUMENT FITTINGS	A121	Arya Crafts & Engineering Pvt. Ltd.	REGULAR	NA	Mr.Sanjay Brahman/Mr.Shyam Vazirani 102, Vora Industrial Estate No.4 Navghar, Vasai Road (E) Dist.Thane, Mumbai-Maharashtra-INDIA Phone- +91-250-2392246 Pincode : 401210 Email : arya@aryaengg.com	, ,
50	145-45000-A	INSTRUMENT FITTINGS	F040	FLUIDFIT ENGINEERS PVT. LTD.	REGULAR	NA	Mr. Abbas Bhola Potia Building No. 2, Office No. 3,292, Bellasis Road,Mumbai Central (East) Mumbai-Maharashtra-India Phone- 9920044113 Pincode : 400008 Email : ab@fluidfitengg.com	Registered as per 22nd Electrical and C&I MISCC Meeting dtd. 15.01.2014 , ,
51	145-45000-A	INSTRUMENT FITTINGS	H61	HP VALVES & FITTINGS INDIA PVT. LTD.	REGULAR	C	S. Harichandran/P.S. Pandi B-11, Mugappair Industrial Estate, CHENNAI-Tamilnadu-INDIA Phone- 044 26252537 Pincode : 600037 Email : sales@hpvalvesindia.com	, ,

52	145-45000-A	INSTRUMENT FITTINGS	H024	Fluid Controls Pvt. Ltd.	REGULAR	NA	Sophie Y. Mochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI-MAHARASHTRA-INDIA Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com	Name changed from M/s Hyd-Air Valves Pvt. Ltd. to M/s Fluid Controls Pvt. Ltd. as per 25th MISCC-Electrical and C&I dtd. 20.02.2014 , ,
53	145-45000-A	INSTRUMENT FITTINGS	V039	VIKAS INDUSTRIAL PRODUCTS	REGULAR	NA	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA-UTTAR PRADESH-INDIA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com	, Financial limit reviewed on 05.06.2014 ,
54	145-38000-A	INSTRUMENTS PIPE FITTINGS	V039	VIKAS INDUSTRIAL PRODUCTS	REGULAR	A	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA-UTTAR PRADESH-INDIA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com	, ,
55	145-38000-A	INSTRUMENTS PIPE FITTINGS	H024	Fluid Controls Pvt. Ltd.	REGULAR	B	Sophie Y. Mochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI-MAHARASHTRA-INDIA Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com	, ,
56	145-38000-A	INSTRUMENTS PIPE FITTINGS	A079	AURA INCORPORATED	REGULAR	NA	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI-DELHI-INDIA Phone- 9810182430 Pincode : 110048 Email : nirai@aurainc.com	, ,
57	145-38000-A	INSTRUMENTS PIPE FITTINGS	P046	PRECISION ENGINEERING INDUSTRIES	REGULAR	NA	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI-MAHARASHTRA-INDIA Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com	, ,
58	145-32000-A	INSTRUMENTS TUBE FITTINGS	P046	PRECISION ENGINEERING INDUSTRIES	REGULAR	C	K. SITARAM/ K. SRINIVAS 7,SIDHAPURA INDUSTRIAL ESTATE S.V. ROAD,GOREGAON(W) MUMBAI-MAHARASHTRA-INDIA Phone- 022 42631700 Pincode : 400 062 Email : peiks@vsnl.com	, ,
59	145-32000-A	INSTRUMENTS TUBE FITTINGS	A079	AURA INCORPORATED	REGULAR	C	NIRAJ SHARAN/SUJIT KUMAR W-167A, GREATER KAILASH-II NEW DELHI-DELHI-INDIA Phone- 9810182430 Pincode : 110048 Email : nirai@aurainc.com	, ,
60	145-32000-A	INSTRUMENTS TUBE FITTINGS	H024	Fluid Controls Pvt. Ltd.	REGULAR	B	Sophie Y. Mochhala/Mayur Rajput J.V.PATEL, I.T.I CMPD, B.MADHUKAR MARG, ELPHINSTONE ROADSTN.(WR), MUMBAI-MAHARASHTRA-INDIA Phone- (022) 43338000 Pincode : 400013 Email : sales@fluidcontrols.com	, ,
61	145-32000-A	INSTRUMENTS TUBE FITTINGS	V039	VIKAS INDUSTRIAL PRODUCTS	REGULAR	NA	S.R.SINGH/NAVEEN SINGH B - 2, SECTOR - 6, NOIDA-UTTAR PRADESH-INDIA Phone- +91-9810122070 Pincode : 201301 Email : naveensingh@vsnl.com	, ,

62	145-25000-A	JUNCTION BOX	S114	Shrenik & Company,	REGULAR	NA	Mr. Mitesh Shah/Mr. Pulin Shah 39 A/3 ,Panchratna Industrial Estate, Sarkhej-Bavla Road Ahmedabad-Gujarat-India Phone- 9825024921 Pincode : 382213 Email : sales@pustron.com, pulin@pustron.com	Registered for FRP JB's AND METAL JB's. , Technical limit reviewed on 30.04.2014; ,
63	145-25000-A	JUNCTION BOX	F201	FLEXPRO ELECTRICALS PVT. LTD.	REGULAR	NA	Mr. Dineshbhai Zaveri C-1/ 27&37, GIDC, Kabilpore, Navsari-Gujarat-India Phone- 02637-265140,265003 Pincode : 396424 Email : flexpro@flexproltd.com	Technical limit reviewed on 12.10.2015; , ,
64	145-25000-A	JUNCTION BOX	A101	AJMERIA INDUSTRIAL & ENGINEERING WORKS	REGULAR	C	JIGNESH MAHENDRA AJMERIA DENA BANK BLDG.,SHREE NAGESH INDL. ESTATE,STATION ROAD, MUMBAI-MAHARASHTRA-INDIA Phone- 022 67973578 Pincode : 400 088 Email : ajmeria@ajmeria.net, jmajmeria@yahoo.com	Reviewed in MISCC dt. 21.07.2015 for non-response in 4 consecutive tender enquiry; , APPROVED FOR GALVANIZED AND FRP JUNCTION BOXES; Technical limit reviewed on 30.04.2014 ,
65	145-25000-A	JUNCTION BOX	K043	K.S.INSTRUMENTS PVT.LTD.	REGULAR	A	S Raghavan No. 72, 3rd Main, 1st Stage Industrial Suburb, Yeshwanthpur Bangalore-Karnataka-India Phone- 9880385770 Pincode : 560022 Email : sales1@ksinstruments.net	, ,
66	145-25000-A	JUNCTION BOX	S095	SUCHITRA INDUSTRIES	REGULAR	A	NO-2,OPP-27 AECS LAYOUT 2ND STG REJAMAHALVILAS EXTN 2ND STG BANGALORE -- Phone- Pincode : Email : suchitra.industriesblr@gmail.com	, ,
67	145-11000-A	LEVEL GAUGE	S008	SIGMA INSTRUMENTS CO.	REGULAR	NA	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI-MAHARASHTRA-INDIA Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.i	, ,
68	145-11000-A	LEVEL GAUGE	B077	BLISS ANAND PVT. LTD.	REGULAR	NA	Mr. Vikas Anand/ Mr.RGRajan 92B & 93 B , IMT MANESAR Gurgaon-Haryana-India Phone- 0124-4366000 TO 9 Pincode : 122001 Email : sales@blissanand.com	, ,
69	145-11000-A	LEVEL GAUGE	T001	TOSHNIWAL BROTHERS PVT.LTD.	REGULAR	NA	WORKS:TOSHNIWAL IND.PVT.LTD, INDUSTRIAL ESTATE MAKHUPURA, AJMER-RAJASTHAN-INDIA Phone- 441171 Pincode : 305002 Email : toshniwalprocess@gmail.com	, ,
70	145-35000-A	LEVEL SWITCH- CAPACITANCE TYPE	S123	Sapcon Instrument Pvt Ltd.	REGULAR	NA	131, PALSHIKAR COLONY Contact Person- Mr. Ashwin (9826080207) INDORE-MP-INDIA Phone- +91-731-4085751, Pincode : 452004 Email : sales@sapconinstruments.co	, ,

71	145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	W017	Baumer Technologies India Pvt. Ltd.	REGULAR	NA	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI-Maharashtra-INDIA Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com	, NAME HAS BEEN CHANGED FROM M/S WAAREE INSTRUMENTS LTD. TO M/S BAUMER TECHNOLOGIES INDIA PVT. LTD. W.E.F. 12.06.2012
72	145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	V040	V. AUTOMAT & INSTRUMENTS (P) LTD.	REGULAR	NA	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI-DELHI-INDIA Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com	, ,
73	145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	B077	BLISS ANAND PVT. LTD.	REGULAR	NA	Mr. Vikas Anand/Mr.RGRajan 92B & 93 B , IMT MANESAR Gurgaon-Haryana-India Phone- 0124-4366000 TO 9 Pincode : 122001 Email : sales@blissanand.com	, ,
74	145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	F033	Flow Star Engineering Pvt. Ltd.,	REGULAR	A1	MR. KHALID AKHTAR/MR. TAPAN KUMAR JANA Plot No- 7 F/2, Northern India Industrial 20/3, Mathura Road FARIDABAD-HARYANA-INDIA Phone- 9818176380 Pincode : 121005 Email : khalid@flowstar.co.in	VENDOR IS REGISTERED IN MSED (MICRO) W.E.F.30.11.2011 FOR FY 2011-12 , ,
75	145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	S008	SIGMA INSTRUMENTS CO.	REGULAR	NA	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI-MAHARASHTRA-INDIA Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.i	, ,
76	145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	S010	SOR INC.	REGULAR	NA	LARRY DEGARMO/Avdesh Chandra, 14685 W. 105TH STREET LENEXA-KANSAS-USA Phone- 09810905139, Pincode : 66215 Email : ldegarmo@sorinc.com, avdesh@sherman-jedia.com	, ,
77	145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	L005	LEVCON INSTRUMENTS PVT. LTD.	REGULAR	NA	Mr Shayak Gupta/Badal Jana Rajkamal', 7th floor, 13, Camac Street KOLKATA- WEST BENGAL-INDIA Phone- 0 33 2283 2766 Pincode : 700017 Email : b_jana@levcongroup.com	, ,
78	145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	P068	Pune Techtrol Pvt. Ltd.	REGULAR	NA	N.P.Khatan/Sudhakar Badiger S-18, MIDC Bhosari, Pune-Maharashtra-INDIA Phone- 9850560042 Pincode : 411 026 Email : ho@punetechtrol.com	, ,
79	145-35000-A	LEVEL SWITCH-CAPACITANCE TYPE	N035	NIVO CONTROLS PVT. LTD.	REGULAR	NA	MR.PRAVEEN TOSHNIWAL/MR. NITIN TAMHANE 104-115, ELECTRONIC COMPLEX, INDORE-MAHARASHTRA-INDIA Phone- 07314081300 Pincode : 452010 Email : sales@nivocontrols.com	, ,
80	145-36000-A	LEVEL SWITCH-CONDUCTIVITY TYPE	L005	LEVCON INSTRUMENTS PVT. LTD.	REGULAR	NA	Mr Shayak Gupta/Badal Jana Rajkamal', 7th floor, 13, Camac Street KOLKATA- WEST BENGAL-INDIA Phone- 0 33 2283 2766 Pincode : 700017 Email : b_jana@levcongroup.com	, ,

81	145-36000-A	LEVEL SWITCH- CONDUCTIVITY TYPE	S010	SOR INC.	REGULAR	NA	LARRY DEGARMO/Avdhesh Chandra, 14685 W. 105TH STREET LENEXA-KANSAS-USA Phone- 09810905139, Pincode : 66215 Email : Ldegarmo@sorinc.com, avdhesh@sherman-india.com	, ,
82	145-36000-A	LEVEL SWITCH- CONDUCTIVITY TYPE	S008	SIGMA INSTRUMENTS CO.	REGULAR	NA	Gopal Kannan/R Gopinath 201, ANANDRAJ INDUSTRIAL ESTATE, OFF.LBS MARG, SONAPUR LANE, BHANDUP (W) MUMBAI-MAHARASHTRA-INDIA Phone- +919821038162 Pincode : 400078 Email : sales@sigmainstruments.co.i	, ,
83	145-36000-A	LEVEL SWITCH- CONDUCTIVITY TYPE	R047	RAMAN INSTRUMENTS PVT.LTD.	REGULAR	NA	Mr. N R Shenoy/Mr G B Vijh 8, First Floor.Plot : 160A Bait-Ush-Sharaf, 29th Road,Bandra(W) MUMBAI-Maharashtra-India Phone- 09892331381 Pincode : 400050 Email : ramanbhai@usol.com	Technical limit reviewed on 12.10.2015; , Technical limit reviewed on 30.04.2014; ,
84	145-36000-A	LEVEL SWITCH- CONDUCTIVITY TYPE	H047	HI-TECH SYSTEMS & SERVICES LTD.	REGULAR	NA	Mr. Vikash Agrawal/Mr. Tarun Debnath 119, PARK STREET , KOLKATA-West Bengal-India Phone- 033-22290045 Pincode : 700016 Email : saadnan@hitech.in	Technical limit reviewed on 12.10.2015; , Technical limit reviewed on 30.04.2014; ,
85	145-36000-A	LEVEL SWITCH- CONDUCTIVITY TYPE	B077	BLISS ANAND PVT. LTD.	REGULAR	NA	Mr. Vikas Anand/ Mr.RGRajan 92B & 93 B , IMT MANESAR Gurgaon-Haryana-India Phone- 0124-4366000 TO 9 Pincode : 122001 Email : sales@blissanand.com	, ,
86	145-36000-A	LEVEL SWITCH- CONDUCTIVITY TYPE	V040	V. AUTOMAT & INSTRUMENTS (P) LTD.	REGULAR	NA	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI-DELHI-INDIA Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com	, ,
87	145-36000-A	LEVEL SWITCH- CONDUCTIVITY TYPE	S123	Sapcon Instrument Pvt Ltd.	REGULAR	NA	131, PALSHIKAR COLONY Contact Person- Mr. Ashwin (9826080207) INDORE-MP-INDIA Phone- +91-731-4085751, Pincode : 452004 Email : sales@sapconinstruments.co	, ,
88	145-37000-A	LEVEL SWITCH-FLOAT TYPE	V040	V. AUTOMAT & INSTRUMENTS (P) LTD.	REGULAR	NA	Mr. R. K. BASSI/Mr. PRAVEEN KUMAR F-61, OKHLA INDL.AREA, PH-1 NEW DELHI-DELHI-INDIA Phone- 9810005826 Pincode : 110 020 Email : sales@vautomat.com	, ,
89	145-37000-A	LEVEL SWITCH-FLOAT TYPE	W017	Baumer Technologies India Pvt. Ltd.	REGULAR	NA	Mr. Shyam Warilani/Mr. V Suresh Babu 36, DAMJI SHAMJI INDUSTRIAL COMPLEX, OFF.-MAHAKALI CAVES ROAD, ANDHERI(E) MUMBAI-Maharashtra-INDIA Phone- +91 99589 25151 Pincode : 400093 Email : sales.in@baumer.com	, NAME HAS BEEN CHANGED FROM M/S WAAREE INSTRUMENTS LTD. TO M/S BAUMER TECHNOLOGIES INDIA PVT. LTD. W.E.F. 12.05.2013
90	145-37000-A	LEVEL SWITCH-FLOAT TYPE	B077	BLISS ANAND PVT. LTD.	REGULAR	NA	Mr. Vikas Anand/ Mr.RGRajan 92B & 93 B , IMT MANESAR Gurgaon-Haryana-India Phone- 0124-4366000 TO 9 Pincode : 122001 Email : sales@blissanand.com	, ,
91	145-37000-A	LEVEL SWITCH-FLOAT TYPE	D046	D.K. INSTRUMENTS PVT.LTD.	REGULAR	NA	N.SIKDAR/ SUMIT SIKDAR 76/2,SELIMPUR RD DHAKURIA Kolkata-West Bengal-India Phone- 033-2415-1310. Pincode : 700031 Email : dkiest@usol.net	, ,