

**PRODUCT PURCHASING SPECIFICATION
TRANSFORMER ENGINEERING DEPARTMENT
BHEL, JHANSI**

Specification No. TRE/19118/02

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Rev. 00 Dt.: 01.01.2016

Mobile Oil storage tank of 25000 liters capacities along with complete accessories & spares

Standard

The oil storage tank shall be designed and fabricated as per relevant Indian standard e.g. IS: 803 or other internationally acceptable standard like BS 2594.

Specification

Transformer oil storage tank shall be tow-able & rested on pneumatic tyres of adequate quantity and size. The oil tank shall be cylindrical, of welded steel construction and shall be designed and fabricated from plate steel conforming to **ASTM A516 Grade-60** in accordance with the **UW of the ASME Code for Unfired Pressure Vessels, Section-VIII**, for the design. It shall be **horizontally mounted** on wheels equipped with inspection manholes, gauge glasses or other means for indicating liquid level, overflow and vent lines and drains.

The thickness of tank plate shall be of sufficient size for temperature effect and pressure due to oil. However, it shall not be less than **8 mm for shell and 10 mm for dish end**. The oil tanks shall be vacuum tested and for leakage as well.

The tank shall be designed for storage of oil at a temperature of 100 °C.

The tank shall have adequate number of jacking pad so that it can be kept on jack while completely filled with oil. The tank shall be provided with suitable saddles so that tank can be rested on ground after removing the pneumatic tyres.

The tank shall be also fitted with manhole, outside & inside access ladder, silica-gel breather assembly, inlet & outlet valve, oil sampling valve with suitable adopter, oil drainage valve, air vent etc. Pulling hook on both ends of the tank shall be provided so that the tank can be pulled from either end while completely filled with oil. Bidder shall indicate the engine capacity in horsepower to pull one tank completely filled with oil. Oil level indicator shall be provided with calibration in terms of liter so that at any time the operator can have an idea of oil in the tank. Four number of suitable rubber hosepipe with couplers and unions each not less than **20 meters** long also be provided.

The internal & external surface to be painted shall be shot or sand blasted to remove rust and scale of foreign adhering matter or grease. All steel surfaces in contact with insulating oil shall have painted with two coats of heat & oil resistant anti corrosive paint. All steel surfaces exposed to weather shall be given primary coats of zinc chromate. Second coat of oil & weather resistant paint of a colour distinct from primary and final two coats of glossy oil and weather resistant paint in accordance with **RAL shade 7035**. All paint shall not scale off or crinkle or be removed by abrasion due to normal handling. The minimum thickness of outside painting of tank shall be 25 micron per coat the total thickness shall be within 150 to 200 micron.

The oil tanker will contain a self-mounted centrifugal oil pump with inlet & outlet valves with coupler-suitable rubber hoses and necessary switchgear for its control. There will not be rigid connection to the pump. The pump motor will be electrically driven & will have the capacity of 6000LPH discharge with Head of 8.0 meter. The pump motor & control cabinet will be enclosed in cubicle with IP-55 enclosure & insulation class-F.

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Location of Project

The NHPC Kishanganaga HE Project is located 5 km (3 mi) north of Bandipore in J&K.

Meteorological data

- o Maximum ambient air temperature = 38°C
- o Minimum ambient air temperature = -12 °C
- o Maximum relative Humidity = 98%
- o Minimum relative Humidity = 50%
- o Seismic Zone of India = V
- o Altitude = 1800 m

Spare Parts (to be quote separately)

S. No.	Description	Quantity
1	Complete set of seals & Gaskets	2 sets
2	Complete set of valves for the system	2 sets

Tools & Tackles

Tools & Tackles to be provided for maintenance and attendance of the equipments.

Documents must required with offer

- General arrangement plan, section of main and sub-assemblies with detailed dimensions of the parts and the size of each and every part of the equipment to be supplied under this specification
- Complete list of accessories and auxiliaries with their make and accompanied with catalogue/pamphlets/literature/write-up.
- Complete list of instruments offered with their make and accompanied with catalogue/pamphlets/literature/write-up.
- List of acceptance test with procedure.
- List of recommended spare if any. The price should be quoted separately.



KISHANGANGA H E PROJECT

(PTS)

29. OIL HANDLING SYSTEM

29.1. Scope of Work

Scope of work under this section covers the provision of labour, tools, plants, materials and performance of work necessary for the design, manufacture, quality assurance, quality control, shop assembly, shop testing, delivery at site, site storage and preservation, installation, commissioning, performance testing, acceptance testing, training of Owner's personnel, handing over to Owner and guarantee for two years of oil handling system as per the specifications hereunder, complete with all auxiliaries, accessories, spare parts and warranting a trouble free safe operation of the installation.

The scope of work shall be a comprehensive functional system covering all supply and services including but not be limited to following:

29.1.1. Vacuum type insulating oil handling system

- i) Two (2) 6000 LPH or higher mobile tyre mounted insulating oil purifying plants complete with transformer evacuation system, oil hoses, vacuum hoses, hose couplings and other accessories to complete the system,
- ii) Two (2) five (5) cubic meter/min or higher capacity regenerative air dryers.
- iii) Two (2) 3000 LPH or higher mobile tyre mounted insulating oil transfer pump with oil hoses, hose coupling and other accessories etc.,
- iv) Two (2) mobile tyre mounted large insulating oil tanks of capacity 25000 litres each or 120% of oil requirement of one GSU transformer whichever is higher.

29.1.2. Lubrication oil handling system

- i) Two (2) 1000 LPH or higher mobile tyre mounted centrifuge type lubrication oil purifying plants complete with oil hoses, hose couplings and other accessories to complete the system,
- ii) Two (2) nos. mobile tyre mounted lubricating oil tanks of capacity 6000 litres.

Any other item(s) not mentioned specifically but necessary for the satisfactory completion of scope of work defined above, as per accepted standard(s) / best international practices.

29.2. Specific Parameters and Layout Conditions

29.2.1. Insulating oil handling system

Suitable arrangement/ provision shall be made in the system/ system components such that the plant can be docked near each of the transformer units for the intended purpose. The Contractor shall ensure adequate coordination while designing the system to ensure compatibility of inlet outlet



ports between the transformers and oil handling equipment.

The oil hoses and vacuum hoses for each plant shall be of sufficient length and size to filter the oil of any transformer unit.

29.2.2. Lubrication oil handling system

The oil hoses shall be of sufficient length and size to connect lubrication oil purifying plant to various equipment / components / systems.

Suitable piping both embedded and exposed, fittings, fixtures etc. shall be coordinated with the Turbine, Governor and Generator manufacturers/ sub-contractors for dockable type arrangement and provision shall accordingly be incorporated.

29.3. Rating and Functional Characteristics

29.3.1. Insulating oil handling system

- The purifier shall be capable of processing the oil on single pass basis at rated flow to the following specification:
 - Moisture content : Less than 5 PPM
 - Gas content : Less than 0.1% by volume
 - Dielectric strength : 70 kV across 2.5 mm gap
 - Filtration : Less than 1 micron
 - Power factor Tan Delta at 90 °C : 0.002

29.3.1.1. Transformer evacuation system

- Capacity to have an ultimate blank-off of 10^{-4} Torr or less.
- Evacuation to the level of 0.1 Torr or less when connected to main transformer tank.

29.3.2. Lubrication oil handling system

The purifier shall be capable of processing the lubricating oil on not more than two (2) passes basis at rated flow to the following specification:

- Free water : 100% reduction
- Moisture content : Less than 50 PPM
- Filtration : Less than 1 micron



29.4. Performance Guarantee

The oil handling system along with all auxiliaries and accessories shall be capable of performing intended duties under specified conditions. The Contractor shall guarantee the reliability and performance of the individual equipment as well as of the complete system.

29.5. Design and Construction

29.5.1. Standards

The system and equipment shall be designed, built, tested and installed to the latest revisions of the following applicable standards. In the event of other standards being applicable they will be compared for specific requirement and specifically approved during detailed engineering for the purpose:

Standards	Description
IS 6034	Insulating oil conditioning plants - specification
ASTM A516	Standard specification for pressure vessel plates, carbon steel, for moderate and lower temperature service
ASME Section VIII	Code for unfired pressure vessels

29.5.2. Oil Purifiers

The systems shall have its own control panel with suitable pressure gauges, push-buttons for starting and stopping with a flow-meter, a volume-meter with manual zero reset etc., other controls and monitoring with necessary protection. The insulation of motors shall be of Class-F with IP 55 protection class.

29.5.2.1. Insulating oil purifiers

The insulating oil purifiers shall be of filtration and vacuum de-hydration type. Unit shall consist of coarse filter, oil transfer pump, thermostatically controlled ceramic heaters, filtration section, deoxidizing column, vacuum pumps, discharge pump, two stage degassing system, transformer evacuation system, thermometers, pressure / vacuum gauges, flow meter, valves, piping, control panels with on-line process monitoring facilities and other accessories necessary for satisfactory operation of purifiers. The insulating oil purifiers shall be suitable for indoor and outdoor duties.

29.5.2.2. Lubricating oil purifiers

The purifying unit shall be a complete self-contained and enclosed unit with motor-driven pumps or pump of suitable rating, centrifuging chamber and other appurtenances to make the system complete and functional.



The lubricating oil may contain free and dissolved moisture of the order of 1000 to 2000 PPM initially which needs to be reduced in the range of 50 PPM. Besides moisture, the oil may contain suspended impurities such as cotton waste, welding slag and spatters, metallic chips, small sand particles, iron fillings, pebbles, dust and pipe scales. The offered equipment shall not be damaged by the flow of oil containing these impurities. The oil may also contain grease and kerosene, which shall also be required to be removed.

29.5.3. Oil tanks

The oil tanks shall be cylindrical, of welded steel construction and shall be designed and fabricated from plate steel conforming to ASTM A516 Grade-60 in accordance with part UW of the ASME Code for Unfired Pressure Vessels, Section VIII, for the design. It shall be horizontally mounted on wheels equipped with inspection manholes, gauge glasses or other means for indicating liquid level, overflow and vent lines and drains. The tank shall also be provided with suitable saddles so that it can be rested on ground after removing from the trolley.

All tank vents shall be fitted with dehydrators to prevent the entry of moisture into the tanks.

The thickness of tank plate shall be of sufficient size for temperature effect and pressure due to oil. However, it shall not be less than 8 mm for shell and 10 mm for dish end. The oil tanks shall be vacuum tested and for leakage as well.

29.5.4. Oil transfer pump

The oil pumps shall be of vacuum tight positive displacement gear type with horizontal driving shaft directly connected to its electric motor through a flexible coupling and complete with a check valve, shut-off valves, safety relief valve, high temperature shutdown etc..

Each pump shall be tyre mounted and shall be equipped with pressure relief valve to protect the pump against excessive pressure in case of throttling in the discharge line. The relief valve shall be set for a pressure, which will not overload the motor when operating at full load.

29.5.5. Pipes, fittings and hoses

All pipes shall be seamless steel tubes. Fittings shall be forged or compression type steel fittings with cutting ring seal. Plug type valves with oil-resistant seats shall be used throughout the system. Hoses shall be steel-armoured, oil resistant and of suitable lengths. The hoses shall be provided with leakage-proof, quick-connect couplings.

The hoses shall be able to withstand the required pressure and temperature of oil during the filtration process.



Suitable mobile hose racks shall be provided to accommodate the hoses. All pipes, fittings and hoses shall be properly labelled and distinctively marked.

29.5.6. Air dryers

The air dryers shall be of regenerative type to fill the dry air in transformers when required. Each air dryer shall be provided with at least 150m cables.

29.6. Drawings, Documents and Design Calculations

29.6.1. Design memorandum

The Contractor shall submit to Owner a design memorandum prepared in accordance to clause 1.6 "Record and Documentation" of "Section 1- General Technical Requirements."

29.6.2. Drawings and documents

The Contractor shall submit all the drawings and documents in accordance with requirements stipulated in "Section 2 - Technical Documents" of "General Technical Specification (GTS)".

These drawings and documents shall include at least the following:

- Schematic drawings of the oil handling plant with all piping systems, control systems and instrumentation with reference of the relevant Indian/international standards followed for the design and construction of the plant and its components/material.
- General arrangement plan, section of main and sub-assemblies with detailed dimensions of the parts and the size of each and every part of the equipment to be supplied under this specification.
- Complete list of accessories and auxiliaries with their make and accompanied with catalogue/pamphlets/literature/write-ups.
- Complete list of instruments offered with their make and accompanied with catalogue/pamphlets/literature/write-ups.

29.6.3. Design calculation

The Contractor shall submit the design calculation in accordance to Clause 2.6 of "General Technical Specification (GTS)" covering at least the following, for review / acceptance.

- Calculation for selecting the pumping capacity of the pumps including vacuum pumps, oil tank and plant capacity.
- Size of De-gassing chamber.
- Methods/ principal adopted for determination of oil characteristics.



- Capacity of the heater for both lubricating oil and insulating oil handling system,
- Total power requirement individually for the insulating oil and lubricating oil purifying system and of oil transfer pumps.
- The Contractor shall also provide other calculations as required by the Owner for his approval of the Contractor's design.

29.7. Delivery, Installation and Commissioning

The Contractor shall follow the requirements of Delivery, Installation and commissioning elaborated in clause 1.7 "Delivery, Installation and commissioning" of "Section 1 - General Technical Requirements".

29.7.1. Specific packaging, handling and storage requirements

Prior to shipping, all threaded openings shall be closed with standard pipe plugs. Flanged openings shall be protected with blind flanges with gaskets bolted in position.

29.8. Spare Parts

Recommended spare parts shall be supplied in accordance to clause 1.8 "Spare Parts" of "Section 1 - General Technical Requirements". Specified spare parts to be supplied under this section are as follows:

S. No.	Description	Quantity
✓ 1	Connecting hose with couplings of each type and size	2 nos. of standard lengths of each used type
2	Oil pump of all type	1 set of each used type
3	Complete set of seals and gaskets for the system	2 sets
4	Complete set of filters for the system	2 sets
5	Complete set of valves for the system	2 sets

29.9. Tools and Instruments

The Contractor shall supply all necessary tools and instruments etc. for installation, repair and maintenance in accordance to clause 1.9 "Tools and Instruments" of "Section 1 - General Technical Requirements".



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29.9.1. Special tools

The Contractor shall propose the list of special tools including their make and detailed specification as recommended by manufacturer(s), to be accepted by the Owner.

29.10. Quality Assurance and Testing

The Contractor shall follow the quality assurance and testing requirements specified separately in "Quality assurance and Testing Specifications (QTS)".



29. OIL HANDLING SYSTEM

29.1. Type Tests

The contractor is required to carry out all type tests as per relevant IEC/International Standard on one apparatus of each type of similar rating and shall submit the reports to the employer. The type test may not be mandatory if similar equipment has been type tested and test certificates for relevant tests are accepted by the employer.

Following Items Test reports shall be submitted

- ◆ Insulating oil purifier and its major components,
- ◆ Lubricating oil purifier,
- ◆ Air dryers.

29.2. Shop Tests

- ◆ The components of Insulating Oil Purifier, Lubricating Oil Purifier and Air Dryers shall be routine tested as per relevant IEC with latest amendments. All shop tests shall be carried out at the manufacturer works.

The following tests shall be done on Insulating Oil and Lubricating Oil Purifier

- ◆ Leak Tightness – Pneumatic Test,
- ◆ Leak Tightness Test Under Vacuum,
- ◆ Pressure Test on Pipe with Assembly,
- ◆ Capacity Check,
- ◆ Power Consumption of Motor and Heater,
- ◆ HV and IR Test,
- ◆ Protection and Inter Lock Verification.

The following Performance Test of Transformer Oil Parameters (Single-Pass) shall be done:-

- ◆ Dielectric Strength (BDV),
- ◆ Moisture Content (PPM),
- ◆ Gas Content,
- ◆ Filtration,
- ◆ Dielectric Disruption factor,
- ◆ Neutralizations Value.

The following Performance Test of Lubricating Oil Parameters (Single-Pass) shall be done:

- ◆ Free Water,



- ◆ Moisture Content,
- ◆ Filtration.

The Details of the tests are given in Model Quality Assurance Plan of Oil Handling System.

29.3. Field Tests

All field tests including tests during installation, pre-commissioning, commissioning and field acceptance tests shall be conducted by the Contractor, in the presence of representative of the Employer.

Procedure to be adopted, for conducting the operational, pre-commissioning, commissioning, performance and field acceptance tests shall be submitted well in advance, at least six (6) months before start of relevant testing, for approval of the Employer.

Following tests shall be performed:

- ◆ Test to demonstrate operational capabilities of the system as per the intended requirement.

29 OIL HANDLING SYSYTEM**29.0 Guaranteed Technical Particulars**

Item / Clause No.	Parameter	Units	Contractor's Data
1	General		
1.1	Type/ designation		HIGH VACUUM TWO STAGE
2	Insulating oil system		
2.1	Tyre mounted large plant		MOUNTED ON FOUR PNEUMATIC TYRES
	- Type/ designation		HIGH VACUUM TWO STAGE
	- Number supplied	Nos.	TWO
	- Rate of oil flow	Lpm	100(6000 LPH)
2.2	Capabilty of insulating oil purifying plant both small and large, after single pass		
2.2.1	Moisture content	PPM	INITIAL - 50 PPM, FINAL - 5PPM
2.2.2	Filtration	micron	LESS THAN 1 MICRON
2.3	Tyre mounted large insulating oil tanks		
	- Number	Nos.	TWO
	- Capacity of tank	Litre	25000
	Transfer pump		PROVIDED AS PER CLAUSE 29.5.4
	- Type/ designation		GEAR TYPE
	- Number of pumps	Nos.	Two (one for each system)
	- Pumping capacity	Lpm	50LPM (3000LPH)
	- Duty of pump-motors		CONTINUOUS
	- Insulation class and protection class of pump-motors		MOTORS " F " CLASS, IP 55
2.4	Air dryers		
	- Number supplied	Nos.	TWO
	- Capacity of air dryer	m ³ /min.	5
2.5	Oil Hoses	Nos.	OIL INLET: 40NBx10MTRS, OIL OUTLET : 40NBx 10MTRS
	- Type/ designation		NITRILE RUBBER
	- Number	Nos.	INLET HOSE 1 NO, OUTLET HOSE 1 NO



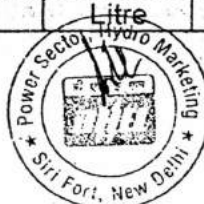
29 OIL HANDLING SYSYTEM

29.0 Guaranteed Technical Particulars

Item / Clause No.	Parameter	Units	Contractor's Data
2.6	Evacuation system for transformer tanks		PROVIDED . MOUNTED WITH THE INSULATING OIL FILTRATION PLANT
	- Type/ designation		ROOTS-ROTARY COMBINATION
	- Number	Nos.	2 SETS. 1 EACH WITH INSULATING & FILTRATION PLANT
	- Pumping capacity of vacuum pumps	Lpm	ROTARY PUMP 1500LTRS/MIN ROOTS PUMP - 500M ³ /HR
	- Duty of pump-motors		CONTINUOUS
	- Insulation class and protection class of pump-motors		IP 55, MOTOR CLASS "F"
	Vacuum Hoses	Nos.	PROVIDED
	- Number		1 NO EACH EVACUATION SYSTEM
	- Type/ designation		NITRILE RUBBER
3	Lubricating oil system		
3.1	Capabilty of lubricating oil purifying plant, after not more than two passes		
3.1.1	Moisture content	PPM	2000 PPM to 50 PPM
3.1.2	Free water reduction	%	Upto 2000 PPM
3.1.3	Filtration	micron	Less than 1 micron
3.1.4	Centrifuge type tyre mounted plant		Mounted on 4 pneumatic tyres
	- Type/ designation		Centrifuge - Vacuum Degasser combination
	- Number supplied	Nos.	Two
	- Rate of oil flow	Lpm	20 LPM (1200 LPH)
	- Pumping capacity	Lpm	20 LPM (1200 LPH)
	- Total heating capacity	kW	24 kW
	- Purifier cleaning effectiveness, particulate matter down to	mm	Less than 1 micron
	- Fineness	mm	1 micron
3.2	Tyre mounted lubrication oil tanks		
	- Number	Nos.	Two
	- Capacity	Litre	8000



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