CLAUSE NO.	QUALITY ASSURANCE

CABLING, EARTHING & LIGHTNING PROTECTION

ATTRIBUTES / CHARACTERISTICS / ITEMS/COMPONENTS / SUB SYSTEMS	Dimension	Paint shade, paint thickness, adhesion	Pre-treatment of sheet	IP protection	Proof load*	Surface finish	Deflection test&	HV & IR	Galvanise Test (If Applicable)	Functional	Bought out items/Bills of material	Routine tests as per relevant standard & specification	Acceptance tests as per relevant standard & specification	Constructional feature as per NTPC
Wall Mounted-Lighting Panel (IS-513, IS:5, IS:2629, 2633, 6745)	Y Y	Y	Y	Y		Y		Y	Y	Y	Y	Y	Y	Y
Switch box/junction box/Receptacles Panel (IS-513, IS:5, IS:2629, 2633, 6745)	Y	Y	Y	Y		Y		Y	Y	Y	Y	Y	Y	Y
Cable glands(BS-6121)	Y											Y		
Cable lug(IS-8309)	Y											Y		
Lighting wire(IS-694)	Y											Y		
Flexible conduits	Y											Y		Y
Conduits(Galvanise & Epoxy) IS-9537 & IS-2629,2633 ,6745	Y		Y								Y	Y		Y
RCC Hume Pipe (IS-458)												Y		
Cable termination & straight through joint (VDE-0278)	Y											Y		Y
Cable Trays, Flexible supports system & accessories IS-513, 2629,2633,6745	Y		Y		Y	Y	Y	Y	Y	Y		Y	Y	Y
Trefoil clamp	Y													Y
GI flats for earthing & lightning protection (IS 2062, 2629, 6745,2633)	Y		Y						Y			Y		Y
GI wire (IS-280)	Y											Y		
Fire Sealing System (BS-476)												Y	Y	Y

Notes:

1. this is an indicative list of tests/checks. The manufacturer is to furnish a detailed Quality Plan indicating practice and procedure along with relevant supporting documents.
2. * Deflection Test on cable trays and Proof Load test on cable trays support system will be as per approved MQP. The above acceptance tests shall be done only on one sample from each size of offered lot.
3. Make of all items will be subject to NTPC approval.

STATION LIGHTING

Attributes/ Characteristics / Item/ Components / Sub System/ Assembly	Make, Type , Rating/ TC	Dimension	Pre-Treatment of sheet	Paint Shade Adhesion & Finish Thickness	Galvanise Test	IP Test	Boought Out Items/ Bill of Material	HV & IR	Functional Check as per spec.	Constructional Feature as per NTPC spec.	Routine & Acceptance Test as per relevant std and spec	Item to conform to relevant standard
Luminaries (IS-10322 Part-5 Sec.1)	Y					Y		Y			Y	
Electronic Ballast	Y											Y
Lighting Wire (IS-694)	Y											Y
Fans (IS-374)	Y											Y
Pole (IS-2713)	Y			Y						Y	Y	
Lamps (IS-9800, IS-9974)	Y											
Lighting Mast (IS-2629, 2633, 4759, 2062, 6745)	Y	Y			Y					Y	Y	
Wall Mounted Lighting Panel (IS-513, IS-5)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Switch Box/ Junction Box/Receptacles/ Local Push Button Station, Lighting Panel (IS-513, 2629, 2633, 4759, 6745)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	
Cable Gland (BS-612)	Y	Y										Y
Cable Lug (IS-8309)	Y	Y										Y
Flexible Conduit	Y											Y
Lighting Transformer (IS-1117)	Y									Y	Y	
Flood Light Mast										Y	Y	
Epoxy & Galvanised Conduit (IS-9537, 2629, 2633, 4759, 6745)	Y	Y									Y	

Notes:1.This is an indicative list of tests / checks. The manufacturer is to furnish a detailed Quality Plan indicating the practice and procedure along with relevant supporting documents.

2.Make of all major Bought Out Items will be subject to NTPC approval.

INSTRUMENTATION CABLES.

INSTRUMENTATION CABLE

TESTS / ITEMS	Visual, Surface finish (A)	Constructional detail, dimensions (A)	Outer-Sheathe/core marking, end	FRLS Test * (A)	Insulation Resistance (A)	High Voltage ®	Spark Test Report Review ®	Volume Resistively (A)	Conductor Resistance ®	Electrical Parameters ** (A)	Tensile Elongation before & after	Thermal Stability (A)	Overall/Coverage/Continuity (A)	Persulphate Test (A)	Flamability Test *** (A)
1. Instrument cable twisted and shielded															
Conductor(IS-8130)	Y	Y							Y						
Insulation(VDE-207)	Y	Y	Y				Y				Y	Y			
Pairing/Twisting	Y	Y	Y												
Shielding	Y	Y											Y		
Drain wire	Y	Y							Y				Y	Y	
Inner Sheath	Y	Y	Y	Y							Y	Y			
Outer Sheath	Y	Y	Y	Y							Y	Y			
Over all cable	Y	Y	Y		Y	Y		Y	Y	Y					Y
Cable Drums(IS-10418)	Y	Y													

Note : High Temp. cables shall be subjected to tests as per VDE-207(Part-6) Compensating cables shall be checked for Thermal EMF

Note : This is an indicative list of tests/checks. The manufacture is to furnish a detailed Quality Plan indicating his practice & Procedure along with relevant supporting documents during QP finalization for all item.

Note : R- Routine Test A - Acceptance Test Y - Test Applicable

- * FRLS Tests: Oxygen / Temp Index (ASTM D-2863), Smoke Density Rating (ASTM – D 2843), HCL Emission (IEC-754-1)
- ** Characterisitic Impedence, Attenuation, Mutual Capacitance, Cross Talk (As applicable)

*** Flammability Test : Vertical Flame Test (IEEE-383) , Swedish Chimney (SS-4241475)

BHEL	QUALITY PLAN		CUSTOMER NTPC			PROJECT NABINAGAR TPS			SPECIFICATION :			
						TITLE 4X250 MW			NUMBER : H2 PLANT			
			BIDDER/ VENDOR			QUALITY PLAN NUMBER PED-506-00-Q-006/0			SPECIFICATION TITLE ~~COMPRESSED AIR SYSTEM~~			
	SHEET 1 OF 2		SYSTEM			ITEM AC ELECT. MOTORS BELOW 75KW (LV)			SECTION			VOLUME III
SL NO	COMPONENT/OPERATION	CHARACTERISTICS CHECK	CAT.	TYPE/ METHOD OF CHECK	EXTENT OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORM	FORMAT OF RECORD	AGENCY P	AGENCY W	AGENCY V	REMARKS
1	2	3	4	5	6	7	8	9	10			11
1.0	PAINTING	1.SHADE	MA	VISUAL	SAMPLE	MANUFR'S SPEC/BHEL SPEC /RELEVANT STANDARD	BHEL SPEC. SAME AS COL.7	LOG BOOK	3	-	-	
2.0	ASSEMBLY	1.WORKMANSHIP	MA	VISUAL	100%	MANUF'S SPEC	MANUF'S SPEC	-DO-	3	-	-	
		2.DIMENSIONS	MA	-DO-	-DO-	MFG. DRG./ MFG. SPEC.	MFG. DRG./ MFG. SPEC.	-DO-	3	-	-	
		3.CORRECTNESS COMPLETENESS TERMINATIONS/ MARKING/COLOUR CODE	MA	VISUAL	100%	MFG.SPEC./ RELEVANT IS	MFG.SPEC. RELEVANT IS	-DO-	3	-	-	
3.0	TESTS	1.ROUTINE TEST INCLUDING SPECIAL TEST AS PER BHEL SPEC.	MA	-DO-	100%	IS-325/ BHEL SPEC./ DATA SHEET	SAME AS COL.7	TEST REPORT	3	2,1	2,1	NOTE -1
		2.OVERALL DIMENSIONS & ORIENTATION	MA	MEASUREMENT & VISUAL	100%	APPROVED DRG/DATA SHEET	APPROVED DRG/DATA SHEET & RELEVANT IS	INSPN. REPORT	2	1	-	

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

	QUALITY PLAN	CUSTOMEI NTPC	PROJECT TITLE NABINAGAR TPS 4X250 MW	SPECIFICATION NUMBER : H2 PLANT
		BIDDER/ VENDOR	QUALITY PLAN NUMBER PED-506-00-Q-006/0	SPECIFICATION TITLE : ~~COMPRESSED AIR SYSTEM~~
	SHEET 2 OF 2	SYSTEM	ITEM AC ELECT. MOTORS BELOW 75KW (LV)	SECTION VOLUME III

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

NOTES:

1. ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON
2. WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION, (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.
3. FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW , ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY.

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

SUB VENDOR LIST FOR HYDROGEN GENERATION PLANT	
Main Equipment	**Manufacturer/Sub-Vendor**
Hydrogen gas generator with purification system	Approved Main supplier own make
Power supply rectifier	Neeltran/Amtek/Rapid USA / Jasper/Hind
Hydrogen Compressor	PPI USA / PDC Machines INC. USA / Burton Corblin / Seybert & Rahier/Gardner Denver
PLC	OMRON, Japan / SAIA / Rock well / GE Fanuc / Seimens / Schneider/Allen Bradley, USA
Transmitters	Rosemount / Torex / Jumo / Yokogawa / Honeywell
Combustible Gas Detector	Sierra Monitor, USA / Zellweger
Trace oxygen Analyser / Hydrogen analyser	Advance Instruments USA, E&H, Yokogawa, H&B, Emerson/Edgetech
Hygrometer	GE Sensing / Miechel Instruments/VAISALA USA
Portable H2 purity Analyser	Teledyne, USA / Gesellshaft Fur Geratebau mbH
Piping Materials(SS)	Sandvik Steel Co.USA/ Ratnamani, Ahemdabad/ Remi Mumbai
Piping Materials(CS)	Maharashtra Seamless, Mumbai/Jindal, Mumbai
Tube / Pipe Fittings	SWAGELOK / PARKER USA
Feed Water Tank	Hydromax,USA/Sharpeville, USA

Annuciator/Control panel (refer note 4)	Internationally reputed make as per choice of Approvedmain supplier.
Solenoid valves	Asco,USA/ IMI Norgen Germany
Vacuum pump	Acmevac Sales Pvt. Ltd, Mumbai, India /NI Tech USA & S.Africa/Edwards Limited, UK/Gardner Denver Nash, China/Dicon, Mumbai Reputed
Hydrogen Dryer	Mellcon ENGS> PVT. LTD, New Delhi/Jindal Elect, Rourkee.
Cylinder test station	Indian compressors Limited, New Delhi, India/ Reputed
Hydrogen Filling Manifold	Misatu Weldquip Pvt. Ltd., Gujarat / Reputed
Nitrogen Manifold	Misatu Weldquip Pvt. Ltd., Gujarat / Reputed
N2 / H2 Cylinders	BPCL Allahabad India/ Everest Kanto Cylinder Ltd. India
Ventilation Equipment	khaitan / ABB / C.Doctr / Nadi,Chennai / Alsthom
Zenner Barrier	MTL / P+ F India / Reputed
Instrument Cable	Delton cables,Faridabad/paramountcables, Hhushkhera/ Reliance, banglore/Polycab, Daman/ Universal Cables, Satna/ Elkay Telelinks, New Delhi/ Cords, Bhiwadi.
415 V LT Switch gear	C&S, Noida/ Seimens LTD. Mumbai/Alstom LTD, Kolkatta/L&T Coimbatore or Munbai/ GE Indai, Banglore/ Schneider Electric India Pvt Ltd, Nasik.
Flame proof motors	KEC,_Hubli/CGL,_Ahmednagar/_Bharat_Bijli,_ Mumbai_

Compressor motors	CEMP, USA/ Lohar, Germany/ABB, Germany
LT Power Cables PVC Insulated	KEI, Bhiwadi/ Delton Cables, Faridabad/ Ravin Cables, Pune/ Cords Cables, Bhiwadi/ Polycab wires, Daman/ Radiant, Hyderabad/ UCL, Satana/ ICL, Rajpura/ HVPL, Faridabad/ Elkay Telelinks, Faridabad/ Finolex Cables, Pune/ Paramount, Alwar/ Torrent, Nadiad/ INCAB, Pune/ NICCO, Kolkata
LT Control Cables	ICL, Rajpura/ Paramount Cables, Alwar/ Radiant Cables, Hyderabad/ Polycab Wires, Daman/ UCL, Satana/Nicco, Kolkata/ FGI, Kolkata/ Torrent, Nadiad/ Cords Cable, Bhiwadi/ Elkay Telelinks, Hyderabad/ Delton Cables, Faridabad/ HVPL, Faridabad
Instrumentation cables, Special cables (Refer Note 1)	Kerpen cables, Germany/ Lapp Cables, Germany/ Thermo Electra B V, Netherlands/ Thermoelectric, USA
PVC FRLS	Reliance Engineers, Bangalore/ Polycab, Daman/ Nicco, Kolkata/ Paramount cables, Alwar/ Delton, Faridabad/ INCAB, Pune
Cable Trays & Access	Vatco, Mumbai/ Indian Perforators Unistar Galv., Kolkata/ Anand Udyog, Mumbai/ Indiana+Karamtara Galv., Mumbai/ Jamuna Metal, Delhi/ Dolphin (Fabrication by INAR), Ankapally, Stellite Engg, Mumbai/ Unitech Fabricators, Kolkata
Cable tray Flexible Support system	Stellite Engg., Mumbai/ Am Tech + BG Shirke galv., Pune/ Vatco, Mumbai/ Dolphin, Ankapally/Comet, Mumbai
Cable Glands	Sunil & Co., Kolkata/ QPIE, Kolkata/ Arup Engineering, Kolkata/ Commet, Mumbai
Lugs	Dowell, Mumbai/Chetna, Nasik
Luminaries & Lamps	CGL, Mumbai/ Philips, Kolkata/ Bajaj, Mumbai
Lighting Panel (Wall mounted)	Positronics, Baroda/ Pyrotech, Udaipur
Flame proof lighting fixtures, JB, PB	Baliga, Chennai/Ajmera, Mumbai/Flexpro, Navsari
Lighting wires as per IS 694	BIS approved source
Cooling water control Valve	Bellito Air Controls Inc., USA, Emerson France, WEIR valves, UK/ Dresser Mesonilan, France/ Copes Valcun

Pressure Transducer	Barksdale, USA/Camille Bauer, Switzerland/ Metrawatt, Germany
Valves Gate, Globe, Check (15 NB to 250 NB) (up to 2500 Class)	TOA Valves, Japan/ Deutsche Babcock, Germany/ Dresser, USA
Valves Gate, Globe, NRV (15 NB to 250 NB) (up to 800 Class)	Audco, Chennai/ BDK, Hubli
Check valves	NUPRO, USA
Level Transmitter (Displacer type)	Dresser Mesonelan, France/ Yamatake Honeywell/ Japan, ECKORDT, Germany/ Dresser, USA
Level Transmitter (Capacitance type)	Magnetrol, Belgium/ E&H, Germany
Pressure Gauges	Swagelok, USA/Alecandria WIKA, Germany/ Dresser Aschcroft, USA/ Budenburg, UK
Pressure switches, Temperature switch, DPS	NEODYN, USA/Delta, UK/ ITT Barton,USA/ KDG, UK/ Dresser,USA/ SOR, USA/Herion, Germany
Differential pressure Indicators	ITT Baron, USA/Budenburg, UK/ Switzer/ Dresser Asherroft,USA
Computers	DELL/COMPAQ/HP/LENOVO
Printers	HP/CANON/Xerox/SAMSUNG
Air Conditioner	Carrier/LG/HITACHI/BLUE STAR
Ventilation Fans	Marathon Electric/Khatan/ABB/Alstom/Bajaj

Notes:-

The sub vendor list enclosed is indicative only and is subjected to approval/acceptance by customer. Bidder to propose his sub vendor list with back up documents (credentials) etc. The same shall be subjected to BHEL and customer approval during detail engineering stage without any commercial & delivery implication to BHEL.

PAINTING REQUIREMENTS

CLAUSE NO.	TECHNICAL REQUIREMENTS
	indicator v) Rise/Lower push buttons for sroke position vi) Local LED based annunciation driven by BOP C&I part of DDCMIS (under Employer's scope) vii) Stroke position indicator on the panel. (d.) The normal mode of operation of dosing system shall be through BOP C&I part of DDCMIS (under Employer's scope). Local/Remote selection is to be done from Remote (CR) and indication for the same is to be provided on local panel. (e.) The ON/OFF commands for individual pumps from local push buttons shall act on the respective drives through BOP C&I part of DDCMIS (under Employer's scope).
~~15.02.00~~	The stroke position and adjustment will be done by 4-20 mA D.C. signal from BOP C&I part of DDCMIS (under Employer's scope) and the pumps stroke actuation should be suitable for accepting 4-20 mA D.C. signal. The pumps are to be provided with 24 V DC, two wire LVDT type position feed back transmitter which will generate 4-20 mA signal indicating stroke position
16.00.00	**SPECIFICATION FOR SURFACE PREPARATION & PAINTING**
16.01.00	Surface preparation methods and paint/primer materials shall be of the type specified herein. If the contractor desires to use any paint/primer materials other than that specified, specific approval shall be obtained by the contractor in writing from the employer for using the substitute material.
16.02.00	All paints shall be delivered to job site in manufacturers sealed containers. Each container shall be labelled by the manufacturer with the manuacturer's name, type of paint, batch number and colour.
16.03.00	Unless specified otherwise, paint shall not be applied to surfaces of insulation, surfaces of stainless steel/nickel/ copper/brass/ monel/ aluminum/ hastelloy/lead/ galvanized steel items, valve stem, pump rods, shafts, gauges, bearing and contact surfaces, lined or clad surfaces.
16.04.00	All pipelines shall be Colour coded for identification as per the NTPC Colour-coding scheme, which will be furnished to the contractor during detailed engineering..
16.05.00	**SURFACE PREPARATION**
16.05.01	All surfaces to be painted shall be thoroughly cleaned of oil, grease and other foreign matter. Surfaces shall be free of moisture and contamination from chemicals and solvents.
16.05.02	The following surface schemes are envisaged here. Depending upon requirement any one or a combination of these schemes may be used for surface preparation before application of primer. SP1 Solvent cleaning SP2 Application of rust converter (Ruskil or equivalent grade) SP3 Power tool cleaning

CLAUSE NO.	TECHNICAL REQUIREMENTS
	SP4 Shot blasting (shot blasting shall be used as surface preparation method for hot worked pipes prior to application of primer) SP4* Shot blast cleaning/ abrasive blast cleaning to SA21/2 (near white metal) 35-50 microns SP5 Phosphating SP6 Emery sheet cleaning/Manual wire brush cleaning.
16.06.00	**APPLICATION OF PRIMER/PAINT**
16.06.01	The paint/primer manuacturer's instructions covering thinning, mixing, method of application, handling and drying time shall be strictly followed and considered as part of this specification.The Dry film thickness (DFT) of primer/paint shall be as specified herein.
16.06.02	Surfaces prepared as per the surface preparation scheme indicated herein shall be applied with primer paint within 6 hours after preparation of surfaces.
16.06.03	Where primer coat has been applied in the shop, the primer coat shall be carefully examined, cleaned and spot primed with one coat of the primer before applying intermediate and finish coats. When the primer coat has not been applied in the shop, primer coat shall be applied by brushing, rolling or spraying on the same day as the surface is prepared. Primer coat shall be applied prior to intermediate and finish coats.
16.06.04	Steel surfaces that will be concealed by building walls shall be primed and finish painted before the floor is erected. Tops of structural steel members that will be covered by grating shall be primed and finish painted before the grating is permanently secured.
16.06.05	Following are the Primer/painting schemes envisaged herein: PS3 - Zinc Chrome Primer (Alkyd base) by brush/Spray to IS104. PS3* - Zinc Chrome primer (Alkyd base) by dip coat. PS4 - Synthetic Enamel (long oil alkyd) to IS2932. PS5 - Red oxide zinc phosphate to IS-12744. PS9 - Aluminum paint to IS 2339. PS9* - Heat resistant Aluminum paint to IS-13183 Gr.-I (for temperature above 400 °C) and to IS-13183 Gr.-II (for temperature 200 °C - 400 °C) PS13 - Rust preventive fluid by spray, dip or brush. PS14 - weldable primer-Deoxaluminate or equivalent.

CLAUSE NO.	TECHNICAL REQUIREMENTS
	PS16 - High Build Epoxy CDC mastic `15' . PS17 - Aliphatic Acrylic Polyurethane CDE134 ,%V=40.0(min.) PS18 - Epoxy based TiO2 pigmented coat PS19 - Epoxy based Zinc phosphate primer (92% zinc in dry film (min.), %VS=40.0(min.). PS20 - Epoxy based finish paint.
16.06.06	All weld edge preparation for site welding shall be applied with one coat of weldable primer.
16.06.07	For internal protection of pipes/tubes, VCI pellets shall be used at both ends after sponge testing and ends capped. VCI pellets shall not be used for SS components and composite assemblies.

16.07.00 Primer/Painting Schedule

Sl. No	Description		Surface Preparation	Primer Coat			Intermediate Coat			Finish Coats			Total Min. Painting DFT (Microns)	Colour Shade
				System	Coat	Min. DFT / coat (Microns)	System	Coat	Min. DFT/ Coat (Microns)	System	Coat	Min. DFT/ Coat (Microns)		
1.	All insulated Pipings, fittings/ components, Pipe clamps, Vessels/Tanks, Equipments etc.		SP3/SP4	PS 5	2	25	-	-	-	PS 4	1	25	75	As per NTPC Colour shade/ coding scheme
2.	All un-insulated Piping, fittings/ components, Pipe clamps, Vessels/Tanks, Equipments etc.	Design temperature <95 °C	SP3/SP4	PS 5	2	25	-	-	-	PS 4	3 $	35 $	155 $	
		Design temperature 95 °C-200 °C	SP3/SP4	PS 9	1	20				PS 9	1	20	40	
		Design temperature > 200 °C	SP3/SP4	PS9*	1	20	-	-	-	PS9*	1	20	40	
3	Constant Load Hanger (CLH), Variable Load Hanger (VLH) and other supports		SP4*	PS19	1	40	-	-	-	PS17	1	30	70	
4.	Valves													
	Cast	Design temperature <95 °C	SP1/SP2/SP3	PS4/PS9	1	40	Polyamid Epoxy	1	100	PS 17	1	40	180	
		Design temperature 95 °C-200 °C	SP1/SP2/SP3	PS9	1	20	-	-	-	PS9	1	20	40	

		Design temperature > 200 °C	SP1/SP2/SP3	PS9*	1	20				PS9*	1	20	40	
	Forged	Design temperature <95 °C	SP1 & SP5	PS13/ Phenolic fortified alkyd	1	40	Polyamid Epoxy	1	100	PS17	1	40	180	
		Design temperature 95 °C-200 °C	SP1 & SP5	PS9	1	20	-	-	-	PS9	1	20	40	
		Design temperature > 200 °C	SP1 & SP5	PS9*	1	20				PS9*	1	20	40	
5.	All Structural Steel components	Outside TG building and in SG envelope	SP4*	Inorganic Ethyl Zinc Silicate	1	75	PS18	1	75	a))Epoxy coat b)Final coat of paint PS17	2 1	35 30	250	
		Within TG building	SP4*	-do-	1	35	PS18	1	35	a))Epoxy coat b)Final coat of paint PS17	2 1	25 30	150	
6.	Weld Edges		SP6 (Hand cleaning by wire bushing)	PS13 (Weldable primer)	1	25	-	-	-	-	-	-	-	

$ The first 2 finished coats (total min.DFT of 70 microns) shall be done at shop and the 3rd finish coat (min.DFT 35 Microns) shall be applied at site.

DRAWING DOCUMENT DISTRIBUTION SCHEDULE

All documents & drawings shall be in English and in metric units and in Soft form in addition to Hard Copies of Documents listed below shall be submitted

S.No	DESCRIPTION	NTPC-EC	NTECL-SITE	BHEL SITE	OTHERS (BHEL)	PLM (BHEL)
1	Master list of drawings / documents (duly indicating schedule of submission)	2 Hard copies+soft copy	2 Hard copies+ soft copy	2 Hard copies	1 Hard copy+ soft copy	+3 hard copies
2	Drawings / documents for Approval (First Submission)	2 Hard copies+soft copy				+3 hard copies
3	Drawings / Documents for approval (second & subsequent submissions till approval)	2 Hard copies+soft copy				+3 hard copies
4	Approved (cat 1 or A) Drawings / documents for distribution	2 Hard copies + 1 set of CD-ROM	8 Hard copies + soft copy	2 Hard copies		+3 hard copies
5	As built Drawings / documents	1 Hard copy + 1 set of CD-ROM	10 Hard copies +2 sets of CD-ROM	2 Hard Copies		+3 hard copy
6	Type Test certificates/Reports	2 Hard copies + Soft copy	2 Hard copies+ soft copy			+2 hard copies
7	Erection Drawings / documents	1 set of CD ROM	8 Hard copies + 2 sets of CD ROM	3 Hard copies		+3 hard copies
8	FINAL Erection / Installation Manual for distribution	2 Hard copies +1 set of CD ROM	8 Hard copies + 2 sets of CD-ROM	3 Hard copies		+2 hard copies
9	APPROVED Operation & Maintenance Manual (for distribution)	3 Hard copies + 1 set of CD-ROM	10 Hard copies + 2 set of CD-ROM	3 Hard copies		+2 hard copies
10	Commissioning & performance procedure manual for approval (DRAFT) $$$	2 Hard copies	4 Hard copies			+2 hard copies
11	Comm. & procedure manual for distribution (FINAL) $$$	2 Hard copies + 1 set of CD-ROM	11 Hard copies + 2 set of CD-ROM	2 Hard copies		+2 hard copies
12	Performance & functional Guarantee Procedure for approval $$$	2 Hard copies	2 Hard copies			+2 hard copies
13	Performance & functional Guarantee test reports $$$	1 set of CD-ROM	6 Hard copies + 1 set of CD-ROM			+2 hard copies

NOTES:

1. The above schedule of submission does not include Docs / Drgs. of quality assurance / inspection and delivery/dispatches.
2. SSS - These Documents shall be submitted to NTPC – Operation Services Dept. for approval directly and an approved copy shall be submitted to NTPC - EC.
3. Any other document not listed above, but is required as per the contract, shall be submitted.
4. Date of submission of softcopy shall be taken as date of submission of document.

LIST OF DOCUMENT TO BE SUBMITTED AFTER LOI

SL. NO.	BHEL DRG NO	DRG TITLE	Document submission schedule
1	PE-V7-300-168-A001	P&I DIAGRAM FOR H2 GENERATION PLANT WITH I/O LIST	4
2	PE-V7-300-168-A002	EQUPMENT LAYOUT OF H2 GENERATION PLANT	4
3	PE-V7-300-168-A003	SUB VENDOR LIST HYDROGEN GENERATION PLANT	4
4	PE-V7-300-168-A004	EQUIPMENT FOUNDATION AND FLOOR DRAIN DETAILS OF H2 GENERATION PLANT	6
5	PE-V7-300-168-A005	DESIGN & CONTROL PHILOSOPHY OF H2 PLANT ALONG WITH INTERLOCK AND LOGIC DIAGRAM	6
6	PE-V7-300-168-A006	DATA SHEET, GA & CIRCUIT DIAGRAM OF RECTIFIER TRANSFORMER	6
7	PE-V7-300-168-A007	QAP FOR RECTIFIER	6
8	PE-V7-300-168-A008	GA OF H2 AND N2 GAS MANIFOLD, CYLINDERS AND CYLINDER TESTING APPARATUS	6
9	PE-V7-300-168-A009	GA OF FEED WATER, KOH TANK AND GAS HOLDER	6
10	PE-V7-300-168-A010	QAP FOR FEED WATER, KOH TANK AND GAS HOLDER	
11	PE-V7-300-168-A011	GA OF ELECTROLYSER AND PURIFICATION SKID	6
12	PE-V7-300-168-A012	QAP FOR ELECTROLYSER AND PURIFICATION SKID	6
13	PE-V7-300-168-A013	ELECTRICAL LOAD DATA	8
14	PE-V7-300-168-A014	DATA SHEET, SLD, GA & CIRCUIT DIAGRAM OF MCC AND MLDB	10
15	PE-V7-300-168-A015	QAP FOR MCC AND MLDB	10
16	PE-V7-300-168-A016	DATA SHEET AND GA FOR COMPRESSORS WITH MOTOR	10
17	PE-V7-300-168-A017	QAP FOR COMPRESSOR WITH MOTOR	10
18	PE-V7-300-168-A018	DATA SHEETS FOR INSTRUMENTS	10
19	PE-V7-300-168-A019	DATA SHEET FOR ANALYSERS	10
20	PE-V7-300-168-A020	DATA SHEET OF VALVE	10
21	PE-V7-300-168-A021	QAP FOR VALVES	10
22	PE-V7-300-168-A022	PIPING LAYOUT FOR HYDROGEN GEN PLANT	10
23	PE-V7-300-168-A023	QAP FOR HYDROGEN GEN PLANT (BALANCE OF ITEMS)	10
24	PE-V7-300-168-A024	DATA SHEETS FOR PUMPS WITH MOTOR	12
25	PE-V7-300-168-A025	QAP FOR PUMPS WITH MOTOR	12
26	PE-V7-300-168-A026	DATA SHEET, GA AND WIRING DETAILS FOR PLC PANEL, BOM, PLC CONFIGURATION DIAGRAM	12
27	PE-V7-300-168-A027	QAP FOR PLC	12
28	PE-V7-300-168-A028	CABLE TRENCH / TRAY LAYOUT FOR HYDROGEN GENERATION PLANT WITH DETAILS OF CABLE TRAYS AND ACCESSORIES	12

29	PE-V7-300-168-A029	Lighting Design/ Layout for Hydrogen Generation Plant along with protection system	12
30	PE-V7-300-168-A030	DATA SHEET, GA AND WIRING DIAGRAM OF BATTERY CHARGER	12
31	PE-V7-300-168-A031	ERECTION PROCEDURE	16
32	PE-V7-300-168-A032	CABLE SCHEDULE	16
33	PE-V7-300-168-A033	ENGINEERING BOQ	20
34	PE-V7-300-168-A034	PG Test report for Hydrogen generation Plant	20
35	PE-V7-300-168-A035	O&M MANUAL OF H2 GEN PLANT	24

Bidder to note that BHEL reserve the right for drawing/document submission through web based Document Management System (DMS). Bidder would be provided access to the DMS for drg/doc approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end.

- **Internet explorer version – Minimum Internet Explorer 7**
- **Internet speed – 2 mbps (Minimum preferred)**
- **Pop ups from our external DMS IP (124.124.36.198) should not be blocked**
- **Vendor's Internal proxy setting should not block DMS application's link (http://124.124.36.198/wrenchwebaccess/login.aspx)**

MANDATORY SPARES

CLAUSE NO.	LIST OF MANDATORY SPARES	
	~~ii) Shafts~~	~~1 No. of each type and size~~
	~~iii) Shaft Sleeve~~	~~1 Set of each type and size~~
	~~iv) Casing Wear ring~~	~~1 Set of each type and size~~
	~~v) Impeller Bearings~~	~~1 Set of each type and size~~
	~~vi) Motor Bearings~~	~~1 Set of each type and size~~
	~~vii) Thrust Bearings~~	~~1 Set of each type and size~~
	~~viii) Radial Bearings~~	~~1 Set of each type and size~~
	~~ix) Gland Packing~~	~~2 Sets of each type and size~~
	~~ix) Mechanical seal~~	~~1 set of each type and size~~
~~5.02.00~~	~~PLATE TYPE HEAT EXCHANGERS~~	
	~~i) Gaskets~~	~~10% of total requirement for each type and size~~
	~~ii) Plates~~	~~2% of total requirement~~ for ~~each type and size~~
6.00.00	SPARES FOR HYDROGEN GENERATION PLANT	
	1) **Water Electrolyser**	
	1 complete cell	: 1 Set
	2) All electronic Cards and power supply card for rectifiers	: 1 no of each type
	3) **Spares for Compressors**	
	b) Suction and discharge Valves (complete)	: 1 set for each stage / size / type.
	c) Seats of suction and Discharge Valves	: 1 set for each stage / size / type.

CLAUSE NO.	LIST OF MANDATORY SPARES		
	d) Springs of suction and Discharge Valves	:	1 set for each stage /size/type.
	e) Gaskets of suction and discharge valve	:	2 sets for each stage /size/type.
	f) Bearings of Drive end, non-drive end, intermediate and motor	:	1 set of each type /rating
	g) Piston rings (if applicable)	:	2 sets of each stage/ type
	h) Diaphragm (if applicable)	:	2 sets of each stage/ type
	i) Complete piston (if applicable)	:	1 set of each stage/type
	j) V-Belts / Coupling	:	1 set of each type
	k) Relief / Unloader assembly	:	1 no of each stage/type
	4) Feed water Valves	:	1 no of each type/size
	5) Filter element	:	2 sets of each type /rating
	6) Dryer desiccant	:	2 complete fill
	7) Blower		
	a) Diaphragm (if applicable)	:	2 nos.
	b) Belts	:	1 set
	8) Hydrogen manifold valves	:	4 nos. of each type/ Size
	9) Adsorption filter elements with gaskets /O rings	:	2 sets
	10) Complete set of valves for isolation for filters, dryers, instruments and drain valves	:	1 no of each type/rating
	11) Measuring device for dew point meter	:	1 no
	12) Special connection cable for dew point meter	:	30 meters
	13) Zenner barrier	:	2 nos. of each type/ rating
	14) Limit switches	:	5% of each type/rating or 1 no. whichever is more
	15) All electronic cards and power supplies	:	10% of main supply or 2 nos. whichever is more
	16) Annunciation indicating lamps	:	100% of main supply
	17) Oxygen analyser panel and Oxygen analyser sensor	:	1 no. of each type

CLAUSE NO.	LIST OF MANDATORY SPARES
	18) Pressure switches : 1 no. each type and rating 19) Pressure gauges : 1 no. each type and rating 20) Temperature gauge : 1 no. each type and rating 21) Flow indicators : 1 no. each type and rating 22) Differential pressure switches : 1 no. each type and rating **Note :** Wherever set is mentioned, one set of the spares of that item shall be for complete replacement of that particular item for one equipment.
~~6.01.00~~	~~**MANDATORY SPARES:LP PIPING**~~
	~~Valves~~ : ~~5% of the total population or minimum 1 no. of each type, material, size and class, which ever is higher.~~ ~~**Note :** Complete valve along with actuator and motor and all other accessories which are the part of original supply shall also be supplied.~~
~~7.00.00~~	~~**MANDATORY SPARES: PCP**~~
	~~1. Spare gaskets for all the gate valve for sizes 15 mm NB to 500 mm NB~~ ~~25% of each type, size & class for one unit or minimum 1 no of each type and size.~~ ~~2. Spare sets of gland packings of all the gate valves for all sizes~~ ~~- do-~~ ~~3. Spare gaskets for all the globe valves for sizes 15 mm NB to 500 mm NB~~ ~~- do-~~ ~~4. Spare sets of gland packings for all the Globe valves for all sizes.~~ ~~- do-~~ ~~5. Spare gaskets for NRV for all the valves~~ ~~- do-~~ ~~6. Spare set of Gaskets for safety relief valves, for all sizes~~ ~~- do-~~ ~~7. Complete gate valves assembly up to the size of 50 NB~~ ~~- do-~~

CLAUSE NO.	LIST OF MANDATORY SPARES
~~14.03.00~~ 7.00.00	**PLC / MICROPROCESSOR BASED CONTROL SYSTEM (To be provided for each plant with PLC based control system)**

1	Power Supply Unit	20 % or 2 nos. of each type and model, whichever is more.
2	Electronic modules like I/O, CPU communication, Interface	10 % of each type and model
3	Cooling fan in PLC system / cabinet	10 % or 2 nos., whichever is more.
4	Audible devices	1 no.
5	Graphical interface units	1 no. of each type
6	Prefab cables and system bus cables	1 no. of each type and length
7	Relays	10% of 10 nos. of each type and model, whichever is more
8	Batteries used for battery back up of RAMs	1 set
9	Fuses	200% of each type and rating

CLAUSE NO.	LIST OF MANDATORY SPARES	
	b) Motor	1 no.
	c) Float for level regulator (if applicable)	1 no.
	d) Filter elements	2 sets
	e) S.S. 3 way cock (if applicable)	1 no.
	f) All type of valves in stator water cooling system (details to be given)	1 set/ 1 no. of each size & type
	g) Ferro-dynamic indicator	1 set
	h) Level signalling device	1 set
	i) Specific resistance measuring	1 set
	j) Insulators for stator water header (if applicable)	1 set
	k) Pressure gauge (details to be given)	1 set /1 no. of each type and size
9.06.00	**Local panels for T.G**	
	a) Indicating instruments type	1 no. of each size
	b) Pressure and temperature switches	20% of the total population or minimum 2 nos.
10.00.00	**MANDATORY SPARES FOR LT SWITCHGEAR (AS APPLICABLE**	
	1) Complete pole of breaker	2 nos. of each type and rating
	2) Spring charging motors	6 nos. of each type and rating
	3) Aux. contact set	12 sets of each type and rating
	4) Limit switches	6 nos. of each type and rating
	5) Arc chutes	4 nos. of each type and rating
	6) Fixed contact set	6 sets of each type and rating
	7) Moving contact set	6 sets of each type and rating
	8) Arcing contact	6 sets of each type and rating
	9) Charging spring	4 nos. of each type and rating

CLAUSE NO.	LIST OF MANDATORY SPARES	
	10) Current transformer (metering)	3 nos. of each type and rating
	11) Current transformer (protection)	3 nos. of each type and rating
	12) Closing coil	12 nos. of each type and rating
	13) Trip coil	12 nos. of each type and rating
	14) CT for Bimetal O/L relays	6 nos. of each type and rating
	15) Voltage transformer	3 nos. of each type and rating
	16) Control supply transformer	2 nos. of each type and rating
	17) Ammeter	2 nos. of each type and rating
	18) Voltmeter	2 nos. of each type and rating
	19) Relays	6 nos. of each type and rating
	20) Power contactor	2 nos. of each type and rating
	21) Coil of above contactor	3 nos. of each type and rating
	22) Air break switches	5 nos. of each type and rating
	23) DP air break switches (DC)	2 nos. of each type and rating
	24) Control & selector switches	2 nos. of each type and rating
	25) Control fuses & neutral links	10% of each type and rating
	26) Indicating lamps	20% of each type and rating
	27) Bus bar support insulators(each type)	5 % of each type and rating
	28) Bus duct flexibles connectors	3 nos. of each type and rating
	29) Primary disconnect in MCC (Male/ female contact)	1 set of each type and rating
	30) Push buttons	10% of each type and rating
	31) Power fuses	10% of each type and rating
	32) Thermal bimetal relays	2 nos. of each type and rating
	33) Indication Lamp Holders complete	10% of each type and rating
	34) Maintenance tools and accessories for Maintenance (bidder to list)	2 sets of each type and rating

CLAUSE NO.	LIST OF MANDATORY SPARES
	35) Terminal blocks — 12 nos. of each type and rating 36) Busbar aluminium flat pieces — 12 meters of each size 37) Busbar angles/formed pieces for breaker — 2 nos. each type **NOTE :** a. Quantity mentioned in percentage (%) is the % of total installed. b. If percentage comes as fraction next higher integer should be considered for the purpose of quantity required.
11.00.00	**LIGHTING** 2 Nos. Lighting fixtures complete with lamp, accessories etc. of type used in Hazardous area suitable for Group II C as per IS 2418 or class-I, Division-II as per NEC 70-428, same as used for hydrogen generation plant shall be supplied as Mandatory spares.
12.00.00	**CONTROL AND INSTRUMENTATION** See General Notes.
12.01.00	**DISTRIBUTED DIGITAL CONTROL MONITORING AND INFORMATION SYSTEM (DDCMIS)** 1 Keyboards/mouse (a) Keyboard — 2 nos. of each type. (b) Mouse — 2 nos. of each type. 2 Printers and their parts (a) Color laser printer (A4) — 1 no. (b) Color laser printer (A3) — 1 no. (c) Blank CDs — 10 boxes. (d) Long Term Storage Drive unit — 1 no. 3 HMIPIS Devices (a) Work stations with licensed Software. — 3 nos.

GUARANTEED POWER CONSUMPTION

SL. NO.	MAJOR EQUIPMENTS NAME	TOTAL POWER CONSUMPTION (IN KW) TO OPERATE ONE STREAM (AT RATED CAPACITY) OF HYDROGEN GENERATION PLANT
1	ELECTROLYSER	
2	COMPRESSOR	

INFORMATION TO BE FURNISHED BY THE BIDDER ALONG WITH BID

DOCUMENTS TO BE FURNISHED ALONG WITH THE OFFER (4 SETS):-

1. Bidder to specify the deviations from the specification. If any, in the schedule of deviations enclosed as VOLUME-III SCHEDULE OF DEVIATIONS of technical specification. In the absence of duly filled in schedule, it will be presumed that the offer confirms to the specifications in all respects.
2. Electrical load data duly filled in. The format for electrical load is enclosed as annexure – 5, section C2 of technical specification.
3. Guaranteed power consumption duly filled in. The format for guaranteed power consumption is enclosed in section C1 of technical specification.
4. Bidder shall clearly bring out in the proposal the redundancy features along with configuration diagram and this shall be subjected to BHEL / Employer's approval during detailed engineering.
5. List of spares for:
    - Commissioning spares
    - Recommended spares
6. Guaranteed Performance Data

DATA SHEET OF HYDROGEN GENERATION PLANT

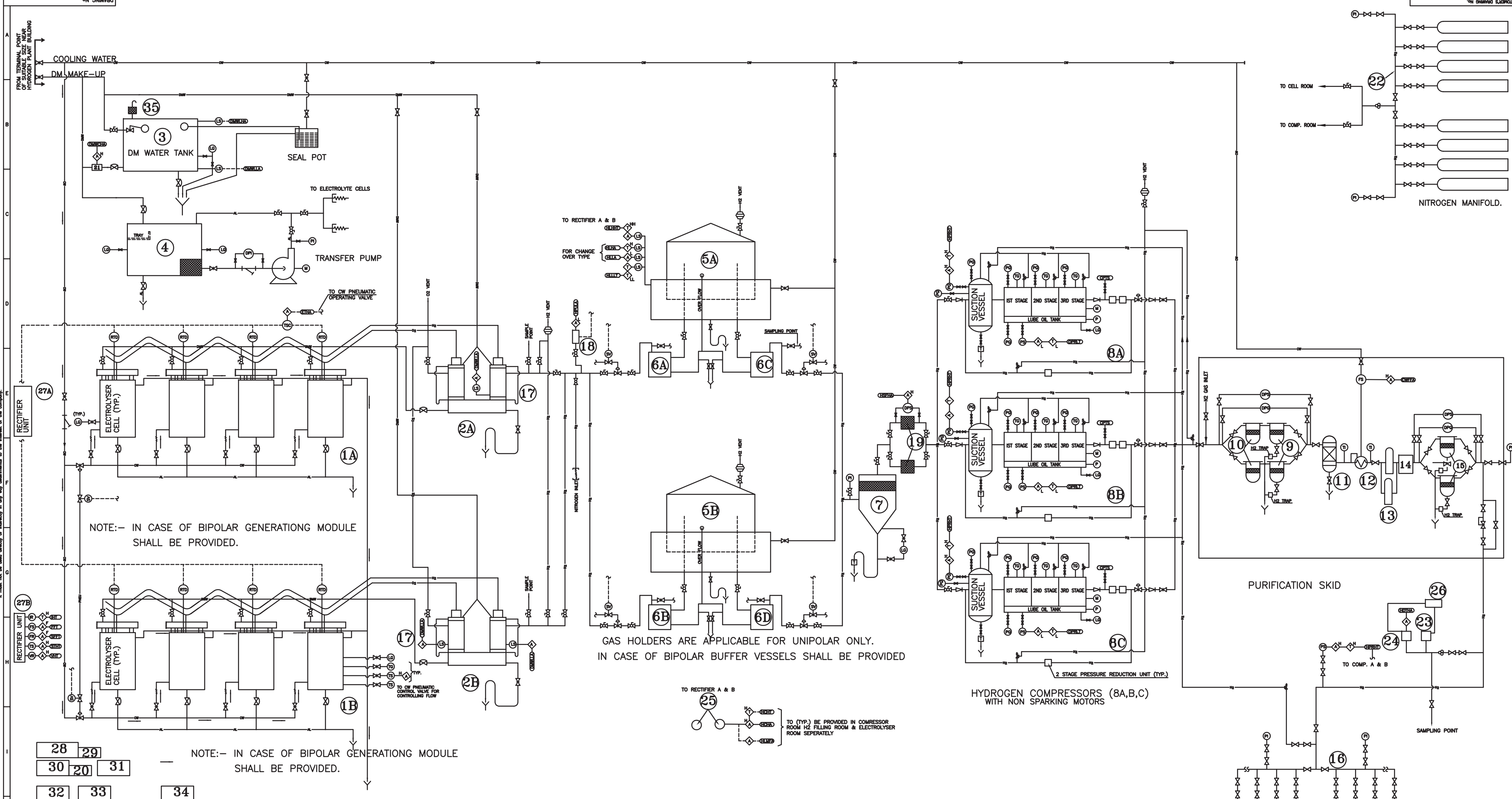
Clause No.	BIDDER'S NAME.....	
	HYDROGEN GENERATION PLANT	
1.00.00	**TYPE OF PLANT**	Unit Polor / Biplor Type
1.01.00	**GENERAL**	
1.02.00	Manufacturer	
1.03.00	**Guaranteed performance data**	
1.03.01	Hydrogen generation Plant Capacity (NM^3/hr)	.....
1.03.02	No. of Streams	.....
1.03.03	Capacity of each Stream	.....
1.03.04	Hydrogen Purity (%)	.....
1.03.05	Moisture content	.....
1.03.06	**Whether the Plant System & equipments are designed as per the rules of Explosives Authority of India?**	Yes/No
1.04.00	Whether the plant is designed for :	
	i) Continuous duty ?	Yes/No
	ii) Parallel operation of streams ?	Yes/No
	iii) Operation of electrolyser in part Load ?	Yes/No
	iv) Operation from the control panel ?	Yes/No
	v) Flexibility of isolating of any cell of electrolyser and operation for rest of the streams ?	Yes/No
	vi) Automatic operation of standby compressors?	Yes/No
	vii) Automatic change over of gas holders ?	Yes/No

Clause No.	BIDDER'S NAME.....	
1.05.00	Whether complete instrumentation and control system provided as specified	Yes/No
1.06.00	Whether complete ventilation system as provided for no. of plants as specified	Yes/No
2.00.00	**EQUIPMENTS**	
	A) Rectifiers	
	i) Make & Model No. of rectifier	.....
	ii) Type of rectifier	.....
	iii) Rating in (KW)	.....
	B) Electrolysers	
	i) Manufacturer	.....
	ii) Capacity of the electrolyser in (Nm^3/hr) (Rated)	.....
	iii) Pressure of hydrogen gas generated (Kg/cm^2 (g))	.....
	iv) Temperature of hydrogen gas generated	.....
	v) Consumption of electricity in KW/NM^3 of H_2	.....
	C) Gas holders of Hydrogen and Oxygen	**Hydrogen** **Oxygen**
	i) No. of gas holders offered	....
	ii) Capacity and size of each gas holder (m^3)	....

Clause No.	BIDDER'S NAME.....	
	D) De-oxy-unit and gas cooler	
	i) Manufacturer	.....
	ii) Type	.....
	iii) Capacity	.....
	E) Hydrogen Gas drier	
	i) Type	.....
	ii) Make	.....
	F) Compressors for Hydrogen	
	i) Manufacturer	.....
	ii) No. of compressor offered	.....
	iii) Type of compressor	.....
	iv) Delivery Pressure (Kg/cm^2 (g))	.....
	v) Capacity (Nm^3/hr)	.....
	vi) Speed (rpm)	.....
	vii) Type of drive	.....
	viii) No. of stages of compressor	.....
	G) Gas Filling Manifold	
	i) No. of Manifolds	.....
	ii) No. of filling points	.....
	H) High pressure cylinder testing apparatus	
	i) Manufacturer & Model No.	.....
	ii) Rating of electric motor (KW)	.....

Clause No.	BIDDER'S NAME.....	
3.00.00	A) Cooling Water Required for Hydrogen Generation Plant per stream (M^3/hr.)	.....
	B) Temperature rise (deg.C)	.....
4.00.00	DM water required for Hydrogen Generation Plant per stream (M^3/hr.) at its rated capacity	.....

P&ID FOR HYDROGEN GENERATION PLANT



NOTES

1. THIS P&ID IS TYPICAL FOR UNIPOLAR SYSTEM. P&ID CAN BE DIFFRENT FOR BIPOLAR SYSTEM.
2. ANY OTHER INSTRUMENT & DEVICES REQUIRED FOR EFFICIENT & SAFE OPERATION OF PLANT SHALL BE SUPPLIED.
3. NO. OF STAGES IN COMPRESSOR SHALL BE AS PER INLET/OUTLET PRESSURE REQUIREMENT AS PER MANUFACTURERS PRACTICE /PROCESS.
4. RELATIVE SEQUENCE OF GAS HOLDERS,PURIFIERS,COMPRESSORS TO SUIT MANUFACTURERS PROCESS DESIGN.
5. NO. OF ELECTROLYSER CELLS/MODULES PER STREAM TO SUIT MANUFACTURERS PROCESS DESIGN.
6. REQUIREMENT OF GAS WASHING TANK/MIST ELIMINATES/KNOCK OUT DRUMS ETC. SHALL BE AS PER MANUFACTURERS DESIGN.
7. IN BIPOLAR SYSTEM THE LOCATION OF PURIFICATION SKID SHALL BE BEFORE COMPRESSORS

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
		DMWLLA	DM WATER LOW LEVEL ALARM-II GAS WASHING TANK/DM WATER TANK	HPRLA	H2 PRESSURE LOW ALARM
		OPRLT	LUBE OIL PRESSURE TRIP-COMPRESSOR	CPTS	COMMON PRESSURE PUMP SWITCH-COMPRESSOR
	CONDENSATE TRAP	CWFFA	COOLING WATER FLOW FAILURE ALARM	DMWLHA	DM WATER LEVEL HIGH ALARM
	PUMP	HSFHA	H2 SUCTION FILTER DIFFERENTIAL HIGH ALARM	HPULA	H2 PURITY LOW ALARM-TRACE O2 ANLYSER
	MOTOR	TSC	TEMPERATURE SCANNER	HCHA	H2 CONCENTRATION HIGH ALARM
	DRAIN	SFFT	THYRISTOR FUSE FAIL TRIP (RECTIFIER)	ETHA	ELCTROLYSE TEMP. HIGH ALARM
	FLAME ARRESTOR	STHT	RECTIFIER SINK TEMP HIGH TRIP (RECTIFIER)	HLLA	H2 LEVEL LOW ALARM
	STRAINER	VHT	DC OVER VOLTAGE TRIP (RECTIFIER)	DMWCHA	DM WATER CONDUCTIVITY HIGH ALARM
	SOLINOID VALVE	IHT	DC OVER CURENT TRIP (RECTIFIER)	HTHA	H2 TEMP HIGH ALARM
	BACK PRESSURE VALVE	FS	FLOW SWITCH	HPRHT	H2 PRESSURE HIGH TRIP COMPRESSOR
	SAFETY VALVE	DPI	DIFFERENT PRESSURE INDICATOR	LS	LEVEL SWITCH/LIMIT SWITCH
	FLOAT VALVE	DPS	DIFFERENT PRESSURE SWITCH	LG	LEVEL GAUGE
	PNEUMATIC OPERATED VALVE	FFT	COOLING FAN FAIL TRIP (RECTIFIER)	TIS	TEMP INDICATOR SWITCH
	NON-RETURN VALVE	RTD	RESISTANCE TEMP DETECTOR	HLLLT	H2 LEVEL LOW LOW TRIP (COMPR.)
	NEEDLE VALVE	HLMFA	H2 LEAKAGE MONITOR FAULT ALARM	HLHHT	H2 LEVEL HIGH HIGH TRIP (RECTIFIER)
	DIAPHRAGM VALVE	PRS	PRESSURE REDUCING STATION	PS	PRESSURE SWITCH
	BALL VALVE	HCHT	H2 CONCENTRATION HIGH TRIP	PI	PRESSURE INDICATOR
	GLOBE VALVE	HDTHA	H2 DEW POINT TEMP HIGH ALARM	HLHA	H2 LEVEL HIGH ALARM
	GATE VALVE		ADJUSTABLE THROTTLE	TI	TEMP INDICATOR

LEGEND & MINOR INSTRUMENT LIST

S.NO.	DESCRIPTION	QTY.	S.NO.		QTY.
19	SUCTION FILTER	2			
18	% OXYGEN /TRACE O2 ANALYSER (L.P. SIDE)	1			
17	MANOMETER	8			
16	HYD. GAS MANIFOLD (2X4 CYL.)	1SET			
15	DUST FILTER	2	35	CO2 ABSORBER	1
14	DRIER (DUAL TOWER)	1	34	MCC	1
13	COALESCING FILTER	2	33	ORSAT ANALYSER	1
12	AFTER COOLER CUM SEPERATOR	1	32	PORTABLE SPECIFIC GRAVITY MEASURING INSTRUMENT	2
11	CATALYTIC TOWER	1	31	PORTABLE TRACE OXYGEN ANALYSER	1
10	OIL ABSORBER FILTER	2	30	H2 CYL. TESTING APPARTUS	1
9	PRE FILTER	2	29	ISI/ZENER BARRIER PANEL	1
8A,B,C	HYD. COMP. WITH NON SPARKING TYPE MOTORS	3	28	CONTROL PANEL	1
7	KNOCK OUT DRUM FOR HYD.	2	27A,B	RECTIFIER UNIT	2
6A,B	CONDENSATE VESSELS FOR HYD. (OUTLET)	2	26	MULTI PEN RECORDER	1
6A,B	CONDENSATE VESSELS FOR HYD. (INLET)	2	25	H2 LEAK DETECTION SYSTEM	LOT
5A,B	GAS HOLDER FOR HYD.	2	24	MOISTURE ANALYSER (DEW POINT METER)	1
4	ELECTROLYTE PREP. TANK & TRANSFER PUMP	1	23	TRACE OXYGEN ANALYSER (H.P. SIDE)	1
3	D.M. WATER TANK	1	22	N2 PURGING SYSTEM (2X4 CTL.)	1SET
2A,B	GAS WASHING TANK	2	21	D.M. WATER CONDUCTIVITY METER	1
1A,B	ELECTROLYSER CELLS	AS REQD	20	VACUUM PUMP	1

EQUIPMENT & INSTRUMENT LIST

SYMBOL	LEGEND
	ALKALI LINE
	OXYGEN LINE
	ELECTRICAL LINE
	COOLING WATER LINE
	NITROGEN LINE
	HYDROGEN LINE

JOB No. : 300
STATUS: CONTRACT
DISTRIBUTION
TO | No.OFF | REV | DATE | ALTD | CHD | APPD

OWNER: BHARTIYA RAIL BIJLEE COMPANY LTD
PROJECT: 4X250 MW, NABINAGAR THERMAL POWER PLANT

BHARAT HEAVY ELECTRICALS LTD
POWER SECTOR
PROJECT ENGINEERING MANAGEMENT
NEW DELHI

DEPT CODE: M | DRN: SP | DESN: SP | CHD: JP | APPD: SB

TITLE: **P&I DIAGRAM FOR HYDROGEN GENERATION PLANT**

DEPT. | SIGN | DATE | SCALE
DRAWING No. PE-DG-300-168A-A000
SHEET OF | REV-1
SIZE-A2