

Annexure - A

BHARAT HEAVY ELECTRICAL LIMITED, JHANSI



Specification No.	7201 Rev 01
Item No.	ME-1/712750
Location	BAY-9
Quantity	1

SPECIFICATION CUM COMPLIANCE CERTIFICATE OF VAPOUR PHASE DRYING PLANT

NOTE:-

1. VENDOR must submit complete information against clause no. 16.0 (Qualifying Condition). The offer meeting this clause would only be processed.
2. VENDOR to furnish the offer using this standard template of the specification. While furnishing the offer, no change is to be made in the first three columns (i.e. 'S.NO.', 'DESCRIPTION FOR BHEL REQUIREMENT' & 'ACTION BY VENDOR'). Only the 'Offered' column and where applicable, the 'Deviations' & 'Remarks' Column of this format shall be filled in by the VENDOR and submitted along with the offer. Wherever 'vender to specify' is mentioned in 'action by VENDOR' column, the VENDOR has to clearly provide the details. Inadequate / incomplete, ambiguous, or unsustainab information against any of the clauses of the specifications/requirements shall be treated as non-compliance.
3. The offer and all documents enclosed with offer should be in English language only.
4. Wherever 'VENDOR to specify' or 'suitable' is mentioned, suitable backup data or calculation or justification is required for establishing the suitability.
5. Circuit diagram of the system offered is to be enclosed with proper writeup.

NAME & ADDRESS OF THE SUPPLIER :

NAME & ADDRESS OF THE INDIAN AGENT :

TELEPHONE NOS.:

TELEPHONE NOS.:

FAX NOS.:

FAX NOS.:

E-MAIL ADDRESS:

E-MAIL ADDRESS :

SCOPE: DESIGN, SUPPLY, ERECTION & COMMISSIONING OF VAPOUR PHASE DRYING PLANT, COMPLYING WITH SPECIFICATIONS AS BELOW

S. NO.	DESCRIPTION FOR BHEL REQUIREMENT	ACTION BY VENDOR	OFFERED	DEVIATION / REMARK
1.0	PURPOSE & WORKPIECE MATERIAL:			
1.1	1 no. Vapour Phase Drying (VPD) Plant is required with the following specification for heating, vapour phase drying of transformer/s & coils or other active part in an autoclave by means of solvent vapour. The oil impregnation (oil filling in transformer tank) shall also be required in some of the cases inside the VPD plant itself.			
1.2	VPD plant: This plant is required for the heating of Complete Power Transformer/s (up to 315 MVA 220 KV Class), transformer coils, reactors etc in an autoclave with the built-in jet evaporator/Thin film evaporator and other accessories using advance vapour phase drying process sequence; i.e. setting up, Heating up phase with Intermediate Pressure Reduction Phases, Final Pressure Reduction Phase, Fihe Vacuum Phase, Oil filling (in transformer tank) Phase and Aeration. (The whole process shall be fully controlled automatically. The computer shall monitor the process and reports can be printed and backup automatically. However manual / semiautomatic control for individual system shall also be provided to run the plant in manual / semiautomatic mode). Maximum limit of temperature in the VPD Plant for heating medium: 180° C. The operating temperature shall be 135° C. This plant shall be used for vacuum drying & oil impregnation of Transformers (i.e. oil filling of the transformer tank) weighing up to 300 Tonnes. Job Heating in the VPD plant shall be under vacuum.	VENDOR TO NOTE & CONFIRM		
1.3	Note: 1. The VPD process is detailed in Annexure - 1. 2. Reference job of 160 MVA 220 KV Class for insulation weight reference is enclosed as Annexure 2.	VENDOR TO CONFIRM		
		VENDOR TO NOTE & CONFIRM		

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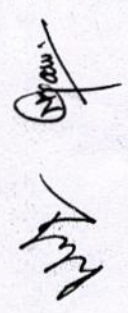
S. NO.	DESCRIPTION FOR BHEL REQUIREMENT	ACTION BY VENDOR	OFFERED	DEVIATION / REMARK
1.4	Optional Scope of supply: (optional price is requested for following item/s separately in price bid)	VENDOR TO NOTE AND SUBMIT		
1.4A.	BHEL intends to add the VACUUM DRYING PROCESS (VDP) feature beside vapour phase drying (VPD) in the offered plan. The VENDOR is requested to quote the system details, scope of supply and additional cost required to add the VDP feature in to offered plant. The decision of to add VDP feature shall be taken by BHEL after price bid opening during P.O. award stage. Note: The VDP process is detailed in Annexure - 3.	VENDOR TO NOTE, SUBMIT & CONFIRM		
1.4B.	BHEL may enter in to the AMC with the VENDOR of VPD plant after completion of warrantee (24 months). The VENDOR is required to quote for the AMC price, which shall remain valid for minimum 03 years after guarantee/warrantee period. The vendor will have to accept the AMC at the quoted price, whenever BHEL awards during the validity period.	VENDOR TO NOTE AND SUBMIT		
2.0	Scope of supply: Complete V.P.D Plant including all accessories/equipments required to operate the plant in totality as per specification below.	VENDOR TO CONFIRM		
2.1	SPECIFICATION:			
	EQUIPMENT . CONFIGURATION :- Vapour phase drying plant shall consist of an autoclave with the built-in jet evaporator/Thin film evaporator and other accessories . The jet evaporator/Thin film evaporator is heated and solvent is circulated via filter system to above evaporator . All sides of the autoclave are heated by heating manifolds located outside . A set of vacuum pumps is used to create vacuum inside the autoclave . The plant shall be equipped with computer aided process optimisation and modem network connection to operate & control the operation. The proven design of the evaporator should guarantee an optimal solvent vapour distribution in the autoclave. The process sequence for vapour phase drying shall be carried out as per BHEL specification (Annexure-1 enclosed) . The equipment shall consist of various components / sub assemblies as listed below.	VENDOR TO CONFIRM		
2.2	FRONT LOADER AUTOCLAVE :-			
2.2.1	The Autoclave shall be of front loading design and the job shall be loaded in autoclave by a rolling trolley. The autoclave shall be in welded construction of steel sheets and beams. All sides of autoclave shall be heated by heating manifolds located between stiffeners on the outside walls of autoclave. The bottom surface of autoclave shall have sufficient stiffeners suitable to take the load of transformer/s (Min. load being 300 tonnes) . The floor should be perfectly leveled without undulations to facilitate the smooth movement of loading trolley in VPD plant. Suitable provision shall be provided for measuring the temperature of autoclave during process . Measurement of temperature in autoclave at different location should be displayed on computer. The door shall be heated by the same medium which is being used for heating the autoclave . The autoclave is to be equipped with the following :-	VENDOR TO CONFIRM		
2.2.2	Clear Usable dimensions of the autoclave for job loading shall be as below - Useful dimensions: 10000mm (L) X 4500mm (W) X 5500mm (H) Vendor may note that the height 5500 mm given above shall be above trolley for accommodating job and additional clearance of 500 mm to be provided for accommodating bushings. The overall height to be designed accordingly.	VENDOR TO CONFIRM		
2.2.3	Loading Capacity of Job Trolley: 300 Tonnes (Min.)	VENDOR TO CONFIRM		
2.2.4	Heating Capacity of evaporator : Suitable capacity to be provided. (400 KW Min.)	VENDOR TO SPECIFY		
2.2.5	Testing Vacuum (partial): 0.05 mbar or better	VENDOR TO CONFIRM		
2.2.6	Working Vacuum (Continuous Duty) : 0.1 mbar or better	VENDOR TO CONFIRM		
2.2.7	Leakage Rate: Less than 5 mbar litr/sec.	VENDOR TO CONFIRM		
2.2.8	Operating Temperature: 135 (+/- 5) deg. Celsius for job; Max. Temperature: 180 deg Celsius for heating medium.	VENDOR TO CONFIRM		

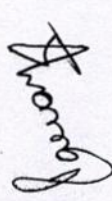
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SCOPE: DESIGN, SUPPLY, ERECTION & COMMISSIONING OF VAPOUR PHASE DRYING PLANT, COMPLYING WITH SPECIFICATIONS AS BELOW

S. NO.	DESCRIPTION FOR BHEL REQUIREMENT	ACTION BY VENDOR	OFFERED	DEVIATION / REMARK
2.2.9	The laterally movable door (in one piece) with suitable electrical drive, including limit switches. Door shall be provided in the front of the autoclave and must have guide rollers at top and bottom side of door.	VENDOR TO CONFIRM & SPECIFY OFFERED SYSTEM		
2.2.10	Hydraulic door pressing system with suitable power pack & hydraulic clamping cylinders. The door sealing material should be viton suitable for vacuum application upto 0.05mbar and capable of withstanding temperature more than 150 degC.	VENDOR TO CONFIRM AND SPECIFY OFFERED SYSTEM		
2.2.11	All the pipe connection to the autoclave shall be flange type bolted joint.	VENDOR TO CONFIRM		
2.2.12	All sides of the autoclave are heated by heating manifolds located between stiffeners on the outside walls of autoclave.	VENDOR TO CONFIRM		
2.2.13	The door is kept on temperature by direct heating through recirculation of thermic fluid. Flexible hose routed through drag chain for connection of door heating shall be provided.	VENDOR TO CONFIRM		
2.2.14	Autoclave shall have vacuum tight measuring lead through with minimum 8 Nos temperature sensors (04 Nos fixed type mounted on four walls for wall temperature measurement and 04 Nos with flexible leads for job temperature measurement. The temperature sensors shall be J-Type thermocouple with silver coated copper wire having heavy duty armoured temperature resistant cable. Average temperature to be displayed on SCADA main screen with all the thermocouple temperature readings on background screen as well as in meters mounted with electrical panel. One no. 8 point vacuum tight measuring lead through shall be provided on autoclave as spare.	VENDOR TO SPECIFY QUOTED ITEM & ATTACH CATALOGUE		
2.2.15	Autoclave shall be provided with a minimum 4 nos. of vacuum tight observation glasses at suitable heights (preferably at 4 feet height) and vacuum sealed LED lights for proper illumination to clearly observe the process inside the autoclave. All the lights should have a single switch on the door control panel/console located besides door.	VENDOR TO SPECIFY		
2.2.16	Ladder with proper safety cage for access to the top of autoclave shall be provided.	VENDOR TO CONFIRM		
2.2.17	A suitable operating electrical console near autoclave door shall be provided for safe operation of autoclave door.	VENDOR TO CONFIRM		
2.2.18	All the heating surfaces including autoclave walls, door, evaporator, separating vessel, steam lines, thermic fluid lines should be insulated and cladded properly so that skin temperature should not be more than 60 degC irrespective of ambient temperature..	VENDOR TO CONFIRM		
2.2.19	Autoclave drain with drain pump alongwith spare pump should be provided.	VENDOR TO SPECIFY		
2.2.20	A bypass line from autoclave drain line shall be provided to drain the spilled transformer oil during oil filling.	VENDOR TO SPECIFY		
2.2.21	Dry air with dew point of the order -40 degC with aeration mechanism for autoclave shall be provided. System should be capable to aerate the entire vessel within 30 minutes. Dry air storage tank of suitable capacity along with dry air plant shall also be provided.	VENDOR TO SPECIFY		
2.2.22	Level sensor with alarm indication shall be provided to indicate flooding inside autoclave.	VENDOR TO CONFIRM		
2.2.23	The bottom of the autoclave shall be designed & manufactured in such a way that all oil/solvent present should get travelled to discharge point and drained through solvent pump. Further mechanism with all required equipment & accessories shall be provided to flush out the traces of solvent & oil in autoclave at the end of the cycle such that the autoclave is completely dry even while processing oil soaked job and there are no fumes/smoke present in the environment after opening of the autoclave door.	VENDOR TO SPECIFY DETAILS OF QUOTED SYSTEM		



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S. NO.	DESCRIPTION FOR BHEL REQUIREMENT	ACTION BY VENDOR	OFFERED	DEVIATION / REMARK
2.2.24	Loading Trolley (Suitable for carrying 2 Nos. jobs at a time): The autoclave is loaded / unloaded by the loading trolley connected to a winch rope drive arrangement driven by electrical motor. Trolley stopper required inside at the end portion of autoclave. Loading trolley shall move on rail and suitable locking arrangement shall be provided in the end portion of trolley. The trolley and rail shall be in the scope of VENDOR (except civil work). Load carrying capacity of loading trolley should be 300 tons (Min.). Safety factor for design to be taken considering impact load during placement of job on trolley. The loading on the trolley can be one/two transformer of total 300 tons placed anywhere along the length/ width of the trolley. Hence the trolley as well as gauge distance has to be designed to distribute the concentrated load throughout the surface area of trolley. During the VPD processing, the entire load gets distributed to the floor through the loading trolley. Trolley to be designed so that it should be capable of withstanding autoclave inside and outside atmospheric conditions. Top surface of the trolley should of strong enough to avoid any localised deformation due to load. Supplier shall suitably design the foundation & the bottom floor considering the load & the temperature of operation. High temperature sealed SKF/FAGINTN make bearings should be used in trolley wheels. The physical dimension of the trolley should be such that it enters along the length of the vessel with a longitudinal clearance of minimum 200 mm and lateral clearance of minimum 100 mm either side from the most protruded wall fitting inside the vessel. In addition, height of trolley should be maximum 450 mm from floor level. Oil filling line should be located in a way to avoid any obstacle during job placement inside autoclave. Detailed drawing/ design of the trolley shall be submitted by the supplier for approval by BHEL before manufacturing.	VENDOR TO CONFIRM AND SPECIFY		
2.2.25	Hydraulically Operated Bridge Platform : Hydraulically operated metallic bridge to be provided at the entrance of the VPD plant to enable the entry of transformer/s on the loading trolley. Supplier shall suitably design the metallic bridge considering the load & the temperature of operation. The hydraulically operated metallic bridge shall enable the smooth joining of rail with ground floor. Details of bridge for VPD plant for easy entry/exit of loading trolley shall be submitted by the supplier at the time of approval of General Arrangement drawing. Make of hydraulic pumps, valves and accessories: Vickers/ Rexroth/Parker/Yuken only.	VENDOR TO CONFIRM		
2.2.26	Powerpack with interconnecting piping for door clamping/ de-clamping, Bridge lifting /lowering shall be provided with all accessories (Oil tank, hydraulic pump, relief valve, strainer, breather, check valve, accumulator, DCV, pressure switches and gauges etc.). All the hydraulic cylinders feed lines and return lines shall be provided with needle isolation valves. Powerpack shall have unloading feature.	VENDOR TO CONFIRM AND SPECIFY		
2.2.27	Provision for safety of autoclave in case of pressurization inside autoclave due to any malfunction shall be provided.	VENDOR TO CONFIRM AND SPECIFY		
2.2.28	NOTE:- Looking into the transportation difficulty of autoclave to BHEL site, the bidder may consider the possibility of fabrication of autoclave at BHEL site. All the equipment, crane, consumables & skilled manpower etc for the same shall be arranged by the VENDOR. All civil work will be carried out by BHEL.	VENDOR TO CONFIRM		
2.3	HEATING SYSTEM & TEMPERATURE REGULATION FOR AUTOCLAVE AND OTHER PARTS:-			
2.3.1	The primary source for heating shall be steam which shall be provided by BHEL at one point. The available steam typically shall have pressure ranging 5-8 kg/cm². The system shall be designed to achieve desired cycle time at minimum of the above specified steam pressure. However, alternate heating through electric heating with thyristorised control shall be provided. Both the heating source (steam and electrical) must be designed to work independently and also together in tandem and achieve the desired cycle time.	VENDOR TO CONFIRM		
2.3.2	In order to achieve the heating of autoclave and other parts of VPD, the preferred method of heat exchange shall be through thermic fluid. The heating plant shall be of stainless steel construction, having required insulation, accessories & safety/thermal interlocks and alarms.	VENDOR TO CONFIRM		
2.3.3	Suitable motorised pumping arrangement shall be provided to fill thermic fluid in storage tank from ground floor by the plant operator.	VENDOR TO CONFIRM		

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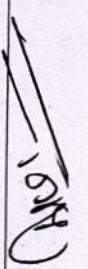
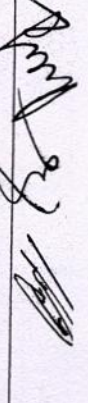
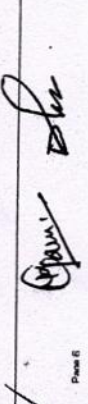
SCOPE: DESIGN, SUPPLY, ERECTION & COMMISSIONING OF VAPOUR PHASE DRYING PLANT, COMPLYING WITH SPECIFICATIONS AS BELOW

S. NO.	DESCRIPTION FOR BHEL REQUIREMENT	ACTION BY VENDOR	OFFERED	DEVIATION / REMARK
2.3.4	One main plus one standby thermic fluid transfer pumping system of suitable capacity shall be provided in the heating system for circulation of thermic fluid to autoclave, evaporator and other equipments requiring heating. In thermic fluid line essential systems like dry run protection, over temperature protection, over pressure protection systems etc shall be provided.	VENDOR TO CONFIRM		
2.3.5	Suitable expansion vessel cum deaerator of steel sheet welded and vacuum tight construction shall be provided with set of fittings in the heating system: if required as per design.	VENDOR TO CONFIRM AND SPECIFY		
2.3.6	Grade of thermic fluid being supplied by IOCL/HPCL/BPCL/Balmer lawrie to be indicated.	VENDOR TO SPECIFY		
2.3.7	Thermic fluid storage tank of suitable capacity with all safety interlocks and accessories shall be provided.	VENDOR TO CONFIRM		
2.3.8	Consumption of thermic fluid per process cycle and replacement cycle time with parameter/s to check healthiness of thermic fluid.	VENDOR TO SPECIFY		
2.3.9	STEAM HEATING OF THERMIC FLUID:	VENDOR TO CONFIRM		
2.3.9.1	Heat exchanger along with set of valves and accessories for steam heating of thermic fluid shall be provided by VENDOR. Steam supply and return line shall be provided with all accessories like Pressure reducing valve, Steam control valve, Condensate trap module, Pressure safety valve, Pressure gauge (Bourdon tube) before and after pressure reduction, steam isolation valves (Gate valve), Steam pressure measuring transmitter, Steam By-pass valve etc. and required IBR approval. Make of steam line accessories: Thermax/ Forbes Marshall/ UNI KLINGER only.	VENDOR TO CONFIRM		
2.3.10	ELECTRICAL HEATING OF THERMIC FLUID:			
2.3.10.1	The heaters shall be heavy duty, rugged finned tubular type. They shall be suitably placed in the Thermic fluid heating chamber with adequate protection. Suitable mechanism shall be built to evacuate heat generated by the heaters and distribute it evenly in thermic fluid. Safety thermostats are also to be provided to prevent heater failures.	VENDOR TO CONFIRM		
2.3.10.2	The heaters shall be evenly divided into minimum two circuits and controlled through two independent Thyristorised controllers.	VENDOR TO CONFIRM		
2.3.10.3	KW rating of heaters(KW): General arrangement drg. & heat load calculations, number of heater banks to be indicated in the technical offer. The heaters shall be of Escorts/ WATCO make Only.	VENDOR TO SPECIFY & SUBMIT CATALOGUE		
2.3.10.4	KW rating of Thyristorised Controllers (KW, Amps): The controllers shall be of Honeywell/Eurotherm make only.	VENDOR TO SPECIFY & SUBMIT CATALOGUE		
2.3.10.5	Temperature control of heaters shall be through PID controller through PLC / SCADA.	VENDOR TO CONFIRM		
2.3.10.6	Any statutory requirement w.r.t. heating system shall be in the scope of VENDOR.	VENDOR TO CONFIRM AND SPECIFY		
2.4	JET EVAPORATOR / THIN FILM EVAPORATOR-			
2.4.1	Heating Capacity: Min. 400 KW or Higher	VENDOR TO SPECIFY		
2.4.2	The evaporator shall be equipped with automatic control system and its parameters to be specified.	VENDOR TO CONFIRM & SPECIFY		
2.4.3	It should be designed to occupy minimum floor/wall space.	VENDOR TO CONFIRM		
2.4.4	All required safety controls & devices shall be provided with the evaporator.	VENDOR TO CONFIRM		
2.4.5	It should be automatically controlled with PLC / Computer aided process system to optimise the process.	VENDOR TO CONFIRM		

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SCOPE: DESIGN, SUPPLY, ERECTION & COMMISSIONING OF VAPOUR PHASE DRYING PLANT, COMPLYING WITH SPECIFICATIONS AS BELOW

S. NO.	DESCRIPTION FOR BHEL REQUIREMENT	ACTION BY VENDOR	OFFERED	DEVIATION / REMARK
2.4.6	Required quantity of heat conveyor solvent (Shellsol-H/ Topsol-H) to be indicated by VENDOR which shall be supplied by BHEL in line with BHEL specification.	VENDOR TO CONFIRM & SPECIFY		
2.4.7	Heating Circuit and temperature regulation for evaporator - The solvent should be circulated via filter system through evaporator. Suitable temperature control mechanism either through VFD or flow control valve shall be provided for evaporator. An optimal solvent distribution in the autoclave and thus homogenous heating up of the drying transformer and its parts etc. by condensation under the given temperature and pressure conditions should take place.	VENDOR TO CONFIRM AND SPECIFY		
2.4.8	Set of valves and accessories for solvent, vapour and vacuum piping shall be provided by VENDOR. Make of valves for vacuum & solvent line: Vass/L&TKlinger /Audco/VALPRES only.	VENDOR TO CONFIRM		
2.5	SOLVENT STORAGE TANK:			
2.5.1	The raw solvent storage tank in addition to process solvent collection/storage tank with all required accessories, made from steel with antirust coating for open air placement shall be provided for storage of solvent. It shall have following features	VENDOR TO CONFIRM		
2.5.2	Usable capacity of tank (Min. 10 KL)	VENDOR TO SPECIFY		
2.5.3	Continuous Level transmitter for display of solvent level in SCADA	VENDOR TO CONFIRM		
2.5.4	Portable pump of suitable capacity with flexible line and an isolation valve for solvent storage tank filling shall be provided.	VENDOR TO SPECIFY		
2.5.5	Suitable capacity solvent pumping system with stand by pump for fresh solvent supply in process from solvent storage tank shall be provided.	VENDOR TO SPECIFY		
2.6	SOLVENT FEEDING SYSTEM:			
2.6.1	Solvent feed pump(Canned Motor), complete with dry run protection, pressure switch and temperature sensor. One main plus one spare pump shall be provided. Make: Rutschil/ Teikoku-Japan/ SIHI Germany only.	VENDOR TO CONFIRM		
2.6.2	Solvent fine filter - For filtration of the solvent being fed to the eveporator, the filter of 10' microns shall be equipped with disposable filter cartridge and magnetic core of suitable capacity. The filters shall be of CUNO/ Eaton make only.	VENDOR TO CONFIRM		
2.6.3	Filter by-pass arrangement with automatic switch over: When large amount of impurities are washed out during process, it is required to have a parallel fine filter. When certain degree of fine filter is contaminated, the system switches automatically to the parallel filter with a switch over alarm generation. This will facilitate change of clogged filter insert without interrupting the drying process.	VENDOR TO CONFIRM		
2.6.4	Solvent Flow meter - Ultrasonic/differential pressure/positive displacement type for heating capacity calibration of the plant .	VENDOR TO CONFIRM		
2.6.5	Coarse Filter - For filtration of the solvent before entering in solvent feeding pump.	VENDOR TO CONFIRM		
2.6.6	In order to reduce the heating and cooling energy requirement, a heat recuperator to be installed.	VENDOR TO CONFIRM		
2.7	CONDENSATE COLLECTION AND SEPERATING VESSEL:			
2.7.1	Condensation & Separation System with inter connecting piping should comprise of separating vessel of stainless steel, continuous level indicator, sight glass, water drain with alarm system, solvent drain system etc shall be provided. Separate drainage lines & pumps shall be provided for handling solvent and water.	VENDOR TO CONFIRM		
2.7.2	Electronic water measuring system for condensate collecting tank - With this feature the amount of water extracted in Heating up phase including each IPR (Intermediate Pressure Reduction) is measured accurately and further process steps are planned for better drying results in shorter time.	VENDOR TO CONFIRM		


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S. NO.	DESCRIPTION FOR BHEL REQUIREMENT	ACTION BY VENDOR	OFFERED	DEVIATION / REMARK
2.7.3	Total Capacity of Separating tank (Min. 5 KL) -	VENDOR TO SPECIFY		
2.8	AUTOCLOAVE SOLVENT COLLECTION (as per requirement of evaporator):			
2.8.1	It shall be of suitable capacity, in welded construction made of stainless steel, vacuum tight with all required accessories.	VENDOR TO SPECIFY		
2.8.2	Total Capacity of solvent collection system (Min 5 KL)	VENDOR TO SPECIFY		
2.8.3	Coarse Filter with standby provision & clogging indicator- For filtration of the solvent returning from autoclave to solvent collection.	VENDOR TO SPECIFY		
2.9	DISTILLATION SYSTEM:			
2.9.1	The distillation system shall be provided to recover the solvent from oil mixed liquid drained from the autoclave. It shall work in simultaneously during the Vapour Phase drying process.	VENDOR TO CONFIRM AND SPECIFY SYSTEM OFFERED		
2.10	WASTE OIL TANK:			
2.10.1	It shall be in welded construction made of stainless steel and equipped with all required accessories eg. pump, pressure transmitter and discharge valve etc.	VENDOR TO CONFIRM AND SPECIFY		
2.10.2	Usable capacity (Min 8 KL)	VENDOR TO SPECIFY		
2.10.3	One main plus one standby Waste oil pump shall be provided for redundancy.	VENDOR TO CONFIRM		
2.10.4	Pumps shall be suitable to withstand minimum 120 degC of oil temperature. Suitable cooling system (heat exchanger) shall be provided to cool the oil being pumped and pipeline shall be suitably insulated between pump & heat exchanger.	VENDOR TO CONFIRM		
2.11	WASTE WATER TANK:			
2.11.1	It shall be in welded construction made of steel with corrosion resistant coating both inside and outside and equipped with all required accessories eg. pump, pressure transmitter and discharge valve etc.	VENDOR TO SPECIFY		
2.11.2	Usable capacity of tank (Min 3 KL) -	VENDOR TO SPECIFY		
2.11.3	One main plus one standby waste water pump shall be provided for redundancy.	VENDOR TO CONFIRM		
2.12	VACUUM PUMPING SYSTEM FOR AUTOCLOAVE :-			
2.12.1	The Vacuum pumping system for evacuation of AUTOCLOAVE shall preferably consist of Rotary - Roots - Roots combination of vacuum pumps in order to achieve desired parameters indicated in 2.2.5, 2.2.6 & 2.12.4. The three stage pumping should preferably comprise of 3 nos. Rotary Vane Pump, 1 no. Intermediate Booster Pump and 2 nos. Main Booster Pump. The pumps shall be sandwiched with Main, Intermediate and Exhaust Condenser of suitable capacity.	VENDOR TO CONFIRM & SPECIFY		
2.12.2	Main Vacuum Pump Complete with gas ballast, temperature sensor, oil level switch and motor in suitable nos.	VENDOR TO CONFIRM & SPECIFY		
2.12.2.1	Suction capacity of main/ base pump (Rotary vane pump) - 1500 m3/hr (Min.) or higher (suitable to achieve required parameters).	VENDOR TO SPECIFY		
2.12.2.1	Make of pump :- Pfeiffer/ Leybold/Shinko Seiki only (suitable for VPD, Preferably Pfeiffer BA 501). Vacuum Pumps should be compatible for operation with VM-4 vacuum pump oil.	VENDOR TO CONFIRM & SPECIFY		
2.12.3	Booster Pumps (Intermediate and Main Booster Pumps) - Complete with temperature sensor & flanged motor with pump isolation EP Valves for independent operation of booster pumps in suitable nos.	VENDOR TO CONFIRM & SPECIFY		
2.12.3.1	Suction capacity of Booster pumps - 12000 m3/hr (Min.) @ 50 Hz or higher (suitable to achieve required parameters).	VENDOR TO SPECIFY		

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S. NO.	DESCRIPTION FOR BHEL REQUIREMENT	ACTION BY VENDOR	OFFERED	DEVIATION / REMARK
2.12.3.2	Make of pump :- Pfeiffer/ Leybold/Shinko Seiki only ((suitable for VPD, Preferably set of Pfeiffer Okta 2000 and Okta 6000 (2 nos.)). Vacuum Pumps should be compatible for operation with VM-4 vacuum pump oil.	VENDOR TO CONFIRM & SPECIFY		
2.12.4	Pumping Time of Autoclave; The combination of pumps shall be such that to achieve vacuum from 1000 mbar to 7 mbar of the empty, dry and vacuum tight autoclave in less than 60 minutes.	VENDOR TO CONFIRM & SPECIFY		
2.12.5	Exhaust pipe from vacuum pumping system shall be designed with sufficient height such that exhaust fumes should not re-enter the work area and it should not affect performance of the pumps as well.	VENDOR TO CONFIRM & SPECIFY		
2.13	VAPOUR CONDENSERS:			
2.13.1	All the condensers (tubing and housing) shall be of stainless steel. All the pipe register shall also be made of non-corrosive material. Construction details, type, capacity and cooling water requirement shall be furnished with offer. In the condensate collecting tank one level sensor with alarm and manual drainage arrangement shall be provided.	VENDOR TO CONFIRM & SPECIFY		
2.13.2	Main Condenser (Mixed Vapour): It shall be supplied together with valves and complete accessories with automatic draining system.	VENDOR TO CONFIRM & SPECIFY		
2.13.2.1	Condensation capacity (in KW & effective heat exchange surface area in m2)	VENDOR TO SPECIFY		
2.13.2.2	Temperature of Cooling Water	VENDOR TO SPECIFY		
2.13.3	Intermediate Condenser - It shall be supplied together with valves and complete accessories with automatic draining system. In the condensate collecting tank one level sensor with alarm and manual drainage arrangement shall be provided.	VENDOR TO CONFIRM		
2.13.3.1	Condensation capacity (in KW & effective heat exchange surface area in m2)	VENDOR TO SPECIFY		
2.13.3.2	Temperature of Cooling Water	VENDOR TO SPECIFY		
2.13.4	Exhaust Condensor - Water cooled with water measuring device/jar of min 2litre with 5ml least count and drainage pump.	VENDOR TO CONFIRM		
2.13.4.1	Condensation capacity (in KW & effective heat exchange surface area in m2)	VENDOR TO SPECIFY		
2.13.4.2	Temperature of Cooling Water	VENDOR TO SPECIFY		
2.13.4.3	One main plus one standby condensate water pumping system shall be provided for redundancy.	VENDOR TO CONFIRM		
2.14	VACUUM MEASUREMENT:			
2.14.1	McLeod Vacuum Gauge - 1 No.. Range : 10 - 0.01 torr	VENDOR TO CONFIRM & SPECIFY		
2.14.2	Bourdon Vacuum Gauge : As per requirement (0 to - 760 torr)	VENDOR TO CONFIRM & SPECIFY		
2.14.3	Pirani Digital Vacuum Gauge: For measuring vacuum level in the autoclave chamber or main vacuum header line. The transmitter shall be of Thermal Conductivity according to Pirani type having measuring range of 0.01 to 1000 mBar. Adequate filters/spiral condensers and isolation valves shall be used in the transmitter line to protect it against contamination. (VENDOR to provide details of protection considered in the offer). Make: Leybold/ Edward/Pfeiffer only.	VENDOR TO CONFIRM & SPECIFY		
2.14.4	Electronic Vacuum Transmitters: In addition to pirani gauge, vacuum transmitters shall be provided to measure vacuum at different locations of the process line (Separating vessel, solvent line etc.). Make: Leybold/ Edward/Pfeiffer/Wika/Jumo only.	VENDOR TO SPECIFY		

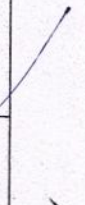
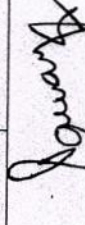
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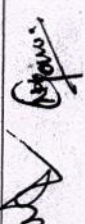
SCOPE: DESIGN,SUPPLY, ERECTION & COMMISSIONING OF VAPOUR PHASE DRYING PLANT, COMPLYING WITH SPECIFICATIONS AS BELOW

S. NO.	DESCRIPTION FOR BHEL REQUIREMENT	ACTION BY VENDOR	OFFERED	DEVIATION / REMARK
2.14.5	Vacuum test points with KF coupling at different locations suitable for handheld digital instrument to be provided for ease of maintenance. Locations of test points to be mutually agreed by BHEL and supplier.	VENDOR TO CONFIRM & SPECIFY		
2.14.6	Handheld Vacuum Measuring Instrument: In addition to the above fixed type vacuum measuring devices installed in the plant, a compact handheld portable, battery powered digital Vacuum measuring instrument shall be supplied for checking and setting vacuum systems. The specifications of the instrument shall be as follows: a) Measurement principle: Piezo-resistive(gas-type independent) and thermal conductance Pirani. b) Measuring Range: 1000 to 0.01 mBar. c) Accuracy: +/- 0.3% of full scale d) Power Supply: Rechargeable battery powered. e) Memory: Minimum 300 readings. The Handheld Vacuum Measuring Instrument shall be Leybold Thermovac TM101 or equivalent.	VENDOR TO CONFIRM & ATTACH CATALOGUE		
2.15	MOISTURE EXTRACTION MEASURING SYSTEM:			
2.15.1	The moisture extraction system shall be such that the digital value (rate) of moisture extracted shall be verifiable with physical water collected in measuring jar during the fine vacuum phase.	VENDOR TO PROVIDE DETAILS OF METHODOLOGY OF OFFERED SYSTEM		
2.15.2	In addition to above digital system, a mechanical type (using jar) condensate rate measuring system having least count 5 ml. And capacity of 2 litres shall also be provided.	VENDOR TO PROVIDE DETAILS OF METHODOLOGY OF OFFERED SYSTEM		
2.15.3	Measuring Instruments & Accessories - All required instruments should calibrated through OEM/NABL Certified agencies.	VENDOR TO CONFIRM		
2.16	CONTROL PANEL:			
2.16.1	A Floor mounted sheet metal control panel with powder coating having the following elements:			
2.16.2	Incomer MCCB/SFU, Switchgears as per requirement comprising of Motor feeders, Contactors, Fuses, MCB's, Relays, Push buttons, Indication lamps etc as per requirements.	VENDOR TO CONFIRM		
2.16.3	Variable frequency drive for Booster pumps and other pumps as per requirement.	VENDOR TO CONFIRM		
2.16.4	Programmable Logic Controller(PLC) for process control and indication: (Siemens/ABB/Allen-Bradley make only). It shall comprise of following: - Analog Input, Analog Output, RTD Inputs, Digital Input, Digital Output : As per requirement (All the I/O's shall be provided with interposing relays for isolation) - Touch Screen HMI of minimum 19" size or higher for complete process control & visualisation. - Licensed SCADA package for Process control, MIMIC display, Trends graphs, Alarm indication etc. - Licensed PLC programming software alongwith communication cable with standard PC.	VENDOR TO SPECIFY		
2.16.5	Industrial PC for process control & Visualisation having the minimum configuration as: Intel core i7 processor, 6 GB RAM or above, 2TB Hard Disk, Keyboard and Mouse, 22" or higher LED Screen alonwith online UPS (2 KVA). The PC shall be loaded with licensed SCADA & PLC software for plant operation & maintenance.	VENDOR TO SPECIFY		
2.16.6	Independent digital display of Pirani fine vacuum transmitter mentioned at 2.14.3 above. This vacuum display shall also be available in SCADA system also.	VENDOR TO CONFIRM		
2.16.7	Laptop with licensed PLC and SCADA programming software, interfacing cable shall be provided for diagnosis and maintenance (min i7 processor, 6GB RAM, 2TB Hard disk).	VENDOR TO CONFIRM		
		VENDOR TO CONFIRM		

SCOPE: DESIGN,SUPPLY, ERECTION & COMMISSIONING OF VAPOUR PHASE DRYING PLANT, COMPLYING WITH SPECIFICATIONS AS BELOW

S. NO.	DESCRIPTION FOR BHEL REQUIREMENT	ACTION BY VENDOR	OFFERED	DEVIATION / REMARK
2.16.8	Colour Laser printer (A4 size) for printing of Trend Graphs & Reports (HP/ Canon make only).	VENDOR TO CONFIRM		
2.16.9	Complete Ghost backup of the SCADA PC in spare hard disc shall be provided such that this SCADA PC can be restored using the GHOST back up in case of hard disk failure.	VENDOR TO CONFIRM		
2.16.10	Jumbo size Scrolling LED Displays/ LED ticker display (preferably 10 feet X 1 feet) suitable for shop installation at approx 6.5 to 7.0 meter height shall be provided to display real time process with major process parameters (W. O. No., Stage of process, Vacuum in mbar, Temperature in degC etc.) with a provision to add parameters in future. Real time data to be fed from SCADA.	VENDOR TO CONFIRM		
2.17	PROCESS CONTROLS & SYSTEM FEATURES:			
2.17.1	The configuration of the SCADA must be such that the plant can be operated independently either through Touch Screen HMI or SCADA PC. Visualisation of the process shall be available simultaneously at both the location, however the control shall be available at only one location for safety purpose. Automatic and Semi-automatic mode of selection shall be available. All the necessary safety interlocks shall be built into the system to automatically switch to a safety in critical situation.	VENDOR TO CONFIRM		
2.17.2	The plant shall be equipped with the system control software for continuously controlling, monitoring, visualising & observing the operation of vapour phase drying plant. In automatic mode the process recipes must be developed and provided to give most suitable process depending upon input condition. The operator will select the recipe and start the process. The advance software shall be configured such that it monitor all process relevant data and allows automatic selection of the optimal parameters for on going drying process depending on the actual achieved values; especially, the duration of heating up phase will be adjusted according to the water extraction measured during intermediate pressure lowering phases etc.	VENDOR TO CONFIRM		
2.17.3	Trends graphs of Coarse Vacuum, Fine Vacuum, Autoclave Temperature, Job Temperature, Total water extraction during IPR, Water extraction rate during fine vacuum etc shall be provided and shall be printable.	VENDOR TO CONFIRM		
2.17.4	After end of the process, the system shall generate the detailed report of the completed process. The report format shall be designed as per the requirement and format approved by BHEL. It shall contain details like Job rating, customer name, work order number, start date, etc entered in the system at the time of start of process. The typical parameters required in the reports shall be Total Process time, Heating time/temperature in each phase, Intermediate pressure reduction phase time/temperature/pressure/water extraction, Fine vacuum phase time/temperature/pressure/water extraction rate, Total quantity of water extracted etc. All the trends Graphs of process variables shall also be available in the report.	VENDOR TO CONFIRM		
2.17.5	Provision for archiving the process reports taking backup in USB pendrive should be available . The process record data should be retrievable/printable in both numeric and graphical form. Moreover, the primary record data will be in numeric form in excel sheet also and plotting of graph should be possible on the basis of this sheet.	VENDOR TO CONFIRM		
2.17.6	Facility for remote monitoring & fault diagnostics through ethernet / modem/wifi dongal is to be provided. Ethernet connection will be preferred. With this facility the operator/maintenance staff of plant shall be assisted directly in operation and problem solving by the OEM expert engineer.	VENDOR TO CONFIRM		
2.18	WATER CHILLING PLANT:			
2.18.1	Suitable capacity Water Chilling Plant (with water cooled water chiller) along with required capacity cooling tower shall be supplied for cooling of vapour condensers, Oil cooler, Solvent cooler of Vapour Phase Plant & water jacket cooling of Vacuum Pumping System etc.	VENDOR TO CONFIRM		
2.18.2	Following accessories will be part of the Plant: Chilled-water Tank, Primary & Secondary Pumping system, Pipes, Valves, Mixing Tank, PLC, etc. integrated with VPD plant.	VENDOR TO CONFIRM		

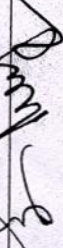



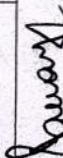





SCOPE: DESIGN,SUPPLY, ERECTION & COMMISSIONING OF VAPOUR PHASE DRYING PLANT, COMPLYING WITH SPECIFICATIONS AS BELOW

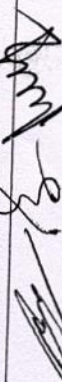
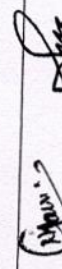
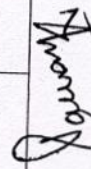
S. NO.	DESCRIPTION FOR BHEL REQUIREMENT	ACTION BY VENDOR	OFFERED	DEVIATION / REMARK
2.18.3	Configuration & Capacity of Package-type Water Chiller: 3 nos. each of minimum cooling capacity of min. 20 TR @ 15 degC, connected in parallel so that any point of time any 2 nos. will be in operation & automatically switches to standby ensuring equal-run time of all the Chillers.	VENDOR TO CONFIRM		
2.18.4	The system shall be complete with chilled water pipelines, circulating pumps with stand-by arrangement, valves, NRVs, filters, chilled water storage tank (min. capacity: 5 KL) , safety interlocks, etc.	VENDOR TO CONFIRM		
2.18.5	Condensor design shall be shell and tube type having tubes made of copper and should be resistant to corrosion from both condensing fluid and medium.	VENDOR TO CONFIRM		
2.18.6	Chilled water mono-block pump shall be supplied with stand-by arrangement. Make of motor: Crompton/ Beacon only.	VENDOR TO CONFIRM		
2.18.7	Chilled water and return water pipeline shall be Stainless steel SS 304 of Tata/ Jindal make only and shall be well insulated to avoid energy loss.	VENDOR TO CONFIRM		
2.18.8	All the valves, NRV, filter, etc. shall be of Audco/ Advance make only.	VENDOR TO CONFIRM		
2.18.9	Latest state-of-the art energy efficient MINIMUM 4 star rating Chiller of Voltas/ Blue Star/ Carrier/Werner Finley/Hitachi make only are acceptable.	VENDOR TO CONFIRM, SPECIFY AND ATTACH CATALOGUE		
2.18.10	Provision for measurement of inlet & outlet temperature and water flow rate at chiller outlet with suitable interlocks shall be provided.	VENDOR TO CONFIRM		
2.19	EQUIPMENT FOR OIL FILLING OF TRANSFORMER UNDER DRYING:			
2.19.1	After completion of VPD process, the transformer may be required to be impregnated with oil. For this purpose two oil filling lines shall be provided. Each line shall comprise of the following elements	VENDOR TO CONFIRM		
2.19.2	2 nos 10m each, flexible hose having steel braided reinforcement to be provided inside the autoclave.	VENDOR TO CONFIRM		
2.19.3	Preliminary manual oil filling valve, Size: 80 NB	VENDOR TO CONFIRM		
2.19.4	Pneumatic actuated EP valve for oil filling	VENDOR TO CONFIRM		
2.19.5	2 nos oil level sensor with flexible armoured temperature resistant cable of length min 10m with an alarm mechanism and with provision to mount these sensors on transformer tank should be provided inside the autoclave having interlock with SCADA.	VENDOR TO CONFIRM		
2.19.6	Oil flow transmitter (Ultrasonic/differential pressure/positive displacement type). A flow totaliser to be built in SCADA for filling the required quantity of oil in transformer.	VENDOR TO CONFIRM, SPECIFY AND ATTACH CATALOGUE		
2.20	COMPRESSED AIR as per DIN - ISO 8573-1 :			
2.20.1	Air compressor of suitable capacity with refrigeration type air drier equipped with automatic condensate drain system to provide instrument quality air conforming to ISO 8573-1 for pressurised air requirement of the plant shall be in the scope of supplier. This compressor shall work as stand by with the compressed air line provided by BHEL and suitable interlock for automatic switching from BHEL compressed air line to supplied air compressor's line shall be provided. Make of Compressor - Elgi/ Ingersoll rand/ Kirloskar/Atlas copco/ Kaeser only. Make of refrigeration type air drier - GEM/ Ultrafilter/ Sabro / Sumit/ Ingersollrand only.	VENDOR TO CONFIRM, SPECIFY AND ATTACH CATALOGUE		
2.20.2	The main pneumatic pipe & distribution pipes should be made from copper or G.I. tube. Connection between distribution tube and control valve/actuators should be made from PU tube (Approx. Max. length 500 MM). Solid distribution lines to be provided upto the valve/actuator end with valve isolation.	VENDOR TO CONFIRM & SPECIFY		



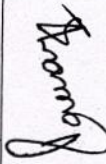
SCOPE: DESIGN, SUPPLY, ERECTION & COMMISSIONING OF VAPOUR PHASE DRYING PLANT, COMPLYING WITH SPECIFICATIONS AS BELOW

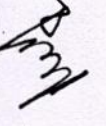
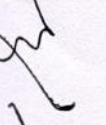
S. NO.	DESCRIPTION FOR BHEL REQUIREMENT	ACTION BY VENDOR	OFFERED	DEVIATION / REMARK
2.20.3	Manual ON / OFF valve, FRL, Automatic moisture drain trap. Suitable capacity air lubricator, Digital as well as analog inline pressure gauge, condensate receiver for pneumatic system, piping & tubing etc. Make of PU tubing and air line accessories: Festo, SMC, Janatics only.	VENDOR TO CONFIRM & SPECIFY		
2.20.4	BHEL will provide single point compressed air supply @ 4-6 bar pressure for pneumatic system as an optional measure for plant operation & all the balance items of pneumatic system required for interconnection and to achieve air quality parameters of unconditioned air shall be provided by VENDOR.	VENDOR TO CONFIRM & SPECIFY		
2.21	ELECTRICAL SYSTEM :-			
2.21.1	415V +/- 10% , 50 HZ +/- 3%, 3 phase AC (3 wire system without neutral) Power Supply Source will be provided by BHEL at a single point near the machine as per layout recommended by VENDOR . All step down transformers, rectifiers & regulators shall also be supplied by the VENDOR. All types of cables, connections, circuit breakers etc. required for connecting BHEL's power supply point to different parts of the machine /control cabinets, shall be the responsibility of VENDOR. Requirement of grounding /earthing with required material details is to be informed by VENDOR well in advance so that same could be incorporated during construction of foundation.	VENDOR TO CONFIRM		
2.21.2	Tropicalisation: All electrical / electronic equipment shall be tropicalized.			
2.21.3	All electrical & electronic control cabinets & panels should be dust and vermin proof fitted with suitable panel air conditioner/s.	VENDOR TO CONFIRM		
2.21.4	All electrical components in the cabinets should be mounted on DIN Rail.	VENDOR TO CONFIRM		
2.21.5	Motors shall conform to IEC or Indian standards.	VENDOR TO CONFIRM		
2.21.6	VENDOR should ensure the proper earthing for the VPD plant and its peripherals.	VENDOR TO CONFIRM		
2.21.7	All electrical equipments shall be suitably protected by HRC fuses/ MCBs/ Overload relays & single phase preventives.	VENDOR TO CONFIRM		
3.0	SAFETY ARRANGEMENTS:			
3.1	Following safety features in addition to other standard safety features should be provided on the vacuum drying plant			
3.2	VPD Plant should have adequate and reliable safety interlocks / devices to avoid damage to the workpiece and the operator due to the malfunctioning or mistakes. VPD Plant functions should be continuously monitored and audio visual warning indication / alarm number with message (on panels) should be available.	VENDOR TO CONFIRM		
3.3	A detailed list of all alarm / indications provided on VPD Plant should be submitted by the supplier with the drawing approval after placement of order.	VENDOR TO CONFIRM		
3.4	All the pipes, cables etc. on the VPD Plant should be well supported and protected.	VENDOR TO CONFIRM		
3.5	All the rotating parts used on VPD Plant should be statically & dynamically balanced to avoid undue vibrations.	VENDOR TO CONFIRM		
3.6	Emergency switches at suitable locations as per International Norms are to be provided.	VENDOR TO CONFIRM		
3.7	Oil & water pipe lines should not run with electrical cable in the same tray / trench.	VENDOR TO CONFIRM		
3.8	All the tanks, enclosures supplied must be fitted with Manhole for cleaning, transparent level tube, sightglass and ladder to reach on top.	VENDOR TO CONFIRM		
3.9	All the control panels/electrical consoles/should be properly grounded/earthed and rubber mats near them to be provided. In addition to this the entire solvent pumping system, any other such systems prone to fire hazard must be grounded.	VENDOR TO CONFIRM		
4.0	ENVIRONMENTAL PERFORMANCE OF THE VACUUM DRYING PLANT:	VENDOR TO CONFIRM		

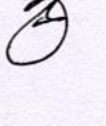





SCOPE: DESIGN, SUPPLY, ERECTION & COMMISSIONING OF VAPOUR PHASE DRYING PLANT, COMPLYING WITH SPECIFICATIONS AS BELOW

S. NO.	DESCRIPTION FOR BHEL REQUIREMENT	ACTION BY VENDOR	OFFERED	DEVIATION / REMARK
4.1	The VPD Plant shall conform to the following factors related to environment:			
4.2	(a) Maximum noise level shall be 85 dB at normal load condition, 1mtr. away from the VPD Plant with correction factor for back ground noise, if necessary. This will be measured as per international standards like DIN 45635-16. Supplier to demonstrate compliance to noise level, if so required.	VENDOR TO CONFIRM		
4.3	(b) There shall not be any emission from the VPD plant.	VENDOR TO CONFIRM		
4.4	(c) If any safety / environmental protection enclosure is required, it should be built in the plant by the VENDOR and certification of conformance to the pertinent act/rule shall be furnished.	VENDOR TO SPECIFY		
5.0	TOOLS FOR ERECTION, OPERATION & MAINTENANCE:			
5.1	Special tools and equipment required for erection of the VPD Plant shall be brought by the VENDOR on returnable basis. However, the necessary tools like Torque Wrench, Spanners, Keys, grease guns etc. for operation and maintenance of the plant should be supplied. List of such tools should be submitted with offer.	VENDOR TO CONFIRM & SPECIFY		
6.0	SPARES:			
6.1	Mandatory Spares: (To be included in the scope of supply) The spares to be handed over after commissioning of the machine.			
6.1.1	PLC-I/O modules, CPU - 1 no. each	VENDOR TO CONFIRM		
6.1.2	PLC Power Supply - 1no.	VENDOR TO CONFIRM		
6.1.3	All the filters: 1 set	VENDOR TO CONFIRM		
6.1.4	Hot Oil Pump: 1 no.	VENDOR TO CONFIRM		
6.1.5	Temperature and vacuum measurement sensors and vacuum transmitters.			
6.2	Optional Spares: (The offer for these optional spares is required to be quoted separately). Note: The prices of optional spares will not be considered while evaluating the offers of the item).	VENDOR TO CONFIRM & QUOTE SEPARATELY		
6.2.1	Item wise breakup of mechanical & hydraulic and electrical & electronic spares used on the plant in sufficient quantity as per recommendation of VENDOR for 2 years of trouble free operation beyond guarantee period on three shifts continuous running basis should be offered by VENDOR. The list to include following, in addition to other recommended spares: (Unit Price of each item of spare should be offered)	VENDOR TO CONFIRM		
6.2.2	a) Mechanical/ Hydraulic Spares: All types of pumps, All types of Valves, All types of pressure switches / transducers, All types of filters, All types of seals.	VENDOR TO CONFIRM		
6.2.3	b) Electrical / Electronic Spares: All types of Relays, Contactors, Proximity Switches, Push Buttons, Indicating Lamps, Semiconductor Fuses, Special Fuses, Circuit Breakers & I/O Cards for PLC.	VENDOR TO CONFIRM		
6.2.4	All types of spares for total VPD plant and accessories should be available with the VENDOR for atleast ten years after supply of the VPD plant. If VPD or control is likely to become obsolete in this period, the VENDOR should inform BHEL sufficiently in advance and provide drawings of parts / details of spares & suppliers to enable BHEL to procure these in advance, if required.	VENDOR TO CONFIRM		
6.2.5	VENDOR to confirm that complete list of spares for VPD and accessories, along with specification / type / model, and name & address of the spare supplier shall be furnished along with documentation to be supplied with the plant.	VENDOR TO CONFIRM		



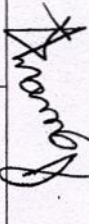
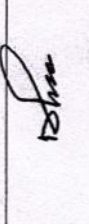



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S. NO.	DESCRIPTION FOR BHEL REQUIREMENT	ACTION BY VENDOR	OFFERED	DEVIATION / REMARK
7.0	DOCUMENTATION: Four sets of following documents (Hard copies) in English language should be supplied along with the vacuum drying plant. Soft copy (in CD) of the complete system back up is to be provided.	VENDOR TO CONFIRM		
7.1	Operating manuals of VPD & PLC System with handbook for operation and bypass guidelines.	VENDOR TO CONFIRM		
7.2	Programming Manuals of VPD & PLC System. Hard & soft copy of PLC ladder logic with comment in english (pdf & hard copy) and PLC MMI programming software along with communication cable.	VENDOR TO CONFIRM		
7.3	Detailed Maintenance manual of VPD with all drawings of VPD assemblies/ sub- assemblies/ parts including Electrical / Pneumatic / Coolant/ Hydraulic circuit diagrams. All Assembly / sub assembly Drawings as commissioned shall be supplied with the part list also.	VENDOR TO CONFIRM		
7.4	Maintenance, Interface & commissioning manuals.	VENDOR TO CONFIRM		
7.5	Manufacturing drawings for all supplied sub assemblies.	VENDOR TO CONFIRM		
7.6	Catalogues, O & M Manuals of all bought out items including drawings, wherever applicable.	VENDOR TO CONFIRM		
7.7	Detailed Specification of all rubber items and hydraulic / lube fittings.	VENDOR TO CONFIRM		
7.8	Operating manuals, Maintenance Manuals & Catalogues for supplied items & Measuring System , Voltage Stabilizer, Isolation Transformer vacuum pump and all supplied Accessories.	VENDOR TO CONFIRM		
7.9	Soft copy of O & M Manual alongwith drawings to be provided.	VENDOR TO CONFIRM		
8.0	TRAINING:	VENDOR TO CONFIRM		
8.1	BHEL Persons shall be trained at BHEL Works in the field of Operation and Mechanical, Electrical & Electronics maintenance of VPD Plant & other supplied equipment.	VENDOR TO CONFIRM		
8.2	Minimum 05 man-days of classroom training shall be provided for PLC as well as SCADA each at OEM's authorised training center.	VENDOR TO CONFIRM		
8.3	Air-fare, boarding & lodging for the trainees shall be borne by BHEL in case of training at OEM's authorised training center.	VENDOR TO CONFIRM		
9.0	FOUNDATION:	VENDOR TO CONFIRM		
9.1	VENDOR shall submit all required drawings including layout drawing for getting BHEL's approval within one month from the date of Letter of Intent (LOI) / P.O. Foundation work will be executed by BHEL. However, detailed foundation drawing with reinforcement details needs to be given by VENDOR within 4 weeks from the date of approval of lay-out drawing. All fixators, insert plates, supports & brackets shall be supplied by the VENDOR.	VENDOR TO CONFIRM		
10.0	ERECTION & COMMISSIONING			
10.1	Supplier to take full responsibility for carrying out the erection & commissioning, start up, testing of VPD plant, its control system & all types of other supplied equipment vacuum drying test expt. etc. Service requirement like power air & water shall be provided by BHEL at any one point (to be indicated by supplier in their foundation / layout drawings). Other requirements like crane, trolley shall be arranged by the VENDOR. Details of the requirements should be informed by VENDOR in advance (within one month prior to the scheduled date of start of erection activities).	VENDOR TO CONFIRM		
10.2	Successful proving of BHEL components by the supplier shall be considered as part of commissioning. All tests, as mentioned at clause 13.4 (VPD Acceptance) shall form the part of commissioning activity.	VENDOR TO CONFIRM		
10.3	Tools, Tackles, Test Material, Instruments and other necessary equipment including Laser Equipment, if any, required to carry out all above activities should be brought by the supplier on returnable basis.	VENDOR TO CONFIRM		

SCOPE: DESIGN,SUPPLY, ERECTION & COMMISSIONING OF VAPOUR PHASE DRYING PLANT, COMPLYING WITH SPECIFICATIONS AS BELOW

S. NO.	DESCRIPTION FOR BHEL REQUIREMENT	ACTION BY VENDOR	OFFERED	DEVIATION / REMARK
10.4	Commissioning spares, required for commissioning of the VPD within stipulated time, shall be brought by the supplier.	VENDOR TO CONFIRM		
10.5	All Cover Plates, Platforms(Grill Type), Railing etc.required for the VPD and its peripherals if any, shall be supplied and installed by the VENDOR.	VENDOR TO CONFIRM		
10.6	Portion, if any, of the VPD accessories and other supplied items where paint has rubbed off or peeled off during transit or erection, should be repainted and merged with the original surrounding paint by the VENDOR. For this purpose, the VENDOR should supply sufficient quantity of touch-up paint of various colours of paints used.	VENDOR TO CONFIRM		
10.7	Schedule of Erection and Commissioning shall be submitted with the offer.	VENDOR TO CONFIRM & SUBMIT		
10.8	Vendor may note that the E & C charges in this case have been mandatorily fixed at 20% of the total cost. This apportioned price has to be compulsorily agreed by all vendors & no deviation shall be acceptable for this.	VENDOR TO CONFIRM		
11.0	ACCURACY TESTS:			
11.1	Complete prove out of VPD Plant components shall be done by VENDOR at BHEL works for dimensional checks, vacuum level, leak rate, operating temperature & process parameters (as indicated in para 2.2.2 to 2.2.8). Any tool, equipment & instrument required for accuracy test shall be arranged by VENDOR.	VENDOR TO CONFIRM		
12.0	AMBIENT CONDITIONS & THERMAL STABILITY:			
12.1	Total VPD including PLC based systems and all supplied items should work trouble free and efficiently under following operating conditions and should give specified accuracies. POWER SUPPLY : Voltage : 415 V -10%, +10% . Frequency : 50 Hz +1.5Hz , -1.5Hz No. of phases : 3 , no neutral Ambient Conditions : Temperature = 5 to 50 degree celsius , Relative Humidity : 95 % (VENDOR to confirm that VPD is suitable for above).	VENDOR TO CONFIRM		
12.2	Weather conditions are tropical, Atmosphere may be dust laden during some part of the year. VPD shall be kept in the normal shop floor conditions. Max. temperature variation is up to 25 deg Celsius in 24 hours. (VENDOR to confirm that VPD is suitable for above).	VENDOR TO CONFIRM		
12.3	Thermal Stability of the complete VPD keeping in view specified Ambient Conditions and accuracy requirements of BHEL components and trouble free operation of the VPD should be ensured by VENDOR. (VENDOR to confirm that VPD is suitable for above).	VENDOR TO CONFIRM		
12.4	The VPD including attachments and accessories, should be suitable for 24 hrs continuous operation to its full capacity for 24 hours a day and 7 days a week throughout till the end of VPD processing. (VENDOR to ensure and confirm the same).	VENDOR TO CONFIRM		
13.0	PROVE-OUT OF BHEL COMPONENTS :			
13.1	Complete prove-out shall be done by VENDOR at BHEL works as per (para 13.4.2.6). Transformer/s for the prove-out shall be provided by BHEL. VENDOR shall be fully responsible for proveout of components as per drawing and other requirements specified by BHEL to the full satisfaction of BHEL.	VENDOR TO CONFIRM		
13.2	VENDOR shall be responsible for any deviation /rejection in proveout component due to wrong process or malfunctioning of the VPD Plant during proveout of VPD Plant.	VENDOR TO CONFIRM		
13.3	Clarifications, if any required by VENDOR, regarding accuracy requirements of the proveout, whether specified or not, should be discussed and cleared by VENDOR during initial technical discussions.	VENDOR TO CONFIRM		

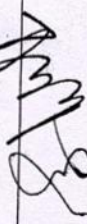



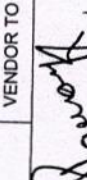




SCOPE: DESIGN,SUPPLY, ERECTION & COMMISSIONING OF VAPOUR PHASE DRYING PLANT, COMPLYING WITH SPECIFICATIONS AS BELOW

S. NO.	DESCRIPTION FOR BHEL REQUIREMENT	ACTION BY VENDOR	OFFERED	DEVIATION / REMARK
13.4	VPD ACCEPTANCE: (Tests / Activities To be Performed by VENDOR)			
13.4.1	Tests / Activities to be carried out at supplier's works in presence of BHEL Representative on the VPD plant before despatch			
13.4.1.1	Inspection of components, assemblies & sub assemblies with test certificates of OEM.	VENDOR TO CONFIRM		
13.4.1.2	Demonstration of all features of the VPD plant, PLC system and all Accessories.	VENDOR TO CONFIRM		
13.4.2	Tests to be carried out at BHEL Works while commissioning the VPD:	VENDOR TO CONFIRM		
13.4.2.1	Accuracy Tests as per para (11.0)/BHEL process specifications.			
13.4.2.2	Demonstration of all features of the VPD Plant, PLC system and all Accessories to the satisfaction of BHEL for their efficient and effective use.	VENDOR TO CONFIRM		
13.4.2.3	Demonstrations by actual use of all supplied attachments and accessories to their full capacity.	VENDOR TO CONFIRM		
13.4.2.4	Prove-out: Minimum three jobs trials will be taken as per BHEL process specifications in Annexure -1.	VENDOR TO CONFIRM		
13.4.2.5	Two weeks supervision of independent operation of VPD Plant by BHEL after proveout by supplier's personnel.	VENDOR TO CONFIRM		
13.4.2.6	Training of BHEL operators in operation of complete equipment & accessories etc by the supplier's experts / engineers during their stay at BHEL works.	VENDOR TO CONFIRM		
14.0	GUARANTEE :	VENDOR TO CONFIRM		
14.1	24 months from the date of commissioning of the VPD plant	VENDOR TO CONFIRM		
15.0	GENERAL : The VENDOR should submit the following information :	VENDOR TO CONFIRM		
15.1	VPD Plant Model	VENDOR TO CONFIRM		
15.2	Total connected load (KVA)	VENDOR TO FURNISH		
15.3	Floor area required (Length , Width , Height) for complete VPD Plant & accessories	VENDOR TO FURNISH		
15.4	Painting of VPD Plant / Electrical Panels : Polyurethane paint (Preferably Apple Green). All the pipeline should be painted in line with 'IS 2379:1990- Pipelines-identification- color code'.	VENDOR TO FURNISH		
15.5	Total Weight of the VPD Plant	VENDOR TO FURNISH		
15.6	Weight of heaviest part of VPD Plant	VENDOR TO FURNISH		
15.7	Weight of the heaviest assembly / subassembly of the VPD Plant	VENDOR TO FURNISH		
15.8	Dimensions of largest part / subassembly / assembly of the VPD Plant	VENDOR TO FURNISH		
15.9	If any foreign VENDOR wants to supply certain components / items from India, the details of such items / components (to be sourced from India) should be submitted alongwith technical offer. Final responsibility for quality & performance of such components / items shall be of principal bidder.	VENDOR TO FURNISH		
15.10	First fill of Thermic fluid & hydraulic oil to be supplied by VENDOR.	VENDOR TO FURNISH		



SCOPE: DESIGN, SUPPLY, ERECTION & COMMISSIONING OF VAPOUR PHASE DRYING PLANT, COMPLYING WITH SPECIFICATIONS AS BELOW

S. NO.	DESCRIPTION FOR BHEL REQUIREMENT	ACTION BY VENDOR	OFFERED	DEVIATION / REMARK
16.0	QUALIFYING CONDITION OF VPD PLANT:			
16.1	Only Original Equipment Manufacturers (OEMs) or their Authorized Dealers/Partners meeting the following conditions are eligible to participate in the tender:			
16.1 (a)	The VENDOR, submitting the quotation, should have supplied and commissioned at least two nos. VPD Plant, each having 247.5 cubic-metre Autoclave Capacity or Higher Capacity with Jet Evaporator/ Falling thin film evaporator of 400 KW capacity or higher capacity in the past seven years to two different customers of transformer industry. OR Indian VENDOR who do not meet above specified qualifying conditions, may also quote if they have a running Collaboration/ Joint Working arrangement with Foreign Manufacturer (meeting above specified qualifying conditions) for manufacturing of VPD Plant. Such Indian VENDOR shall have to submit a back to back guarantee from their foreign partner for satisfactory performance of the offered VPD plant in compliance to all the specified tender requirements. The bidder in this case has to furnish the collaboration certificate with their domestic/foreign partner.	VENDOR TO CONFIRM & SUBMIT		
16.2	The following information is to be submitted by the VENDOR about the companies where such plants have been supplied. This is required from all the VENDORS for qualification of their offer.	VENDOR TO CONFIRM & SUBMIT		
16.2.1	Name of the customer / company where such a VPD Plant is installed, (unpriced copy of purchase order to be furnished in line with point no. 16.1)	VENDOR TO CONFIRM		
16.2.2	Complete Name, designation, postal address, Phone, FAX no. and E-mail address of the contact person of the customer.	VENDOR TO FURNISH		
16.2.3	Year of commissioning.	VENDOR TO FURNISH		
16.2.4	Application for which Vapour Phase Drying plant has been supplied.	VENDOR TO FURNISH		
16.2.5	Performance certificate from the customer regarding satisfactory performance for minimum two years after commissioning of VPD plant supplied in line with point no. 16.1.	VENDOR TO FURNISH		
16.3	BHEL reserves the right to verify information or visit the place of installation of customer as indicated by VENDOR. In case the information is found to be false / incorrect, the offer shall be rejected.	VENDOR TO FURNISH		
16.4	Reference list of customers alongwith capacity of all VPD plants supplied till date to be submitted by vendor.	VENDOR TO NOTE & CONFIRM		
17.0	TERMS & CONDITIONS	VENDOR TO FURNISH		
17.1	Time of Project Completion including material supply, E&C and prove-out (within 36 Weeks from date of LOI)			
17.2	Schedule of Supply and Erection & Commissioning shall be submitted with the offer.	VENDOR TO CONFIRM		
		VENDOR TO CONFIRM		

Abhishek Gupta
Sr. Engineer/ FCX

Prabhat Katiyar
Dy. Mgr./TRM

D. K. Sharma
Dy. Mgr./TRM

Satish Soni
Dy. Manager/WEX

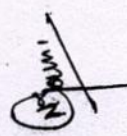
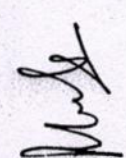
Nitin Kumar Gaur
Manager/WEX

Dhirendra Kumar
Manager/TRM

Bawan Kumar
Sr. Manager/WEX

FOLLOWING PRICE BREAKUP IS REQUESTED IN SUBMITTED PRICE BID AGAINST ENQUIRY

Sl. No.	Spec. Point No.	Description of item	PRICE
		MAIN ITEM	
1	2.0 TO 2.20	VPD COST(MATERIAL SUPPLY)	XXXX
2	10.0 TO 13.0	E&C CHARGES FOR VPD	XXXX
		OPTIONAL ITEMS	
3	1.4 A	Optional price for additional optional ^{to operate} system the offered VPD PLANT in VDP Mode (Plant shall operate in both VPD mode & VDP mode with this feature)	XXXX
4	1.4 B	Optional price for three years AMC contract of above plant with a validity of 3 years after completion of guarantee period (24 months from the date of commissioning)	XXXX




Dinesh
 N. Srinivas
 M. S. Srinivas
 S. Srinivas
 S. Srinivas
 S. Srinivas

BHARAT HEAVY ELECTRICALS LIMITED

TRANSFORMER PLANT JHANSI

Date: -08/02/2019

PROCESS PARAMETERS

Annexure-1

Standard process parameters required for a 160MVA 220KV class Power transformer processing in VPD mode

Sl.No	STAGE	TIME (hrs.)	REMARKS	PARAMETERS
1	Setting Up	02		Achieve autoclave vacuum 7 torr
2	Heating up(including IPRs)	30	No. of IPRs as per requirement	Up to job temperature 130°C and autoclave vacuum 30torr
3	Final Pressure reduction	04		Up till the extraction of solvent condensate stops
4	Fine Vacuum and process termination	16	Fine vacuum as specified in 2.2.5,2.2.6,2.12.4	Up to absolute vacuum 0.05torr Job temperature 120-130°C
5	Aeration and door opening	0.5		With dry air having dew point -40°C
<u>Total process time</u>		<u>52.5hrs</u>		

Final process termination criteria: - Six consecutive readings of collection of 30ml of condensed water/moisture in the measuring jar at an interval of one hour in "Fine Vacuum" stage.

Note: - Over and above all these above parameters, irrespective of time consumed in individual stages, the total process time should optimally be 52.5 hrs with a permissible upper limit deviation of 10%.

(Vendor's acceptance sign and seal)

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19/2/19
Page:-19

BHARAT HEAVY ELECTRICALS LIMITED

TRANSFORMER PLANT JHANSI

Date: -19/02/2019

Reference job for Insulation weight calculation

Annexure-2

W.O.: - 72225A

Customer- UPPTCL

MVA- 160

KV class -220

Sl.No	ITEM	Weight(Kg)
1	COPPER	32596
2	STEEL	45070
3	INSULATION	6098

Total Insulation Weight – 6.098 ton

(Vendor's acceptance sign and seal)

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Handwritten signature
19/2/19
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BHARAT HEAVY ELECTRICALS LIMITED

TRANSFORMER PLANT JHANSI

PROCESS PARAMETERS

Annexure-3

Standard process parameters required for a 160MVA 220KV class Power transformer processing in VDP mode

Sl.No	STAGE	TIME (hrs.)	REMARKS	PARAMETERS
2	Heating up	40		Up to job temperature 125+/- 5°C
4	Vacuum and process termination	16	Fine vacuum as specified in 2.2.5, 2.2.6, 2.12.4	Up to absolute vacuum 0.05torr Job temperature 120-130°C
5	Aeration and door opening	0.5		With dry air having dew point -40°C
<u>Total process time</u>		<u>56.5hrs</u>		

Final process termination criteria: - Six consecutive readings of collection of 30ml of condensed water/moisture in the measuring jar at an interval of one hour in the final stage.

Note: - Over and above all these above parameters, irrespective of time consumed in individual stages, the total process time should optimally be 56.5 hrs with a permissible upper limit deviation of 10%.

(Vendor's acceptance sign and seal)

(Signature)

(Signature)
19/11/19

(Signature)

(Signature)

(Signature)