

VOLUME-2
PART- I
Section-24
Oil Filtration System

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24. Oil Filtration System

24.1 Intent of Specifications

The intent of these specifications is to define and cover the scope of work under this section which 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, storage at site, erection, acceptance testing, commissioning, performance testing, handing over to Purchaser and guarantee for trouble free operation of Oil filtration system for Keyi H E Project, Arunachal Pradesh as per the specifications hereunder, complete with all auxiliaries, accessories, spare parts and warranting a trouble free safe operation of the installation.

It is not the intention to specify the minute details/smallest items to deliver a functional system or to define the standard manufacturing practice but to outline the performance, constructional, operational, and guaranteed requirements. It is the responsibility of the contractor to ensure these requirements.

24.2 Scope of Supply

Scope of work under this section covers 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, handing over to purchaser, training to Owner's engineers and guarantee for performance of Oil Handling & Purification System as per the specifications furnished hereunder each complete with all accessories, spare parts and warranting a trouble free safe operation of the installation as detailed below:

The scope also covers all the equipment & accessories required for completion of the system to give the desired performance even though specifically not mentioned in these specifications.

a. Vacuum Type Transformer Oil Purifying System

It shall consist of:

- (i) One (1) pneumatic tyre mounted, mobile 1600 L/hr-transformer oil filtration plants complete with transformer evacuation system, dehumidifier, degasification unit, oil hoses, vacuum hoses, hose couplings and other accessories to complete the system.
- (ii) One (1) 50 LPM Trolley mounted oil transfer pump electrically powered with oil hoses, hose coupling and other accessories etc.
- (iii) One (1) trolley mounted transformer oil tanks of capacity 3000 liters each or the capacity to fill one transformer.

b. Lubrication Oil Purifying System

It shall consist of:

- (i) One (1) pneumatic tyre mounted, mobile 600 L/hr electrostatic type lubrication oil filtration plants complete with dehumidifier, degasser, oil hoses, vacuum hoses, hose couplings and other accessories to complete the system.
- (ii) One (1) trolley mounted lubricating oil tank of capacity 1000 liters.

- (iii) One (1) LVDH system 300 liters per hour minimum.
- (iv) Necessary lubricating oil piping including pipes, valves, fitting hose coupling etc. for filtering / circulation of oil in various equipment / components / systems.

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

The lubricating oil may contain free and dissolved moisture of the order of 1000 ppm to 2000 ppm initially which needs to be reduced in the range of 5-10 ppm. Besides moisture, the oil may contain suspended impurities such as cotton waste, welding slag and spatters, metallic chips, small sand particles, iron filings, 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. The purifier shall reduce the free and dissolved moisture in the lubricating oil to acceptable level for reuse.

- c. One (1) set of standard spares

24.3 Codes and Standards

All equipment and materials shall be designed, manufactured, and tested in accordance with the latest applicable Indian Standards (IS) / International Standards as given below except where modified and/or supplemented by this specification.

ISO 9001	Quality Systems Model for Quality Assurance in Design, Development, Production, Installation and Servicing.
ASME Code VIII	Code for Unfired Pressure Vessel
IS 6034	Insulating oil conditioning plants Specification
ASTM A516	Standard Specification for pressure vessel plates, carbon steel for moderate and lower temperature service
IS 325	Specification of induction motors

Equipment and material conforming to any other standard, which ensures equal or better quality, may be accepted subject to approval of the Owner. In such case, copies of the English version of the standards adopted shall have to be submitted along with the bid.

24.4 Special Design and Layout Conditions

24.4.1 Transformer Oil Purifying System

The transformer oil purifying system shall consist of one mobile purifying plants complete in all respects and one air dryer (to be used during drying the transformers) & degasser. The oil hoses and vacuum hoses for each plant shall be of sufficient length and size to filter the oil of any transformer unit.

24.4.2 Lubrication Oil Purifying System

The lubrication oil purification system suitable to purify bearing oil, governor oil and inlet valve oil shall consist of one mobile purifying plants complete in all respects the oil hoses shall be sufficient length and size to connect lubrication oil purifying plant to various equipment/ components/ system.

24.5 Basic Dimensions and Ratings

The rating of the oil filtration plant shall be as per relevant clauses of this document.

24.6 Performance Criteria and Guarantee

The Oil Filtration system along with all auxiliaries and accessories shall be capable of performing intended duties under specified conditions. It is the responsibility of the contractor to supply the equipment as per guaranteed technical particulars and shall guarantee the reliability and performance.

24.7 Design and Construction

24.7.1 Oil Purifying System

The oil purifying plant shall be mounted on a trolley with pneumatic tyre and shall be furnished with power cable of sufficient length. The systems shall have its control panel mounted on the same trolley having purifying plant. Pressure gauges, pushbuttons for starting and stopping and a volume meter with manual zero reset shall be located on the control panel with necessary protection system.

24.7.2 Oil Purifiers

a. Insulating Oil Purifiers

The insulating oil purifiers shall be used for processing the transformer oil and shall be of filtration and vacuum de-hydration type conforming to respective IEC/IS codes. The unit shall be capable of purifying 1600 L/hr. Unit shall consist of coarse filter, oil transfer pump, thermostatically controlled heaters, filtration section, deoxidizing column, vacuum pumps, discharge pump, two stage degassing system, transformer evacuation system, thermometers, pressure / vacuum gauges, flowmeter, valves, piping, control panels and other accessories necessary for satisfactory operation of purifiers. The insulating oil purifiers shall be suitable for indoor and outdoor duties.

Transformer evacuation system consisting of vacuum pumps of continuous duty shall be provided for purpose of evacuating transformer tank and shall have sufficient capacity to have an ultimate blank off of 10⁻⁴ Torr or less and evacuation to the level of 0.5 Torr or less when connected to main transformer tank. The vacuum pumps combination shall be provided with all accessories for its satisfactory operation. Vacuum gauges to monitor vacuum shall also be provided at various stages in machines and that of external pipe beyond valve for external system.

The purifier shall be capable of processing the oil on single pass basis at rated flow to the following specifications:

- (i) Moisture content - Less than 5 PPM
- (ii) Gas content - Less than 0.1% by volume

- (iii) Dielectric strength - 60 kV across 2.5 mm gap
- (iv) Filtration - Less than 1 micron
- (v) Power factor - Tan Delta at 90 °C 0.005
- (vi) Vacuum level - 0.5 torr or less
- b. Lubricating Oil Purifier System

The lubricating oil purifiers shall be centrifuge type required for the purification of lubricating oil. The capacity of the purifier shall be minimum 600 L/hr. 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, in not more than 2 passes after purification by purifier. 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. The size of suspended particles in the purified oil leaving the purifier shall not be bigger than 5 microns.

c. Transformer Evacuation System

One separate transformer evacuation system consisting of vacuum pumps of continuous duty shall be provided in addition to the transformer evacuation system provided with insulating oil purifiers for purpose of evacuating transformer tank and shall have sufficient capacity to have ultimate blank - off 10⁻⁴ Torr or less and evacuation to the level of 0.5 Torr or less when connected to main tank. The vacuum pumps combination shall be provided with all accessories for its satisfactory operation. Vacuum gauges to monitor vacuum shall also be provided at various stages in machines and that of external pipe beyond valve for external system.

24.7.3 Oil Tanks

The oil tanks shall be trolley mounted. 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.

24.7.4 Oil Transfer Pump

The motors for pumps shall be suitable for 415 V, 50 Hz supply. The oil pumps shall be of 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 and safety valve.

Each pump shall be mounted on a suitable wheeled trolley 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. The insulation of motor shall be class-F.

24.7.5 Pipes, Fittings and Hoses

All pipes shall be seamless steel tubes. Fittings shall be forged or compression type steel fittings with cutting ring seal. 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

24.8 Drawings, Documents and Design Calculations

24.8.1 Drawings and documents

The Contractor shall submit all the drawings and documents in accordance with requirements stipulations in "General Technical Specification (GTS)". The following minimum drawings/documents shall be furnished.

- a. OGA drawing.
- b. Schematic diagram of electrical system.
- c. Bill of quantities
- d. O&M manual.

24.8.2 Design calculations

The contractor shall submit the design calculations minimum for the following for review and approval during detailed engineering.

Calculations for selecting the vacuum pump capacity to achieve as specified.

- a. Size of degassing chamber.

24.9 Quality control and Assurance

To ensure quality during each stage of work, the Contractor shall establish a system defining quality assurance plan/procedures during various stages of work.

The contractor shall maintain quality control during manufacturing of equipment as per the approved quality assurance plan. Inspection and testing shall be carried out as per the approved quality assurance plan with due regard to the Quality Assurance Plan attached with the tender documents at various stages of manufacturing for assuring the full compliance of supply with the requirements of specification.

The Contractor shall follow approved site quality assurance plan and installation procedures. The contractor shall maintain the quality record during site installation and commissioning which shall be produced to the Owner for approval.

Inspection and tests shall be carried out at site by the Owner during installation and commissioning stages as described in the relevant clauses.

All subcontractors including vendors associated in completing the supply and work under this section shall have their own quality assurance system conforming to ISO 9000 series and certified by an internationally acceptable organization.

24.10 Tests

24.10.1 Shop Tests

The pumps, pipes, valves, and complete purification plants shall be routine tested as per relevant IEC/IS at the works of bidder. The bidder is required to submit type test certificates and routine test report of the equipment.

24.11 Installation and Commissioning

The bidder shall furnish all labour, supervision, tools, supplies, bracing, spiders, shims and supports and all other provisions or materials necessary to assemble, erect, install, test and commission the equipment in a thorough workman like manner following the best modern practices.

The equipment and all its components shall be placed with great care and accuracy and shall be aligned correctly to provide an installation consistent with the close tolerances used in the erection of modern equipment.

All site assembly and commissioning of the equipment shall be done by skilled workers.

24.12 Field Tests

After installation, the oil filtration system shall be field tested for operational tests as per the intended requirements.

The bidder shall prepare and hand over to the Owner details of all test results in a report in a mutually agreed format.

24.13 Spare Parts

24.13.1 Recommended Spare Parts

The bidder shall furnish the list of recommended spare parts as required.

24.13.2 Mandatory Spare Parts

Mandatory spare parts shall be supplied in accordance with the list mutually agreed between the Owner and Contract, which is furnished by the Contractor in their final offers.

24.13.3 Special Tools

In addition to the tools listed in general technical specification the bidder shall provide one set of all necessary special tools and maintenance equipment for repairs and maintenance of the oil Handling & Purification systems as recommended by the manufacturer.

A list of such tool shall be approved during detail engineering.

24.14 Packaging, Handling and site Storage

The contractor shall follow the “General Technical Specification” for packaging, handling and storage requirement.

The contractor shall pack all the consignment in seaworthy packaging strong enough to withstand rough handling during transit. Machine surface shall be suitably protected against scratches, corrosion, shocks, impact etc. Packages shall be suitably and distinctively identified for type of handling and kind of storage.

Electronic equipment shall be packaged, shipped and stored in anti-static packing. All packages shall be stored indoor. Packages containing electronic equipment shall be stored in humidity-controlled environment.