TECHNICAL SPECIFICATION
FOR
SUPPLY OF AVGF COMPONENTS AND
ERECTION & COMISSIONIONG SERVICES OF AVGF

PROJECT:	**1 X 100MW NAMRUP COMBINED CYCLE REPLACEMENT POWER PROJECT (PHASE -1) –NAMRUP , ASSAM**
CUSTOMER:	**ASSAM POWER GENERATION CORPOTATION LTD, GUWAHATI, ASSAM**
CONSULTANT:	**M/S DEVELOPMENT CONSULTANTS (P) LTD CONSULTING ENGINEERS**

1.0 INTENT OF SPECIFICATION:

1.1 This specification along with its annexures is intended to cover the design, manufacture, supply (to project site in properly packed condition), unloading at site, site storage, material handling at site and erection and commissioning of the system along with all accessories as specified in the scope of work and as required for the safe and trouble-free operation of system at site.

2.0 GENERAL DESCRIPTION

2.1 The project site, referred here-in, located at Namrup Assam, is provided with auto valve less gravity filters (AVGF) for removing suspended solids from the circulating water of CCPP.

2.2 Three no. of Vertical Automatic Valve less Gravity with capacity 3x50% (i.e. 2W+1S) filters are provided to filter 2.5% of the recirculating water. The inlet water to AVGF is tapped from the hot water return header to cooling tower and outlet filtered water is connected to cooling tower fore bay.

2.3 Major components of the AVGF such as Vessels, Piping, etc. were already supplied by our package vendor and are available in plant stores (Please refer attached photographs). However, there is a shortage in the supply which is detailed in the subsequent clauses of this specification.

Note: The details of supplies in the bidder's scope are provided to the best of our knowledge. However, bidder may ascertain the same, if required, by doing a physical assessment through a site visit.

3.0 PROJECT DESCRIPTION

Name of the Project	1 X 100MW Namrup Combined Cycle Replacement Power Project (Phase -1) –Namrup , Assam
Customer	Assam Power Generation Corporation Ltd, Guwahati, Assam
Project Consultant	M/s Development Consultants (P) Ltd Consulting Engineers
Project Location	Namrup , Assam

4.0 SCOPE OF SUPPLY

4.1 The items to be supplied are as listed below:

Sl. No.	ITEM DESCRIPTION	QTY.	Remark
1.	PP Nozzles For filter internals (Strainer plate)	3 Set	
2.	Sand (Filter grade) (Approx.10MT/Filter)	As reqd.	As per data sheet for all 3 vessels
3.	Gravel for filter under bed	As reqd.	As per data sheet for all 3 vessels.
4.	Backwash System for Tank Dia.4000mm	3 Set	Vendor may utilize the existing system available at site.
5.	Inter connecting Piping (Refer Piping GA 21036-5M-DWG002/001 for details)		
5a	PIPE - 250 NB, #150 , SCH20, as per ANSI B36.1	22 meter	For inlet and outlet CW headers of AVGF system.
5b	PIPE - 200 NB, #150 , SCH20, as per ANSI B36.1	40 meter	Interconnecting piping between feed tank, loop tank and AVGF.
5c	Flange -250NB, SOFF, #150, SCH20, as per ANSI B16.5	2 no's	
5c	Blind Flange-250NB, SOFF, #150, SCH20, as per ANSI B16.5	2 no's	
6.	Needle valve , 15 NB, #300, SW, with MOC SS316	12 no.'s	(For sampling lines and instrument isolation)
7.	Piping 15NB, #300, SS316, sch 40	30m	
8.	Gaskets and fasteners for complete piping	1 set	
9.	DP Indicator along with 3 way manifold valve with tubing and ferrule adaptor.	3 Set	
10.	Structural steel for erection of filter (<500Kg)	1 set	Channel and angles required for supports.
11.	Paints	As reqd	Painting of complete AVGF system as per data sheet.
Any other items not specifically mentioned but required for successful operation of AVGF is included in the vendor scope of supply.			

4.2 Bidder to ensure that the material to be supplied is compatible in all respects (Design, Installation and commissioning) with the existing system present at site.

4.3 Any tools and tackles required for erection, commissioning and trail run shall be part of diddre scope. The tools and tackles to be considered as returnable basis items.

5.0 SCOPE OF SERVICES

The following services are included in the vendor scope

5.1 Unloading and storing of supplied materials at site.

5.2 Shifting of all components of AVGF (complete assembly) from plant stores to site location of AVGF (Distance between plant stores to site location is approximately 1 km.)

5.3 Any repair, if required, of the existing supplies.

5.4 Complete erection of the AVGF system such as

a) Erection of filter vessels, shell tanks, feed tanks and loop tanks.
b) Fabrication and erection of interconnecting piping with supports.
c) Fabrication and erection of piping including supports from terminal point to inlet of the filter.
d) Fabrication and erection of piping including supports from outlet of the filter to terminal point.
e) Erection of back wash system.
f) Erection of PVC pipes in filter bed and filling filter media.
g) Painting of complete system.
h) Installation of instruments (Rotameter, DP indicator, etc.)
i) Any other activity not mentioned but required for successful commissioning of the AVGF system.

5.5 Complete commissioning of the AVGF system.

5.6 Testing and Performance guarantee of the AVGF system.

Notes:

1. All consumables like welding electrodes, grits for blasting, paints, etc are in the bidder scope of supply.

2. It is bidder responsibility to arrange all the equipment/machinery like crane or hydra (for material handling), welding machine, painting guns, required for erection, fabrication and painting of the system. BHEL/NBPPL shall only arrange for construction power as required.

3. All tools and tackles required for erection and commissioning should be arranged by bidder.

4. Any commissioning spare if required during commissioning of the AVGF should be arranged by the bidder.

6.0 DATA SHEET OF AVGF

Sl. no.	PARAMETER	UNIT	VALUE / REQUIREMENT
1.1	DESIGN FLOWRATE (EACH)	M3/HR	120
1.2	SIZE	MM	4000 DIA X 4500 HOS
1.3	QUANTITY	NOS	3 (2W + 1S)
1.4	TYPE		AUTOMATIC VALVELESS GRAVITY FILTER
1.5	LOCATION		OUTDOOR
1.6	DESIGN SURFACE VELOCITY	M/HR	9.55
1.7	DESIGN INLET TURBIDITY	NTU	50
1.8	DESIGN OUTLET TURBIDITY	NTU	< 5
1.9	FILTER MEDIA		Bed of graded Sand supported over graded gravel
1.10	DEPTH OF FILTER MEDIA	MM	600
1.11	UNDER BED PROVIDED		GRAVEL
1.12	FREE BOARD		50%
2.1	**MATERIAL OF CONSTRUCTION**		
2.2	SHELL		MS – IS 2062
2.3	BOTTOM PLATE		MS – IS 2062
2.4	HEAD PLATE		MS – IS 2062
2.5	STAINER PLATE		MS – IS 2062
2.6	STRAINERS		PP
	PAINTING INTERNAL		
3.1	PREPARATION		BLAST CLEAN TO BS 4232 2ND QUALITY (SA21/2)
3.2	TOTAL COATS		3 COATS OF SOLVENT FREE EPOXY PAINT (FINAL) WITH SUITABLE PRIMER
3.3	TOTAL THICKNESS		175 MICRONS
	PAINTING EXTERNAL		
3.4	PREPARATION		BLAST CLEAN TO BS 4232 2ND QUALITY (SA21/2)
3.5	PRIMER COAT		2 COATS OF ZINC CHROME PRIME, DFT 40 MICRONS PER COAT
3.6	INTERMEDIATE COAT		1 COAT OF MICACEOUS IRON OXIDE PAINT, DFT 60 MICRONS PER COAT
3.7	FINISH		1 COAT OF POLYURETHANE PAINT, DFT 50 MICRONS PER COAT
3.8	TOTAL THICKNESS		190 MICRONS
	PERIPHERAL EQUIPMENT		
4.1	FEED TANK		
4.2	SIZE	MM	1100 DIA X 600 HOS
4.3	MATERIAL OF CONSTRUCTION		MS – IS 2062
4.4	LOOP SEAL TANK		
4.5	SIZE	MM	800 DIA X 800 HOS
4.6	MATERIAL OF CONSTRUCTION		MS – IS 2062

	EJECTOR		
5.1	QUANTITY	NOS	2
5.2	SIZE	INCH	3/4" Suction 2" Power Water
	BACKWASH VELOCITY	M/HR	13 (min) - 48(max)
6.1	BACKWASH FLOWRATE	M3/HR	163 – 603
6.2	TIME REQUIRED FOR BACKWASH	MIN	3-5
6.3	BACKWASH VOLUME	M3	8.17 – 30.16
6.4	FREQUENCY OF BACKWASH		ONCE IN A DAY
6.5	MANHOLE & HANDHOLE		PROVIDED

7.0 CIRCULATING WATER ANALYSIS :

PARTICULARS	AS	*VALUE*
Cations		
Calcium	as $CaCO_3$ in ppm	18.0
Magnesium	as $CaCO_3$ in ppm	18.0
Sodium	as $CaCO_3$ in ppm	11.0
Total Cation	as $CaCO_3$ in ppm	47.0
Anions	as CaCO3 in ppm	--
Chloride	as CaCO3 in ppm	8.0
Sulphate	as CaCO3 in ppm	19.0
Bicarbonate	as CaCO3 in ppm	20.0
Total Anions	as CaCO3 in ppm	47.0
Iron Total	ppm as Fe	0.5
Total silica	ppm as SiO2	7.0
Turbidity	NTU	10.0
PH	@25°C	7.1
Total suspended Solids	Mg/l	25.0
Conductivity @25°C	in μ Siemens / cm	60.0
Total Dissolved Solids	Mg/l	40.0
Dissolved CO2	ppm as CO2	4.0

Cycle of concentration for design for circulating water system is = 4

8.0 GUARANTEE:

Bidder has to guarantee the following for side stream filtration system.

a) Turbidity in effluent shall be less than 5 NTU with respect to influent turbidity of around 50 NTU.
b) Each filter will work continuously for a period not less than three (3) years without any change in filter media.

9.0 SPECIAL NOTES:

9.1 It is complete responsibility of the Bidder to ensure compatibility of the components being supplied with the existing system at site. In the event of any mismatch, Bidder shall supply and install the suitable components at free of cost.

9.2 The Bidder shall at his cost perform any services, tests etc, although not specified but required for the completion of work.

9.3 It may be noted that the best efforts have been made to give full clarity of the scope to the bidder. Bidder is advised to visit the site and understand the scope of works before making a quotation against this specification. However no price implications shall be acceptable with regards to non-familiarity of works or additional works.

10.0 LIST OF ANNEXURES:

Sl.No.	**Description**	**Drg/Doc.No.**
1.	GA Drawing Of AVGF	**21036-5M-DWG002**
2.	P&ID Of AVGF	**21036-5M-DWG011**
3.	Piping GA drawing of AVGF	**21036-5M-DWG002/01**
4.	Painting Specification	**M-19** of Volume-2 of K7205-SPC-001
5.	Piping Specification	**M-20** of **Volume-2** of K7205-SPC-001
6.	Valve specification	**M-21** of **Volume-2** of K7205-SPC-001
7.	Approved Vendor List For The Project	-
8.	Site Photographs	-

11.0 PRICE-BID FORMAT

Sl. No:	Description	Unit	QTY	Unit Rate (Rs)	Total Price (Rs)
	Supply				
1	Supply of the components defined in Technical Specification (Doc. No. PY 51344) and all its annexures.	Lot	1		
2	**Erection and commissioning** of Side stream filtration system as per BHEL job specification and its annexures				
	Total (Sl no.1 + Sl no.2)				
	Notes: 1. All the prices quoted in this price bid format shall be without taxes and duties. 2. The above prices shall be quoted strictly in-line with Technical Specification for Vendor Services at Project Site (Doc. No. PY 51343) and all its annexures. 3. Bidder to fill the above prices manually put his seal & signature and submit the same for price bid opening. 4. For purpose of evaluation the total price quoted by the bidder (i.e. Sl no. 1 + Sl no. 2) will be considered for evaluation.				

Variant Table:

Var no.	Item Type	Material Code	Remarks
00	SUPPLY OF AVGF COMPONENTS	PY9751343003	
01	ERECTION & COMISSIONING OF AVGF	PY9851343013	

ANNEXURE – I

Bidder to fill and furnish the following information in the indicated format:

KEY INFORMATION

1.	Name of the Bidding Company	:	
2.	Registered in (mention the name of the Country)	:	
3.	Name, designation, telex & telephone number and postal address of responsible officer of Bidder to whom all reference shall be made for expeditious coordination.	:	
4.	Name, designation, telex & telephone number and postal address of responsible officer of Indian Agent.	:	
5.	Bidder's proposal number	:	
6.	Bidder's proposal date	:	
7.	Validity of offer, counted from the date of opening of bid	:	
8.	Guaranteed completion period, counted from date of issuance of LOI/TOI	:	
9.	Confirm that Scope of supply and services are exactly as per specification requirement.	:	Yes/No
10.	Confirm technical compliance with specification	:	Yes/No
11.	Confirm that List of Recommended Spares has been furnished as per Annexure-II	:	Yes/No
12.	Confirm that Special Tools & Tackles are as per Annexure-III	:	Yes/No
13.	Confirm that deviations ,if applicable, have been furnished as per Annexure-IV	:	Yes/No

Signature of Bidder's
Authorized representative with date.....
Date .....

ANNEXURE – II

DEVIATION FROM SPECIFICATION

If the proposal submitted has got any deviation from the technical stipulations in the bidding document, the Bidder shall tabulate below the full particulars of such deviations and shall sign below. Additional sheets may be enclosed, if necessary. Deviation is to be furnished with mention of specific clause numbers. Technical and commercial deviations to scope of supply and services, shall be indicated separately.

Sl.No.	CLAUSE NO.	DESCRIPTION AS PER SPECIFICATION	DEVIATION BY BIDDER

We confirm that all the deviations/exceptions to the Job specification and enclosures including reference documents attached are listed in this format only. No other deviations or exceptions even if mentioned elsewhere shall be considered for any technical/ commercial evaluation or for ordering.

Signature of Bidder's
Authorized representative with date.....
Date.....

RECORD OF REVISIONS				
Rev. No.	**Date**	**Revision Details**	**Prepared/ Reviewed By**	**Approved By**
00	04.04.18	First Issue	DSK	MSSN

1.0.0 INTENT OF SPECIFICATION:

This specification is intended to cover the design, manufacture, assembly, testing at manufacturer's works, painting at works, delivery to site, proper packing and forwarding, unloading at site, site storage, handling at site, erection, painting at site, commissioning, testing at site (including site performance test), of the system along with all accessories as specified in the scope of work and as required for the safe and trouble-free operation of equipment to be installed at site.

1.1.0 This specification shall be read in conjunction with its enclosures. In case of any discrepancy arising between this job specification & its enclosures, wherein more than one level (i.e. both less stringent level and more stringent levels) of same requirement have been indicated for a particular item, the most stringent of all shall be followed and shall relevantly over-ride others. Otherwise, the requirements indicated in this job specification shall be considered as additional requirements to the ones indicated in the enclosures. Further, if a requirement in this specification or its enclosures, calls for decision of owner/BHEL, it shall be bidder's sole responsibility to clearly bring out the same before submitting his technical tender offer, so as to enable owner/BHEL to furnish their decision. If such a requirement is not duly addressed by bidder during tender stage and same comes out during order execution stage, it shall be binding on the bidder to comply with the decision furnished by owner/BHEL then, without any cost, delivery, or any other commercial implications.

1.2.0 Any additional equipment, material, etc., which are not specifically mentioned here, but are required to make the supplied equipment complete in all respect, in accordance with the intent of this technical specification, contractual agreement, statutory requirements, relevant/applicable codes/standards, good engineering practices, and for safe and trouble-free operation, shall be deemed to be covered under the scope of this specification.

2.0.0 SCOPE OF WORK: REFER JOB SPEC PY51343

Scope of supply is covered in PEMC-06864 and the same is to be referred.

3.0.0 GENERAL CONDITIONS OF CONTRACT

3.1.0 LOCATION/POSITIONING OF WORKS

The CONTRACTOR shall be responsible for the true and proper setting out of the WORKs in relation to points, levels of reference co-ordinates, orientation, alignment and marks given in the CONTRACT DOCUMENT in writing and for correctness of the positions, levels, dimensions, orientation and alignment of all parts of the WORKs, and for the provision of all necessary instruments, appliance and labour in connection therewith. If, at any time during the progress of WORKs, any error appears or arises in the position, orientation, alignment, levels or dimensions or dimensions or any part of the WORKs, the CONTRACTOR shall rectify the error at his own cost to the satisfaction of Purchaser/Customer. The checking of any setting out of any line, level, co-ordinate, depth, orientation or alignment or position of a marker by the Purchaser/Customer shall not in any way relieve the CONTRACTOR of his responsibility for the correctness thereof. CONTRACTOR shall carefully protect and preserve all bench marks, sight rails, pegs and other things used in setting out the WORKs.

3.2.0 SAFETY PROCEDURES AND RESTRICTIONS

The CONTRACTOR shall adhere to the following safety requirements at SITE during execution of WORKs:

(i) SAFETY REGULATIONS

a) In respect of all labour, directly, or indirectly employed in the WORKs for the performance of CONTRACTOR's part of this agreement, the CONTRACTOR shall at his own expense arrange for all the safety provisions as per safety CODES of CPWD, Indian Standards Institute, The Electricity Act, The Mines Act and such other Acts as applicable.

b) The CONTRACTOR shall observe and abide by all fire and safety regulations of the COMPANY before starting construction WORK. CONTRACTOR shall consult with OWNER's Safety ENGINEERs and must make good to the satisfaction of the OWNER

(ii) GENERAL

a) No labour below the age of eighteen years shall be employed on the WORK.
b) The CONTRACTOR shall not pay less than what is provided under laws to labourers engaged by him on the work.
c) The CONTRACTOR shall at his own expense comply with all labour laws and keep the OWNER indemnified in respect thereof.

(iii) WATCHING AND LIGHTING

The CONTRACTOR shall, in connection with the WORK, provide and maintain at his own cost all lights, guards, fencing, safety equipment, markers and watching when and where necessary or required by the Purchaser/Customer or by any duly constituted authority for the protection of the WORKs or for the safety and convenience of the public or others.

(iv) TIME SPAN FOR RESPONSIBILITY OF WORKS

From the time of commencement of the WORKs till the issuance of a CERTIFICATE OF COMPLETION AND ACCEPTANCE of the WORKs , CONTRACTOR shall be fully responsible for the care of WORKs and of all Temporary WORKs, in case any damage or loss happens to the WORKs or to any part of them or to any Temporary WORKs from any cause whatsoever other than war risks in respect of which insurance cover is not available even with payment of additional premium including damage caused by the CONTRACTOR himself during the execution of the CONTRACT, the CONTRACTOR shall repair and make good the same as his own cost. The CERTIFICATE OF COMPLETION AND ACCEPTANCE will be issued by the Purchaser/Customer only if the WORKs are in good order and conditions and conform in every respect with the requirements of the CONTRACT and OWNER's REPRESENTATIVE's instructions in accordance with the CONTRACT .

(v) USE OF OWNER's FACILITIES

Notwithstanding anything contained elsewhere in the CONTRACT, the CONTRACTOR shall make its own arrangements for all the facilities/resources required to carry out the WORK including but not limited to crane and Material Handling, living accommodation, etc. OWNER's Crane and any other hoists, living accommodation etc. shall not be available for CONTRACTOR's use.

(vi) COMPLIANCE OF LOCAL LAWS & REGULATIONS

The CONTRACTOR shall comply with all the laws, rules and regulations including but not limited to CONTRACT Labour (REA) Act, Minimum Wages Act etc. and shall keep the OWNER harmless and indemnified for any action brought against it for any violation non-compliance of any of the Acts etc.

3.3.0 POLLUTION RESPONSIBILITY

In the performance of any and all services and the WORKs by the CONTRACTOR or his sub- Contractors, the CONTRACTOR shall accept full responsibility for compliance with all applicable laws and governmental orders, rules and regulations as amended/in force from time to time relating to pollution. CONTRACTOR and his sub-contractors shall also comply additional provisions as may be notified to the CONTRACTOR by the OWNER.

The CONTRACTOR agrees to inform himself and his supervisors of such Laws, Orders and Regulations and to make all his employees and the sub-contractors fully cognizant of their responsibilities there under.

The CONTRACTOR shall:-

i) Clean up and remove any pollution resulting from its non-compliance with the provisions of this section, at his cost and expense

ii) If the CONTRACTOR fails to do so, the COMPANY may clean up and remove the pollution. In which case the CONTRACTOR shall reimburse the OWNER upon receipt of bill from the OWNER, the cost of such clean up and removal.

3.4.0 GUARANTEE AND WARRANTY/DEFECT LIABILITY PERIOD

The CONTRACTOR agrees to ensure that all materials , equipment and components used in execution of the WORKs under this CONTRACT, shall be new and unused (not reconditioned) and of recent manufacture which shall in no case be of a date of manufacture older than one year from the date of shipment to SITE as the case may be.

4.0.0 CONSUMABLES

Supply of all consumables required till commissioning and performance testing (including first fill) shall be included in the scope and the same shall be supplied by the successful Bidder at appropriate time.

NOTE: Also Refer to Job specification for applicability.

5.0.0 LUBRICANTS

All flushing oil required, together with first fill of oil and/or grease for all parts of equipment requiring lubrication, shall be provided by the Bidder. For all types of lubricants, equivalent grade of other makes shall be readily obtainable locally.

NOTE: Also Refer to Job specification for applicability.

6.0.0 MANDATORY SPARES

Mandatory spare shall be as per Job Specification

7.0.0 RECOMMENDED SPARES

A minimum requirement of spare parts **based on the experience** of the Bidder sufficient for two (2) years of normal trouble free operation shall be recommended and quoted separately **as optional item.** Bidder shall furnish the description along with recommended quantity for each item in the offer.

8.0.0 ERECTION & COMMISSIONING SPARES

The Bidder shall also supply erection & commissioning spares along with his main equipment as per his experience, for replacement of damaged or unserviceable ones during the execution of the project at site, to avoid delay in the project schedule. This shall form part of the main equipment supply. The initial fill of lubricants, oil etc. shall also be supplied by the Bidder. Bidder shall not be allowed to use Mandatory Spares for Erection and Commissioning.

9.0.0 SPECIAL MAINTENANCE TOOLS AND TACKLES

One set of special tools and tackles required for operation, maintenance, inspection and repair, neatly packed in steel boxes complete with operating instructions for the complete Water Treatment system shall form part of the main equipment supply and a separate list for the same shall be furnished along with bid.

Ref. Doc

10.0.0 VENDOR DOCUMENTATION PROCEDURE

Sl. No.	Document Name / Type	To Contain	Required With Offer	Required After P.O	
			Compliances from Vendor & No. of Sets Reqd.	No. of Sets Required – Engg. & Approval /Review Activities .	No. of Sets Required- For Site & Customer Submission
1	(a) Drgs, , Data Sheets , Catalogues. BOM etc. (b) PIDs , SLDs, Block-Schematics etc. (wherever applicable)	Adequate Information & essential for proper Technical Evaluation of the Offers. Other Information to be furnished as defined in the applicable Tech Specs.	4 (Addl. Copies Required – wherever Offer Docs. Are subject to Review by Customer . See Spec. Requirement)	–	–
2	Terminal Point (s)	List of Scope Terminal Point (s) & Process Datra etc. – wherever applicable.	2 (See also Sl-1 above)	–	–
3	Deviations if any	To be clearly listed, furnishing reasons for non-compliance	2 (See also Sl-1 above)	–	–
4	Master Document List (**MDL**)- (***Blank format Attached with this specification)***	**a)** List of all Documents & Drgs., Spares Items etc. which are applicable for the Project . They shall be group wise enlisted in MDL Doc. **b)** Submission of Up-dated MDL Doc.is required at the time of each submission of Drgs./Doc or group of Drgs. / Docs.	-	3	10
5	Project completion activity “Bar-chart” matching with BHEL Project Schedule	Required for packages & for contracts and also for projects where Erection & Commissioning activities are in vendor scope.	Compliance required to meet BHEL Delivery Sch.	3	10
6	(a) Drgs, , Data Sheets , Catalogues. BOM etc. (b) PIDs , SLDs, Block-Schematics etc. (wherever applicable)	While carrying out Detailed Engg. during Post-Ordering Stage.	-	10	10
7	Information Reg. “INITIAL – FILL” Items & Consumable Items – List - As Required (for each applicable systems)	**a**) Confirmation from Vendor Required. The Items shall be considered as Part of main scope of supply.	**a**) Supply Confirmation Required from Vendor **b**) Doc. To be	10	10

Sl. No.	Document Name / Type	To Contain	Required With Offer	Required After P.O	
			Compliances from Vendor & No. of Sets Reqd.	No. of Sets Required – Engg. & Approval /Review Activities .	No. of Sets Required- For Site & Customer Submission
		b) A Separate Doc. To be furnished with Detail List & Quantity. (Applicable Items & Qty subject to Review during detail Engg.)	Enlisted in MDL.		
8	SPARES for Erection / Commissioning	**a**) Informative List required with Technical & Commercial bids. **a.1**) To consider as Part of main scope of Supply. **b**)Such Spares List is subject to Review during Detail Engg.	Vendor to Confirm Supply in their Offer.	6	10
9	"Operation and Maintenance Spares" / "Mandatory Spares" List	**a**)Recommended List by Vendor **b**) List with Other Data – if Specified in Tech. Spec.	**1**) To Enclose with Offer. **2**)To indicate price for the listed items in commercial offer & with extended validity	6	10
10	Vendor's "Bill of Material" Doc. (**BOM) –*Blank format attached with this specification)*** This Doc. Shall be Enlisted in MDL Doc.	1) The Engg. Part of Information in this Doc. Shall be approved by BHEL 2) Submission of this Document is essential during initial Submission stage of Engg. Docs. & the same be progressively Updated as the Detail Engg. progresses. 3) All Dispatchable Units shall be identified in this Doc with "Dispatch Tag-No." (5 Chr. BHEL Des. No. with 3 Chr. Running Item Sl No. – e.g. "Jxxxx / 001" , max. upto 999) . 4)The Despatch Tag no. shall be written on an 'Al- Strip' and tied to the dispatch able Unit or be prominently painted on each Item with washable paint.	-	6	10

Sl. No.	Document Name / Type	To Contain	Required With Offer	Required After P.O	
			Compliances from Vendor & No. of Sets Reqd.	No. of Sets Required – Engg. & Approval /Review Activities.	No. of Sets Required- For Site & Customer Submission
		PL. NOTE – This Standard Unified System shall be followed being an essential part of Field Quality Assurance Practices & for proper Identification of Items at Site.			
11	Quality Assurance Plan (QAP) & Factory Testing Procedure Documents	1) Approval from BHEL required. 2) Submission along with the Engg. Docs.	**A**) Submission –if already standardized with BHEL / Draft proposal & it may be finalized after Review. **B**) Submission compliance from Vendor required	6	4
12	FQAP (Field Quality Assurance Plan) & Site Erection, Testing & Commissioning Procedure documents	1) Approval from BHEL site. 2) Submission along with the Engg. Docs.	Same as for Sl-11 above	6	4
13	Erection Documents & Drawings:-	1) To contain final MDL, BOM, Handling & Storage Instructions Doc., Initial-Fill & Consumables Items list, Erection & Commissioning Spares List, Operation & Maintenance spares list / Mandatory Spares List etc. 2) Submission minimum 6 – weeks before eqpt. Schedule dispatch. 3) The drgs. Shall be kept in plastic pouches and neatly arranged, submitted in an aesthetic, appropriate & durable folder(s). Documents filed appropriately in Folder in – seriatim of MDL.	-	-	10

Sl. No.	Document Name / Type	To Contain	Required With Offer	Required After P.O	
			Compliances from Vendor & No. of Sets Reqd.	No. of Sets Required – Engg. & Approval /Review Activities .	No. of Sets Required- For Site & Customer Submission
14	O&M Manual Document Folder(s)	1) Submission 1-month before schedule eqpt. Dispatch (Draft copy shall be submitted beforehand for review by BHEL) 2) The manual shall be submitted in an aesthetic, appropriate & durable folder(s). Each vol. Shall be marked with its Vol. No. 3)**<u>This Manual shall include</u> primarily following information: -** **i)** Operational & safety instructions. **ii)** Environmental Safety instructions & indicating compliances of the Regulations in-force. **iii**) Guidelines incorporating requirements for Operation of the Equipment in Hazardous Environment- wherever applicable. **iv)** Master document List (MDL) doc. **v)** Bill of material (BOM) doc. **vi)** Erection Instructions.	-	Adv. Copy (2 sets)- for review by BHEL	Final Copies – (10 sets)

Sl. No.	Document Name / Type	To Contain	Required With Offer	Required After P.O	
			Compliances from Vendor & No. of Sets Reqd.	No. of Sets Required – Engg. & Approval /Review Activities.	No. of Sets Required- For Site & Customer Submission
		vii) Operational & Maintenance Instructions for all Systems / Items with adequate planations and sketches etc., Catalogue information included-(and applicable Model no.marked therein), Overhaul schedules etc. viii) Lubrication Schedule **ix**) Initial-Fill Items List **x**) Approved QAP's Shop Tests & Calibration Reports. **xi**) Approved FQAP – along with related docs, with site testing & commissioning Protocols etc. xii) Sub-Vendor O&M manuals.			
15	"As –Built" Drawings & Documents	Submission within three weeks –after commissioning at site	-	-	10
16	Compact Disc (CD)	1) MDL, All drawings, Documents, Data sheets – as Listed in Approved MDL Doc. , all applicable Catalogues (Scanned), BOM & all items covered in the O&M Manuals & the "As-built" Drgs. 2) To submit along with the submission of "As-built" drgs. & docs.	-	-	3

Notes:

10.1.1 BHEL will furnish their approvals / comments within 15 days after submission of drawings/ documents.

10.1.2 The O&M manuals shall contain the following details as minimum in addition to those indicated in the above table:-

- Identification details of the equipment like BHEL PO NO., Vendor's Sl. No., Vendors contact address with tel., fax details.
- Description of the equipment.

- Final Data sheets and Drawings of the equipment as per the list mentioned in this specification.
- O&M Manuals of the equipment.
- Recommended 2 years operational spares.
- Test reports.

10.1.3 The erection documentation shall consist of

- All drawings/documents,
- O&M instructions of pump, motor, instruments, ARC valve, etc.
- All such drawings/documents, not submitted for review, but essential for erection/commissioning, e.g. cooling plan, flushing plan, assembly drawings, etc.
- Master document list
- Site dispatch able B.O.M.
- Any special safety/erection/commissioning requirements, vendor would like to specify.

10.1.4 For drawings, data, sheets and all graphic works Auto Cad release 2006 or later versions and for all texts, MS Word 2000 shall only be used.

11.0.0 TESTING, INSPECTION AND QUALITY PLAN

Test at Manufacturer's work:

1. Shop tests shall include all tests to be carried out at contractor's works; works of his sub-contractor and at works where raw materials supplied for manufacture of equipment is manufactured. The tests to be carried out shall include but not limited to the tests as follows:

2. Composition of all material, castings, forgings, etc. correlation certificates for the same for each equipment and component shall be furnished.

   Hydraulic test for vessels, pipes, valves, specialties, pump casting, etc.

3. Performance test (Head, Capacity and Power) on pumps in line with applicable codes.

4. Tests on all electrical equipment/accessories as specified in respective electrical sub-sections.

5. Calibration tests for weight/load indicator.

6. Calibration tests of all standard orifices, nozzles, level switches and other instruments.

Material Tests

All materials used for construction shall be of tested quality. All materials shall be tested as required by such standard, and test certificates shall be made available to the Purchaser.

Where stage inspection is to be witnessed by the Purchaser before starting the fabrication, all material test certificates shall be correlated and verified with the actual material used for construction by Purchaser's inspector who shall stamp the material. In case mill test certificates for the material are not available, the Bidder shall carry out physical and chemical tests at his own cost from a testing agency, approved by the Purchaser, as per the requirement of specified material standard. The samples for

physical and chemical testing shall be drawn up in presence of Purchaser's inspector who shall also witness the testing.

Wherever, the components shall be subjected to Non-Destructive Examination (NDE). The requirements of NDE shall comply with the relevant standards. All components subjected to NDE shall be identified and stamped by Purchaser's inspector on successful completion of testing.

Other Tests

Bidder to conduct all other tests as per this specification, applicable codes /standards and as per standard engineering practices.

12.0.0 Site Performance Test:

The equipment shall be guaranteed to meet performance requirements required by this specification and rectification shall be carried out until satisfactory results are obtained. The Purchaser reserves the right to reject the equipment should the performance values fall short of those indicated in the schedule of Technical data sheets.

Test at Sites:

Bidder shall carry out tests at site to prove to the Purchaser/Customer that the equipment of the plant complies with the requirements stipulated and is erected in accordance with requirements. Before the plant is put on trial run the contractor will be required to conduct tests to demonstrate to the Purchaser/Customer that each item of the plant is capable of correctly performing the functions for which it was specified to. These tests may be conducted concurrently with those required under commissioning sequence. Tests required shall generally be as follows:

All piping and valves, after installation, will be tested hydraulically at a pressure, 1½ times of the maximum attainable pressure in the system, to check against leak tightness.

All storage tanks shall be tested for leak tightness as per IS: 803.

All pressure vessels shall be hydraulically tested at 1½ times the design pressure or 2 times the working pressure, whichever is higher for a period of not less than 1 hr.

All valves/gates (Manual/automatic/remotely operated) shall be operated throughout 100% of the travel and these should function without any trouble whatsoever.

All pumps shall be run with the specified fluid from shut off conditions to valve wide open condition. Head developed will be checked from the discharge pressure gauge reading. Capacity may be checked from flow indicators where applicable. If flow indicators are not available in the system capacity can be checked from the volume of fluid handled (determined from level indicator reading of concerned tank) and duration of test.

During the test, the pumps and drive motors shall run smoothly without any undue vibration, flow pulsation, leakage through gland, temperature rise in the bearing parts, noise etc.

Visual check on all structural components, welding, rubber lining, and painting etc. and if doubt arises these will be tested again.

All testing and calibrating instruments and equipment shall be furnished on load basis to the satisfaction of the Purchaser/Customer.

Checks on electrical items as mentioned under electrical specification.

13.0.0 QUALITY & INSPECTION

13.1.0 Quality Assurance Programme

To ensure that the equipment and services under the Scope of Contract whether manufactured or performed within the Bidder's works or at his Sub-Vendor's premises or at the Owner's site or at any other place or work are in accordance with the specifications, the Bidder shall adopt suitable quality assurance program to control such activities at all points, as necessary. Such program shall be outlined by the Bidder and shall be finally accepted by the Owner / Authorized representative after discussions before the award of Contract. The QA program shall be generally in line with ISO-9002/IS-14001. A quality assurance program of the Bidder shall generally cover the following :

System for shop manufacturing and site erection control including process controls and fabrication and assembly controls.

- Inspection and test procedure both for manufacture and field activities.
- Control of calibration and testing of measuring, testing equipment.
- System for indication and appraisal of inspection status.
- System for authorizing release of manufactured product to the Owner.
- System for handling, storage and delivery.
- Furnishing quality plans for manufacturing and field activities and detailing out the specific quality control procedure adopted for controlling the quality characteristics relevant to each item of equipment / component.

13.2.0 Quality Assurance Documents

The Bidder shall be required to submit required no. of copies of the following Quality Assurance documents as required.

1. Material mill test reports on components as specified by the specification and approved Quality Plans.
2. The inspection plan with verification, inspection plan check points, verification sketches, if used and method used to verify that the inspection and testing points in the inspection plan were performed satisfactorily.
3. Sketches and drawings used for indicating the method of traceability of the radiographs to the location on the equipment.
4. Non-destructive examination results, reports including radiography interpretation reports.
5. Factory tests results for testing required as per applicable codes and standard referred in the specification and approved Quality Plans.
6. Inspection reports duly signed by QA personnel of the Owner and Bidder for the agreed customer hold points.

During the course of inspection, the following will also be recorded.

a) When some important repair work is involved to make the job acceptable:
b) The repair work for the remaining part of the accepted product quality.

All the accepted deviations shall be included with complete technical details.

The equipment shall be guaranteed to meet performance requirements required by this specification and rectification shall be carried out until satisfactory results are obtained. The

Owner reserves the right to reject the equipment should the performance values fall short of those indicated in the schedule of Technical data sheets.

In case of such option of rejection being exercised by the Owner the Bidder shall replace the faulty equipment with one which shall meet the guaranteed values.

13.3.0 Quality Plan:

Bidder to furnish Quality Plan [Supply Quality plan as well as Erection & Commissioning Quality Plan] to BHEL along with offer in their standard format for general review by BHEL.

However, after award of contract Bidder shall submit Quality plan [Both supply as well as Erection & Commissioning Quality Plan] for approval. The Quality plan shall be submitted in the BHEL quality plan format, [enclosed with job specification] . During Detailed engineering, in addition to various tests indicated in this specification, Quality plan will be reviewed with respect to standard Inspection, standard Engineering practices , applicable standards, code etc.. Accordingly, various tests required , stages of inspection and appropriate agencies for Inspection will be intimated. Bidder to abide by the same.

13.4.0 Inspection agency :

BHEL/Third Party appointed by BHEL/Customer.

The various inspection stages will be witnessed by individual agencies (or) Group of Agencies as per above, in line with approved quality plan.

14.0.0 SURFACE PREPARATION, PAINTING AND SURFACE PROTECTION:

14.1.0 Painting details are mentioned in the Job specification PEMC-06864 and the same is to be referred.

15.0.0 PACKING AND TRANSPORTATION:

All equipment shall be suitably protected, coated, covered or boxed and crated to prevent damage or deterioration during transit, handling and storage at site till the time of erection. While packing all the materials the limitations from the point of view of availability of railway wagon sizes in India should be taken into account. Bidder shall follow necessary road safety rules and shall obtain permission from highway authorities for goods movement, if the transportation in their scope. However, these aspects shall be taken into consideration in the design of the packing for the system.

16.0.0 NAME PLATES & TAG PLATES:

16.1.0 Components whose identity is important for operation and maintenance of the plant viz., all apparatus, motors, signal tapping points, instruments and control equipment, cubicles, as well as the terminal boards etc., installed shall be provided with permanently attached tag bearing the Purchaser's coding together with relevant text clearly inscribed. The tags shall be as given below.

16.2.0 A corrosion-resistant nameplate shall be attached to each unit in a clearly visible, easily accessible location. The nameplate shall be stamped with the following information:

a) Manufacturer's name
b) Manufacturer's model number
c) Manufacturer's shop order number
d) Manufacturer's serial number
e) Purchaser's equipment tag number (item No.)
f) Service name
g) Weight (kg)
h) Hydrostatic test pressure, Bar. g
i) Other design information of the flow media like flow rate, temp., pressure etc.

16.3.0 Name plates shall be 3 mm (0.12") thick engraved plate of sufficient rigidity with lettering of a minimum height of 4 mm (0.16"). The method of implementation and labeling will be informed for all components after award of contract.

16.4.0 Identification tags shall be provided and placed on all Bidder furnished valves, instruments and others. Tags shall be corrosion resistance, having a larger than diameter of 3 cm, and shall have black identification figures stamped thereon. Figure height shall be larger than 0.5 cm. Tags shall bear the component system designation symbol shown on the Bidder's drawings

17.0.0 SUB VENDORS:

Bidder to abide by the Customer approved sub vendors list enclosed with job specification. However, for items which are not listed Bidder may follow his standard vendors.

18.0.0 GENERAL:

Even though, the requirements are specified in detail to the extent possible, bidder to Apply good engineering practices in the design, selection of equipment, fabrication, Painting, inspection & testing, dispatch of the system, wherever same is not clearly spelt Out.

Compliance with this specification shall not relieve bidder of the responsibility of Furnishing material and workmanship to meet the specified conditions. Accordingly, Bidder to furnish their comments if any on this speciation in their offer.

19.0.0 PROPOSAL EXHIBIT SHEETS

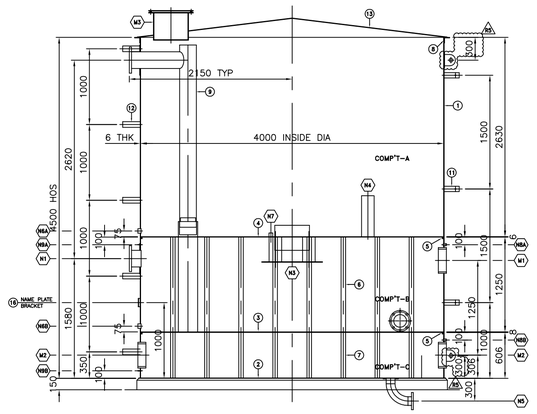
Instructions to Bidder for submitting technical proposal:

The bidder may provide technical proposal as per his convenience. However, following things are to be ensured:

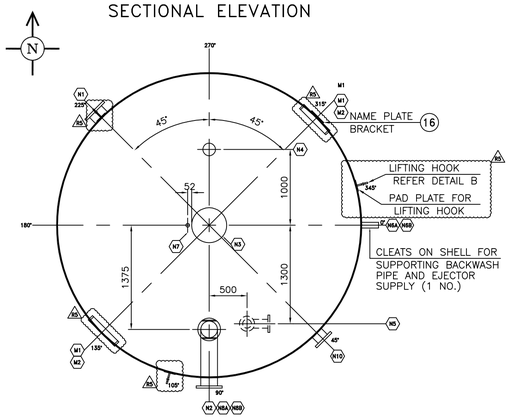
A list of deviations or exceptions, if any, to Technical specification PY51199, Job Specification and its enclosures including reference documents as attached shall be provided as per Annexure-IV

It is hereby informed that only those deviations which are listed by the bidder in Annexure-IV and subsequently accepted by BHEL will be considered for evaluation of the bid and for finalisation of the order. No other deviations or exceptions even if mentioned elsewhere will be considered for any technical/ commercial evaluation or for ordering.

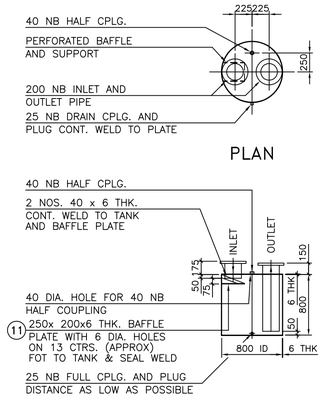
Bidder will need to sign Annexure- IV specifically endorsing the above understanding.



SECTIONAL ELEVATION



PLAN WITHOUT CONICAL COVER



PLAN

SECTIONAL ELEVATION

LOOP SEAL TANK
(SIZE : 800 DIA. x 800 DEEP)

PLAN

SECTIONAL ELEVATION

DETAIL-A

FEED TANK
(SIZE : 1100 DIA. x 600 DEEP)

Bharat Heavy Electricals Limited
Ramachandrapuram, Hyderabad

PROJECT ENGINEERING DEPARTMENT

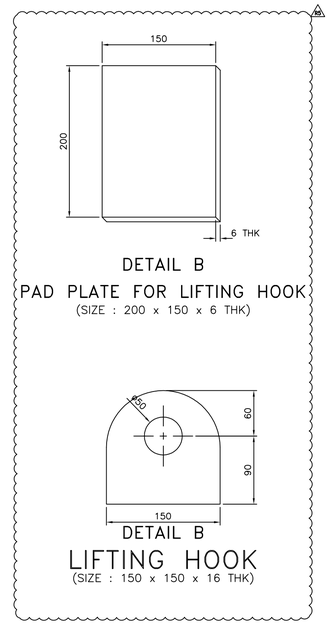
DESCRIPTION OF CODE :

01. APPROVED.SUBMIT AS BUILT DRAWINGS / DOCUMENTS.
02. APPROVED WITH MINOR COMMENTS.ACTIVITY MAY PROCEED.PLEASE RESUBMIT FOR FINAL APPROVAL.
03. REVISE AS PER BHEL COMMENTS AND RESUBMIT FOR APPROVAL.
04. RETAINED FOR INFORMATION.

This approval does not absolve the vendor from the responsibility to comply with BHEL's specification and all applicable codes and standards. Vendor has to ensure safe and smooth operation and meet the intended performance of the equipment.

Comments as marked on drawing	Comments as in enclosed document.	
✓		

Dt:29.03.11



LIST OF NOZZLE CONNECTIONS

MK.NO.	QTY.	SIZE NB	RATING	TYPE OF CONN.	DESCRIPTION
N1	1	200	150#	SOFF	INLET (DETAIL 'J1')
N2	1	200	150#	SOFF	OUTLET (DETAIL 'D1')
N3	1	450/400	–	PIPE BOTTOM OPEN END	BACKWASH (DETAIL 'H1')
N4	1	150	150#	PIPE PLAIN END	SIPHON SEAL WELL (DETAIL 'F1')
N5	2	100	150#	SOFF	DRAIN (DETAIL 'B1')
N6A	1	50	–	SOCKET	CLEANOUT (DETAIL 'B1')
N6B	1	50	–	SOCKET	CLEANOUT (DETAIL 'B1')
N7	1	40	3000# FS	SCREWED FULL CPLG.	VENT (DETAIL 'H1')
N8A	1	20	3000# FS	SCREWED FULL CPLG.	DPI CONNECTOR (DETAIL 'A1')
N8B	1	20	3000# FS	SCREWED FULL CPLG.	DPI CONNECTOR (DETAIL 'A1')
N9A	1	6	3000# FS	SCREWED FULL CPLG.	TEST CONN. (DETAIL 'A1')
N9B	1	6	3000# FS	SCREWED FULL CPLG.	TEST CONN. (DETAIL 'A1')
N10	1	150	150#	SOFF	HAND HOLE
M1	2	300x400	–	REFER DRG. NO. A3–AVGF–4000–10–01	RING TYPE PRESSED STEEL MANHOLE MAJOR DIA. TO BE HORIZONTAL COVER YOKES, BOLTS & NATURAL RUBBER GASKET
M2	2	300x400	–		
M3	1	380x450	–		MANHOLE (REFER DETAIL M3)

LIST OF ITEM NOS.

ITEM NO.	QTY.	DESCRIPTION	SIZE
1	1	SHELL	4494 WIDE x 12566 LG. x 6 THK.
2	1	BASE PLATE	4050 OD. x 6 THK.
3	1	STRAINER PLATE	3994 OD. x 8 THK.
4	1	HEAD PLATE	3994 OD. x 8 THK.
5	1	SUPPORT SQUARE BAR	25 SQ. x 12566 LONG
6	12	SUPPORTS	50 NB SCH. 40 x 1250 LONG
7	12	SUPPORTS	50 NB SCH. 40 x 600 LONG
8	1	CURB ANGLE	75 x 75 x 6 THK. x 12606 LONG
9	1	OUTLET ASSEMBLY	REFER DETAIL 'D1'
10	1	SQ. BAFFLE PLATE FOR LOOP SEAL TANK	250 x 200 x 6 THK.
11	1	SUPPORT CLEAT FOR BACKWASH PIPE	REF. DRG. NO. A2–AVGF–4000–07–01
12	1	SUPPORT CLEAT FOR LADDER	REF. DRG. NO. A1–AVGF–4000–11–01
13	1	CONICAL ROOF	REF. CONICAL ROOF DETAIL SAME DRG.
14	1	FEED TANK SUPPORT BRACKER ASSEMBLY	REFER DETAIL 'C' SAME DRG.
15	1	ADJUSTABLE COLLAR	REF. DRG. NO. A1–AVGF–4000–05–02
16	1	NAME PLATE BRACKET	REF. DRG. NO. A1–AVGF–4000–05–02

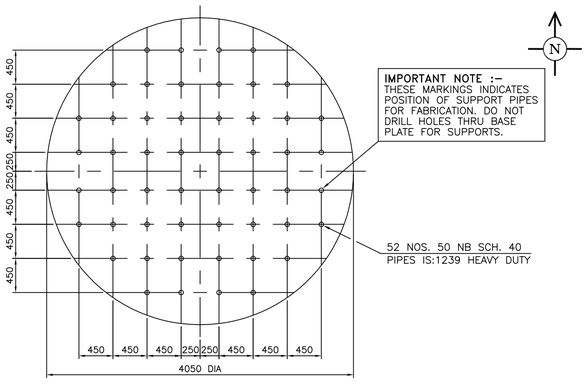
DESIGN DATA

DESIGN CODE	GOOD ENGINEERING PRACTICE	
DESIGN PRESSURE	ATMOSPHERIC	
DESIGN TEMPERATURE	50° C	
TEST PRESSURE	FULL OF WATER	
FLANGES INTERNAL/EXTERNAL	ANSI B 16.5 150# SOFF OFF CRS.	
CORROSION ALLOWANCE	3 mm	
RADIOGRAPHY	SHELL : NIL	BOTTOM PLATE : NIL
JOINT EFFICIENCY	SHELL : 0.70	BOTTOM PLATE : 0.70
STRESS RELIEF	SHELL : NIL	BOTTOM PLATE : NIL
WEIGHT (APPROX.)	EMPTY : 6600 kg.	OPERATING : 66000 kg.
INSPECTION BY	HIIL	

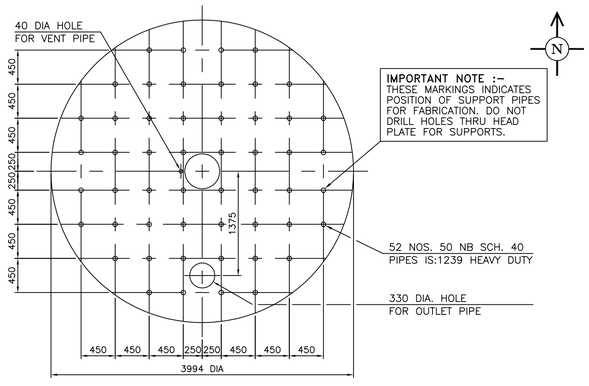
MATERIAL CONSTRUCTION

SHELL/NOZZLE PAD/COMPENSATING PAD	IS 2062 Gr. A
STRAINER PLATE	IS 2062 Gr. A
FLANGE INTERNAL/EXTERNAL	IS 2062 Gr. A
NOZZLE NECK UPTO 150 NB	IS 1239 HEAVY DUTY
NOZZLE NECK ABOVE 150 NB	UPTO 450 NB IS 3589 Gr. 330 WALL TH. 6.35
MANHOLE NECK	UPTO 450 NB IS 3589 Gr. 330 WALL TH. 6.35
MANHOLE FLANGES	IS 2062 Gr. A
BOLT & NUT INTERNAL/EXTERNAL	IS 1367
GASKET	3 mm THK. NATURAL RUBBER

SERVICE	: AUTOMATIC VALVELESS GRAVITY FILTER
MARK NO./EQPT. NO.	: AVGF
NOS. OFF	: THREE



2 BASE PLATE
6 mm THK. STEEL PLATE



4 HEAD PLATE
6 mm THK. STEEL PLATE

FABRICATION NOTES :

ALL NOTES ARE GIVEN BELOW AND MAIN DRAWING MUST BE READ IN CONJUCTION WITH SPECIFICATION DATA.

1. THE ITEM TO BE OF WELDED CONSTRUCTION, USE 6mm FILLET WELDEDS, UNLESS OTHERWISE SPECIFIED. ALL SHARP CORNERS TO BE REMOVED.
2. VERTICAL WELDS TO BE SPECIFIED AT 120° APART AND SHOULD NOT COINCIDE WITH ADJACENT WRAPERS. THE WELD SEAMS SHOULD NOT INTERFERE WITH ANY SHELL FITTINGS.
3. 'T' WELDS SHALL NOT BE USED ON DISH END, END PLATES, BOTTOM PLATE AND TOP CONES.
4. DIMENSIONAL TOLERANCES ON ELEVATION/LENGTH = ±3 mm
   FOR OVERALL LENGTH OF THE ITEM = ±5 mm. ORIENTATION = ±0.5
5. SHELL, BOTTOM AND ROOF PLATE LAYOUT SHALL BE APPROVED BY HIIL QC. ENGINEER.
6. ALL FLANGES AND PADS SHALL BE AS PER B.S. 10 TABLE 'D' OFF CRS.
   ALL BOLT HOLES TO BE OFF CRS. CENTER TO PRINCIPLE CENTERLINE OF TANK.
7. WELDS WHICH ARE ACCESSIBLE FROM SECOND SIDE SHALL BE CHIPPED TO SOUND METAL BEFORE WELDING.
8. FABRICATOR TO SUPPLY :–
   a. ALL FACILITIES AND MATERIALS FOR STAGEWISE INSPECTION AND TESTING BY HIIL AT SITE.
   b. ALL BOLTS, NUTS, WASHERS AND FULL FACE GASKETS FOR MANHOLES, NOZZLES WITH COVER AND BLANK FLANGES FOR ALL SPARE NOZZLES.
9. PAINTING EXTERNAL : EPOXY PRIMER ONLY FOR TANKS
   a. PREPARATION :– BLAST CLEAN TO BS 4232 2ND QUALITY(SA 21/2).
   b. PRIMING :– 2 COATS OF ZINC CHROME PRIMER,DFT 40 MICRONS PER COAT.
   C. INTERMEDIATE COAT :– 1 COAT OF MICACEOUS IRON OXIDE PAINT,DFT 60 MICRONS PER COAT.
   d. FINISH :– 1 COAT OF POLYURETHANE PAINT,DFT 50 MICRONS PER COAT.
10. ALL WELDS TO BE OF 6mm SIZE UNLESS OTHERWISE INDICATED AND SHALL BE ACCORDING TO IS 816–1969.
11. TOTAL 4 NOS. OF LIFTING HOOK REQUIRED 3 ON TOP & 1 AT BOTTOM. BOTTOM HOOK IS ORIENTED AT 345° TOP HOOKS ORIENTED AT 105°,225°,345°.

FOR APPROVAL	KK	AAG	YSM	4	28–03–11
FOR APPROVAL	KK	AAG	YSM	4	19–02–11
FOR APPROVAL	KK	AAG	YSM	3	04–02–11
FOR APPROVAL	KK	AAG	YSM	2	21–01–11
FOR APPROVAL	KK	AAG	YSM	1	11–01–11
FOR APPROVAL	KK	AAG	YSM	0	30–12–10
NATURE OF REVISION & DISCRIPTION	APPROVED	CHECKED	DRAWN	REV.	DATE

ASSAM POWER GENERATION CORPORATION LTD.
GUWAHATI, ASSAM

CONSULTANT:
DEVELOPMENT CONSULTANTS (P) LTD.
CONSULTING ENGINEERS

PROJECT:
1X100MW NAMRUP COMBINED CYCLE REPLACEMENT POWER PROJECT (PHASE-1) AT NAMRUP, ASSAM

BHARAT HEAVY ELECTRICALS LTD.
HYDERABAD

EPC SUB-CONTRACTOR
NTPC BHEL Power Projects Private Limited
(A Joint Venture company of NTPC & BHEL)

Gactel Turnkey Projects Ltd.
(FORMERY GAMMON COOLING TOWER LIMITED)

DWG TITLE: G.A. OF SIDE STREAM FILTER

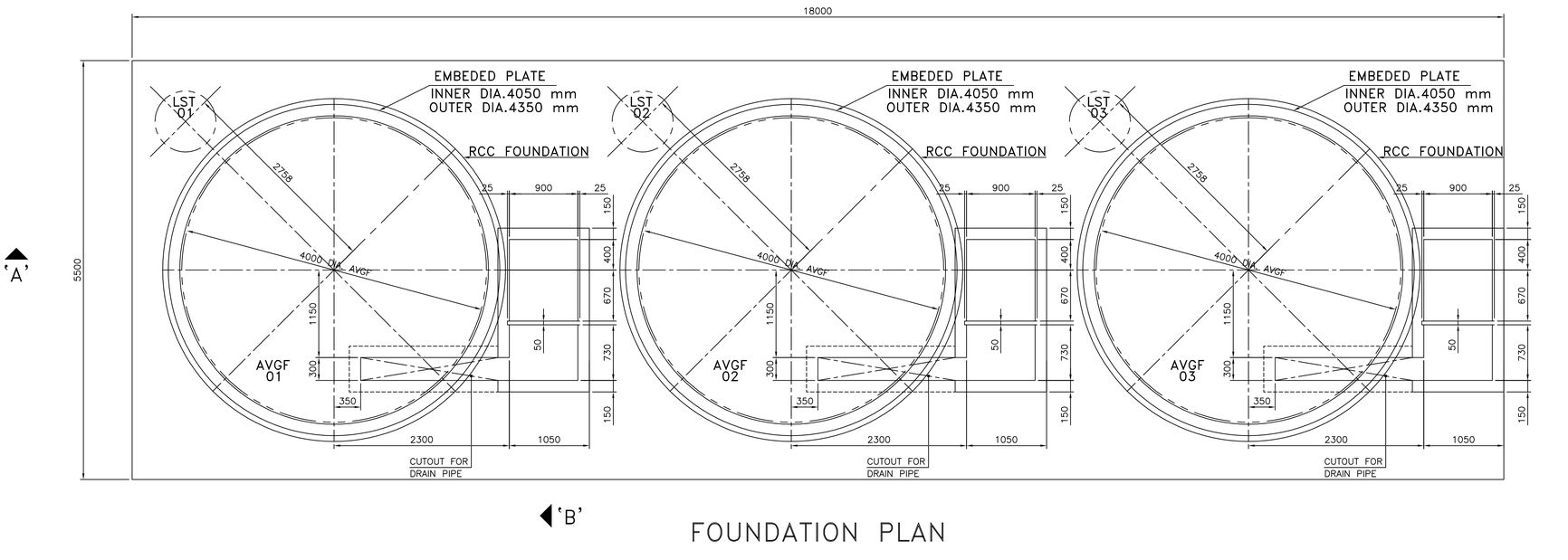
CV	ME	EL	I&C				SCALE:	BHEL DWG. NO: _
						SIGN		GTPL DWG. NO: 21036-5M-DWG002
						DATE		SHT. NO. 1 OF 2 (A1) REV. 05

A1 (12.00) [841 x 594]

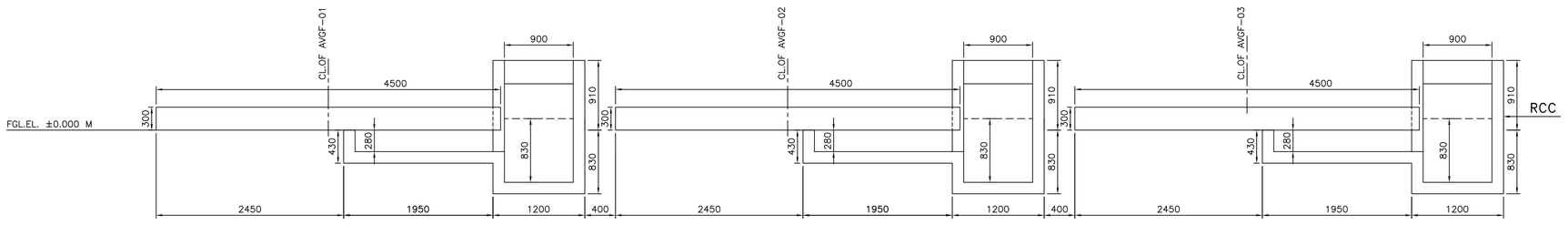
THIRD ANGLE PROJECTION

DWG. NO.	REV.

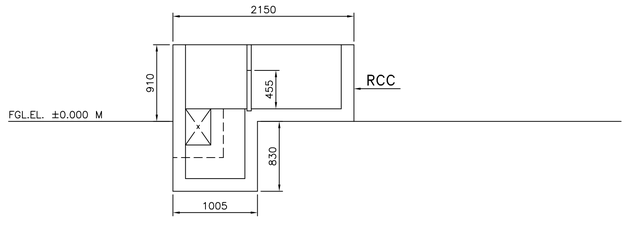
LOAD DATA		
MARK NO.	EMPTY LOAD	OPERATING LOAD
AVGF–01/02/03	6600 kg(EACH)	66000 kg(EACH)
LST–01/02/03	175 kg(EACH)	600 kg(EACH)



FOUNDATION PLAN



SECTION A–A



SECTION B–B

NOTES :
1. ALL DIMENSIONS & ELEVATIONS ARE IN mm.
2. FOR TRUE ORIENTATION REFER PLAN VIEW.

Bharat Heavy Electricals Limited
Ramachandrapuram, Hyderabad

PROJECT ENGINEERING DEPARTMENT

DESCRIPTION OF CODE :

01. APPROVED.SUBMIT AS BUILT DRAWINGS / DOCUMENTS.
02. APPROVED WITH MINOR COMMENTS.ACTIVITY MAY PROCEED.PLEASE RESUBMIT FOR FINAL APPROVAL.
03. REVISE AS PER BHEL COMMENTS AND RESUBMIT FOR APPROVAL.
04. RETAINED FOR INFORMATION.

This approval does not absolve the vendor from the responsibility to comply with BHEL's specification and all applicable codes and standards. Vendor has to ensure safe and smooth operation and meet the intended performance of the equipment.

Comments as marked on drawing	Comments as in enclosed document.	Signature

Dt:29.03.11

NATURE OF REVISION & DISCRIPTION	APPROVED	CHECKED	DRAWN	REV.	DATE
FOR INFORMATION	YSM	AAG	KK	5	28-03-11
FOR INFORMATION	YSM	AAG	KK	4	19-02-11
FOR INFORMATION	YSM	AAG	KK	3	04-02-11
FOR INFORMATION	YSM	AAG	KK	2	21-01-11
FOR INFORMATION	YSM	AAG	KK	1	11-01-11
FOR INFORMATION	YSM	AAG	KK	0	30-12-10

ASSAM POWER GENERATION CORPORATION LTD.
GUWAHATI, ASSAM

CONSULTANT:
DEVELOPMENT CONSULTANTS (P) LTD.
CONSULTING ENGINEERS

PROJECT:
1X100MW NAMRUP COMBINED CYCLE REPLACEMENT POWER PROJECT (PHASE-1) AT NAMRUP, ASSAM

BHARAT HEAVY ELECTRICALS LTD
HYDERABAD

EPC SUB-CONTRACTOR
NTPC BHEL Power Projects Private Limited
(A Joint Venture company of NTPC & BHEL)

Gactel Turnkey Projects Ltd.
(FORMERY GAMMON COOLING TOWER LIMITED)

DWG TITLE: GA DRAWING FOR SIDE STREAM FILTER

CV	ME	EL	I&C				SCALE:	BHEL DWG. NO: _
							SIGN	GTPL DWG. NO: 21036-5M-DWG002
							DATE	SHEET NO. 2 OF 2 (A1) REV. 05

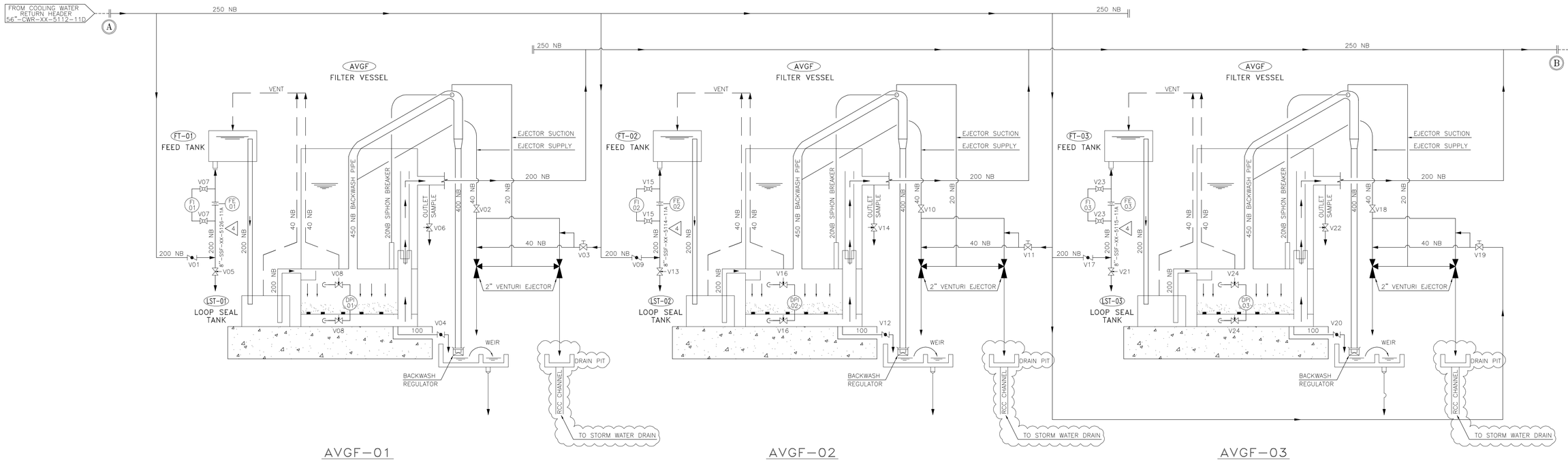
A1 (12.00) [841 x 594]

File name: \\fileserver\TMS\Projects\NAMRUP\FINAL\ FOUNDATION GA DRAWING FOR SIDE STREAM FILTER–(R5).dwg

A1

NOTES :

1. ALL PIPES ARE MS, UNLESS OTHERWISE SPECIFIED.



AVGF–01
AUTOMATIC VALVELESS GRAVITY FILTER

AVGF–02
AUTOMATIC VALVELESS GRAVITY FILTER

AVGF–03
AUTOMATIC VALVELESS GRAVITY FILTER

EQUIPMENT LIST				
MARK NO.	DESCRIPTION	SIZE	MATERIAL	QTY.
AVGF-1/2/3	FILTER VESSEL	4000 DIA. x 4500 HOS.	MS-IS 2062	3 NO.
FT-1/2/3	FEED TANK	1100 DIA. x 600 HIGH	MS-IS-2062	3 NO.
LST-1/2/3	LOOP SEAL TANK	800 DIA. x 800 HIGH	MS-IS-2062	3 NO.

VALVE SCHEDULE/VESSEL					
MARK NO.	DESCRIPTION	SIZE	TYPE	MATERIAL	QTY.
V01/09/17	WATER INLET	200 NB	BUTTERFLY	CI	3 NOS.
V02/10/18	EJECTOR SUPPLY	40 NB	DIAPHRAGM	CI	3 NOS.
V03/11/19	PRIMING INLET	40 NB	DIAPHRAGM	CI	3 NOS.
V04/12/20	AVGF DRAIN	100 NB	BUTTERFLY	CI	3 NOS.
V05/13/21	INLET SAMPLE	15 NB	NEEDLE	SS 316	3 NOS.
V06/14/22	OUTLET SAMPLE	15 NB	NEEDLE	SS 316	3 NOS.
V07/15/23	FI ISOLATION	15 NB	BALL	SS 316	6 NOS.
V08/16/24	DPI ISOLATION	15 NB	NEEDLE	SS 316	6 NOS.

INSTRUMENT LIST/VESSEL			
MARK NO.	DESCRIPTION	QTY.	REMARKS
FI	FLOW INDICATOR(ROTAMETER)	3 NO.	
FE	FLOW ELEMENT	3 NO.	
DPI	DIFFERENTIAL PRESSURE INDICATOR	3 NO.	

LEGEND	DESIGN PARAMETERS
DIAPHRAGM VALVE	DESIGN CAPACITY : 120 m3/hr
BUTTERFLY VALVE	INLET TOTAL SUSPENDED SOLIDS : 50 ppm
BALL VALVE	OUTLET TOTAL SUSPENDED SOLIDS : < 5 ppm
NEEDLE VALVE	

TERMINATION POINTS				
MARK NO.	DESCRIPTION	SIZE	FLOW	PRESSURE
A	WATER INLET	(250) NB	120 m3/h	1.0 kg/cm2
B	FILTERED WATER OUTLET	(250) NB	120 m3/h	BY GRAVITY

INSTRUMENT TAG NO. (4)		
MARK NO.	DESCRIPTION	TAG NO.
FE 01	FLOW ELEMENT	8"-SSF-XX-5126-11A
FE 02	FLOW ELEMENT	8"-SSF-XX-5114-11A
FE 03	FLOW ELEMENT	8"-SSF-XX-5115-11A

NATURE OF REVISION & DISCRIPTION	APPROVED	CHECKED	DRAWN	REV.	DATE
FOR INFORMATION	KK	AAG	PRITAM	4	13.03.12
FOR INFORMATION	KK	AAG	PRITAM	3	04.02.11
FOR INFORMATION	KK	AAG	PRITAM	2	21.01.11
FOR INFORMATION	KK	AAG	PRITAM	1	11.01.11
FOR INFORMATION	KK	AAG	PRITAM	0	30.12.10

ASSAM POWER GENERATION CORPORATION LTD.
GUWAHATI, ASSAM

CONSULTANT:
DEVELOPMENT CONSULTANTS (P) LTD.
CONSULTING ENGINEERS

PROJECT:
1X100MW NAMRUP COMBINED CYCLE REPLACEMENT POWER PROJECT (PHASE-1) AT NAMRUP, ASSAM

BHARAT HEAVY ELECTRICALS LTD.
HYDERABAD

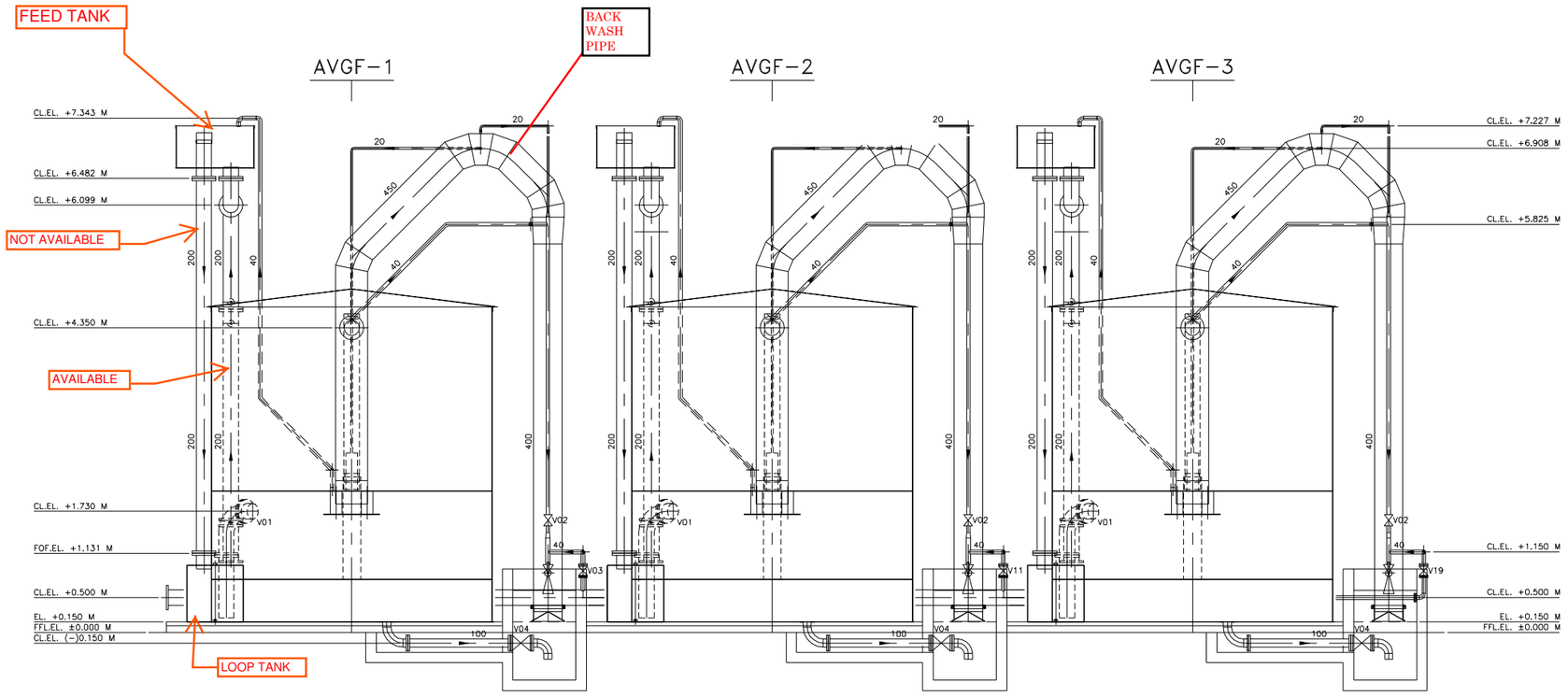
EPC SUB-CONTRACTOR
NTPC BHEL Power Projects Private Limited
(A Joint Venture company of NTPC & BHEL)

Gactel Turnkey Projects Ltd.
(FORMERY GAMMON COOLING TOWER LIMITED)

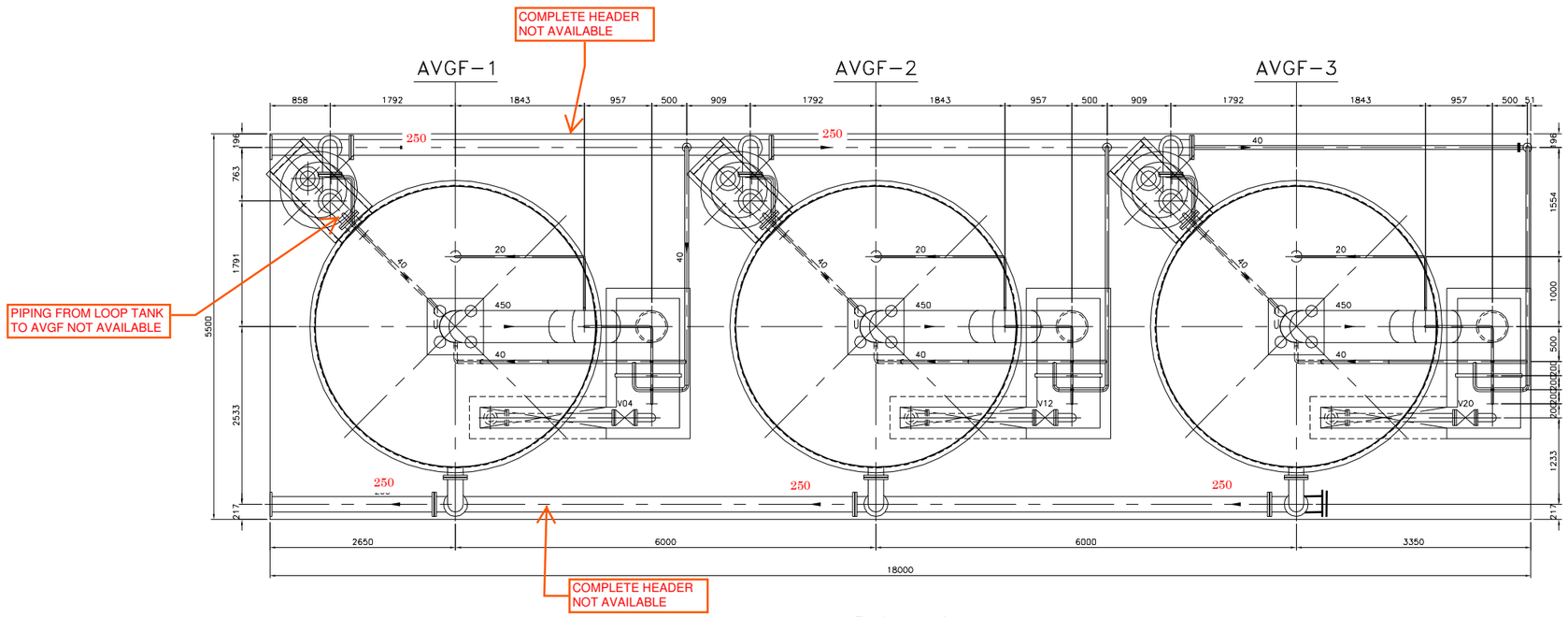
DWG TITLE: P & I DIAGRAM FOR SIDE STREAM FILTER

CV	ME	EL	I&C				SCALE:	BHEL DWG. NO: _
							SIGN	GTPL DWG. NO: 21036-5M-DWG011
							DATE	SHT. No 1 OF 1 (A1) REV. 4

A1 (12.09) [841 x 594]



ELEVATION



PLAN

NOTES :
1. ALL DIMENSIONS ARE IN MM, UNLESS OTHERWISE SPECIFIED.

REFERENCE DRAWINGS :
1. A3-AVGF-4000-01-01 P & I DIAGRAM
2. A1-AVGF-4000-05-01 FABRICATION DETAILS OF AVGF

FOR APPROVAL	DPT	AAK	GANESH	0	30-12-10
NATURE OF REVISION & DISCRIPTION	APPROVED	CHECKED	DRAWN	REV.	DATE

ASSAM POWER GENERATION CORPORATION LTD.
GUWAHATI, ASSAM

CONSULTANT:
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1X100MW NAMRUP COMBINED CYCLE REPLACEMENT POWER PROJECT (PHASE-1) AT NAMRUP, ASSAM

BHARAT HEAVY ELECTRICALS LTD.
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NTPC BHEL Power Projects Private Limited
(A Joint Venture company of NTPC & BHEL)

Gactel Turnkey Projects Ltd.
(FORMERY GAMMON COOLING TOWER LIMITED)

DWG TITLE: PIPING G.A. OF SIDE STREAM FILTER

CV	ME	EL	I&C				SCALE 1:40	BHEL DWG. NO: _	
						SIGN		GTPL DWG. NO:	21036-5M-DWG002/001
						DATE		SHT. No 1 OF 1 (A1)	REV. 0

SPECIFICATION NO. M-20

FOR

PIPING

SPECIFICATION NO. M-20
FOR
PIPING

C O N T E N T S

SPECIFICATION NO. M-20
FOR
PIPING

1.00.00 INTENT OF SPECIFICATION

This Standard Specification is intended to cover the standard technical requirements for design, materials, fabrication, erection and testing of plant piping systems.

2.00.00 GENERAL REQUIREMENTS

2.01.00 General

The piping systems shall include all pipework and accessories, complete in every respect, and suitable for satisfactory continuous operation.

The piping systems shall be in accordance with latest ASME, ASTM or BS standards. The use of other equivalent internationally recognized standards and codes are subject to the Engineer's approval. Copies of alternative standards in English shall be made available to the Engineer.

The Contractor shall design all piping systems in accordance with applicable system performance and operating data and shall be responsible for all dimensions, wall thickness, pressure losses, stress calculations and reliability of the systems.

The piping systems shall be designed to meet the requirements of trouble-free and safe operation under maximum load, part load and transient conditions.

Piping shall be designed for flooded weights, seismic conditions and in outdoor locations wind design criteria as given in the Project Specifications shall be considered.

Pipe sleeves shall be provided for pipe and tubing which penetrates platforms, floors, roofs and partitions. Proper flashing shall be provided to ensure tightness and waterproofing, where required.

Surface protection and painting of piping and auxiliaries shall be executed according to the requirements of the Technical Specification for "Surface Protection and Painting".

2.02.00 Layout

The piping scheme layout and arrangement shall be clearly shown on flow diagrams, piping routing and erection drawings. Pipe dimensions, materials, operating conditions, insulation thickness and piping and equipment identification numbers shall be shown on the relevant drawings.

The Contractor shall design all piping systems with the piping arranged in orderly pipe runs giving due consideration to pipe expansion, valve locations, practical pipe supporting and access to all piping accessories for maintenance purposes.

Piping arrangements shall provide for the removal and/or maintenance of equipment internals without removing the piping. A min. 2.0 m headroom shall be maintained to the lowest point of all piping components or insulation in walking areas. All underground piping shall have a min. earth cover of 1.0m.

A minimum passageway of 1.2 m shall be provided for access between and around all equipment and a 50 mm minimum clearance shall be provided between piping, including insulation if applied, and any point of adjacent equipment or piping including flanges and/or pipe supports.

Access way to equipments shall have clear width of 1.2 M. Additional clearance shall be provided, where required, for pipe movement due to thermal expansion.

All valves, strainers, orifices, valve motor drives and other piping accessories shall be provided with adequate space for access and removal of parts for maintenance. Bracket supports and other protruding attachments which constitute a hazard to operating personnel shall be elevated to a minimum of 2.0 m from the operator's access elevation.

All horizontal runs of outdoor piping shall be supported by pipe racks and a minimum ground clearance of 6.0 m shall be designed for road crossing. Pipe accessory handles, stems, linkages, instruments, brackets etc., shall not project into passageways.

All piping in Power Block Area shall be routed on Pipe rack. Piping outside power block area shall be routed on pipe sleepers / pipe racks and Pipe bridge shall be provided at all road crossings.

All instruments shall be positioned to allow easy observation and maintenance.

A 230 mm minimum clear space shall be provided from the bottom surface of pipe to trench bottom or finished grade.

Wherever possible pipe risers should run near columns rather than in open areas; risers shall be grouped together and pipe openings shall be provided in the floors with kick plates and handrails where necessary.

2.03.00 Flow Calculations

Hydraulic flow calculations shall be submitted by the Contractor for all major pipework systems (fire water etc.) and other systems for approval of the Engineer.

2.04.00 Drain and Vents

All pipelines shall be provided with vent and drain connections at all high and low points, respectively, and as required for suitable operation.

Where practicable, all steam lines shall be sloped in the direction of steam flow and shall be adequately trapped at low points and vented at high points in the pipe runs.

Drain chambers shall be provided on steam lines at the drainage points to assist drain collection and to avoid blockage of drain pipes. Each trap and strainer arrangement shall have suitable block valves, bypass valve, strainer, and blow-off valve.

The minimum valve sizes for vents and drains shall be 20 mm. In general, the piping for drain and vents from vessels shall be manufactured from the same material as the vessel.

All piping shall be arranged to permit complete drainage when a particular unit or system is shutdown.

All vent lines shall be terminated 3.0 m or higher above the highest platform trench, floor drain or sewer.

Drains and vents for all piping systems associated with steam systems shall be provided with double valves.

2.05.00 Stress and Flexibility Analysis

Piping system shall be designed in such a way that no excessive stresses, forces, moments or deflections can take place. The forces and moments transmitted by the pipelines to the connected equipment shall not exceed the maximum permissible values allowed by the supplier of these components.

Design calculations and stress analysis for required piping systems shall be performed by the Contractor and the appropriate documents shall be subject to approval by the Engineer.

The calculations shall be based on maximum operating pressures, temperatures and weights. The calculations shall determine the maximum combined pipe stresses and the forces, moments, and deflections at all points of support, anchors and restraints.

The pipe stress and flexibility analysis shall be performed on the proposed layout of power piping systems in accordance with ASME or BS, as applicable.

In all calculations the manufacturing tolerance shall be taken into account. In addition, the water weight for hydrostatic testing and the insulation weight shall be taken into account.

From the calculated results, the positions of supports or hangers and springs used in the piping systems shall be established. Loads and deflections at the proposed hanger position shall be given, together with the type of hanger support, or restraint, i.e. constant support, variable spring etc.

Spring locations shall be chosen to suit the building steelwork, but where this is not practical, additional steelwork shall be provided by the Contractor.

The Contractor's design shall take into account possible maximum values, e.g. the maximum head of the pumps in the system as well as exceptional operating conditions, such as over-pressures, actuation of safety valves, vibrations and water hammer.

There shall be sufficient allowance for thermal expansion and displacement without excessive stresses. The thermal expansion of the pipework shall be carefully analysed and appropriate pipe routing and location of the supporting equipment shall prevent the piping from causing excessive forces and moments to the anchoring points (pressure vessels, turbine, boiler, header etc). The shape of branch sections shall be such that the stresses caused by transient conditions will be acceptable.

2.06.00 Material Cleanliness, Packaging Handling

The Contractor shall submit a detailed procedure to the Engineer for approval prior to its use.

Exterior and interior surfaces of piping system components shall be free of particulate contaminants such as sand, metal chips, weld slag, etc. Thin uniform rust films are acceptable on internal carbon steel surfaces. The outside surface shall have a coat of mill varnish or surface primer coat in accordance with the Specification for "Surface Protection and Painting."

Internal and external surfaces of stainless steel materials shall be "metal clean" when visually examined without magnification, and shall be free of organic films and contaminants such as oils, paints and preservatives.

Packing shall provide protection against corrosion, contamination, physical damage or any effect which would lower the quality or cause the item to deteriorate during the time it is shipped, handled and stored.

All bevels, threads, flange faces and other sealing surfaces shall be suitably protected with wood, plastic or soft metal to prevent damage to these surface during shipping and handling.

All pipe shall be capped using plastic or soft metal caps or plugs. All caps or plugs shall be taped.

All packaging or crating shall be suitable for long term outdoor storage on or off the ground.

Each fabricated pipe section as well as fittings, flanges, etc., shall be properly identified by a piece mark number printed on each end and on opposite sides. Code symbols and inspection stamps shall be applied to each fabricated pipe section where required. Markings shall indicate type of material, size and pressure class and thickness and shall conform to the relevant drawings. If cleaning is performed on the material and the markings are removed, the material shall be re-marked. The Contractor shall submit his proposed procedure to the Engineer for approval.

2.07.00 System Cleaning and Flushing

Immediately prior to installation, all piping sub-assemblies, pipes, valves, fittings, etc., shall be examined internally for any evidence of contamination from any foreign material. A very close inspection shall be made on those items whose end protectors or seals have been damaged during shipment or removed in advance during fabrication process.

The surfaces shall be free of organic films and contaminants such as oils, paints, and preservatives as determined by a visual examination or a piece of rag dampened with an organic solvent or any suitable alternative method.

When visual inspection is not possible, a dry rag wipe followed by a solvent dampened rag, may be used to evaluate the cleanliness of the surface. If any of the rags exhibit indication of contamination, the material shall either be re-cleaned or the specific contaminant shall be determined and evaluated as to its potential harmful effects.

The Contractor shall submit his procedure for cleaning, pickling and flushing of pipework systems. Where hazardous chemicals are applied the procedures shall clearly state what safety precautions are to be followed.

2.08.00 Field Tests

2.08.01 General

The Contractor shall submit his proposed test procedures for the approval of the Engineer prior to any testing.

The Contractor shall provide all necessary equipment, materials, labour, water, air, etc., and all consumables to perform the required tests.

The complete live steam, feed water and all pressure piping systems shall be tested and inspected by means of hydrostatic pressure test.

Details of all testing procedures shall be indicated on pipe drawings.

All pressure tests shall be complete system tests conducted in the presence of the Engineer.

All pressure vessels, and equipment connected to the piping shall be included in the tests.

Every precaution shall be taken during testing to ensure the safety of the operator. Systems to be pressurised shall be provided with appropriate gauges and pressure relieving devices.

All joints, including welds, are to be left uninsulated, unpainted and exposed for examination during testing.

Equipment which is not to be subjected to the pressure test shall be either disconnected from the piping/isolated by blinds or other means during the test. Valves may be used provided that the valve is suitable for the test procedure.

Expansion joints shall be provided with temporary restraints, if required, for the additional pressure load under test, or shall be isolated from the test.

Pressure gauges shall not be subjected to pressure in excess of their scale range. All pieces of equipment which do not have their test pressures indicated or those test pressures which are below the piping system test pressure shall be excluded from these tests.

Where necessary, test pressure gauges shall be provided by the Contractor complete with current calibration certificates.

Pressure relief and thermal relief valves shall be excluded from these tests.

Prior to every test the piping systems shall be visually inspected to ensure that there are no visual defects and that all connections are tight.

Control valves, unless being tested, shall be set and maintained in the wide open position.

Lines that are spring or counterweight supported and all vapour or gas lines shall be temporarily supported during test in order to support the test fluid load when necessary.

Lines containing check valves shall have the pressure applied upstream of the check valve so that pressure is applied under the seat.

All in-line instruments, gauge glasses, flow meter pots, liquid level float gauges, and all other pressure parts of instruments shall be included in these tests, where feasible.

Joints found to be defective shall be repaired and retested.

Retesting of lines after repairs shall be done at the pressure originally specified for the test.

2.08.02 Hydrostatic Tests

The hydrostatic test pressure shall be 1.5 times the system design pressure or as specified in the applicable codes. The test pressure of a system shall not exceed the maximum test pressure of any vessels or components included in the test, and a minimum pressure 350 kPa (g) shall apply in any case. The test pressure shall be maintained for a minimum of 30 minutes before visual examination of joints begin.

The hydrostatic test pressure shall not be applied until the piping system and the testing medium have reached thermal equilibrium.

During the tests, hydrostatic pressure shall be monitored and corrections shall be made to compensate for thermal expansion or contraction. By this procedure the test pressure shall be kept within 35 kPa, or one percent, whichever is greater. All joints shall be visually examined for leakage during the test.

Tested systems shall be vented and drained immediately upon successful completion of the test.

No repair welding shall be done on any section of piping that contains water.

All stainless steel lines shall be emptied and dried immediately after hydrostatic tests are completed. To avoid possibility of pitting, due to chlorine contents in water, demineralised water shall be used as the testing medium.

2.08.03 **Pneumatic Tests**

Pneumatic testing of a piping system may be used upon approval of the Engineer when one or more of the following conditions is met :

i) When the piping system is so designed that it cannot be filled with water or other liquid testing medium;

ii) When the piping system is to be used in services where traces of the testing medium cannot be tolerated;

iii) When the piping system cannot be completely drained and dried out;

iv) When hydrostatic testing would contaminate, or adversely affect catalyst or chemical handled during the process;

v) When the testing fluid would affect or damage internal lining;

vi) When cost of temporary supports for supporting hydrostatic load during testing of large piping system is prohibitive.

For any proposed pneumatic testing, the Contractor shall submit his procedure to the Engineer for approval.

Any such procedures shall, as a minimum, meet the following requirements :

- Air test shall be performed with clean, dry air. The source shall be equipped with appropriate pressure relief valves and gauges. The pneumatic test pressure shall not be less than 1.2 nor more than 1.5 times the design pressure of the piping system.

- Pneumatically tested systems shall include a preliminary check at not more than 175 kPa(g). The system shall then be brought up to test pressure in 70 kPa increments. Sufficient time shall be left between steps to allow the system to equalise strains, to inspect for leaks by soap and water method and to allow test media to reach thermal equilibrium.

- During the test, pressures shall be monitored and corrections shall be made to compensate for thermal expansion or contraction. By this procedure, test pressure shall be kept within 35 kPa of its intended value.

- Tested systems shall be vented immediately upon successful completion

of the test.

- No repair welding shall be performed on a pressurised system.

2.08.04 **Test Reports**

The Contractor shall make a record of the test for each piping system tested. In addition, the Contractor shall stamp the date of the test and the test pressure on a convenient pipe section or flange OD.

The test results shall be subject to approval by the Engineer.

2.09.00 **Hangers and Supports**

The terms "hangers and supports" shall mean all types of piping support assemblies such as hangers, anchors, guides, brackets, vibration dampers and include the miscellaneous steel quantities required to support the piping.

Hangers for main pipes shall be supplied by the Contractor as finished construction elements, where as small hangers may be fabricated on Site by the Contractor.

Whenever it is practicable, all hot pipe lines shall be supported with flexible connections, such as constant support and spring hangers, to permit axial and lateral movements without restraint or binding of any piping or piping support. However, in no case shall the angular deflection of the hanger rod exceed **4°** as measured from the vertical axis.

Hangers and supporting elements shall be fabricated and assembled to permit the free movement of piping caused by thermal expansion and contraction. The design of elements for supporting or restraining piping systems, or components thereof, shall be based on all the currently acting loads transmitted into the supporting elements.

Where resonance with imposed vibration and shocks occur during operation, suitable dampers, restrains, anchors, etc., shall be added to remove these effects. Hangers and/or supports shall be spaced as far as apart as economically possible, with due consideration to assure that the sag of the pipe between supports is within limits that will permit drainage and which will also avoid excessive bending stresses from concentrated loads.

Temporary construction supports shall not be welded to the pipe except within approval of the Engineer and shall be attached in a manner that will not damage the pipe. These supports shall be completely removed upon completion of construction. Permanent supports shall be provided where regular maintenance necessitates the removal of equipment to avoid the need for any temporary support.

Equipment connections shall not be used to support piping either for temporary or permanent support.

Supports and maximum support spacing of GRP and PVC shall be in strict accordance with the manufacturer's recommendations.

All outdoor installation supports and spring hangers shall be suitably coated to withstand the local environmental conditions.

Springs shall be Neoprene-coated and all other parts shall be hot dipped galvanized. Sliding type supports for indoor service shall have lubricated surfaces. Sliding supports for outdoor services shall have a self-lubricating surface.

Riser pipes shall be individually supported. To reduce riser loads, the riser supports may be supplemented by the nearest support on a horizontal pipe. The horizontal length of pipe between the support and risers shall be not longer than the section of the riser supported by it. Bends shall have the supports no further away from the riser than the radius. End loads of horizontal pipes and bends may be supported by the top of bottom of the connecting riser. Where two rods are used in a solid rod riser hanger, each rod shall be capable of taking the either load.

When riser clamps are used, the Contractor shall not rely solely on the friction of the pipe clamp to support the pipe; instead he shall provide stops or lugs and attach same to the pipe. All lugs or attachments welded to the pipe shall be of the same material as the pipe. All temporary or permanent attachments shall be welded to alloy piping materials using the required preheat and stress-relief.

The Contractor shall ensure that the piping is properly supported with particular attention to :

- The setting of spring hangers
- The avoidance of cold springing, unless considered absolutely necessary, in agreement with the Engineer.
- The introduction of the correct pitch to allow for drainage.

The Contractor shall give instructions for the proper re-adjustment of the hangers after the system has reached its service temperature and is fully insulated.

All spring hangers shall be equipped with a device to enable locking during hydrostatic testing and flushing of the system. Temporary supports, if required, shall be supplied by the Contractor.

Design shall be such that, during the installation of the pipe hanger supports, drilling of holes in building or equipment structural steel can be avoided. Overheating of building structures by welding operations shall be avoided by suitable design of the pipe hanger supports. Attachment welds to structural steel beam flanges shall be foreseen to be made in the longitudinal direction of the beam.

2.09.01 Variable Spring Hangers

Variable spring hangers, of an approved design, shall be used where piping is subjected to vertical movements to prevent undue transfer of weight or force to the piping system.

All springs, shall be of the enclosed helical, precompressed type with the end coil ground flat and square with the spring axis. Springs shall be designed so that the variation in load from cold to hot does not exceed **15 percent**. Travel stops shall be easily removable but shall act as a "rigid" hanger during erection.

Each variable spring hanger shall have two 25 mm wide slots, 180 degrees apart. A load scale plate shall be placed at one of these slots and at each slot there shall be a red and a white marker to indicate the design hot and cold positions, respectively. Each variable spring hanger shall have a travel indicator in each slot, protruding to the outer casing edge, to facilitate hanger inspection. Hanger type, mark number and calibrated load shall be die-stamped on each hanger name plate.

Each spring hanger shall have provisions for clamping the spring to support the load under hydrostatic test condition. The hanger structural components shall be designed to withstand this load.

Sway braces, of an approved design, shall be used to prevent undue or unwanted movement or vibration, in all flexibly supported pipe lines. Sway braces shall be designed to apply an instant counteracting force when subject to vibrations, and shall impose a zero force when not subject to vibration or movement. It shall not interfere with normal thermal movement of the piping.

2.09.02 Constant Support Hangers

Constant support spring hangers, of an approved design, shall be used where piping is subjected to a vertical movement, which is sufficient to set up significant pipe stresses by undue transfer of weight or force to the piping system and to the support of piping at critical equipment terminals. Unless otherwise specified, all hangers which are subjected to a vertical movement of more than 80 mm shall be of constant support type.

Constant support hangers shall be calibrated to support the actual load of the piping system.

For constant support hangers, the total travel shall be equal to the actual travel plus 20 percent. The difference between total travel and actual travel shall not be less than 12 mm.

The factory setting of the hanger shall be indicated by an arrow die-stamped on the load scale plate. Means shall be provided for field adjustment of the supporting force through a range of plus or minus 10 percent of the load specified. A total travel range of at least 12 mm in excess of the specified thermal movement of the supported load shall be provided. A travel scale shall be provided to indicate the position of the supported load. Red and white markets shall be attached to the travel scale to indicate the design hot and cold positions.

2.09.03 Rigid Rod Hangers

Piping systems, where flexibility is not required, shall be supported by rigid hangers.

Rigid hangers shall be designed and fabricated so that they will not become disengaged by pipe movement.

All hangers shall be adjustable, after erection, while supporting load. The full length of threads in turnbuckles, clevises and adjusting nuts shall be engaged and the amount of adjustment shall be visible at all times.

Locknuts or suitable locking devices shall be provided to secure the adjustment.

Hanger rods shall be provided with suitable sockets or eyes to permit lateral piping movement without imposing a bending moment on the hanger rod.

The eyes in the rods shall be welded shut. Safe loads for hanger rods shall be calculated on the root area of the threads. In no case shall hanger rods of less than 10mm diameter be used for support of piping of 50mm and smaller or less than 15mm diameter rod for supporting piping 60mm and larger.

When the pipe is covered with insulation and is to rest on the support, protection saddles shall be used whenever possible. Protection saddles shall be tack welded to carbon steel piping to prevent slipping and/or falling. The saddle material shall be the same as the pipe material, however, alloy saddles shall not be welded to alloy piping in the field. On lines where service temperatures are 250°C and under, the pipe shall slide or rest directly on the support and the pipe shall be left bare of insulation at such locations.

3.00.00 STEEL PI PI NG SYSTEM

3.01.00 Standard and Codes

The plant piping systems shall be designed, fabricated, erected and tested in accordance with the requirements of BS, ASME, ANSI, and API Standards.

3.02.00 Fabrication and Erection

3.02.01 General

All steel piping shall be welded construction, unless otherwise specified. Socket welded joints shall not be permitted on piping greater than 50mm diameter.

Piping shall be worked into place without springing or forcing. All piping shall be adequately supported during construction so that excessive moments or loads are not placed on equipment or other piping.

The piping shall be installed to permit free expansion and contraction without damage to joints or supports.

Piping connections on equipment shall be installed such that no excessive stresses shall be transferred from the piping system to the equipment.

Piping bending, where required, shall have a min. of five (5) diameter radius.

Pipe chosen for bend fabrication shall be the heavier wall pieces and the pipe wall shall be measured and marked so that the heaviest wall will have turned to be on the outside arc of the bend.

A removable section of pipe shall be provided where necessary to facilitate the installation of removable can-type start-up strainers in pump suction lines.

3.02.02 **Welding of Pipework**

a) **General**

Welding procedure qualification tests shall be performed in accordance with Section-IX of the ASME Code.

Inert backing gas for TIG Welding single-sided joints shall be required for alloys with more than 2% of chromium.

For butt weld joints, first layer welding shall be full penetration weld using welding rods confirming to type and class as per applicable standards.

As a rule, permanent backing rings shall not be used for circumferential butt-welding of piping components.

Welding shall only be done by qualified welders qualified to 6G position.

Prior to welding, surfaces shall be cleaned and free from rust, oil, paint, sand, moisture and foreign material.

Root opening of the joints shall be preserved using bridges or pipe clamps.

Temporary welding (tack welding) on the root face shall be made by a qualified welder with filler metal equivalent to that used for the root pass. Any temporary welding with bridges shall be removed after completion of welding by gas cutting and grind finishing.

Completed welds shall be free from imperfections such as cracks, undercutting, pin-hole, slag inclusion, catering and incomplete penetration.

As a rule, branch connections shall be made by the use of a fitting (tee, cross, etc.). But when there is no fitting applicable, butt-welding and end preparation shall be in accordance with the welding procedure specification. On preparation of branch connections, all cuts shall be carefully bevelled using a profile cutter and accurately matched to form a suitable groove for welding and to permit complete penetration of the welds at all points.

Fillet and socket welds shall be of at least two layers.

Slag and weld spatter between weld passes and on completed welds shall be removed by brushing or grinding. Carbon steel brushes or high speed brushing wire wheels shall not be used on 18-8 stainless steel welds.

All stubs, rods, flux and other foreign materials shall be removed from inside and outside of pipe. Defect removal shall be preferably by grinding or chipping.

Argon gas with a purity of more than 99.99 percent shall be used for TIG arc welding. Flow rate of shielding gas shall be within the range of minus 10 percent to plus 25 percent of the flow rate used in the welding procedure specification.

The on-site pipework shall be fabricated in accordance with ANSI B 31.3 as amended by BP Standard 167.

Pipework for sour gas service shall be fabricated in accordance with BP Standard.

b) **Availability of Standards**

The Contractor shall have the applicable standards on site. In case of any discrepancy between this Specification, the Contractors Standard, the most stringent shall be applicable.

The non-destructive testing of welds will be carried out by the Contractor's Independent Welding Authority to the satisfaction of the Engineer.

c) **Welding Procedures and Welders**

Prior to commencing the work, the Contractor shall prepare in written form an exact description of the welding procedures he intends to use and submit same to the Engineer for approval.

The procedure shall be in accordance with Section IX of the ASME Boiler and Pressure Vessel Code.

Following approval, the Contractor shall qualify his welding procedure as set out in clause 3.02.02.10. The Contractor may, in lieu of developing his own welding procedure, use the procedure described in Clause 3.02.02.09. However, he shall be required to qualify this method as if it were his own.

Procedure and welder qualification test welds shall be inspected and tested in accordance with Clauses 3.02.02.10 and 3.02.02.11 ` Qualification of Welding Procedures' and 'Qualification of Welders'.

d) **Alignment**

Each structural element shall be aligned prior to being welded to the preceding structural element to form continuous sections of pipe fittings and appurtenances. Welds joining the sections of the pipeline, valve installations or similar welds classed as tie-in welds shall be tacked in position.

For pipe-to-pipe connections, tie-in welds, pipe-to-valve, fittings and other welds, externally hydraulic clamps shall be used to obtain optimum line up.

Misalignment (high-low) shall not be allowed. Seam orientation of welded straight pipe shall be selected to ensure that, at the circumferential welds, the longitudinal welds shall be staggered over the top of the pipeline at least by 30° left and 30° right side of the centerline for the preceding element. Preferably the minimum distance between the staggered joints should be 50mm or more.

e) **Welding Equipment**

Only DC welding machines with electrodes connected to positive terminal shall be used. The Contractor shall tabulate proposed amperages in his welding procedure.

f) **Electrodes**

Electrodes shall conform to the ASTM-AWS classification.

All electrodes to be used for the Work shall be of a make approved by Lloyds Register of Shipping Controllers, TUV or other internationally acknowledged organisation.

The Contractor shall carefully store all electrodes and protect them from dampness.

Detailed written procedures shall be prepared for the control of the welding consumables. A copy of these procedures shall be included in the Contractor's Quality Plan.

g) **Joint Spacing**

The joint spacing between bevelled ends of pipe shall be maintained between 1.5 and 2.5mm.

Where fitting or equipment design calls for closer proximity the Engineer's approval must be obtained prior to commencement of the work.

h) **Preparation of Pipe, Valves, Fittings, etc.**

Each bevelled edge shall be either cleaned by grinding or with a power driven steel wire brush to a bright metal appearance. The cleaning shall extend at least one centimeter from the edge on both the external and internal surface.

Burrs, or small nicks in the bevelled edges or excessive rust and scale shall be removed using a disc power grinder.

Repairing of damaged pipes, appurtenances and bevels by hammering and/or heating is not allowed.

Cleats welded to pipe to assist construction shall be removed by flame cutting, and ground smooth

Unacceptable surface defects or defects which in the opinion of the Engineer cannot be repaired satisfactorily shall be removed by field cutting using an oxy-acetylene or mechanical cutting and bevelling machine.

Flame cut edges shall be ground or filled to the dimensions, smoothness and regularity of the original factory bevel or as may be required by the Contractor's welding procedure.

Immediately prior to line-up, the Contractor shall inspect each pipe and fitting along its entire length on both internal and external surface for nicks, dents, gouges, laminations and other surface defects.

The Contractor shall satisfy himself of the suitability of each pipe with regard to visual defects and shall accept all responsibilities thereafter.

i) **Production Welding**

For 6 inch piping and below, welding shall be carried out using a technique in accordance with Section IX of the ASME Code.

All slag and excessive weld build-up shall be removed before deposition of each succeeding weld pass.

All weld passes shall be completed around the entire circumference before commencing the succeeding weld pass. The starts and stops of weld beads from weld pass to weld pass shall be staggered. All slag and scale shall be removed by power tools from each bead for visual inspection immediately after deposition.

After completion of the finish weld pass, the completed weld shall be thoroughly cleaned of all slag and weld spatter.

There shall be no other welding on the pipe, except those required to deposit the circumferential welds and to attach appurtenances as shown on applicable construction drawings. Arcing on the surface of the pipe outside of the bevelled ends shall be prohibited.

The finished welds shall have a consistent continuous bead, 0.5mm to 2.5mm above the surface of the pipe. No undercutting will be accepted.

No section of pipe in which only 'stringer' and 'hot pass' beads have been applied shall be left at end of any working day.

Should a section of the line, containing unfinished welds, be dropped, the Contractor shall immediately report the same to the Engineer.

If, in the opinion of the Engineer weather conditions demand protection of welding, an effective shield shall be placed over the weld to be made so that the quality of the weld is not impaired and the welder is not hindered by adverse weather conditions.

j) **Qualification of Welding Procedures**

All welds intended for qualification purposes shall be made under simulated field and environmental conditions and witnessed by the Engineer and the Purchaser's welding Inspector.

Procedure qualification tests shall be made and approved prior to production welding. The tests shall be carried out in accordance with Section IX of the ASME Code. These tests shall be carried out at site under realistic field and environmental conditions and witnessed by the Engineer and the Purchaser's Welding Inspector.

The details of each qualified procedure shall be recorded. This record shall show complete results of the procedure qualification tests. Forms similar to the sample forms in Sec. IX of the ASME Code shall be used.

Visual and radiographic examination and hardness checks shall be made before destructive testing and the test results must comply with Clause 3.02.02 (m).

Upon failure of test weld by visual and/or radiographic examination, destructive testing shall not be required and the test failed. If visual and radiographic examination is acceptable, destructive testing shall be carried out as per Section IX of the ASME Code.

The welding procedure shall be qualified only if all certificates and tests are approved by the Engineer.

k) **Qualification of Welders**

Welder qualification test welds shall be made on any one of the grades and sizes of pipe to be used in the Work. All materials required for qualification tests shall be provided by the Contractor.

For piping and branches, 6 inch and smaller, each welder shall be required to make a complete weld, using the uphill technique in the 6G position (ASME Section IX), 45° to the horizontal.

The Contractor's Independent Welding Authority in conjunction with the Engineer will qualify welders by visual examination and radiographical examination of the weld. The test results shall conform to Clauses 3.02.02 (j).

The test results shall be submitted to the Engineer and the Purchaser. No welder shall be permitted to perform welding until written notification of acceptance is given. A form similar to sample form in Section IX of the ASME Code shall be used.

A welder who has successfully completed weld qualification tests in accordance with Clause 3.2.2.10 shall be qualified within the limits of variables described in paragraphs QW-304 of Section IX of the ASME Code. If any of these essential variables are changed the welder shall be requalified using a new procedure.

The Contractor shall prepare weld history sheets to the approval of the Engineer.

The Contractor shall give each weld a number and mark these numbers on the Drawings and on the pipe adjacent to the weld. This identification system shall be approved by the Engineer.

Each welder shall identify that portion of each weld on which he has worked with his symbol number marked with a weatherproof crayon.

l) **Quality Control of Production Welding**

Welding may be visually inspected by the Engineer during each deposition and after completion. Non-destructive testing shall be performed on completed welds.

The Contractor shall schedule his work in such a manner as to permit the radiographic inspection of completed welds not later than the day following the completion of the weld.

m) **Acceptability for Repair**

The acceptance requirement for repair or cut out of defective welds shall be based on the standards set forth in 3.2.2.15 'Standards of Acceptability'.

n) **Repair Welding**

Welds which do not comply with the Standards of Acceptability may upon approval by the Engineer be repaired.

In all cases where repairs are authorised and approved by the Engineer repairs shall be carried out in accordance with Section IX of the ASME Code. All repairs shall be carried out the day after examination or earlier.

All repaired welds shall be re-radiographed at the Contractors own cost.

o) **Standards of Acceptability**

Any weld which, as a result of radiographic examination, exhibits imperfections greater than the limits stated in the API Standard 1104 Section 6, if not superseded elsewhere in the Specification, shall be considered defective and shall be so marked with an identifying paint marker prior to repair.

Any individual instance of excessive stringer bead deposition shall not exceed 4mm and shall not be longer than 20mm. The total length of excessive stringer bead deposits in any 300mm length of weld shall be separated by at least 150mm of sound weld metal.

Welds containing cracks regardless of size or location shall be rejected.

p) **Radiographic Testing**

Radiographic inspection shall be carried out by the Contractor in accordance with the requirements of ANSI B 31.1, B 31.3, B 31.8 and ASME V latest editions and as required by the drawings and specifications.

Random radiography shall be carried out in accordance with ASME V Article 2 of all full penetration butt welds.

The initial incidence shall be 100% which may progressively be reduced to 10% depending on the quality of welding and at the discretion of the Engineer.

Radiography shall be carried out as follows :

a) For piping 2½ inch NB or smaller, a single elliptical exposure which encompasses the entire weld circumference.

b) For 3 inch NB or larger, the double-wall-single-image technique shall be used with at least three exposures at 120°C to each other.

Whenever the Engineer has allowed a reduction of the rate of radiography below the initial 100% the following guidelines shall be applied.

The welds to be examined shall be selected to ensure that the work of each individual welder or welding operator engaged in production welding is included. They shall also be selected to maximise coverage of intersections with longitudinal joints. A minimum of 1½ inches of the longitudinal weld should be examined.

When the examination of a weld reveals a defect requiring repair, two additional welds made by the same welder or welding operator shall be examined. If the second group of welds examined are acceptable, all welds represented by these additional examinations shall be accepted.

For each of the second group of welds which reveal defects requiring repair, two additional welds shall be examined. If all of the third group of welds examined are acceptable, the items requiring repair shall be repaired or replaced to meet the requirements of the relevant design code, and all welds represented by the examined welds shall be excepted. If any of the third group of welds examined reveals defects requiring repair, all comparable welds may be replaced or shall be fully examined and repaired as necessary to meet acceptable quality requirements.

Welding preparation, deposition and NDT will be subject to inspection by the Engineer.

The radiographic film recording shall be performed in accordance with the ASTM E94-77, the requirements set forth in these Specifications and/or as required by the Engineer.

The Radiographic Procedures and Standards of Acceptability shall be in accordance with ASME V and as specified in the appropriate design requirements:

a) Gamma isotope double wall IR-192.

b) Type of film to be used shall be fine-grained, a high contrast, direct type, approved by the Engineer.

c) Intensifying screen shall be 'lead'.

d) Image quality indicators shall be of the wire type (DIN 54109) selected to give the required level of sensitivity.

The Contractors Independent Authority shall employ fully qualified and certified experienced technicians to carry out the non-destructive testing. The Engineer reserves the right to require each technician to demonstrate his ability and proficiency.

The Contractor shall supply and be responsible for all personnel, monitoring protection and safety equipment as required.

A tape measure with 1cm divisions marked with lead numbers, shall be placed around the weld to be inspected so that the distance of any defects can be read off on the field from the zero point. The zero points shall be on top of the pipe and the division of the tape, seen in the direction of the flow, shall be in the clockwise direction.

When radiographing circumferential welds (360° exposure) on pipes with an external diameter exceeding 16 inches, at least one image-quality indicator shall be included in each quadrant. On smaller diameter pipes, at least one image-quality indicator shall be included. Two image-quality indicator shall be used per film for radiographs made using an external source of radiation, one image-quality indicator shall be placed at the limit of legibility and one in the middle of each film.

The Contractor shall use the necessary techniques as indicated in the Standard ASTM E 142-77 to obtain films which meet the necessary requirement.

The density measured in the welds shall be as described in Article 2 of the ASME V 1980 Edition.

The image-quality and indicators to be used shall be in accordance with Clause 3.2.2.15 of this Specification.

The sensitivity for panoramic X-ray shall not be less than 1.5% of pipe, penetration of film side. For any other technique, the sensitivity shall not be less than 1.8%.

Each film shall be marked according to Article 2 of the ASME 1980 Edition, and subjected to the Engineer's approval.

The average H and D density through the thickest shown portion of the weld shall be in between 2 and 3 for transparent base film. The films shall be processed such as to meet the requirements described in Article 8.1 of the API Standard 1104. The radiographs shall be processed to allow storage for at least three years without discoloration.

Radiographic technique and standard films shall be subject to approval of the Engineer.

Radiographs shall be systematically indexed and stored in cartons kept in a safe by the Contractor.

Upon completion of welding for the project, the Contractor shall hand over the radiographs to the Engineer.

3.02.03 Threaded Joints

All screw threads shall be of the ISO metric form and the diameter and pitch of thread for all bolts, studs and nuts shall conform to the ISO standards.

Care shall be taken to avoid over-tightening of threaded joints and care shall be taken to avoid damaging the pipe exterior with pipe wrenches.

Threaded joints which are to be seal-welded shall be made up without the use of any joint compound or sealing tape.

Where threaded joints are to be seal-welded, those threads that remain exposed after the joint has been made up, shall be completely removed prior to welding.

Threaded joints which are not to be seal-welded shall be made leak-tight by use of suitable joint compound.

Backing off of the make-up threaded joints to facilitate fit-up to alignment will not be permitted.

3.02.04 Flanged Joints

All gaskets and bolting materials for flanged joints shall be new, undamaged and shall comply with the material specifications.

Weld neck flanges shall be attached with faces in perfect alignment with the pipe and with bolt holes straddling pipe centrelines, unless otherwise specified.

Steel flange which are to be bolted to flat faced flange are to be without a raised face.

All threads and nut bearing surfaces shall be thoroughly lubricated prior to assembly with a suitable lubricant.

Bolting for all flanged joints shall be tightened in a sequential, stepwise manner to ensure even tensioning of the bolts or studs and proper seating of the gasket without distortion.

All flange bolts to be of high tensile steel suitably surface treated.

All fabricated units shall be thoroughly cleaned after welding and bending, and so far as is consistent with the best practice for the intended duty, the inner and outer surfaces shall be smooth, clean, free from blisters, mill scale, dirt, laminations and potential injurious effects.

All exposed finished surfaces, except weld end surfaces, shall be coated with protective compound before shipment. All flanges shall be provided with wood or steel covers securely bolted to prevent damage or infiltration of dirt or water during shipment or storage.

After installation, the entire piping system along with the vessels connected to it shall be subjected to flushing and cleaning as per the following minimum requirement : The purpose of the cleaning is to remove all mill scales, rust spots, internal debris and produce suitably clean internal surfaces. Once the base material surfaces are exposed, care shall be taken to passivate the surfaces so as to prevent further scaling of surfaces while the systems are idle before being put into trial operation.

All main steam pipes shall be steam blown to remove all mill scales, rust spots, etc.

Hot alkaline wash and hot oil flushing shall be performed for all lube oil system piping. High velocity water flush shall be performed for all auxiliary systems like bearing cooling water piping, chemical feed piping, etc.

All temporary piping, pumps, chemicals, drain tanks, chemical storage tanks, etc., needed for pipe cleaning shall be furnished by the Contractor. The procedure for pipe cleaning shall be subject to prior approval by the Engineer.

SPECIFICATION NO. M-21

FOR

VALVES AND SPECIALTIES

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C O N T E N T S

SPECIFICATION NO. M-21
FOR
VALVES AND SPECIALTIES

1.00.00 INTENT OF SPECIFICATION

This specification covers the standard technical requirements for design, materials, fabrication, installation and tests of general and special purpose valve, valve drives and related accessories.

General purpose valves include gate, globe, check, butterfly, plug, ball and instrument valves.

Valve drives include pneumatic (diaphragm and cylinder) and electric (motor and solenoid) actuators.

Related accessories include steam traps and drain valves.

2.00.00 GENERAL REQUIREMENTS

2.01.00 General

The Bidder shall furnish all valves, valve drives and related accessories which are necessary or desirable for the safe, efficient and reliable operation and maintenance of the plant and its components.

The Bidder shall select valves, valve drives and accessories which are suitable for the operating conditions of the systems in which they are to be used, and shall be responsible for the pressure and temperature ratings of the selected components. The selected components shall meet the requirements of trouble free and safe operation under maximum load, part load and transient conditions.

Valves, valve drives and accessories which are of a similar make, size and type shall be interchangeable with one another. The Bidder shall standardise the types and the sizes of the valves as far as possible, in order to facilitate maintenance and limit the stock of spare parts.

All regularly operated isolation valves and control valves shall be accessible from a permanent floor or access platform.

All valve bodies shall be of the same nominal size as the adjacent piping, unless otherwise specified. The internal diameter of valve ends adjacent to the pipework shall be the same as the internal diameter of the connecting pipe.

The stems of all valves for outdoor service shall have weatherproof protection covers of approved construction.

All valves shall be installed so as to provide adequate access for maintenance and repair. Sufficient overhead access and clearance shall be provided to enable the valve internals to be withdrawn or the complete valve to be removed by means of lifting tackle, if necessary. Eye bolts shall be provided where

necessary to facilitate handling heavy valves or parts of valves. Pipework systems shall be designed so that valves can be isolated for maintenance purposes without shut down of the system whenever feasible and practical. Pipework supports shall be installed such that valves can be removed without the necessity of installing temporary supports.

An arrow indicating the direction of flow in the valve shall be clearly cast or embossed on the body of each valve.

2.02.00 Manually Operated Valves

Manually operated gate, globe, or butterfly valves shall be handwheel operated & plug valves/ball valves shall be wrench-operated unless otherwise specified.

Valve stem extensions where required, shall be sturdily constructed and guided to provide satisfactory service. Valves floor stands, where required, shall have a vertical column with the handwheel 1 m above the base of the stand.

Manual gear operators shall be provided, as required, depending on the size and pressure rating of the valve.

All gear operators shall be of the totally enclosed type, self-locking, with position indicators.

All manually operated valves shall be arranged for closing with a clockwise rotation of the handwheel. The words "open" and "shut", with adjacent arrows, shall be cast on the rims of all handwheels in order to indicate the direction of rotation.

All valves shall be equipped with a locking facility which permits locking in the open or closed position. When valves are required to be locked in position for operation they shall be provided with a padlock, chain and two keys or other approved locking device.

Each valve handwheel shall be fitted with a circular name plate of an approved material indicating in English the valve reference number and the function of the valve. Nameplates should be of polished stainless steel sheets and secured by stainless steel screws, to a suitably reinforced section of the valve.

The Contractor shall submit to the Engineer for approval details of the information to be included on valve nameplates including dimensions of nameplates and method of fixation for all types of valve to be utilised.

Valves which do not have handwheels, for example check valves, shall be provided with nameplates securely fixed to the valve body. In cases where valves are insulated and the nameplate is covered, an additional nameplate shall be secured to the aluminium lagging.

2.03.00 End Preparation

Valve ends shall be butt-weld, socket-weld, flanged or screwed type in accordance with the requirements given in the Technical Specification of Piping and Auxiliaries enclosed elsewhere with this volume.

2.04.00 Valve Position Indicators

All valves shall be fitted with indicators such that it may be readily seen whether the valves are open or shut, and the extent of opening. In the case the valves fitted with extended stems, indicators shall be provided both on the valve and at the extended stem handwheel.

Where remote indication is required, the valves shall be equipped with limit switches mounted on the valves for electrical signal of valve positions "open" and "shut".

2.05.00 Storage, Transport and Installation

During installation and in storage, open ends of valves shall be plugged, capped or otherwise securely sealed. Protectors shall be installed on valve ends and other special ends at the factory. Protection shall not be removed until the valves or accessories are installed. Valves and accessories shall be stored off the ground and protected from humidity, dust, dirt, etc. Butt-weld ends shall be protected by metal, wood or plastic end protectors. The Bidder shall submit the cleaning, painting, packing and shipping procedures to the Engineer for approval prior to their use.

3.00.00 CODES AND STANDARDS

The design, manufacture and testing of the valves shall comply with the requirement of the latest edition of all relevant codes. The latest edition of the following codes, in particular shall be followed.

API-600	:	Steel gate valves, flanged and butt welding end.
API-602	:	Compact Carbon Steel gate valves
API-598	:	Valve inspection and test
ANSI B 16.34	:	Steel valves flanged and butt welding end
BS-1868	:	Steel check valves (flanged and butt welding end) for the petroleum, petrochemical and allied industries.
BS-1873	:	Steel globe, globe stop and check valves (flanged and butt welding end) for the petroleum, petrochemical and allied industries.
BS EN-12334	:	Industrial Valves. Cast Iron Check valves.
BS EN-13789	:	Industrial Valves. Cast Iron globe valves.
BS EN-12266(Part-I)	:	Industrial Valves. Testing of valves. Pressure tests, test procedures & acceptance criteria. Mandatory requirements.

BS EN-12266(Part-II)	:	Industrial Valves. Testing of valves. Pressure tests, test procedures & acceptance criteria. Supplementary requirements.
BS EN ISO-10497	:	Testing of valves. Fire type-testing requirements.
BS EN ISO-17292	:	Metal Ball valves for petroleum, petrochemical and allied industries.
IS-778	:	Copper alloy gate, globe and check valves (for water works purpose)
IS-14846	:	Sluice valve for water works purpose (50 to 1200 mm)
IS-5312 (Part-I)	:	Specification for swing check type reflux (non-return) valves for water works purposes.

The equipment shall conform to the standards and codes specified in the General Requirements and those herein. The standards and codes shall be of the latest edition including all revisions, supplements and addenda which are in effect as of the date of specification issue, and shall be considered to be part of this specification. The use of other internationally recognised standards and codes are subject to the Engineer's approval.

4.00.00 MATERIALS OF CONSTRUCTION

All materials of construction and the pressure and temperature ratings of valves and accessories shall be suitable for the intended service conditions.

Materials of construction of valve internals and valve stems shall be in accordance with the following tabulation:

VALVE BODY	VALVE TYPE	VALVE INTERNALS AND STEMS
Alloy Steel (Cast or Forged)	Gate, Globe or Check	Stainless steel (of type to suit service conditions) Stems: 13% Cr. Seating Surface: Stellited
Carbon Steel (Cast or Forged)	Gate, Globe or Check	Stainless steel (of type to suit service conditions) Stems: 13% Cr.
Cast Iron	Gate, Globe or Check	Bronze Stem: Silicon bronze
	Butterfly	Disc: DN 50mm and smaller: 316 stainless steel or Al-bronze DN 60mm and larger: Ductile iron with 316 stainless steel edge. Shaft: Stainless steel Seat: Buna-N or EPDM rubber
Bronze	Gate, Globe or Check	Bronze Stem: Silicon bronze

VALVE BODY	VALVE TYPE	VALVE INTERNALS AND STEMS
Ni-A1 Bronze	Ball	Ball and stem : Monel (for sea water) Seats: reinforced Teflon
Ni-A1 Bronze	Butterfly	Disc: Ni-A1-Bronze (ASTM A148 alloy 958) with Monel K-500 edge welded overlay) Shaft & internal bolts : Monel 400 or K-500 Seat: Inconel 625
	Check	Monel Seat: Buna-N or EPDM rubber
Ni-Resist	Butterfly	Disc: Ni-Al Bronze (ASTM Bronze (ASTM A148 alloy 958) Shaft: Monel 400 or K-500 Internal bolts: Stainless steel Seat: 316L Stainless steel
Stainless steel Type 304	Gate, Globe or Check	304 Stainless steel seating surface: Stellited
	Ball	Ball and stem: 304 stainless steel Seats: Reinforced Teflon
	Butterfly	Disc: 304 Stainless steel per ASTM A743 Gr. CF-8 Shaft, internal bolts and seat: 304 Stainless steel
Stainless steel Type 316L	Gate, Globe or Check	316L Stainless steel Seating surface: Stellited
	Ball	Ball and stem: 316L stainless steel Seats: Reinforced Teflon
	Butterfly	Disc: 316L stainless steel per ASTM A743 Gr. CF-3M Shaft, integral bolts and seat : 316L stainless steel
Unplasticised PVC (UPVC)	Ball	Ball and stem: UPVC-I Seats: Teflon
	Check	Seats: Fluorine rubber(for water service only)
	Diaphragm	Diaphragm: Teflon or EPDM (Neoprene for water service)
Chlorinated PVC (C-PVC)	Ball	Ball and stem: C-PVC Seats: Teflon
	Check	Seats: Fluorine rubber

5.00.00 DESIGN AND CONSTRUCTION

5.01.00 Gate and Globe Valves

All gate and globe valves, except bronze body valves, shall be of the outside screw and yoke design with rising stems. Bronze body valves shall have union type bonnets and rising stems.

Bonnets joints shall be of the bolted, flanged type for design pressures up to 40 bar. Pressure seal bonnets shall be provided for design pressures above 40 bar.

Valves, of 150 mm nominal size and larger, for service pressure above 40 bar, shall be provided with bypass valves. The bypass shall be integral with the main valve, unless otherwise approved.

Valves shall be provided with back-seating construction and shall be suitable for re-packing at full pressure with the valve in the open position.

Gate valves for pressure above 40 bar shall have double wedge type discs. Globe valves shall have plug type discs. All valves shall have replaceable seat rings.

The maximum force required to open or close the valves under maximum operating conditions shall be less than 450 N applied to the handwheel.

All steam and high pressure hot water valves of 50 mm and smaller shall be of the packless type (bellows seal).

5.02.00 Check Valve

Check valves shall be designed for mounting in horizontal or vertical piping runs. Check valve shall be of a non slam type with a swing disc and, in special cases, of the tilting disc type or guided piston lift type.

Check valves shall be placed in line with a gate valve or a globe valve where guaranteed tightness is required.

A flow direction arrow shall be clearly indicated on the valve body.

5.03.00 Butterfly Valves

Butterfly Valves may be used instead of gate or globe valves for low pressure liquid or gas service.

Valves shall be designed for minimum pressure loss when open and capable to withstand the full pressure of the line when closed and cause minimum vibration when used for throttling of flow.

All manually operated valves of 150 mm and larger shall be of the gear type with totally enclosed gearing, of 150 mm and smaller shall have multiposition lever operators.

Valves shall be subject to approval by the Engineer.

5.04.00 Plug Valves

Eccentric plug valves may be used for low pressure liquid or gas service. Valves shall have bolted bonnets and plugs of the conical type. Valves shall be synthetic seated and are subject to approval by the Engineer. Manual valves up to 150 mm nominal size shall be lever- operated.

Larger size valves shall be provided with worm-geared handwheels.

All lubricant fittings and injectors required for introduction of plug lubricant shall be supplied with each valve.

5.05.00 Ball Valves

Ball valves may be used for low pressure liquid or gas service in normal sizes up to 80 mm.

Each ball valve shall be provided with an operating lever.

5.06.00 Instrument Valves

Instrument shut-off valves shall be needle valves of stainless steel construction, no bonnet, outside screw, rising stem, with vent plugs and flanged or socket weld ends.

5.07.00 Special Purpose Valves

5.07.01 Power Operated Valves

Power operated valves shall be provided with both motor and hand operating gear. Electrically operated valves are preferred for non safeguarding service. However, should the Bidder consider that an electric motor element would not satisfy the requirements, he may offer alternative methods which shall be approved by the Engineer.

Local operation shall be provided on all valves but where remote and local operation is provided for, it shall be only effective when the selector switch on the contactor gear is in the "local" position. Every selector switch shall be lockable in "local" or "remote" or "hand" positions and each shall be provided with a padlock and two keys.

The following definitions apply :-

"Hand" Denotes manual operation

"Local" Denotes pushbutton operation at the valve actuator

"Remote" Denotes pushbutton operation remote from the valve

Remote operated and automatically controlled valves shall be provided with an approved type of position transmitter and indicator. Each power operated valve shall be equipped with all necessary control gear which shall be mounted

integrally on the valve assembly. Control gear shall include contactors for "open" and "close" motions (which shall be electrically and mechanically interlocked with incorrect phase rotation or with on phase dead), heater and indicator lamp.

The Bidder shall ensure that all valve control circuits are designed to prevent incorrect operation and shall also take into consideration the route lengths of control cables. The Bidder shall verify the capacitance between cores of multicore cables and shall, wherever necessary, provide interposing relays and equipment for the remote control circuits to prevent incorrect operation.

Terminals shall be screen type and accommodated in a separately sealed chamber with segregated power and control connections.

Valve motors shall be as per relevant electrical specification.

Each power-operated valve shall be supplied from a separate fused circuit and it shall be possible to isolate the valve from all electrical supplies including all control voltages.

Electric actuators shall have torque limiting devices effective throughout full travel, the torque at which these operate being readily adjusted, and travel limit switches for controls and also for the operation of remote indicating lights.

The position of power operated valves when operated remotely shall be indicated by coloured lamps consistent with existing plant in addition to the spindle driven local position indicator.

If the Bidder proposes to use electro-hydraulic actuator systems the system must be approved by the Engineer. Where operation of the valve is by an approved electro-hydraulic actuator and it is specified or is vital to the safety of the plant, hydraulic accumulators shall be provided to allow adequate operation in the event of failure of the hydraulic pumping units.

The speed of operation of all power operated valves is to be selected to suit the operating conditions of the system and to minimise pressure surges. Actuators shall have adequate power and control systems to operate the valves accurately under all system operating conditions.

All motor operated valves shall be fitted with both hand and motor operating gear. The face of each handwheel shall be clearly and permanently marked "open" and "shut" with the appropriate direction arrows.

The motor shall be placed in such a position relative to the valve so that there is no possibility of leaking oil, water or steam from the valve joints or glands blowing on to the motor or control equipment.

The operation of opening and closing the valve shall be controlled by means of three pushbuttons, labelled respectively "open", "close" and "stop". The control shall be so arranged that the motor can be stopped with the valve in any position, by means of the "stop" push button and after having been closed can be restarted in either direction by the "open" or "close" pushbutton.

The hand operating gear specified above shall automatically disengage when the valve is power operated. Unless otherwise specified, valves shall lock in position on failure of the operating medium.

5.07.02 Control Valves

Control valves shall be provided where specified or deemed necessary. A gate valve shall be placed upstream and downstream of each control valve with a globe vent valve, and a globe type bypass valve shall be provided in all cases where manual bypass valve manipulation can provide satisfactory control or where it is required for the safe plant shutdown following failure of the control valve. Bypass valves shall not be provided in cases where manual control cannot sensibly be achieved (e.g. spray water control valve for live steam temperature control).

Special attention shall be paid to trim design of valves which handle flashing condensate to avoid erosion, excessive noise and vibration.

Plugs shall be of one-piece construction, either cast, forged or machined from solid bar stock. Plugs shall be screwed and pinned to valve stems or shall be integral with the valve stems. All valves shall be arranged such that the internals may be removed from the valve bodies from the bonnet side.

Unless otherwise specified, all control valves shall have stainless steel stems, guide bushing, inner valves, seat rings, stem lock pins and stuffing box parts and stellited, or other equivalent hardening seating surfaces.

Flow control valves shall be especially designed to meet high pressure drop applications. They shall have stainless steel stems, stellited, or other equivalent hardening, seats and discs. They shall be capable of regulating the flow through the valve from zero flow to fully open.

Control valve actuators shall be provided according to the requirements of the service and the General Instrumentation and control Specification.

5.07.03 Safety and Relief Valves

Safety valves shall be provided in accordance with the requirements of BS or ANSI Standards only.

All relief valves shall be direct spring loaded, angle body types of a design suitable for their respective operating conditions. Relief valves for steam or compressed air service shall be of the "safety" type. These valves shall be provided with adjustments for blowdown range. Relief valves for water or oil shall be of the liquid relief type having a slow opening and closing action. All relief valves shall be arranged for field adjustment of the set pressure and shall be provided with lifting levers.

5.07.04 Pressure Reducing Valves

Pressure reducing valves shall be perfectly stable, quiet and non-vibratory over the full range of operation and shall be suitable for continuous use of the operating temperature.

Where an electrical or hydraulic valve operator is provided, on failure of the operating mechanism, the valve shall not close automatically and the valve opening shall be readily adjustable by hand. A pressure relief valve shall be provided at the discharge of each reducing valve, capable of discharging the maximum flow of the reducing valve without build-up pressure.

The discharge from the relief valve shall be led to a safe location approved by the Engineer.

Pressure gauges and thermometers shall be provided upstream and downstream of each reducing valve and shall be according to the requirements of the General Control and Instrumentation Specification.

6.00.00 MISCELLANEOUS

6.01.00 Steam Traps

Trap bodies shall be adequate for maximum inlet pressure conditions. Capacities shall be sufficient for maximum and minimum inlet pressure conditions. Inverted bucket type traps, with bottom inlet connections, are preferred and shall be employed unless conditions of the installation make the use of other type necessary. Moving or wearing parts, including orifice plugs, shall be conveniently renewable.

All traps shall be protected by suitable inlet strainers, either integral or separate. Each trap shall be provided with isolating and bypass valves, as well as test and free-blow valves and, where necessary, discharge check valves. Preference shall be given to steam traps with facility to monitor conditions.

6.02.00 Drain Valve

High pressure drain valves for wet stream service shall be provided with erosion and corrosion resistant seats and discs. The valves shall permit extended drain operation without any loss of tightness.

7.00.00 INSPECTION AND TESTING

7.01.00 The Bidder shall conduct all tests required to ensure that the valves furnished will conform to the specification requirement and the relevant standards and codes.

7.02.00 All materials which go in the finished product shall be of tested quality and the bidder shall submit the relevant material test certificates for the approval of the Owner/Engineer.

7.03.00 Valves and accessories shall be subjected to hydrostatic testing and seat leak testing for the requirement of the applicable codes and valve pressure classes, in particular BS 5146. All motor actuators shall be supplied with type and routine test reports.

8.00.00 VALVE SCHEDULES

The Contractor shall produce schedules of all valves used on the project. The format of the schedules shall be agreed with the Engineer at an early stage of the contract, but shall include for each valve and valve number, functional group/functional sub-group reference, description, mechanical and material characteristics, design characteristics, manufacturer and re-ordering information, reference drawings, actuation and failure mode. All valves shall be numbered on drawings and documents such as P & IDs, valve schedules, purchase orders, data and spares sheets etc.

SPECIFICATION NO. M-19

FOR

PAINTING

SPECIFICATION NO. M-19
FOR
PAINTING

C O N T E N T S

SPECIFICATION NO. M-19
FOR
PAINTING

1.00.00 INTENT OF SPECIFICATION

1.01.00 The intent of this Specification is to cover the requirements for the supply and application of protective finishes. The work includes for the supply of all consumable materials, tools and equipment to complete the work.

1.02.00 Where paint systems are applied in the manufacturers works, the Contractor may offer the manufacturer's standard paint finish suitable for the operating and ambient conditions, subject to the approval of the Engineer. However, regardless of the manufacturer, the colour finish of all equipment shall produce a coordinated appearance. All electrical panels in the same area shall have the same shade of colour and equipment installed into the same system shall have the same finish colour, regardless of manufacturer.

2.00.00 GENERAL INFORMATION

2.01.00 All work shall be carried out in strict compliance with any safety regulations for the site and any relevant requirements of national or local law. In particular, when working in restrictive areas, the Contractor shall ensure that all plant, equipment and tools meet the appropriate regulations controlling work in such areas and are approved by the Engineer.

2.02.00 Blast cleaning and spray painting equipment, working in locations where an explosive atmosphere may be present at any time, shall be continuously bonded from the nozzle to the surface being painted and backwards from the nozzle to the compressor, which shall be earthed.

2.03.00 Compressors and any associated pressure vessels shall be protected against over pressure.

2.04.00 The Contractor shall provide and maintain in good condition all plant, equipment and tools necessary to carry out the work in an efficient manner and provide lubricating oils, greases, consumable materials and parts as necessary to maintain the plant, equipment and tools in good working order.

2.05.00 Prior to the commencement of the work the Contractor shall submit, for approval, detailed proposals as to how he intends to carry out the work within the framework of this Standard. The Contractor shall provide full details regarding the use of subcontractors, location of work and choice of materials.

2.06.00 The Contractor shall provide all paints, thinners, abrasives, scaffolding, lighting and all other materials necessary to complete the work.

2.07.00 Unless otherwise instructed, stainless steel and nonferrous alloys shall not be painted.

2.08.00 The Contractor shall, prior to painting, protect nameplates, lettering, gauges, sight glasses, light fittings and similar such items, to ensure that these are in no way defaced or damaged during the work.

3.00.00 PAINT

3.01.00 General

3.01.01 Red lead primers shall be equivalent to BS 2523 Type B but based on quicker drying media in order to ensure overnight drying.

3.01.02 Zinc phosphate primer shall be based on suitable oleoresinous media and shall contain a minimum of 30% zinc phosphate pigment by weight in the dry film. Where zinc phosphate primer is offered as an alternative to red lead primer the manufacturer shall produce evidence of comparative performance.

3.01.03 Zinc silicate primer shall be based on inorganic or ethyl silicate media and shall contain not less than 85% metallic zinc by weight in the dry film.

3.01.04 Zinc rich primers shall be based on two pack epoxy media and shall contain a minimum of 90% metallic zinc by weight in the dry film.

3.01.05 Zinc phosphate chlorinated rubber primer shall be based on suitably plasticised chlorinated rubber media and shall contain a minimum of 20% zinc phosphated by weight in the dry film.

3.01.06 Zinc phosphate two pack epoxy primer shall be based on polyamide cured two pack epoxy media and shall contain a minimum of 20% zinc phosphate by weight in the dry film.

3.01.07 Mordant solution (T-Wash) shall comprise a phosphoric acid solution incorporating copper salts in a solvent/water solution.

3.01.08 Micaceous iron oxide paint shall be based on a phenolic linseed tung oil media or equivalent and shall contain a minimum of 50% micaceous iron oxide by weight in the dry film.

3.01.09 Where colour finishes other than micaceous iron oxide are required these shall be based on titanium dioxide and/or light fast coloured pigments dispersed in alkyd media. A full gloss finish is required. Such paints should be used in conjunction with their appropriate undercoating.

3.01.10 Two-pack epoxy finishing paints shall be based on a polyamide or amine adduct cured two-pack epoxy media and shall be pigmented with titanium dioxide and/or light fast coloured pigments to provide the necessary opacity, film building and weather resistance. A semi-gloss finish is required.

3.01.11 Vinyl finishing paints shall be based on a vinyl copolymer media and shall be pigmented with titanium dioxide and/or light fast coloured pigments to provide the necessary opacity, film build and weather resistance. A semi-gloss finish is required.

3.01.12 Chlorinated rubber finishing paints shall be based on suitably plasticised chlorinated rubber media and shall be pigmented with titanium dioxide and/or light fast coloured pigments to provide the necessary opacity, film build and weather resistance. A semi-gloss finish is required.

3.01.13 Epoxy coal tar shall be based on a two-pack formulation incorporating epoxy resin and suitable pigments in one pack and a polyamide curing agent and coal tar in the second. The epoxy resin shall comprise 35-45% by weight of the resin coal tar blend. The finishing colour shall be black. Aluminium or red oxide pigmentations shall be allowed for contrasting of intermediate coats. Alternative curing agents shall be allowed where necessary to provide low temperature cure.

3.01.14 Aluminium silicone paint shall be based on a one-pack formulation comprising leafing aluminium pigment dispersed in silicone or modified silicone media. The paint shall be capable of withstanding continuous exposure to temperatures between 120°C and 500°C.

3.01.15 Aluminium in the form of paint or metal spray shall not be used on any steel surface which may operate above 120°C located where an explosive atmosphere may be present at any time (Zone 1 Areas).

3.01.16 Urethane paints shall be of isocyanate reactive types which are made by reacting excess TDI (Toluene di isocyanate) with a hydroxyl (oH) bearing substance to form a prepolymer, which then reacts further with hydroxyl groups of polyol or with moisture to form the film.

4.00.00 SURFACE PREPARATION

4.01.00 Preparation Requirements

4.01.01 Surface preparation shall not take place at temperatures below 5°C, when the relative humidity is greater than 85% or when the metal surface temperature is less than 3°C above the ambient dew point or outside daylight hours on exterior locations.

4.01.02 Surface preparation may also be suspended at the direction of the Engineer when adverse weather conditions are likely to develop before painting could be carried out.

4.01.03 Surface preparation of new steel surfaces shall remove all surface irregularities and mill scale together with all rust and surface contaminants, such as grease, dirt and solid pollution.

4.01.04 Surface irregularities including weld spatter, rough capping, undercut and slag together with sharp or rough edges and burrs, surface laminations and laps shall be removed or made smooth prior to commencement of surface preparation. Such irregularities which become apparent after surface preparation by blast cleaning or hot acid pickling shall be similarly treated.

4.01.05 Grease or oil contamination shall be removed by either wiping or scrubbing the surface with rags or brushes wetted with white spirit and then wiping down with clean dry cloths. Alternatively proprietary emulsifying agents may be used

for this purpose and the surface then washed down with clean water. The surface shall be allowed to dry out before proceeding with further preparation and painting.

4.01.06 Steel surfaces shall be prepared by blast cleaning to BS 4232 to the appropriate quality specified. Reference shall be made to Swedish Std. SIS 05 59 00- 1967 for photographic illustrations of equivalents to these qualities.

4.01.07 Selection of abrasives for blast cleaning shall be in accordance with Table 2 in BS 4232 and shall give surface profile or anchor pattern generally within the range 50-75 microns with rogue peaks of maximum amplitude 100 microns. Spent abrasives shall be completely removed from the prepared surface by either vacuum cleaning or stiff brushing.

4.01.08 The pressure and volume of the compressed air supply for blast cleaning shall meet the work requirement and shall be sufficiently free from all water contamination to ensure that the cleaning process is not impaired. Traps, separators and filters shall be emptied and cleaned regularly.

4.01.09 Acid descaling and derusting followed by hot passivation by the Jenolising process or as described in SSPC SP 8 will be accepted as a substitute for blast cleaning provided this method of preparation is complete with the specified paint system.

4.01.10 Chipping, scraping and steel wire brushing using manual or power driven tools cannot remove firmly adherent mill scale and shall only be used where blast cleaning is impractical and with the approval of the Engineer. Such preparation shall be in accordance with the photographic illustrations in SIS 05 59 00- 1967 Grade C ST 2 or 3 as specified.

4.01.11 New galvanised surfaces shall be thoroughly degreased with white spirit or emulsifying agents and chemically etched either by a proprietary pretreatment solution, or by using a two-pack etching primer in the painting process. Weather galvanised surfaces shall be prepared by steel wire brushing to remove all corrosion products and followed by digressing with white spirit.

4.01.12 Surface preparation by wet blasting may be used in certain environments at the discretion of the Engineer, in order to provide increased safety against sparking, to minimise atmospheric and surface pollution, or to prepare surfaces which are salt contaminated and spend much of their time in wet conditions.

5.00.00 PAINTING

5.01.00 All painting shall be carried out in conformity both with this Standard and with the paint manufacturer's recommendation. All paints in any one particular system, whether shop or site applied, shall originate from one paint manufacturer.

5.02.00 Particular attention shall be paid to the manufacturer's instructions on storage, mixing, thinning and pot life. The paint shall only be applied in the manner detailed by the manufacturer e.g. brush, roller, conventional or airless spray and shall be applied under the manufacturer's recommended condition. Minimum and maximum time intervals between coats shall be closely followed.

5.03.00 Hand mixing of paints shall only be permitted for containers up to 5 litres. All larger containers shall be mixed by mechanical agitators and brought to a uniform consistency. Where pigment separation readily occurs, provision shall be made for continuous mixing during application.

5.04.00 Two-pack paints shall be mixed in strict accordance with manufacturer's instructions. The pot life of such paints shall be specifically noted and any mixed paint which has exceeded its pot life shall be discarded irrespective of its apparent condition.

5.05.00 The Contractor shall avoid contamination of any adjacent items of plant and equipment or property by paint overspray, drips or spillage, providing appropriate protection where necessary. If any such contamination does occur the Contractor shall remove it.

5.06.00 Painting shall not take place under adverse weather conditions, in particular rain, fog, snow, sandstorm or when such conditions are likely to occur before the paint has become dry. Painting shall not take place at temperatures below $5^{o}C$ when the relative humidity is greater than 85%, or when the metal surface temperature is less than $3^{o}C$ above the ambient dew point. Painting shall not take place outside daylight hours on exterior locations. Painting may also be suspended due to wind speed.

5.07.00 All prepared steel surfaces should be primed before visible re-rusting occurs or within 4 hours, whichever is sooner.

Acid-descaled steel surfaces shall be primed as soon as the surface is dry and while the surface is still warm.

5.08.00 Where further painting is to be carried out, zinc silicate primers shall be sealed with a tie coat as soon as practical after complete curing has taken place, to avoid salt or chemical contamination of the porous zinc silicate primer. The tie coat shall be selected to ensure sound adhesion to the zinc silicate primer and be compatible with the finishing coat process. When over coating with aluminium silicone paint, a tie coat is not necessary.

Where the quality of film is impaired by excess film thickness, (wrinkling, mud cracking or general softness) the Contractor shall remove the unsatisfactory paint coating and apply another. As a general rule, dry film thickness should not exceed the specified minimum dry film thickness by more than 25%. In all instances where two or more coats of the same paint are specified, such coatings shall be of contrasting colours so that each stage of the work can be readily identified and film thicknesses determined accordingly.

Intervals between coats shall comply with manufacturer's recommendations and should generally be kept to the absolute minimum in order to prevent contamination between coats. Where contamination occurs between coats, this shall be completely removed, generally by washing with 1% By-Prox detergent solution of equivalent, and rinsing with clean fresh water.

5.09.00 All points of damage of paintwork incurred at any stage of the work, including site welding operations, shall be re-prepared by blast cleaning to the original standard and recoating with the specified priming coat and finish coat to restore the film thickness. In all such instances preparation shall extend 25mm of sound paintwork shall be lightly blasted to etch the surface.

6.00.00 INSPECTION

6.01.00 The Contractor shall inform the Engineer before the start of work. The Engineer or the Engineer's representative shall have free access to the fabrication and/or the field painting shop during the course of the work to inspect the following:-

- visual inspection of surface preparation; comparison basis : photo index given in the Swedish Standard SIS 055900.

- consecutive inspection of workmanship and conformity of specification.

- post-inspection of painted surfaces and surface preparation by local removal of the coat(s).

All test areas for destructive tests (e.g. removal of paint, cutting tests, etc.) shall be correctly repaired by the Contractor.

To ensure conformity with the Specification with regard to dry film thickness the Contractor himself shall carry out a sufficient number of tests. The dry films thickness will be measured by the Engineer. The tolerances of dry film thickness of all inspected parts shall be as follows:

- not less than 90% of all measurements may only have 90 - 100% of the specified thickness

- all areas having less than 90% of the specified dry film thickness shall be repaired at the Contractor's expenses.

7.00.00 GALVANISING

7.01.00 All galvanising shall be carried out by the hot dip process (and unless otherwise specified shall conform in all respects with BS 729 and BS 2989 as applicable).

7.02.00 Attention shall be paid to the detail design of members (in accordance with BS 4479). Adequate provision for filling, venting and draining shall be made for assemblies fabricated from hollow sections. Vent holes shall be suitably plugged after galvanising.

7.03.00 All surface defects in the steel including cracks, surface laminations, lamps and folds shall be removed (in accordance with BS 4360). All drilling, cutting, welding, forming and final fabrications of unit members and assemblies shall be completed before the structures are galvanised. The surface of the steelwork to be galvanised shall be free from welding slag, paint, oil grease and similar contaminants.

7.04.00 The minimum average coating weight shall be as specified in Table 1 of BS 729. Structural steel items shall be initially grit blasted to BS 4232, second quality (SA2 1/2), and the minimum average coating weight on steel sections 5mm thick and over shall be 915 g/m^2.

7.05.00 On removal from the galvanising both the resultant coating shall be smooth, continuous, free from gross surface imperfections such as bare spots, lamps, blisters and inclusions of flux, ash or dross.

7.06.00 Galvanised contact surfaces to be joined by high strength friction grip bolts shall be roughened before assembly so that the required slip factor (defined in BS 3294, Part 1 and BS 4604 Part 1) is achieved. Care shall be taken to ensure that roughening is confined to the net area of the mating surfaces.

7.07.00 Bolts, nuts and washers, excluding general grade high strength friction grip bolts (referred to in BS 3139 Part 1 and BS 4395 part 1) shall be hot dip galvanised and subsequently centrifuged (according to BS 729). Nuts shall be retapped after galvanised and the threads oiled to permit the nuts to be finger turned on the bolt for the full depth of the nut. No lubricants, applied to the projecting threads of a galvanised high strength friction-grip bolt after the bolt has been inserted through the steelwork, shall be allowed to come into contact with the mating surfaces.

During off loading and erection nylon slings shall be used. Galvanised work which is to be stored in works or on site shall be stacked so as to provide adequate ventilation to all surfaces to avoid wet storage staining (white rust).

Small areas of the galvanised coating damaged in any way shall be restored by cleaning the area of any weld slag and thoroughly wire brushing to give a clean surface followed by the application of two coats of zinc rich-paint, or the application of a low melting point zinc alloy repair rod or power to the damaged area, which is heated to 300^{o}C.

After fixing, bolt heads, washers and nuts shall receive two coats of zinc rich paint.

Connections between galvanised surfaces and copper, copper alloy or aluminium surfaces shall be protected by suitable inert tape wrapping to the Engineer's approval.

8.00.00 SCHEDULE OF FINISHES

8.01.00 Structural and Supporting Steelwork, Shell Plates

8.01.01 Preparation

Blast clean to BS 4232 2nd Quality (SA 2½).

8.01.02 Priming

Zinc chrome primer, dft 40 microns per coat (2 coats).

8.01.03 **Intermediate Coat**

Micaceous iron oxide paint, dft 60 microns per coat (1 coat).

8.01.04 **Finish**

Polyurethane paint, dft 50 microns per coat (1 coat).

8.01.05 **Total Dry Film Thickness**

190 microns.

8.02.00 **Steel Surfaces Exposed to Solvent/ Chemical attack**

8.02.01 **Preparation**

Blast clean to BS 4232 2nd Quality (SA 2 1/2)

8.02.02 **Priming**

Zinc Phosphate 2 pack epoxy primer, dft 50 microns per coat (2 coats).

8.02.03 **Finish**

Two pack epoxy finish dft 75 microns per coat (2 coats).

8.02.04 **Total Dry Film Thickness**

250 microns

8.03.00 **Steel Surfaces exposed to Salt Contamination**

8.03.01 **Preparation**

Blast clean to BS 4232 2nd Quality (SA 2½).

8.03.02 **Priming**

Zinc Chrome Primer, dft 40 microns per coat (2 coats).

8.03.03 **Intermediate Coat**

Micaceous Iron Oxide Paint, dft 60 microns per coat (2 coats).

8.03.04 **Finish**

Polyurethane paint, dft 25 microns per coat (1 coat).

8.03.05 **Total Dry Film Thickness**

250 microns.

8.04.00 **Steel Surfaces exposed to Continuous condensation**

8.04.01 **Preparation**

Blast clean to BS 4232 2nd Quality (SA 2 1/2).

8.04.02 **Priming**

Zinc Phosphate 2 peak chlorinated rubber primer, dft
50 microns per coat (2 coats).

8.04.03 **Finish**

Micaceous iron oxide chlorinated rubber, dft 75 microns per coat (2 coats).

8.04.04 **Total Dry Film Thickness**

250 microns.

8.05.00 **Steel Surface Operating at Elevated Temperatures Uninsulated**

8.05.01 **Preparation**

80 - 350 degree C Blast clean to BS 4232 2nd Quality

80 - 550 degree C Blast clean to BS 4232 1st Quality

8.05.02 **Priming**

80 - 350 degree C Zinc silicate primer, dft 75 microns

80 - 550 degree C Aluminium spray, dft 125 microns.

8.05.03 **Finish**

Aluminium Silicone paint, dft 25 microns.

8.05.04 **Total dry film thickness**

80 - 350^{o} 100 microns

80 - 550^{o} 150 microns

8.06.00 **Steel Surface Operating at Elevated Temperature Insulated**

8.06.01 **Preparation**

Blast clean to BS 4232 2nd Quality (SA 2 1/2)

8.06.02 **Priming**

1 coat of zinc silicate primer, dft 75 microns.

8.06.03 **Finish**

None or 1 coat of aluminium silicone paint, dft 25 microns.

8.06.04 **Total Dry Film Thickness**

75 or 100 microns

8.07.00 **Steelwork encased in concrete, brickwork or fire proofing**.

8.07.01 **Preparation**

Blast clean to BS 4232 3rd quality (SA 2).

8.07.02 **Priming**

2 coats bituminous paint to BS 3416 type 1, dft 40 microns per coat.

8.07.03 **Finish**

None

8.07.04 **Total Dry Film Thickness**

80 microns.

8.08.00 **General Requirements for Painting Completed Off site**

8.08.01 **Preparation**

Blast clean to BS 4232 2nd Quality (SA 2½)

8.08.02 **Priming**

1 coats zinc rich 2 pack epoxy primer, dft 35 microns.

8.08.03 **Finishing**

2 coats 2 - pack epoxy undercoat, dft 75 microns per coat.

1 coats 2 - peak epoxy finish, dft 50 microns.

8.08.04 **Total Dry Film Thickness**

235 microns.

8.08.05 Manufacturers may offer their standard paint procedure subject to the approval of the Engineer.

8.09.00 **Internal Surfaces of Storage Tanks**

8.09.01 **Preparation**

Blast clean to BS 4232 2nd Quality (SA 2 1/2).

8.09.02 **Priming**

1 coat zinc phosphate, dft 25 microns.
or
1 coat red oxide 2 pack epoxy primer, dft 25 microns.
or
1 coat zinc rich 2 - pack epoxy primer, dft 35 microns.

8.09.03 **Finish**

3 coats epoxy coal tar, dft 125 microns per coat.
or
3 coats non-staining bituminous paint, dft 50 microns per coat.

8.09.04 Paint system and total dry film thickness to be selected on contents of storage vessel and operating temperature and conditions.

8.10.00 **Galvanised Surfaces**

8.10.01 **Preparation**

Remove all corrosion by wire brushing by hand, degrease and chemically etch the cleaned zinc surface. Rinse with clean water.

8.10.02 **Priming**

1 coat zinc phosphate primer in oleoresinous, vinyl epoxy or chlorinated rubber media to suit finish paint system, dft 30 microns.

8.10.03 **Finish**

2 coats finish paint in oleoresinous, vinyl epoxy, or chlorinated rubber media, dft 50 microns per coat.

8.10.04 **Total Dry Films Thickness**

205 microns, including 75 microns of galvanising.

All underground pipework shall be coated and wrapped as per AWWA C-203.

QAP GUIDELINES & FORMAT

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(ANNEXURE -)

The QAP format and guidelines for filling up the format shall be used by vendor for preparation and submission of QAP after order placement.

Note :

1. Typical /Indicative /Standard QAP(s) for equipment /package attached is reference document and to use by successful bidder in future for preparation and submission of QAP for BHEL /CUSTOMER approval.

2. No deviation to reference document is acceptable.

GUIDELINES TO VENDORS FOR PREPARATION OF QUALITY ASSURANCE PLAN

1. QAP shall be made in landscape mode on A4 size paper as per the format enclosed. Font size shall be minimum 10.

2. Each page of QAP shall contain the following information.
   a) Vendor's name & address.
   b) Customer: BHEL, Hyderabad.
   c) Project.
   d) BHEL Product Standard Number/revision number as referred in P.O.
   e) BHEL Purchase Order Number & Date.
   f) Product as per P.O. description.
   g) QAP Number (unique and shall not repeat)/revision number/date.
   h) Page number and number of pages

3. QAP shall contain four parts / stages as follows.
   a) Raw materials and bought out items.
   b) In process Control / Inspection.
   c) Final assembly, Inspection & Testing.
   d) Painting, preservation & packing.

4. Under 'Component', indicate name of the component (say casing, rotor, pressure gauge, etc).

5. Under 'Characteristics', indicate appropriately (say chemical analysis, mechanical properties, NDT (UT,DP etc.), hydrostatic test, calibration check etc.)

6. Under 'Class', indicate minor, major or critical depending on the importance of characteristic.

7. Under 'Type of check', indicate appropriately (say chemical, mechanical, UT, DP etc.)

8. Under 'Quantum of check', indicate appropriately (say 100%, 10%, sample, per melt, per heat, all pieces etc.)

9. Under 'Reference document' and 'Acceptance norms', appropriate National & International standards, BHEL standards, approved drawing references etc. should be indicated. It is not correct to mention as "Vendor's internal standards or Vendor's standard practice etc.". If vendors' internal standards are referred, same shall be in line with BHEL Spec. indicated in the P.O. These may require review & approval by our Engineering dept.

10. Under 'Format of record', indicate appropriately supplier's test certificate, calibration certificate, lab report, inspection report etc.

11. Please refer 'Agency' in QAP format.
    Under P: Perform, W: Witness, V: Verify
    Indicate against each characteristic 1: (BHEL CQS/Nominated inspection agency), OR
    2: (Vendor / Sub vendor)

Note: Performing agency is normally vendor or his sub vendor (Legend 2). Where witness points are indicated in specification, P.O., Drawing etc., for such operations, under Witness (W) column use 1. Under 'Verify' column, use code1.

12. Under 'D' please put (□ Tick) against each characteristic where vendor proposes to submit test certificate/report etc. OR as required as per BHEL Specification.

13. Vendor's signature & stamp should be available on each page of QAP.

14. Vendor should read the BHEL Product Standard thoroughly and QAP should be made only inline and relevant to the Specification & Approved Drawings.

15. The following operations/characteristics/check points may be included (AS APPROPRIATE)
    a) Visual check
    b) Dimensional check
    c) Mechanical and Chemical properties.
    d) Surface preparation before painting (by chemical cleaning, sand blasting, shot blasting etc. as the case may be.)
    e) Painting check for shade, Dry Film Thickness (DFT), Adhesion/ peel off test etc.
    f) Check for correctness for all components mounted as per General arrangement Drawing, Bill Of Materials (BOM), etc. for range, rating, make, color, size, location as per GA, quantity, label description including tag nos., annunciator facia, loose components, accessories, spares etc.
    g) Verification of test certificate for protection class for the enclosures.
    h) Mechanical functioning of switches.
    i) Continuity of earthing and provision of earth points.
    j) Colour coding of wiring, size, tightness & dressing of wiring.
    k) Review of test certificates of assembled items, raw materials, internal test reports etc.
    l) Witness of functional checks, which may include mechanical run & electrical run, H.V.test, IR measurement, Electrical and Mechanical tests etc.
    m) PQR, WPS, Welder Qualification Record, welding records (fit up, DP) etc.
    n) Material identification (for punch marks of serial numbers, Heat No, Melt No, Inspector's stamp etc.)
    o) Hydraulic Pressure Test, Pneumatic Pressure Test, Liquid Penetration Examination and other Non Destructive Tests.
    p) Tests on Galvanised items (Visual, Hammer Test, Knife Test, Thickness, Pierce Test (Copper sulphate test), Hydrogen evaluation test, Stripping test (for Mass of Zinc coating)
    q) All tests as per BHEL Product Standard & approved drawings including Type tests and Routine tests on individual items and on System as a whole.
    r) Packing and Preservation.
16. **QAP Format enclosed.**
17. **Typical Manufacturing QAP is attached.**

VENDOR'S NAME & ADDRESS:	**MANUFACTURING QUALITY PLAN**		QP. NO.:	
	CUSTOMER: BHEL, HYDERABAD – 32. PROJECT: PRODUCT:	BHEL P.O.NO.: P.O.DATE: BHEL SPEC: REV:	REV NO:	DATE:
			PAGE 1 OF 1	

SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY P	AGENCY W	AGENCY V	REMARKS
1.0	**RAW MATERIALS & BOUGHT OUT ITEMS**												
2.0	**INPROCESS INSPECTION**												
3.0	**FINAL INSPECTION & TESTING**												
4.0	**PRESERVATION & PACKING**												

VENDOR TO NOTE: THIS FORMAT IS IN MICROSOFT WORD. HEADER & FOOTER SHALL BE AVAILABLE IN EACH PAGE OF QP. QP SHALL BE IN LANDSCAPE & A4 SIZE ONLY. FONT SIZE SHALL BE MIN 10. VENDOR SHALL SIGN & STAMP IN EACH PAGE OF QP. LOI REF. & DATE ARE NOT ACCEPTABLE. P.O.NO. & DATE SHALL BE INDICATED. QP NO. SHOULD BE UNIQUE AND SHALL NOT REPEAT. ALL THE TESTS / CHECKS INDICATED IN THE BHEL SPEC. SHALL BE INDICATED IN THE QP.

LEGEND: P: PERFORM, W: WITNESS, V: VERIFICATION. INDICATE 1 FOR BHEL CQS (OR BHEL NOMINATED INSPECTION AGENCY) & 2 FOR VENDOR/SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.	PREPARED BY VENDOR'S SIGNATURE & STAMP	APPROVED BY BHEL QA SIGNATURE & STAMP	APPROVED BY CUSTOMER'S SIGNATURE & STAMP

DEVELOPMENT CONSULTANTS PRIVATE LIMITED

CONSULTING ENGINEERS

Regd. office : 24-B Park Street, Kolkata 700 016, India
Phone : 249 7603/7605/7609/7610/7612
Fax : (91) 33 2492897, 2492340, 2493338
E-mail: dcl@ddlgroup.com

ISO 9001

BY COURIER SERVICE / SPEED POST

K7205/ 110 June 26, 2009

Bharat Heavy Electricals Ltd.
Power Sector, Project Management
5TH Floor, BHEL HOUSE, SIRI FORT
NEW DELHI – 110049 (Telephone: 011 26493268)

Attn : **Mr. D P Agrawal – Project Manager, PS-PMG**

Sub : 1 x 100 MW CCPP Namrup Replacement Power Project
at Namrup, Assam.
BHEL Drawings and Document. (Sub-Vendor List)

Dear Sir,

Further to our e-mail reference K7205/G/094 dated and subsequent BHEL – Hyderabad e-mail dated 19th June, 2009, BHEL Sub-Vendor list (BOP) have been coorected

We are enclosing herewith one (1) corrected copy (dt. 26.06.2009) of APGCL/DCPL accepted sub-vendors list marked as (√) on the aforesaid BHEL's Sub-vendor list for your necessary action & distribution to BHEL's various units involved in the said project.

Thanking you and assuring you of our best attention at all times.

Very truly yours
Development Consultants Pvt. Ltd.

S. Bhattacharya 26/6/09
Salil Kr. Bhattacharya
Deputy General Manager
Development Consultants Pvt. Ltd.
Export Cell, 3rd Floor, Block-DG,
Plot no. 4, Sector-II, Salt Lake, Karunamoyee
Kolkata – 700 091
Phone: 033-40125307 (Dir), 09432368471(Mob)

Copy: Assam power Generation Corp. Ltd. (Attn: Mr. A. K. Das, CGM / Mr. J. Sharma, Sr. Manager)
Bijulee Bhawan, 3RD Floor
Paltan Bazar
Guwahati – 781 001, Assam **(With one set of above document)**

✓ Copy: Mr. Kodanda Ramaiah – Dy. General Manager (Contract Management)
Bharat Heavy Electricals Limited
Ramachandrapuram **(With one set of above document)**
Hyderabad – 502032, AP
Telephone: 040 -23182463

Encl: As above **SF/MF**

BHEL SUB-VENDOR LIST (FINAL)
ACCEPTED BY APGCL/DCPL (DT. 26.06.09)

Sushatkalay (DCPL)
26/06/2009.

REV.	DATE	DESCRIPTION	PREPD. BY	REVIEW BY	APPROVED BY
Final	26.06.09	BHEL SUB-VENDOR LIST	....	....	....	....	....	....

PROJECT : 1x100MW NAMRUP REPLACEMENT POWER PROJECT (PHASE-I) AT NAMRUP, ASSAM

CUSTOMER : ASSAM POWER GENERATION CORPORATION LTD.
GUWAHATI, ASSAM

CONSULTANT : DEVELOPMENT CONSULTANTS PVT. LTD.
CONSULTING ENGINEERS
KOLKATA CHENNAI MUMBAI NEW DELHI

	NAME	SIGN.	DATE	NO.OF VAR.
DRN.	..		–	
CHT.	..		–	
APP.	..		–	N.A

DEPT.	UNTOL. DIMS.	SCALE	WEIGHT	REF. TO ASSY. DRG.	ITEM NO.	NO.OF ITEMS
PED	GR. C/M/F	N.A	N.A	N.A	N.A	N.A
CODE. 450						

TITLE
BHEL SUB-VENDOR LIST (FINAL)

CARD CODE N.A

REV. ....

SHT. No 01 NO. OF SHT. ..

COVER + 15.

A4 (9-96) [210x297]

Sl. No.	ITEM DESCRIPTION	SUPPLIER NAME	REMARKS
I	ELECTRICAL (A)		
1	Battery Charger	M/s Amara Raja Power Systems Ltd, Hyd	√
		M/s Quasar Engineering Pvt Ltd,Bangalore	Furnish Credential(F. C.)
		M/s Chhabi Electricals P Ltd., Maharashtra	√
		~~M/s Statcon Power Controls Ltd., Noida~~	X
2	Sealed Maintenance Free Battery (For UPS System)	M/s Amara Raja Power Systems Ltd, Hyd	√
		M/s Exide Industries Limited, , Hyderabad	√
		M/s HBL Power Systems Ltd., Hyd	√
3	Lead Acid Storage Battery (Plante type only)	M/s Exide Industries Limited, , Hyderabad	√
4	Nickel-Cadmium Battery	M/s HBL POWER SYSTEMS LTD., HYD	√
		M/s AMCO SAFT INDIA LTD., B LORE	√
5	Lt Motors (Safe Area)	M/s Siemens India Ltd, Secunderabad.	√
		M/s Areva T&D India Limited, Hyd	√
		M/s Asea Brown Boveri Ltd., Hyderabad	√
		M/s Jyothi Limited., Vadodara	√
		M/s Kirloskar Elec.Co.Ltd, Bangalore	√
		M/s Bharat Bijlee Ltd, Mumbai	√
		M/s Crompton Greaves. Mumbai	√
6	H.T. Motors (Safe/Hazardous Area)	M/s Siemens India Ltd, Secunderabad.	√
		M/s Asea Brown Boveri Ltd; , Hyderabad	√
		M/s Bharat Heavy Electricals, B Pal	√
		M/s Jyothi Limited., Vadodara	√
		M/s Kirloskar Elec.Co.Ltd, Bangalore	√
		M/s Crompton Greaves Mumbai	√
		Alstom	Add Vendor
7	Direct On Line Starters	M/s Crompton Greaves. Mumbai	√
		M/s Crompton Greaves Ltd , Secunderabad	√
		M/s Larsen & Toubro Limited, Hyderabad.	√
		M/s Controls & Switchgear , New Delhi.	√
		M/s SIEMENS INDIA LIMITED, CHENNAI.	√
8	Direct On Line Starters (Explosion Proof)	M/s Flameproof Equipments Pvt.Ltd. , Mumbai	√
		M/s F.C.G. Flameproof Control Gears P.Ltd., Mumbai	√
		M/s Baliga Lighting Equipment Pvt. Ltd. , Chennai	√
9	Ht Cable Jointing / Terminating Kits	M/s Yamuna Gases & Chemicals Ltd., Jagadhri	√
		M/s BIRLA 3 M LTD., BANGALORE	√
		M/s RAYCHEM RPG LIMITED, CHENNAI	√
10	Cable Lugs & Crimping Tools	M/s Dowells Elektro Werke, M U M B A I	√
		M/s POWER ENGG. CO., Mumbai	√
		M/s ELECTROMAC INDUSTRIES, MUMBAI	√
11	Power Transformers (Rating > 10 M.V.A)	M/s Areva T&D India Limited, Sec Bad	√
		M/s Bharat Bijlee Limited, Sec Bad	√
		M/s Voltamp Transformers Ltd., Gujarat	√
		~~M/s Emco Limited, Mumbai~~	X Not Acceptable (N.A.)
		M/s BHEL, Jhansi	Add Vendor
		M/s Crompton Greaves, Mumbai	√
		M/s Bharat Heavy Electricals, Up	√
12	Auxiliary Transformers	M/s Crompton Greaves Ltd , Secunderabad	√
		M/s AREVA T&D INDIA LIMITED, SEC BAD	√
		M/s BHARAT BIJLEE LIMITED, SEC BAD	√
		M/s VOLTAMP TRANSFORMERS LTD., GUJARAT	√
		M/s EMCO LIMITED, MUMBAI	√
13	Cast Resin Distribution Transformers	M/s Intra Vidyut Ltd., Bangalore	√
		M/s Emco Limited, Mumbai	√
		M/s Bharat Heavy Electricals, Up	√
14	Neutral Grounding Resistors	~~M/s Lachhman Electronics, , New Delhi~~	X Not Acceptable (N.A.)
		M/s R.S.I. Switchgear Pvt.Ltd., Haryana	√
		M/s S R Narkhede Engineering P.Ltd., Maharastra	√
		M/s Ampcontrol Equipments Pvt.Ltd, Pune	√
		M/s National Switchgears, Chennai.	√

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15	Lighting Fixtures, Luminiaire (for Safe Area Applications) NOTE: 1. Energy Efficient type only 2. PHILIPS, Crompton & Bajaj Lighting system is acceptable	M/s SQUARE A ENTERPRISES	√
		M/s PHILIPS India, Pune	√ Add Vendor
		M/s BAJAJ ELECTRICALS LTD., HYD. *	√
		M/s CROMPTON GREAVES. MUMBAI	√
16	Lighting Fixturos & Luminiairs (Explosion Proof area applications) NOTE: 1. Energy Efficient type only 2. PHILIPS, Crompton & Bajaj Lighting system are only acceptable	M/s Square A Enterprises	√
		M/s Bajaj Electricals Ltd.,	√
		~~M/s Prompt Engineering Works, , Mumbai~~	X N. A.
		M/s Flameproof Equipments Pvt.Ltd. , Mumbai	√
		M/s CROMPTON GREAVES. MUMBAI	√
		M/s F.C.G. FLAMEPROOF CONTROL GEARS P.LTD., MUMBAI	√
17	Lt.Motor Control Centres, Power Control Centres, A C & D C Distribution Boards.	M/s Schneider Electric India Pvt Ltd.,	√
		M/s Larsen & Toubro Limited, Hyderabad,	√
		M/s Controls & Switchgear , New Delhi.	√
		~~M/s Specage Switchgears Limited,~~	X N.A.
		M/s Siemens India Limited,	√
18	Ups System NOTE: IGBT Technology as per NIT	M/s Emerson Network Power (India) Pvt. Ltd.	√
		M/s Hi-Rel Electronics Ltd.,	√
		M/s Db Power Electronics (P)Ltd. ,	√
		M/s Gutor Electronics Ltd., Switzerland	√
		M/s Chloride Power Protection, Uk	√ Furnish Credential
19	L.T. / H.T. Busduct	M/s Controls & Switchgear , New Delhi.	√
		M/s Powergear Limited, B A N G A L O R E .	√
		~~M/s Emlorm Power Projects P Ltd., Bangalore.~~	X N.A.
		M/s Larsen & Toubro Limited, Bombay	√
		M/s BHEL, Jhansi	√ Not for LT Bus-duct
		M/s Stardrive Busducts Private , Madras.	√
		~~M/s JASPER ENGINEERS PVT. LTD.~~	X N.A.
20	Telecommunication System (Lstb / Paging / Epabx & Pa System)	M/s Larson Engineers And- ,	√
		M/s BNA TECHNOLOGY CONSULTING LTD	√
		M/s Siemens India Ltd.	√
		~~M/s Elixir Electronics,~~	√
21	Electrical Contols Panels	M/s Electronics Corporation Of India Ltd., Hyderabad.	√
		~~M/s Panam Controls, Secunderabad~~	X N.A.
		M/s Controls & Switchgear , New Delhi.	√
		~~M/s Industrial Controls & , Mumbai~~	N.A.
		M/s Bharat Heavy Electricals , Bhopal	√
		~~M/s Shibaha Instruments (India) Pvt. Ltd., , Chennai~~	X N.A.
22	Electrical Control System (Ecs) / Power Management / Energy Management System	M/s AREVA T&D INDIA LIMITED,	√
		M/s Larsen & Toubro Limited, Hyderabad.	√
		M/s Asea Brown Boveri Ltd; , Hyderabad	√
		M/s Westing House Electric Pvt.Ltd., New Delhi	√
		M/s Bharat Heavy Electricals ,	√
		M/s Honeywell Pte Ltd.,	√
		M/s Siemens India Limited,	√
23	Lighting Panels (Safe Area)	M/s Panam Controls, Secunderabad	√
		M/s Indo Asian Marketing Limited, Secunderabad	√
		M/s Baliga Lighting Equipment Pvt. Ltd. , Chennai	√
		M/s FCG FLAMEPROOF CONTROL GEARS	√
24	RUBBER MAT	M/s NATARAJ RUBBER & PLASTIC WORKS , HYDERABAD	√
		M/s SRIDHAR ENGINEERING AND RUBBER ,	√
		M/s INDIAN RUBBER PRODUCTS ,	√
		M/s THE RUBBER PRODUCTS LTD. ,	√
25	Load Break Switch	M/s ASEA BROWN BOVERI LTD; , HYDERABAD	√
		M/s JYOTHI LIMITED.,	√
		M/s A.BOND STRANDS PRIVATE LTD.,	√
		M/s SIEMENS INDIA LIMITED,	√
		M/s DRIESCHER PANICKKER SWITCHGEAR ,	√
26	Earthing And Lightening Protection Materials	M/s Unique Engineering - , S E C U N D E R A B A D.	√
		M/s Patny Systems Pvt. Ltd., Secunderabad	√
		M/s JAMNA METAL COMPANY.,	√
		M/s Premier Power Products (Calcutta) Pvt. Ltd. , Kolkata	√
		M/s India Electricals Syndicate, Kolkata	√

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27	Flexible Wire For Lighting	M/s Thermo Cables Limited,	√
		M/s Radiant Cables Pvt. Ltd., Hyderabad	√
		M/s Techno Cables Pvt. Ltd.,	√
		M/s Finotex Cables Ltd.,	√
28	CURRENT LIMITING REACTOR	M/s CROMPTON GREAVES LTD , SECUNDERABAD	√
		M/s INTRA VIDYUT LTD.,	√
		~~M/s SHRIHANS ELECTRICALS PVT LTD.,~~	X N.A.
		M/s BHARAT BIJLEE LIMITED,	√
		M/s PS ELECTRICALS (P) LTD,	√
29	DC Starter Cubicles	M/s Larsen & Toubro Limited, Hyderabad,	√
		~~M/s Lashhmon Electronics, , New Delhi~~	X N.A.
		M/s Controls & Switchgear , New Delhi,	√
		M/s Industrial Controls & , Mumbai	√
30	Local Control Stations (Safe / Hazardous Area)	M/s Prompt Engineering Works, , Mumbai	√
		M/s Flameproof Equipments Pvt.Ltd., , Mumbai	√
		M/s FCG FLAMEPROOF CONTROL GEARS	√
31	LT Power Cables (Vendors As Per R.C)	M/s Universal Cables Ltd., , Hyderabad	√
		M/s Radiant Cables Pvt. Ltd., Hyderabad	√
		M/s Nicco Corporation Ltd., Hyderabad	√
		M/s Polycab Industries Pvt.Ltd.,	√
		~~M/s Cords Cable Industries Ltd.,~~	X N.A.
		M/s Delton Cables Limited,	√
		M/s Torrent Cables Ltd., Ahmedabad	√
		~~M/s Ravin Cables Ltd~~	X N.A.
		M/s KEI Industries, ND	√
32	Control Cables	M/s Universal Cables Ltd., , Hyderabad	√
		~~M/s THERMO CABLES LIMITED, HYD~~	X N.A.
		M/s Radiant Cables Pvt. Ltd., Hyderabad	√
		M/s Nicco Corporation Ltd., Hyderabad	√
33	HT Power Cables	M/s Universal Cables Ltd., , Hyderabad	√
		M/s RPG CABLES LTD., HYD.	√
		M/s RADIANT CABLES PVT. LTD., HYD	√
		M/s Nicco Corporation Ltd., Hyderabad	√
		M/s Torrent Cables Ltd., Ahmedabad	√
		~~M/s RAVIN CABLES LTD., MUMBAI~~	X N.A.
34	Cable Trays	M/s Patny Systems Pvt. Ltd., Secundersbad	√
		M/s JAMNA METAL COMPANY., NEW DELHI	√
		M/s Parmar Metals Pvt. Ltd	√
		M/s Metalemms Bombay Pvt Ltd.,	√
		M/s Am-Tech Engineering Services , Pune	√
		M/s Premier Power Products (Calcutta) Pvt. Ltd. , Kolkata	√
		M/s India Electricals Syndicate, Kolkata	√
35	Junction Boxes For Weather Proof And Explosion Proof For Lighting And Other Application	M/s Panam Controls, Secunderabad	√
		M/s Prompt Engineering Works, , Mumbai	√
		M/s Flameproof Equipments Pvt.Ltd., , Mumbai	√
		M/s Fcg Flameproof Control Gears	√
		M/s Electromac Industries ,	√
36	Cable Glands (Weather Proof/Ex.Proof)	M/s Prompt Engineering Works, , Mumbai	√
		M/s Fcg Flameproof Control Gears	√
		M/s Electromac Industries ,	√
		M/s Potential Engineering,	√
		M/s Jainsons Industries,	√
37	Vaccum Circuit Breakers (Upto 33 Kv Indoor)	M/s Crompton Greaves Ltd , Secunderabad	Furnish Credential(F. C.)
		M/s AREVA T&D INDIA LIMITED,	√
		M/s Asea Brown Boveri Ltd; , Hyderabad	√
		M/s Jyothi Limited.,	√
		M/s Bharat Heavy Electricals , Bhopal	√
		M/s Siemens India Limited,	√
38	Sf6 Circuit Breaker (Upto 33kv, Indoor) NOTE: Not Applicable	M/s Crompton Greaves Ltd , Secunderabad	
		M/s Voltas Limited,	
		M/s Asea Brown Boveri Ltd; , Hyderabad	
		M/s Jyothi Limited.,	

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(DCPL)

39	Signal Cable, Thermocouple, Extn. Comp. Cables	M/s Thermo Cables Limited,	√
		M/s Radiant Cables Pvt. Ltd., Hyderabad	√
		M/s Cords Cable Industries Pvt. Ltd., , New Delhi	√
		M/s Kei Industries Limited,	√
		M/s Delton Cables Limited,	√
40	Jbs For Lighting (Explosion Proof)	M/s Flameproof Equipments Pvt.Ltd. , Mumbai	√
		M/s Fcg Flameproof Control Gears	√
		M/s Flamepack,	√
41	Ac Variable Speed Drives	M/s AREVA T&D INDIA LIMITED,	√
		M/s Larsen & Toubro Limited, Hyderabad.	√
		M/s Hi-Rel Electronics Ltd.,	√
		M/s Bharat Heavy Electricalsltd.,	√
		M/s Siemens India Limited,	√
		M/s Rockwell Automationindia Ltd.,	√
42	LIGHTING TRS. DRY TYPE (AIR NATURAL) UP TO 150 KVA	M/s SOUTH EASTERN EQUIPMENT CO.,	√
		M/s INTRA VIDYUT LTD.,	√
		M/s AUTOMATIC ELECTRIC LTD.,	√
		M/s PS ELECTRICALS (P) LTD,	√
43	Lighting Panels Hazardous Area	M/s Flameproof Equipments Pvt.Ltd. , Mumbai	√
		M/s Fcg Flameproof Control Gears	√
44	Electrical Relay Panels NOTE: Siemens/Areva/ABB relays are acceptable as main protective relays as per Contract	M/s AREVA T&D INDIA LIMITED,	√
		M/s Asea Brown Boveri Ltd; , Hyderabad	√
		M/S Siemens, Chennai	Add Vendor
		~~M/s Easun Reyrolle Limited,~~	N.A.
45	Electric Actuators	M/s LIMITORQUE INDIA LTD,	√
		M/s AUMA (INDIA) LTD; ,	√
		M/s ROTORK CONTROLS INDIA LTD., CHENNAI	√
46	L.T Motors (Flame Proof)	M/s AREVA T&D INDIA LIMITED,	√
		M/s Kirloskar Elec.Co.Ltd, Bangalore	√
		M/s Crompton Greaves ,	√
		M/s Bharat Bijlee Ltd,	√
47	Loading Transformer	M/s Umatson Trading Corporation, Chennai	X N.A.
48	Illumination Items Package NOTE: Illumination Fixtures: Philips/CGL/Bajaj	M/s SQUARE A ENTERPRISES	√
		M/s Bajaj Electricals Ltd.,	√
		M/s Crompton Greaves	√
II	ELECTRICAL (B)		
1	Fire proof Sealing Materials	M/s Vijay systems engineers limited, Mumbai	√
		M/s Signum fire protection, Nagpur	√
		M/s Navair International Ltd, Nagpur	√
		M/s AGP Passive fire safety Pvt. Ltd, Chennai	√
2	Lab Equipments	M/s PCI Ltd, Hyderabad	√
		M/s Power Electronics International, New Delhi	√
		M/s Avantha Global Services, New Delhi	√
III	CONTROLS & INSTRUMENTATION (A)		
1	Ups System NOTE: REFER ELECTRICAL PART 'A' -18	M/s Tata Liebert Limited, , Secunderabad	
		M/s Toshiba India Pvt. Ltd., New Delhi	
		M/s Hi-Rel Electronics Ltd.,	
		M/s Fuji Electric Co. Ltd., Japan	
		M/s Db Power Electronics (P)Ltd.,	
		M/s Mgs Asia Pte Ltd., Singapore	
		M/s Gutor Electronics Ltd., Switzerland	
		M/s Sab Nife Ab ,	
		M/s Chloride Power Protection, Uk	
2	Telecommunication System (Lstb / Paging / Epabx & Pa System) NOTE: REFER ELECTRICAL PART 'A' -20	M/s Larsen Engineers And- ,	
		M/s Philips India Limited, Pune	
		M/s Motwane Private Limited ,	
		M/s Elixir Electronics,	
		M/s Siemens India Limited,	
3	Signal Cable, Thermocouple, Extn. Comp. Cables	~~M/s THERMO CABLES LIMITED,~~	X N.A.
		M/s Radiant Cables Pvt. Ltd., Hyderabad	√
		M/s Cords Cable Industries Pvt. Ltd., , New Delhi	√
		M/s Kei Industries Limited,	√
		M/s Delton Cables Limited,	√
		M/s Reliance Engineers Pvt.Ltd.,	√
		~~M/s Goyalens Fibres (I)Pvt.Ltd.,~~	X N.A.
		~~M/s Technowire Cables , Jaipur~~	X N.A.
		M/s General Instruments Consortium , Chennai	√

SRBhattacharya 26/06/09
(DGM)

4	TURBINE FLOWMETER	M/s TOSHNIWAL BROTHERS (HYD),	√
		M/s EMERSON PROCESS MANAGEMENT (I) PVT. LTD., SECUNDERABAD	√
		M/s ENDRESS & HAUSER GMBH + CO., GERMANY	√
		M/s FOXBORO,	√
		M/s ROCKWIN FLOWMETER INDIA PVT,	√
5	Mass Flowmeter	M/s Toshniwal Brothers (Hyd) ,	√
		M/s Emerson Process Management (I) Pvt. Ltd., Secunderabad	√
		M/s Forbes Marshall (Hyd) Limited, Hyderaba	√
		M/s Endress & Hauser Gmbh + Co., Germany	√
		M/s Yokogawa India Limited ,	√
6	Fuel Gas Analysers	M/s Emerson Process Management (I) Pvt. Ltd., Secunderabad	√
		M/s Abb Limited, , Hyderabad	√
		M/s Forbes Marshall (Hyd) Limited, Hyderaba	√
		M/s Dkk-Toa Corporation,	√
		M/s Yokogawa India Limited, , Bangalore	√
		M/s Honeywell Automation India Limited , Pune	√
		M/s Analysers Instrument Co. Pvt. Ltd., , Kota	√
7	Gas Chromatograph (On Line Systems)	M/s Siemens India Ltd, Secunderabad,	√
		M/s Emerson Process Management (I) Pvt. Ltd., Secunderabad	√
		M/s ABB LIMITED,	√
		M/s Yokogawa India Limited, , Bangalore	√
		M/s Analysers Instrument Co. Pvt. Ltd., , Kota	√
		M/s Perkine Elmer Analytical - , Usa	√
8	Radar Type Level Gauges	M/s Magnetrol International N.V., Belgium	√
		M/s Vega Grieshaber Kg., Germany	√
		M/s Endress & Hauser Gmbh + Co., Germany	√
		~~M/s Easaf-Noniu B.V.,~~	X N.A.
		~~M/s PUNE TECHTROL PVT LTD~~	X N.A.
		~~M/s L & J Technologies, Usa~~	X N.A.
9	FLOW ANNUBAR	M/s EMERSON PROCESS MANAGEMENT (I) PVT. LTD., SECUNDERABAD	√
		M/s MICRO PRECISION PRODUCTS (P) LTD., FARIDABAD	√
		M/s TECHNOMATIC S.P.A., I T A L Y.	√
		M/s KDG MOBREY LTD, E N G L A N D.	√
		M/s DIETERICH STANDARD,	√
10	Gas Chromatograph (Portable) NOTE: NOT APPLICABLE	M/s Elico Private Limited,	
		M/s Almil Limited,	
		M/s Nayco Engineers Pvt. Ltd., Secunderabad	
		M/s Chemito Technologies Pvt. Ltd.,	
		M/s Netel Chromatographs, Chennai	
11	PRDS	~~M/s Mazda Ltd., Ahmedabad~~	X N.A.
		M/s Chemtrols Engineering Ltd., M U M B A I	√
		M/s Forbes Marshall Arca Ltd., Pune	√
		M/s FISHER SANMAR LIMITED,	√
		M/s Copes Vulcan Limited, U.K	√
		M/s Yarway Corporation, U.S.A.	√
12	AIR DISTRIBUTOR POTS CONDENSING CHAMBERS AND SYPHONS	M/s MICRO PRECISION PRODUCTS (P) LTD., FARIDABAD	√
		M/s TECHNOMATIC (INDIA) PRIVATE LIMITED, MUMBAI	√
		M/s PRECISION ENGINEERING INDS., MUMBAI	√
13	Air Filter Regulators	M/s SHAVO NORGERN I PVT.LTD., BOMBAY,	√
		~~M/s P RAI AND COMPANY, B O M B A Y~~	X N.A.
		~~M/s J R U CONTTROL PVT LTD., CHENNAI~~	X N.A.
14	ANNUBARS NOTE: Included in Item-9 above	M/s TECHNOMATIC S.P.A., I T A L Y.	
		M/s DIETERICH STANDARD,	
15	Ball Valves (Pneumatically Operated)	M/s Sdl Valves ,	√
		M/s Petrol Valves S.R.L.,	√
		M/s Nuovo Pignone, Italy.	√
		M/s Metso Automation Pte Ltd., Singapore	√
		M/s Walthon Wier Pacific S.A., Spain	√
		M/s Cameron Iron Works Inc.,	√
16	Conductivity And Ph Monitoring System And Do2 Analyser	M/s Abb Limited, , Hyderabad	√
		M/s Dkk-Toa Corporation,	√
		M/s Emerson Process Management (I) ,	√
		~~M/s Rota Instruments,~~	X N.A.
		M/s Forbes Marshall Ltd.,	√
		M/s Instrumentation Limited, Chennai	√
		M/s Honeywell Automation (I) Ltd.	√ Add vendor
		M/s Yokogawa India Ltd.	√ Add vendor
		~~M/s Upiron India Limited,~~	X N.A.

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17	Control Cables NOTE: Pl. REFER Electrical Part	M/s Universal Cables Ltd. , Hyderabad	√
		M/s Radiant Cables Pvt. Ltd., Hyderabad	√
		~~M/s Techno Cables Pvt. Ltd.,~~	X N.A.
		M/s Polycab Industries Pvt.Ltd.,	√
		M/s Kei Industries Limited,	√
		~~M/s Hindusthan Vidyut Products Ltd.,~~	X N.A.
		M/s Delton Cables Limited,	√
		~~M/s Elkay Telelinks Limited , Faridabad~~	X N.A.
		~~M/s Conterno Instrumentation P Ltd .,~~	X N.A.
		M/s Rpg Cables Limited, Thane	√
		~~M/s Goyalsons Fibres (I)Pvt.Ltd.,~~	X N.A.
		M/s Cable Corporation Of India Ltd., Chennai	√
		M/s Incab Industries Limited.	√
		M/s Fort Gloster Industries Ltd.,	√
		Crystal Cycle Industries Ltd.	Furnish Credentia
18	Control Valve (Self Actuated Pressure Control For Oil Service)	M/s Samson Ag Mess- Und Regeltechnik, Germany	√
		M/s Nuovo Pignone, Italy.	√
		M/s Samson Controls Pvt Ltd., Thane	√
		M/s Dresser Valve India Pvt.Ltd., Mumbai	√
		~~M/s Mil Controls Limited., Secunderabad~~	X N.A.
		M/s FISHER SANMAR LIMITED,	√
19	Control Valves (Pneumatic Diaphragm)	M/s Fouress Engineers (India) , B A N G A L O R E	√
		M/s Forbes Marshall Arca Ltd., Pune	√
		M/s Dresser Valve India Pvt.Ltd., Mumbai	√
		~~M/s Mil Controls Limited., Secunderabad~~	X N.A.
		M/s Instrumentation Limited, Chennai	√
		M/s FISHER SANMAR LIMITED,	√
20	Cable Glands (Weather Proof And Explosion Proof)	M/s COMET BRASS PRODUCTS.,	√
		M/s FLAMEPROOF EQUIPMENTS PVT.LTD. , MUMBAI	√
		M/s CEAG FLAMEPROOF CONTROL GEARS , B O M B A Y	√
		M/s BALIGA LIGHTING EQUIPMENT PVT. LTD. , CHENNAI	√
21	Differential Pressure Indicator / Gauges	~~M/s VIRLEKAR PRECISION ENGG. PVT. LTD.,~~	X N.A.
		M/s Samson Controls Pvt Ltd., Thane	√
		M/s Switzer Instrument Ltd., Chennai	√
		M/s A.N.Instruments Pvt.Ltd., Madras.	√
22	Desuperheaters	M/s Instrumentation Ltd, Palghat	√
		M/s Fouress Engineers (India) , B A N G A L O R E	√
		M/s Chemtrols Engineering Ltd., M U M B A I	√
		M/s Forbes Marshall Arca Ltd., Pune	√
		M/s FISHER SANMAR LIMITED,	√
23	FLOW NOZZLES	M/s MICRO PRECISION PRODUCTS (P) LTD. , FARIDABAD	√
		M/s INSTRUMENTATION LTD, PALGHAT	√
		M/s BALIGA LIGHTING EQUIPMENT PVT. LTD. , CHENNAI	√
		M/s GENERAL INSTRUMENTS CONSORTIUM , CHENNAI	√
24	FLOW ORIFICES	M/s MICRO PRECISION PRODUCTS (P) LTD. , FARIDABAD	√
		M/s INSTRUMENTATION LTD, PALGHAT	√
		M/s BALIGA LIGHTING EQUIPMENT PVT. LTD. , CHENNAI	√
		M/s GENERAL INSTRUMENTS CONSORTIUM , CHENNAI	√
25	FLOW VENTURI	M/s MICRO PRECISION PRODUCTS (P) LTD. , FARIDABAD	√
		M/s INSTRUMENTATION LTD, PALGHAT	√
26	FLOW SWITCHES	M/s V.AUTOMAT&INSTRUMENTS PVT LTD, SECUNDERABAD.	√
		M/s SWITZER INSTRUMENT LTD., CHENNAI	√
		M/s LEVCON INSTRUMENTS(P) LTD , CALCUTTA	√
27	Flow Switches (For 110 Mw & Above)	M/s E-T-A ELEKTROTECHNISCHE ,	√
28	Hart Communicator Universal Type	M/s EMERSON PROCESS MANAGEMENT (I) PVT. LTD., SECUNDERABAD	√
29	JUNCTION BOXES (WEATHER PROOF)	~~M/s PANAM CONTROLS, SECUNDERABAD~~	X N.A.
		M/s FLAMEPROOF EQUIPMENTS PVT.LTD. , MUMBAI	√
		M/s CEAG FLAMEPROOF CONTROL GEARS , B O M B A Y	√
		M/s STERLING SWITCHGEARS , BOMBAY	√
		M/s BALIGA LIGHTING EQUIPMENT PVT. LTD. , CHENNAI	√

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30	JUNCTION BOXES (EXPLOSION PROOF)	M/s FLAMEPROOF EQUIPMENTS PVT.LTD. , MUMBAI	√
		M/s CEAG FLAMEPROOF CONTROL GEARS , B O M B AY	√
		M/s STERLING SWITCHGEARS , BOMBAY	√
		M/s BALIGA LIGHTING EQUIPMENT PVT. LTD. , CHENNAI	√
31	LEVEL GUAGES (MAGNETIC TYPE)	M/s V.AUTOMAT&INSTRUMENTS PVT LTD, SECUNDERABAD.	√
		M/s J.N.MARSHALL LTD,	√
32	Liquid Level Float Switch	M/s Magnetrol International Inc. ,	√
		M/s V.Automat&Instruments Pvt Ltd, Secunderabad.	√
		M/s Chemtrols Engineering Ltd., M U M B A I	√
		~~M/s PUNE TECHTROL PVT LTD~~	X N.A.
		M/s Levcon Instruments(P) Ltd , Calcutta	√
33	Liquid Level Gauges	M/s BLISS ANAND PVT. LTD.,	√
		M/s Technomatic (India) Private Limited, Mumbai	√
		~~M/s Protoline Instruments Pvt.Ltd., Bombay~~	X N.A.
		M/s Chemtrols Engineering Ltd., M U M B A I	√
		M/s Pune Techtrol Pvt Ltd	√
		~~M/s Asian Industrial Valves , Chennai~~	X N.A.
		M/s Levcon Instruments(P) Ltd , Calcutta	√
34	LEVEL SWITCHES (CAPACITANCE TYPE)	M/s ENDRESS & HAUSER GMBH + CO., GERMANY	√
		M/s SWITZER INSTRUMENT LTD., CHENNAI	√
		M/s LEVCON INSTRUMENTS(P) LTD , CALCUTTA	√
35	LEVEL TRANSMITTER (SMART) (CAPCITANCE TYPE)	M/s ENDRESS & HAUSER GMBH + CO., GERMANY	√
36	Level Transmitter (Electronic - Smart)	M/s V.Automat&Instruments Pvt Ltd, Secunderabad.	√
		M/s Chemtrols Engineering Ltd., M U M B A I	√
		M/s Dresser Valve India Pvt.Ltd., Mumbai	√
		M/s FISHER SANMAR LIMITED,	√
37	Pressure And Differential Pressure Switches ** Under Hold	M/s Indfos Industries Limited, Ghaziabad	√
		M/s Vasu Tech Limited., New Delhi - 110 065.	√
		M/s HIRLEKAR PRECISION ENGG. PVT. LTD.,	√
		M/s Switzer Instrument Ltd., Chennai	√
38	PRESSURE GAUGES	M/s FORBES MARSHALL (HYD) LIMITED, HYDERABA	√
		M/s H.GURU INSTRUMENTS(S.I)PVT.LTD , BANGALORE	√
		M/s Ascroft India Ltd.	Add Vendor
		M/s GENERAL INSTRUMENTS CONSORTIUM , CHENNAI	√
		M/s A.N.INSTRUMENTS PVT.LTD., MADRAS.	√
39	Pr. & Diff. Pr. Transmitters (Electronic - Smart)	M/s Emerson Process Management (I) Pvt. Ltd., Secunderabad	√
		M/s Abb Limited. , Hyderabad	√
		M/s Yokogawa India Limited., , Bangalore	√
		M/s Chemtrols Engineering Ltd., M U M B A I	√
		M/s Honeywell Automation India Limited , Pune	√
40	Pressure Reducing And Desuperheating Stations (Combined Prds)	M/s Schroedahl International B.V., Netherland	√
		M/s Gadelius Control ,	√
		M/s Chemtrols Engineering Ltd., M U M B A I	√
		M/s Forbes Marshall Arca Ltd., Pune	√
		~~M/s Bonnier Technology Group~~	X N.A.
		~~M/s FISHER SANMAR LIMITED,~~	X N.A.
		~~M/s Copes Vulcan Limited, U.K~~	X N.A.
		M/s Yarway Corporation, U.S.A.	√
41	PRESSURE GUAGE VALVES, INSTRUMENT VALVES, MANI FOLDS AND BAR STOCK VALVES, NEEDLE VALVE, GATE VALVES, BALL VALVES (FOR INSTRUMENT ERECTION MATERIAL)	M/s MICRO PRECISION PRODUCTS (P) LTD. , FARIDABAD	√
		M/s TECHNOMATIC (INDIA) PRIVATE LIMITED, MUMBAI	√
		M/s PRECISION ENGINEERING INDS., MUMBAI	√
		M/s EXCEL HYDRO-PNEUMATICS PVT.LTD , MUMBAI	X N.A.
42	Rotameters	M/s INSTRUMENTATION ENGINEERS , HYDERABAD.	√
		M/s TRANSDUCERS AND CONTROLS , HYDERABAD	√
		M/s J R U CONTTROL PVT LTD., CHENNAI	√
43	RESISTANCE TEMPERATURE DETECTORS (RTD & THERMOCOUPLES)	M/s PYRO ELECTRIC INSTRUMENTS GOA , GOA	√
		M/s DETRIV INSTRUMENTATION , B O M B A Y	√
		M/s GENERAL INSTRUMENTS CONSORTIUM , CHENNAI	√
44	SOLENOID VALVES (TRIP)	M/s IMI NORGREN-HERION FLUIDTRONIC , GERMANY	√

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45	SAFETY RELIEF VALVES (NOT COVERED IN BHEL (T) RANGE)	M/s INSTRUMENTATION LTD, PALGHAT	√
		M/s SEMPELL VALVES PVT.LIMITED .	√
		M/s TYCO SANMAR LIMITED.,	√
46	SAFETY RELIEF VALVES	M/s BHARAT HEAVY ELECTRICALS LTD., TIRUCHIRAPALLI	√
47	THERMOMETERS (BIMETALLIC)	M/s NUOVAFIMA SPA, ITALY	√
		M/s GENERAL INSTRUMENTS CONSORTIUM , CHENNAI	√
48	THERMOMETERS (GAS FILLED)	M/s NUOVAFIMA SPA, ITALY	√
		M/s FANTINELLI S.A.S ,	√
		M/s GENERAL INSTRUMENTS CONSORTIUM , CHENNAI	√
		M/s BUDENBERG GAUGE CO.LTD, U.K	√
		M/s DRESSER INDUSTRIES, U.S.A.	√
49	THERMOMETERS (MERCURY IN STEEL DIAL)	M/s FORBES MARSHALL (HYD) LIMITED, HYDERABA	√
		M/s H.GURU INSTRUMENTS(S.I)PVT.LTD , BANGALORE	√
		M/s GENERAL INSTRUMENTS CONSORTIUM , CHENNAI	√
		M/s A.N.INSTRUMENTS PVT.LTD., MADRAS.	√
50	Thermocouple Extension Cables And Signal Cables	M/s Universal Cables Ltd, , Hyderabad	√
		M/s THERMO CABLES LIMITED,	√
		M/s Radiant Cables Pvt. Ltd., Hyderabad	√
		M/s Kei Industries Limited,	√
		M/s Delton Cables Limited,	√
		M/s Elkay Telelinks Limited , Faridabad	√
		M/s Reliance Engineers Pvt.Ltd.,	√
		~~M/s Centemp Instrumentation P Ltd ,~~	X N.A.
		~~M/s Brooks Cable Works,~~	X N.A.
		~~M/s Associated Flexibles And ,~~	X N.A.
		~~M/s Goyalone Fibres (I)Pvt.Ltd.,~~	X N.A.
		~~M/s Toshniwal Cables , Jaipur~~	X N.A.
		M/s General Instruments Consortium , Chennai	√
51	THERMOWELLS	~~M/s VALUE TREK ENGINEERS, HYDERABAD.~~	X N.A.
		~~M/s CARLO DYNATECH INDUSTRIES, PATANCHERU~~	X N.A.
		M/s MICRO PRECISION PRODUCTS (P) LTD. , FARIDABAD	√
		M/s H.GURU INSTRUMENTS(S.I)PVT.LTD , BANGALORE	√
		~~M/s PRECISION ENGINEERING INDS., MUMBAI~~	X N.A.
		M/s GENERAL INSTRUMENTS CONSORTIUM , CHENNAI	√
52	Temperature Transmitter	M/s Emerson Process Management (I) Pvt. Ltd., Secunderabad	√
		M/s Abb Limited, , Hyderabad	√
		M/s Yokogawa India Limited., , Bangalore	√
		~~M/s Digital Electronics Ltd,~~	X N.A.
		M/s Honeywell Automation India Limited , Puna	√
		~~M/s Smar Singapore Ltd., Singapore~~	X N.A.
53	TURBO SUPERVISORY INSTRUMENTS FOR VIBRATION, ECCENTRICITY, AXIAL DISPLACEMENT, DIFF.EXPANSION, CASING EXPANSION AND SPEED ETC.	M/s SHINKAWA ELECTRIC CO LTD., JAPAN	√
		M/s ENTEK IRD INTERNATIONAL , MUMBAI	√
		M/s VIBROMETER,	√
		M/s BENTLY NEVADA LLC, U.S.A.	√
		~~M/s SCIENTIFIC ATLANTA,, U.S.A~~	X N.A.
		~~M/s SKF CONDITION MONITORING INC., U.S.A~~	X N.A.
IV	CONTROLS & INSTRUMENTATION (B)		
1	Ultra sonic Gas Flow Meter	M/s Toshniwal Brothers (Hyd) ,	√
		M/s Emerson Process Management (I) Pvt. Ltd., Secunderabad	√
		M/s Forbes Marshall (Hyd) Limited, Hyderaba	√
		M/s Endress & Hauser Gmbh + Co., Germany	√
		M/s Yokogawa India Limited ,	√
2	Walkie-Talkie Package	**Will be mutually finalised during detail engineering**	APGCL/DCPL to provide list of atleast four vendors for this package as this is new item for BHEL.
V	MECHANICAL (A)		
1	Gas Conditioning Skid	M/s Multitex Filteration Engineers Ltd., New Delhi	√
		M/s GRAND PRIX ENGINEERING PVT. LTD	√
		M/s Nirmal Industrial Controls Pvt. Ltd., , Bombay	√
		~~M/s A Plus Projects & Technology (P) Ltd , Pune~~	X N.A.
		~~M/s Gaso Energy Systems(I)Pvt Ltd,~~	X N.A.

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2	Atmospheric Storage Tank For Liquid Fuels And Dm Water Of Capacity 1000 Cu M And Above	~~M/s Ruksan Engineers Pvt.Ltd., Hyderabad~~	X N.A.
		M/s Technofab Engineering Limited ,	√
		M/s Vijay Tanks & Vessels Ltd. ,	√
		M/s India Tube Mills & Metal ,	√
		~~M/s G.R.Engg Works,~~	X N.A.
		M/s Bridge And Roof Co.(India)Ltd, Kolkata	√
3	HSD/NAPTHA CENTRIFUGE. NOTE: NOT APPLICABLE	M/s WESTFALIA SEPARATOR(I) P. LTD, NEW DELHI.	
		M/s ALFA-LAVAL (INDIA)LIMITED, PUNE	
4	FUEL OIL TREATMENT PLANT FOR HEAVY FUELS NOTE: NOT APPLICABLE	M/s WESTFALIA SEPARATOR(I) P. LTD, NEW DELHI.	
		M/s ALFA-LAVAL (INDIA)LIMITED, PUNE	
5	Fuel Oil Forwarding/Unloading Pumps As Per Api-610 (Centrifugal Pumps) NOTE: NOT APPLICABLE	M/s Ksb Pumps Limited, Secundersbad.	
		M/s Sulzer Pumps India Ltd.,	
		M/s Kirloskar Ebara Pumps Limited,	
		M/s FLOWSERVE INDIA CONTROLS PVT.LTD.(PUMP DIV)	
6	FUEL OIL FORWARING / UNLOADING PUMPS (SCREW PUMPS) NOTE: NOT APPLICABLE	M/s IMO INDUSTRIES GMBH,	
		M/s BORNEMANN (INDIA) LIMITED, FARIDABAD	
		M/s TUSHACO PUMPS PVT. LTD., MUMBAI	
7	Raw Water, CONDENSOR / AUXILLARY Cooling Water Pumps (Vertical)	~~M/s Grundfos Pumps India Pvt. Ltd., Hyderabad~~	X N.A.
		M/s Kirloskar Brothers Ltd, Secunderabad	√
		M/s Ksb Pumps Limited, Secunderabad.	√
		~~M/s Sulzer Pumps India Ltd.,~~	X N.A.
		M/s Jyothi Limited.,	√
		M/s M/S. Voltas Limited ,	√
		M/s Mather & Platt(India)Ltd. , Pune	√
		M/s Wpil Limited,	√
8	Raw Water, Condensor /Auxillary Cooling Water Pumps (Horizontal) NOTE: NOT APPLICABLE	M/s Grundfos Pumps India Pvt. Ltd., Hyderabad	
		M/s Kirloskar Brothers Ltd, Secunderabad	
		M/s Ksb Pumps Limited, Secunderabad.	
		M/s Sulzer Pumps India Ltd.,	
		M/s Jyothi Limited.,	
		M/s M/S. Voltas Limited ,	
		M/s Mather & Platt(India)Ltd. , Pune	
9	Horizontal Centrifugal Pumps, (Non Api) For Dm Water, Condensate, Service Water, PotaBle Water, Cooling Water Etc.	~~M/s Grundfos Pumps India Pvt. Ltd., Hyderabad~~	X N.A.
		M/s Kirloskar Brothers Ltd, Secunderabad	√
		M/s Ksb Pumps Limited, Secunderabad.	√
		M/s Sulzer Pumps India Ltd.,	√
		M/s Mather & Platt(India)Ltd. , Pune	√
10	Fuel Oil Forwarding Skids / Unloading Skid NOTE: NOT APPLICABLE	M/s Thermosystems Private Limited.,	
		M/s TECHNOSTRENGTH PVT. LTD.,	
		M/s Epe Process Filters & Accumulators Pvt. Ltd., , Hyderabad	
		M/s Multitex Filteration Engineers Ltd., New Delhi	
		M/s Southern Lubrication (P) Ltd; ,	
		M/s Techno Consultants,	
		M/s Enpro Industries Pvt. Ltd., Pune	
11	Horizontal Centrifugal Pumps (Api)- For Dm Water, Condensate, Srevice Water, Potable Water, Cooling Water Etc	M/s Ksb Pumps Limited, Secunderabad.	√
		M/s Sulzer Pumps India Ltd.,	√
		M/s Kirloskar Ebara Pumps Limited,	√
		M/s FLOWSERVE INDIA CONTROLS PVT.LTD.(PUMP DIV)	√
12	Fuel Oil Fine Filters NOTE: NOT APPLICABLE	M/s VIZAG FILTERS (P) LTD	
		M/s Epe Process Filters & Accumulators Pvt. Ltd., Secunderabad	
		M/s Bolt & Kirch Filterbau Gmbh.,	
		M/s Pall Pharmalab Filtration Pvt. Ltd., Mumbai	
		M/s Hilliard Corporation,	
13	Feed Water Pumps	M/s Ksb Pumps Limited, Secunderabad.	√
		M/s Sulzer Pumps India Ltd.,	√
		~~M/s Mather & Platt(India)Ltd. , Pune~~	X N.A.
		M/s Kirloskar Ebara Pumps Limited,	√
		M/s FLOWSERVE INDIA CONTROLS PVT.LTD.(PUMP DIV)	Furnish Credential
14	Lp Dosing System	~~M/s TECHNOSTRENGTH PVT. LTD.,~~	X N.A.
		M/s Techno Consultants,	√
		M/s Enpro Industries Pvt. Ltd., Pune	√
		~~M/s P S I Engineering Systems (P) Ltd~~	X N.A.
		M/s Miltonroy India Pvt. Ltd.,	√

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15	~~Reverse Osmosis System~~/ Dm Plant System Package	M/s Thermax Limited , Hyderabad	√
		~~M/s Dripex Water Engineering Limited.,~~	X N.A.
		M/s Doshion Limited.	√
		M/s Ion Exchange (I) Ltd,	√
		~~M/s M/S. Paramount Pollution ,~~	X N.A.
		M/s TRIVENI ENGINEERING & INDUSTRIES LTD.	√
		VA Tech Wabag	Add Vendor
16	Cooling Towers (Conventional)	M/s Hamon Shriram Cottrell Pvt.Ltd (Joint venture of Hamon Thermopack and Shriram EPC)	√
		M/s Paharpur Cooling Towers Ltd.,	√
		M/s Larsen & Toubro, Bombay	√
		M/s Gammon Cooling Towers Ltd.,	√
17	Package Type Cooling Towers	~~M/s SAI INDUSTRIAL TECHNO SERVICES~~	X N.A.
		M/s Himgiri Cooling Tower P. Ltd., Thane	√
		M/s Hamon Thermopack Engineers Pvt. Ltd.,	√
		~~M/s Mikir Engineers Pvt.Ltd.,~~	X N.A.
		M/s Shriram Epc Limited, , Chennai	√
		M/s Paharpur Cooling Towers Ltd.,	√
18	Chlorination Plant	~~M/s DOSHION LIMITED.~~	X N.A.
		M/s Capital Controls India Pvt.Ltd., Mumbai	√
		M/s Babubhai Narolamdas & Co.,	√
		~~M/s Ion Exchange (I) Ltd,~~	X N.A.
		~~M/s Thermax Limited., Pune~~	X N.A.
		M/s Iec Fabchem Limited,	√
		M/s Pennwalt	Add Vendor
19	D.G. SET	M/s TRADING ENGINEERS , NEW DELHI	√
		M/s POWERICA LIMITED,	√
		Rai Industrial Power P Ltd., ND	Add Vendor
		M/s Sudhir Gensat Ltd., Gurgaon	Add Vendor
20	Fire Protection, Fire Detection And Alaram System Package	~~M/s Gunnebo India Ltd.~~	X N.A.
		M/s New Fire Engineers(P) Ltd,	√
		M/s Kidde India Limited	√
		M/s Agnics Fire Protection Ltd., , Chennai	√
		M/s De S Technico Private Limited	Furnish Credential
21	Surge/Pressure Vessels	M/s Excel Industries, Hyderabad	√
		~~M/s Ruksan Engineers Pvt Ltd., Hyderabad~~	X N.A.
		M/s Indcon Projects & Equipment , ,	√
		M/s P S A Nitrogen Limited.,	√
		~~M/s Inox Air Products Limited.,~~	X N.A.
22	SUMP PUMPS	~~M/s GRUNDFOS PUMPS INDIA PVT. LTD., HYDERABAD~~	X N.A.
		M/s KSB PUMPS LIMITED, SECUNDERABAD.	√
		M/s MATHER & PLATT(INDIA)LTD. , PUNE	√
23	Naptha Coalescent Filter Skid NOTE: NOT APPLICABLE	M/s VIZAG FILTERS (P) LTD	
		M/s Pall Pharmalab Filtration Pvt. Ltd., Mumbai	
		M/s Fewcett Christie- , United Kingdom,	
		M/s Hillard Corporation,	
24	Air Conditioning System	M/s Voltas Limited,	√
		~~M/s Avalanche Air Conditioning ,~~	X N.A.
		M/s C.Doctor India Private Ltd.,	√
		M/s Patels Airtemp (India) Ltd., , Gandhinagar	√
		M/s Blue Star Limited,	√
		~~M/s Gemini Shreenwa (Engineers) P.Ltd., Chennai~~	X N.A.
25	Ventilation System	M/s Voltas Limited,	√
		M/s Hyderabad Pollution Controls , Hyderabad	Furnish Credential
		M/s C.Doctor India Private Ltd.,	√
		M/s Blue Star Limited,	√
		~~M/s Aerovent Projects Pvt.Ltd., Mumbai~~	X N.A.
		~~M/s Gemini Shreenwa (Engineers) P.Ltd., Chennai~~	X N.A.
26	E.O.T. Crane	~~M/s Shivpra Cranes Pvt. Ltd.,~~	X N.A.
		~~M/s Rock Well Hoists Cranes Pvt. Ltd., , New Delhi~~	X N.A.
		M/s Anupam Industries Limited,	√
		M/s Wmi Cranes Ltd.,	√
		M/s Mukand Limited, Bombay	√
		~~M/s Eddycranes Engineers Pvt. , Mumbai~~	X N.A.
		~~M/s Til Limited.,~~	X N.A.
		M/s Jessop & Co. Ltd.,	√
27	MAGNETIC FILTERS	M/s V.M. CORPORATION,	√
28	H.O.T. (Hand Operated Travelling) Cranes & Hoists	~~M/s Southern Plantside Pvt Limited ,~~	X N.A.
		M/s Rock Well Hoists Cranes Pvt. Ltd., , New Delhi	√
		M/s W.N.Brady & Co Ltd.,	√
		M/s Eddycranes Engineers Pvt. , Mumbai	√
		~~M/s Mm Engineers Pvt. Ltd.,~~	X N.A.
		M/s W. H. Brady & Co., Limited,	√

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29	Steam Turbine Drives	M/s ASEA BROWN BOVERI LTD., SWITZERLAND	√
		M/s DRESSER-RAND, U.S.A.	√
		M/s TUTHILL CORPORATION,	√
30	Vertical Submersible Pumps For Drain Tanks	~~M/s GRUNDFOS PUMPS INDIA PVT. LTD., HYDERABAD~~	X N.A.
		M/s KIRLOSKAR BROTHERS LTD, SECUNDERABAD	√
		M/s KSB PUMPS LIMITED, SECUNDERABAD.	√
		M/s SULZER PUMPS INDIA LTD.,	√
31	THERMAL INSULATION PACKAGE	M/s LLOYD INSULATIONS (INDIA) LTD:, HYDERABAD	√
		M/s MINWOOL ROCK FIBRES LTD., HYDERABAD.	√
32	BOREWELL PUMP NOTE: NOT APPLICABLE	M/s GRUNDFOS PUMPS INDIA PVT. LTD., HYDERABAD	
		M/s KSB PUMPS LIMITED, SECUNDERABAD.	
		M/s JYOTHI LIMITED.,	
33	Silencers	M/s Indira Industries,	√
		M/s Bharat Heavy Electricals Ltd., Tiruchirapalli	√
		M/s Acoustics India Pvt Ltd., Tiruchirapalli	√
		M/s P.R.Accoustical And Engg. Works (P) Ltd., Tiruchirapalli	√
34	Floor Gratings	M/s Perfect Engineering Works,	√
		M/s GE GODAVARI ENGINEERING LTD.,	√
		M/s Excel Industries, Hyderabad	√
		M/s Astro Engg. Pvt. Limited,	√
		M/s Indiana Engineering Works ,	√
		M/s Pms Grate Floorings Pvt.Ltd., Poona	√
35	ACCUMULATORS NOTE: NOT APPLICABLE	M/s EPE PROCESS FILTERS & ACCUMULATORS PVT. LTD., SECUNDERABAD	
		M/s HYDAC INDUSTRIESTRABE,	
		M/s PARKER HANNIFIN INDIA PVT.LTD. , MUMBAI	
		M/s FAWCETT CHRISTIE- , UNITED KINGDOM.	
36	Hitech Skids / Vanadium In Hibitor Dosing Skid NOTE: NOT APPLICABLE	M/s Epe Process Filters & Accumulators Pvt. Ltd., , Hyderabad	
		M/s Southern Lubricabon (P) Ltd:,	
		M/s Techno Consultants,	
		M/s Enpro Industries Pvt. Ltd., Pune	
		M/s MILTONROY INDIA PVT. LTD.,	
37	Flame Arrestors	M/s Process Instrument Industries, Delhi	√
		M/s Pramabergo Italiana S.P.A., ,	√
		M/s Nirmal Industrial Controls Pvt. Ltd., , Bombay	√
		M/s Protego Equipment Pvt Ltd., Mumbai	√
38	GASKETS	M/s SPENTA GASKETS & SEAL,	√
		M/s I G P ENGINEERS LIMITED, MADRAS	√
		M/s MADRAS INDUSTRIAL PRODUCTS, CHENNAI	√
		M/s PACKINGS & JOINTINGS GASKETS- , CHENNAI	√
		M/s SPIRASEAL GASKETS PVT.LTD., MADRAS	√
39	Flanges	M/s Golden Iron & Steel Wks. , New Delhi.	√
		M/s The Punjab Steel Works, New Delhi.	√
		M/s Echjay Industries Pvt Ltd , Rajkot	√
		M/s Chaudhry Hammer Works (P) Ltd. , Ghaziabad.	√
		M/s Kisaan Steels (Pvt) Ltd., Ghaziabad.	√
		M/s GHAZIABAD ISPAT UDYOG LTD.,	√
40	SPRING HANGERS	M/s SARATHI ENGINEERING ENTERPRISES PVT LTD., HYDERABAD	√
		M/s BHARAT HEAVY ELECTRICALS ,	√
		M/s PIPE SUPPORTS INDIA PVT LTD.,	√
		M/s SPRING SUPPORTS MANUFACTURING COMPANY , HOWRAH	√
41	FLEXI GLASS RINGS	M/s PRECISE ENGINEERING PLASTICS, HYDERABAD	√
		M/s PETER KUMPEL & SOHN, GERMANY	√
42	METTALIC BELLOWS	M/s THE ANUP ENGINEERING LTD ,	√
		M/s FLEXICAN BELLOWS&HOSES PVT.LTD , BARODA - 390 010.(INDIA)	√
		~~M/s METALLIC BELLOWS(I)PVT.LTD.,~~	X N.A.
		~~M/s LONESTAR INDUSTRIES,~~	X N.A.
		M/s FLUIDYNE ENGINEERS(I) LTD,	√
		M/s SUR INDUSTRIES PRIVATE LIMITED ,	√

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43	IA/PA SYSTEM (SCREW COMPRESSOR)	M/s ELGI EQUIPMENTS LIMITED,	√
		M/s ATLAS CAPCO (INDIA) LTD.,	√
		~~M/s INDCON PROJECTS & EQUIPMENT ,~~	X N.A.
		M/s P S A NITROGEN LIMITED.,	√
		M/s CONSOLIDATED PNEUMATIC ,	√
		~~M/s INOX AIR PRODUCTS LIMITED,~~	X N.A.
		M/s INGERSOLL-RAND (INDIA) LIMITED ,	√
45	NITROGEN PLANT	~~M/s GOYAL MG GASES LIMITED, HYDERABAD~~	X N.A.
		M/s CHICAGO PNEUMATIC SALES,	√
		~~M/s MVS ENGINEERING LTD.,~~	X N.A.
		~~M/s INDCON PROJECTS & EQUIPMENT ,~~	X N.A.
		M/s P S A NITROGEN LIMITED.,	√
		~~M/s INOX AIR PRODUCTS LIMITED,~~	X N.A.
		M/s INGERSOLL-RAND (INDIA) LIMITED ,	√
46	Drain Tank- For Hsd/Naptha/Ifo/Gas Condensate Drains	M/s Thermosystems Private Limted.,	√
		M/s Ge Godavari Engineering Ltd.,	√
		M/s Excel Industries, Hyderabad	√
		M/s Ruksan Engineers Pvt.Ltd., Hyderabad	√
47	Hp Dosing System	M/s Techno Consultants,	√
		M/s P S I ENGINEERING SYSTEMS (P) LTD	√
48	Rubber Expansion Joints	M/s Simplex Rubber Products ,	√
		M/s Cori Engineers Private Ltd.,	√
		M/s D.Wren Industries Pvt.Ltd.,	√
49	Atmospheric Storage Tank For Liquid Fuels And Dm Water Of Capacity 25 To 1000 Cu M	~~M/s Thermosystems Private Limited.,~~	X N.A.
		M/s Ruksan Engineers Pvt.Ltd., Hyderabad	√
		M/s Technofab Engineering Limited ,	√
		M/s Precision Tanks & Vessels,	√
		M/s Vijay Tanks & Vessels Ltd. ,	√
		M/s Bridge And Roof Co.(India)Ltd,	√
50	Effluent Treatment Plant (Etp)	M/s Driplex Water Engineering Limited,	√
		M/s Doshion Limited.	√
		~~M/s Richardson & Cruddas (1972) Ltd .,~~	X N.A.
		~~M/s Shriram Epe Limited , Chennai~~	X N.A.
		M/s TRIVENI ENGINEERING & INDUSTRIES LTD.	√
		Ion Exchange	Add Vendor
		Thermax	Add Vendor
51	Tanks (Ls, Hs, Hsd, Naphtha/Dm Condensate Water) Less Than 25 Cum NOTE: NOT APPLICABLE	M/s Thermosystems Private Limited.,	
		M/s Ge Godavari Engineering Ltd.,	
		M/s Excel Industries, Hyderabad	
		M/s Ruksan Engineers Pvt.Ltd., Hyderabad	
52	Steam Trap & Strainers	M/s Esco, Ahmedabad	√
		M/s MICON VALVES (I) PVT. LTD.	√
		M/s Spirax Marshall Limited,	√
		~~M/s Pennant Engineering Pvt Ltd.,~~	X N.A.
		M/s Greaves Limited,	√
53	Ball Valves (Cs,Ss)	M/s Larsen & Toubro Limited, Hyderabad.	√
		M/s Flow Chem Industries, Ahmedabad.	√
		~~M/s Akay Industries Pvt Ltd,~~	X N.A.
		~~M/s Micro Finish Valves Pvt.Ltd., Hubli~~	X N.A.
		M/s MICON VALVES (I) PVT. LTD.	√
		M/s Virgo Engineers Limited, Pune	√
		~~M/s Asian Industrial Valves , Chennai~~	X N.A.
		~~M/s Unitlow~~	X N.A.
54	Gas Detection System	M/s Detection Instruments (India) -	√
		M/s Chemtrols Industries Limited	√
55	PORTABLE POSITIVE MATERIAL IDENTIFICATION MACHINE (PMI), XRF TYPE NOTE: NOT APPLICABLE	M/s I.R. TECHNOLOGY SERVICES PVT. LTD.	
		M/s HINDITRON SERVICES PVT. LTD.	
56	Water/Pre-Treatment System (Raw Water/ Brakish Water/ River Water Systems) NOTE: NOT APPLICABLE	M/s Thermax Limited	
		M/s Doshion Limited.	
		M/s WIPRO LIMITED (WIPRO WATER)	
		M/s Ion Exchange (I) Ltd,	
		M/s Triveni Engineering & Industries Ltd.	
57	Chemical Dosing System (For Circulating Cw System)	M/s DOSHION LIMITED.	√
		M/s Thermax Limited.,	√
		M/s Iec Fabchem Limited.	√
58	Y- Type Strainer- (Open Loop & Circulating Cw Systems)	M/s MULTITEX FILTERATION ENGINEERS LTD.,	√
		~~M/s Skill Fabricators Pvt Ltd,~~	X N.A.
		M/s Spirax Marshall Limited,	√
		~~M/s Sungav Engineering Pvt Ltd.~~	X N.A.
59	Sewage Treatment Plant	M/s UEM INDIA LIMITED	√
		M/s Ion Exchange (I) Ltd,	√
		M/s Thermax Limited.,	√
		VA Tech Wabag	Add Vendor
		~~M/s Shriram Epe Limited,~~	X N.A.

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60	AIR COOLED CONDENSOR PACKAGE NOTE: NOT APPLICABLE	M/s GEI HAMON INDUSTRIES LTD.,	
61	AIR/NITROGEN COMPRESSOR(SCREW/RECIPROCATING)	M/s INGERSOLL RAND (INDIA) LTD.,	√
		M/s ELGI EQUIPMENTS LIMITED,	√
		M/s CHICAGO PNEUMATIC SALES,	√
		M/s ATLAS CAPCO (INDIA) LTD.,	√
62	PACKAGE AIR CONDITIONING/CENTRAL AIR CONDITIONING SYSTEM.	M/s BLUE STAR LTD.	√
		M/s VOLTAS LIMITED,	√
63	SPLIT/WINDOW AIR CONDITIONERS	M/s LG ELECTRONICS INDIA LTD.,	√
		M/s BLUE STAR LTD,	√
		M/s SAMSUNG INDIA ELECTRONICS LTD.,	√
		M/s VIDEOCON INTERNATIONAL LIMITED.	√
		M/s VOLTAS LIMITED,	√
64	VAPOUR ABSORBE MACHINE FOR AIR CONDITIONING SYSTEM.	M/s VOLTAS LIMITED.	√
		M/s THERMAX LIMITED.,	√
65	Ventilation Fan Unit	M/s Hyderabad Pollution Controls Ltd.,	√
		M/s C.Doctor India Private Ltd.,	√
		M/s Aerovent Projects Pvt.Ltd.,	√
66	PICK & CARRY MOBILE CRANE	M/s ESCORTS CONSTRUCTION EQUIPMENT	√
67	IA/PA SYSTEM PACKAGE (WITH RECIPROCATING TYPE COMPRESSOR)	~~M/s M/S ENGINEERING LTD.,~~	X N.A.
		M/s INDCON PROJECTS & EQUIPMENT -	√
		M/s P S A NITROGEN LIMITED.,	√
		M/s INGERSOLL-RAND (INDIA) LIMITED	√
68	Sluice Gate Valve	M/s Durga Engineering Company	√
		M/s JASH ENGINEERING (PVT)LIMITED.	√
		M/s BHARATMATA ENGINEERING WORKS	√
		M/s JUPITER ENGINEERING CO	√
69	Air Release Valve	M/s Durga Engineering Company	√
		M/s BHARATMATA ENGINEERING WORKS	√
		M/s JUPITER ENGINEERING CO	√
70	Compression Type Double Ferrule Tube Fittings, Needle Valves & Instruments Manifold	M/s Bangalore Fluid System -	√
		M/s HY-LOK CORPORATION	√
		M/s Parker Hannifin India Pvt.Ltd.	√
71	POWER PLANT PIPING-ENGINEERING SERVICES - 3D MODELLING	~~M/s AVINEON INDIA PVT LTD.~~	X N.A.
		~~M/s ANEWA ENGG. PVT. LTD.~~	X N.A.
		M/s SST INDIA PVT LTD.,	√
		M/s ROLTA INDIA LIMTIED,	√
72	Valves-Gate/Globe/Reg.Globe/Non-Return; Pr.Cl.:#150 & #300; Mat.Cs/As/Ss; Fl/Bw Ends-For Sizes-2" & Above & Sw Ends:#800 Class - For Sizes-1/2" To 1-1/2"	M/s Larsen & Toubro Limited, Hyderabad	√
		M/s Fouress Engineering (I)Pvt.Ltd, Hyderabad	√
		~~M/s Flostar Engineers Pvt. Ltd.,Ahmedabad~~	X N.A.
		M/s B.D.K.Engineering Inds.Limited, Hubli	√
		M/s NSSL LIMITED	√
		M/s Niton Valve Industries Ltd	√
		~~M/s Skil Fabricators Pvt.Ltd., Bombay~~	X N.A.
		~~M/s Fluidline Valves Co.Pvt.Ltd., Mumbai~~	X N.A.
		M/s K.S.B Pumps Ltd., Chennai	√
		M/s Bharat Heavy Electricals Ltd.,Tiruchirapalli	√
73	Valves-Gate/Globe/Reg.Globe/Non-Return; Pr.Cl.:#600; Mat.Cs/As/Ss;Fl/Bw Ends-For All Sizes-2" & Above	M/s Larsen & Toubro Limited, Hyderabad	√
		M/s Fouress Engineering (I)Pvt.Ltd, Hyderabad	√
		M/s B.D.K.Engineering Inds.Limited, Hubli	√
		M/s Nssl Limited	√
		M/s Niton Valve Industries Ltd	√
		~~M/s Skil Fabricators Pvt.Ltd.Bombay~~	X N.A.
		M/s FORBES MARSHALL LTD.,	√
		M/s K.S.B Pumps Ltd.,Channai	√
		~~M/s Tiagarh Steels Limited, Madras~~	X N.A.
		M/s Bharat Heavy Electricals Ltd.,Tiruchirapalli	√
74	Valves-Gate/Globe/Reg.Globe/Non-Return; Pr.Cl.:#900; Mat.Cs/As/Ss, Fl/Bw Ends-For All Sizes-2" & Above	M/s Larsen & Toubro Limited,Hyderabad	√
		M/s Fouress Engineering (I)Pvt.Ltd	√
		M/s B.D.K.Engineering Inds.Limited, Hubli	√
		M/s Nssl Limited	√
		M/s Niton Valve Industries Ltd	√
		M/s FORBES MARSHALL LTD.,	√
		M/s K.S.B Pumps Ltd.,Chennai	√
		~~M/s Tiagarh Steels Limited,Madras~~	X N.A.
		M/s Bharat Heavy Electricals Ltd.,Tiruchirapalli	√

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75	Valves-Gate/Globe/Reg.Globe/Non-Return; Pr.Cl.:#1500; Mat.Cs/As/Ss, Sw Ends-For Sizes1/2" To 1-1/2"; Fl Ends - For Sizes 2-1/2" & Above; Bw Ends For Sizes 2" And Above	M/s Larsen & Toubro Limited,Hyderabad	√
		M/s Fouress Engineering (I)Pvt.Ltd	√
		M/s B.D.K.Engineering Inds.Limited, Hubli	√
		M/s Nasl Limited	√
		M/s MICON VALVES (I) PVT. LTD.	√
		M/s Nilon Valve Industries Ltd	√
		M/s Forbes Marshall Ltd.,	√
		M/s K.S.B Pumps Ltd.,Chennai	√
		~~M/s Tilagarh Steels Limited,Madras~~	X N.A.
		M/s Bharat Heavy Electricals Ltd., Tiruchirapalli	√
76	Valves-Gate/Globe/Reg.Globe/Non-Return; Pr.Cl.:#2500:Mat.Cs/As/Ss;Sw Ends For Sizes 1/2" To 1-1/2"; Fl. Ends-For Sizes 2-1/2" & Above; Bw Ends; For Sizes 2" And Above	M/s Larsen & Toubro Limited,Hyderabad	√
		M/s Fouress Engineering (I)Pvt.Ltd	√
		M/s B.D.K.Engineering Inds.Limited, Hubli	√
		M/s Nasl Limited	√
		M/s MICON VALVES (I) PVT. LTD.	√
		M/s Nilon Valve Industries Ltd	√
		M/s Forbes Marshall Ltd.,	√
		M/s K.S.B Pumps Ltd.,Chennai	√
		~~M/s Tilagarh Steels Limited,Madras~~	X N.A.
		M/s Bharat Heavy Electricals Ltd.,Tiruchirapally	√
77	Valves-Gate/Globe/Reg.Globe/Platon Lift Non - Return; Pr.Cl.:#1500; Mat.Cs/As/Ss; Fl.Ends; For Sizes 1/2" To 2"	M/s Larsen & Toubro Limited, Hyderabad	√
		M/s Fouress Engineering (I)Pvt.Ltd	√
		M/s B.D.K.Engineering Inds.Limited, Hubli	√
		M/s Nasl Limited	√
		M/s MICON VALVES (I) PVT. LTD.	√
		M/s Nilon Valve Industries Ltd	√
		~~M/s Skill Fabricators Pvt.Ltd, Bombay~~	X N.A.
		M/s Forbes Marshall Ltd.,	√
		M/s K.S.B Pumps Ltd., Chennai	√
		~~M/s Tilagarh Steels Limited, Madras~~	X N.A.
78	Valves-Gate/Globe/Reg.Globe/Platon Lift Non-Return; Pr. Cl.#2500; Mat.Cs/As/Ss; Fl.Ends; For Sizes 1/2" To 2"	M/s Larsen & Toubro Limited, Hyderabad	√
		M/s Fouress Engineering (I)Pvt.Ltd	√
		M/s B.D.K.Engineering Inds.Limited, Hubli	√
		M/s Nasl Limited	√
		M/s MICON VALVES (I) PVT. LTD.	√
		M/s Nilon Valve Industries Ltd	√
		~~M/s Skill Fabricators Pvt.Ltd, Bombay~~	X N.A.
		M/s Forbes Marshall Ltd.,	√
		M/s K.S.B Pumps Ltd., Chennai	√
		~~M/s Tilagarh Steels Limited, Madras~~	X N.A.
79	Valves-Gate/Globe-Pr.Cl.:#300; Mat.Cs/As/Ss; Fl.Ends; For Sizes 1/2" To 2"	M/s Larsen & Toubro Limited, Hyderabad	√
		M/s Fouress Engineering (I)Pvt.Ltd., Hyderabad	√
		M/s B.D.K.Engineering Inds.Limited., Hubli	√
		M/s Nasl Limited	√
		M/s Nilon Valve Industries Ltd., Bombay	√
		~~M/s Skill Fabricators Pvt.Ltd, Bombay~~	X N.A.
		M/s FORBES MARSHALL LTD.,	√
		M/s K.S.B Pumps Ltd., Chennai	√
		~~M/s Tilagarh Steels Limited, Madras~~	X N.A.
80	Valves-Gate/Globe: Pr. Cl.:#600; Mat.Cs/As/Ss; Fl. Ends; For Sizes 1/2" To 2"	M/s Larsen & Toubro Limited, Hyderabad	√
		M/s Fouress Engineering (I)Pvt.Ltd., Hyderabad	√
		M/s B.D.K.Engineering Inds.Limited, Hubli	√
		M/s Nasl Limited	√
		M/s Nilon Valve Industries Ltd., Bombay	√
		~~M/s Skill Fabricators Pvt.Ltd, Bombay~~	X N.A.
		M/s FORBES MARSHALL LTD.,	√
		M/s K.S.B Pumps Ltd., Chennai	√
		~~M/s Tilagarh Steels Limited, Madras~~	X N.A.
81	Valve-Butterfly; ;S-#150-With Soft Seat- Flanged/Wafer Type-For All Sizes	M/s Larsen & Toubro Limited, Hyderabad	√
		~~M/s Instrumentation Ltd, Palghat~~	X N.A.
		M/s B.D.K.ENGINEERING INDS.LIMITED	√
		M/s Fouress Engineers (India), Bangalore	√
		~~M/s Skill Fabricators Pvt.Ltd, Bombay~~	X N.A.
		~~M/s Unique Valves Limited, Shindawadi~~	X N.A.
		~~M/s Inter Valve (India) Pvt.Ltd., Pune~~	X N.A.
		M/s Virgo Engineers Limited, Pune	√
		~~M/s Galaxy Controls Pvt.Ltd., Chennai~~	X N.A.
		~~M/s Xomax India Ltd., Madras~~	X N.A.

S.S.Kalkachary 26/06/09
(DGM)

VI	MECHANICAL (B)		
1	Gas Booster Compressor (Reciprocating)	Will be mutually finalised during detail engineering	
			APGCL/DCPL to furnish atleast 4 vendors for these items.
2	Plate Type Heat Exchanger		

Note:

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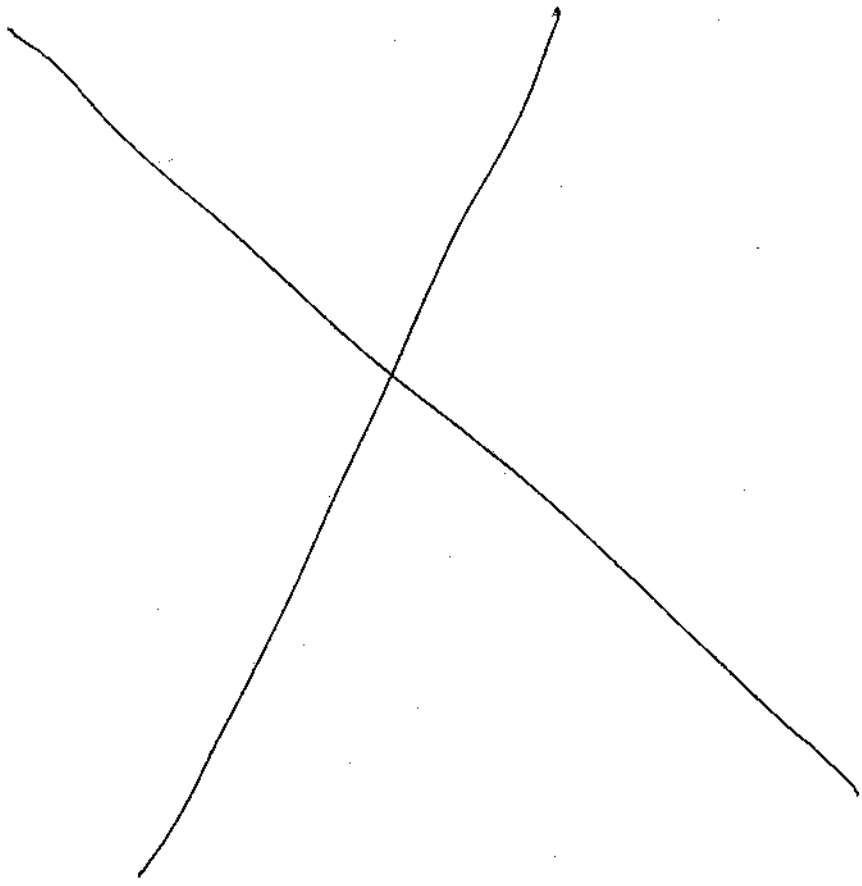
(DCPL)



PHOTOGRAPHS OF COMPONENTS AT PROJECT SITE

FILTER VESSELS

FILTER VESSELS

FEED TANKS AND LOOP TANKS

ALL 9 NO'S AVAIALABLE

BACKWASH PIPE - 3 SETS AVAILABLE

(450 / 400 PIPE REFER PIPING GA ATTACHED)

PRE-FABRICATED PIPE FROM FEED TANK TO LOOP TANK

(3 SETS AVAILABLE)

MISCELLANEOUS PIPES

COVER PLATES

DIAPHRAGM VALVES, FASTNERS AND MISCELLANEOUS COMPONENTS

INTERNALS OF FILTER VESSEL

CHECK LIST

S.No.	Description	Enclosed or [Yes/No]	Remarks / Comments By Bidder
1.	**Bidder to confirm compliance with Job Specification** and its annexures		
2.	Bidder has already raised pre-bid queries (if any) on Purchase specification.		
3.	**Bidder to Confirm Compliance with** scope, terminal points and exclusions for Mechanical/Electrical/C&I Sub-Sections of Purchase Specification.		
4.	Bidder Shall submit completely filled following Annexures enclosed with Technical Purchase Specification PY 51343, along with their offer **Annexure-I:** Key Information **Annexure-II:** Deviation from specification (Only those deviation indicated in this list will be considered during technical evaluation of offer. Bidder to indicate the deviations which are impractical.)		
5.	Bidder to comply compliance with list of sub-vendor list indicated in Specification.		
6.	Tentative Electrical Load List is enclosed with offer.		
7.	Bidder to Confirm Compliance with Typical QAP enclosed with purchase specification.		
8.	Bidder has filled-up and submitted Unpriced Price bid format along with technical offer.		

Note: Bidder to note that Check List shall be completely filled and the data required in-line with Check List shall be submitted along with their Offer to enable Purchaser to evaluate the offer submitted.