BHARAT HEAVY ELECTRICALS LIMITED
J H A N S I

ITEM	:	Vacuum Drying Vessel
ITEM NO.	:	ME- 1 / 4/2602
SPECIFICATION NO.	:	7096 R1
LOCATION	:	BAY-6
QUANTITY	:	1 No.

VACUUM DRYING VESSEL

GENERAL : -

1. Vacuum Drying vessel is required for processing of power transformers coils under vacuum & must be made to withstand absolute vacuum. The vacuum vessel is to be designed to take a payload of 65 MT which is comprised of following materials:

i) Copper & steel	:	50MT
ii) Insulation (fuller board, Kraft paper & Parma wood) including moisture content of 30%	:	15MT
iii) Total payload	:	65MT

The preliminary & final drying of transformer coils is to be carried out under vacuum of **0.5 mbar** or better. The empty and dry vessel shall be tested to hold the minimum pressure of 0.1 mbar and the equipment is to be tested for leak rate of 5 Torr Ltr/sec.

2 VESSEL DETAILS : -

2.1 The vessel is to be placed in a shallow pit so as to have the top of the inside rail track of the vessel flushed with the factory floor level. The vessel shell be of rectangular construction, suitable for operating under vacuum as stated above. It is to be fabricated from tested quality mild steel confirming to IS: 226 and suitably reinforced from out side to with-stand the vacuum and the pay load on the trolley.

2.2 The payload is to be fed in to the vessel through a mobile trolley movable on rails. The rail required for trolley movement shall span from inside of the vessel chamber to a distance of 10 meters out of the vessel. A section of the rail track in between the out side segment & the segment within the vessel, shall be in the form of a removable / foldable bridge, in order to ensure closure of vessel gates for processing. Trolleys and suitable rails are also to be supplied with the equipment. The trolley is to be fabricated from standard steel sections and designed to carry a distributed load of **65 M.T**. It is to be designed in such a way that height above floor level is minimum and does not exceed in any case 400 m.m., The dimension of the trolley shall be LENGTH 6800mm, WIDTH 4000mm, HEIGHT not more than 400mm Suitable provision is to be made either for mechanically propelling the trolley into and out of the vessel with the help of a proper winch fixed out side the vessel or the trolley can be self propelled type.

2.3 The vessel is to be provided with a front door with side sliding opening, by hydraulically / Electrically and mechanically operated mechanism controlled by push buttons. The door after closing is to be sealed against rim of the vessel which is having two gaskets of circular cross section placed in the machined rim having dovetailed grooves on vessel rim. The rim of the vessel and door is to be machined to an accuracy of +/ - 0.75 mm across diagonals and ground finished to ensure perfect sealing. The gasket sealing material is to be of best quality VITON, oil resistant and suitable to with stand continuous temp of 120 degree centigrade. Vacuum tightening of sliding door over the opening of vessel is to be done by hydraulic cylinders clamps from all four sides. The hydraulic cylinders clamping is to be operated with push buttons and appropriate hydraulic system.

2.4 Saturated steam shall be provided at 6kg/sq.cm in our works. The pressure reducing station is to be included in the supply to reduce the steam pressure to 3kgs/sq.cm. or required pressure for heating the vessel . All accessories in the steam and condensate line like steam separator, strainer, pressure reducing valve with bypass arrangement, control valve, safety valve, pressure gauges, steam traps, non return valves etc. are to be included in the offer. steam pipe line system and accessories should of IBR quality and IBR clearance from CIB ,UP is to be obtained by the supplier.

Air circulating fans are to be provided for rapid and equi - distribution of heat for thorough heating of charge inside the vessel. The air circulating fans are to be designed for operation at 120 deg C and shall be fixed in such a way that there will be no loss of vacuum from the vessel. The vessel is to be provided with a relief valve to facilitate emergency blowing off, in case of sudden bursting of steam line.

2.5 The vessel is to be complete with all accessories and the whole equipment is to be tested for a leak rate of 5 torr ltrs/ Sec.

2.6 The following pipe connections are to be provided on the vessel by means of flanges which are to be drilled as per relevant Indian standard:

2 Nos., 65 mm dia drain pipe at the maximum depth of the vessel to drain out any accumulated oil with control valve that can be operated from out side. A vacuum tight valva with flanges at both ends should also be fitted.

Two Nos., blank ports with 8 terminals each having epoxy cast bushings for megger / tan delta measurements shall be provided at 1200 mm from the base of the vessel on side. Details of the terminal board shall be submitted for approval from BHEL. These terminals shall be suitable for application of 5KV.

2.7 The following opening / accessories are to be provided and located suitably on sides at convenient position:

- 4 Nos. sight glasses for viewing inside of the vessel placed suitably and two nos. sight glasses on sliding door.
- 4 Nos. suitable light fittings on the side of the vacuum drying vessel to ensure proper illumination in side area to facilitate visual inspections.
- Vacuum pipe connections of adequate size near the top edge of the vessel and he canal between two gaskets around the door flange is also to be connected with vacuum line.

(3)

- Dry hot air entry and exit ports located suitably on the vessel for the supply of dry air for scavenging the humid air during heating phase and also to break the vacuum.
  2 Nos. blank ports with 8 terminals each having epoxy cast bushing for thermo couple connections positioned on each side of the vessel.
- All seals, gaskets, light fitting, site glass assembly and wiring should be able to with stand variation of pressure and temperature.

2.8 EFFECTIVE INTERNAL DIMENSIONS OF VESSEL :

LENGTH / DEPTH	:	**7000 M.M.**
WIDTH	:	**4.500M.M.**
HEIGHT	:	**5000M.M.**

3.0 TEMPERATURE RECORDING AND CONTROL:

The vessel shall be designed for working on steam and capable of maintaining any temperature between **70 to 125 deg.C** to an accuracy of +_ **2 deg.C** throughout the vessel with transformers in side. The temperature inside the vessel is to be thermostatically controlled by sensing units fitted in the heating medium.

4.0 VACUUM PUMPING & MEASURING EQUIPMENTS:

Two stage vacuum pumping unit is to be designed and capacity determined in such manner that at the end of drying total pressure of approximate **0.5 m bar** is existing in the chamber and that it draws / achieved absolute vacuum in the vessel in about **90 minutes** when vessel is empty with out charge. The capacity of the whole pumping system should be related to volume of vessel taking in to consideration of leakage factor and moisture content in the insulation of job.

The vessel shall be equipped with a suitably designed two stage vacuum pumping unit capable of achieving:

(i) Absolute vacuum in side an empty vessel with in 90 minutes.
(ii) A vacuum level of 0.5 mbar at the end of drying cycle of the charged vessel.

Capacity of the vessel, moisture contents of the job and overall leak rate are the main features that needs to be considered for deciding capacity of the vacuum pumping unit.

The vacuum pumping unit shall be consist of a rotary oil sealed pump with air ballast and a mechanical booster pump with automatic switching on / cut off device. The rotary oil seal pump shall be provided with a metallic steel bellows on inlet side. Necessary calculation imparts of the designed system shall be furnished with the offer. Also, provision shall be made to include dust filter on inlet side and oil mist eliminator on exhaust line of rotary oil sealed pump. Immediately after the vacuum connection from vacuum vessel, a water cooled trap cum vapour condenser of adequate capacity shall be provided. Another vapour condenser shall be provided between mechanical booster vacuum pump and rotary oil sealed pump. Condensers shall have automatic condensate drain off facility into condensate receivers having adequate holding capacity. The receivers shall have graduated gauge glass to indicate the water level of condensate in the tank at any time. The vacuum pumping unit shall be complete with all necessary devices as well as flanges and counter flanges. The capacities of each equipment in the group should be suitably matched and details furnished with the offer. The vacuum pumping system shall be package type, mounted on an open type frame work. All equipments are to be mounted in such a manner that they can be taken out easily when required for maintenance. Separate offers are to be made for pumping units of various make like "Pfieffer", Leybold , TOHO, Etc. The vacuum pumping unit shall be complete with vacuum breaking valves, automatic shut off device etc.

5.0 VACUUM RELEASE AND RELIEF VALVE:

Vacuum is to be released before opening the vessel by admitting dry air from air dryer which should be capable of vacuum release within 30 Minutes. The air drying unit is also to be used for supplying dry air for scavenging. The air dryer shall be provided with hygrometer, temperature gauge, timer etc. for regeneration of Silica gel.

6.0 LAGGING AND CLADING OF THE VESSEL

The vessel is to be lagged by a suitable heat insulating material so as to keep the temperature in the neighborhood of vessel not to exceed 5degree centigrade over the ambient and finally covered with Aluminium cladding.

7.0 CONTROL PANEL AND GUAGES

To ensure processing of job as per the desired process parameter, a dust proof control panel having the following items shall be provided. Following items shall be provide in side the panel:

(i) All necessary control / switch gears & fuse gears.
(ii) Indicating lamps, various types of switches etc.
(iii) Illuminated mimic diagram of the process sequence.
(iv) Voltmeter, ammeter with selector switches.
(v) Mecleod gauge and pirani vacuum gauges with double / multiple gauge heads.
(vi) Six point data logger to log various process parameters like temperature, pressure etc.
(vii) Temperature controllers along with blind controllers/ thermostats for overriding control.

All cables inside control panel and out side control cable shall be of copper conductor of suitable rating. The colour of control cable should be red and all cables for power shall be RED/Yellow/Blue for phases and green for neutral.

All Electrics used in the plant shall be suitable for operation on 415Volts, 3 Phase , 4 wire , 50HZ A.C. Supply.

8.0 INSTALLATION

The vessel is to be installed on our prepared foundation, details of which will be furnished by manufacturer. Suitable ladders and platforms should be provided to reach top of the vessel and various equipments fitted at height.

9.0 ERECTION AND COMMISSIONIN

The offer should include the charges for complete transportation, erection 'and commissioning of the vessel and ancillary equipments with duration. Your commissioning engineer's services should also be available at site for setting all controls while demonstrating the working of the plant. Leak rate test shall be carried out for the empty vessel.

10.0 LOAD TEST

Load test at full load shall be carried out for complete one cycle of processing of ESP transformer and various parameter shall be checked like achieving final vacuum, time taking to achieve the final vacuum, Time taken to complete the cycle of processing, Measuring of various parameter in transformer which have been processed and final filling the oil.

11.0 MISCELLANEOUS

11.1 The offer should be descriptive and complete. Details of all equipments and accessories like Vacuum pumping system, Vessel and door heating system, door opening, sliding and sealing arrangement, Job loading and movement system with general arrangement drawings and catalogues to be enclosed with the offer. Offer with out complete details are liable to be rejected.

11.2 Firm should give breakup prices of all major items and activities.

11.3 The following drawings and information are to be furnished along with the offer:

(a) General arrangement drawing of vacuum vessel along with vacuum pumping system and accessories.
(b) Details and drawing of door supporting, door sliding and sealing arrangement including clamping of door.
(c) Details of proposed Hydraulic system / electromechanical drive.
(d) Details of piping layout of steam, condensate, oil and vacuum.
(e) Details of various controls (Electric/ Hydraulic/ Mechanical), instrumentation, safety devices etc.
(f) Electrical control and power schematic diagram.
(g) To including chilling and cooling water requirement.

12.0 QUALIFYING CONDITIONS

Only those vender, who have supplied and commissioned at least two Vacuum drying Vessel for similar application in the past ten years and such oven is presently working satisfactorily for more than one year (more than six month if supplied to BHEL) after commissioning should quote. The following information is to be submitted by the vender about the companies where similar Vessels have been supplied. This is required from venders for qualifications of their offers.

1. Name of the customer/ company where similar machine/plant is installed
2. Complete postal address of the customer
3. Year of commissioning
4. Name and designation of the contact person of the customer
5. Phone , Fax No. and e.mail address of the contact person of the customer
6. Performance certificate from the customer regarding satisfactory performance of the machine/ plant supplied to them

Drafted by	Checked by		Approved		
19/11/08			08/02/08		
Inder Mathur Manager (WE&S)	Incharge Maint.	Incharge production	AGM (TRE)	AGM (FW)	AGM (TRM/TRP)