

GUIDELINE TO POWER PLANT LUBRICATION



Introduction

Lubricants used in the power generating industry can be divided into two categories. First there is the transformer oil with insulating properties. Second there is a range of lubricants suitable for the lubrication of the machinery generating the energy. These can either be large reciprocating engines or generators requiring high TBN marine like lubricants, reciprocating gas engines requiring lubricants with a specific ash content or turbines varying from high performance aviation turbines to smaller hydroelectric units.

Transformer oil

Transformer oil is a highly-refined mineral oil that is stable at high temperatures and has excellent electrical insulating properties. It is used in oil-filled transformers, some types of high voltage capacitors, fluorescent lamp ballasts, and some types of high voltage switches and circuit breakers. Its functions are to insulate, suppress corona and arcing, and to serve as a coolant.

The oil helps cool the transformer. Because it also provides part of the electrical insulation between internal live parts, transformer oil must remain stable at high temperatures over an extended period. To improve cooling of large power transformers, the oil-filled tank may have external radiators through which the oil circulates by natural convection. Very large or high-power transformers (with capacities of millions of watts) may also have cooling fans, oil pumps, and even oil-to-water heat exchangers.

Large, high-voltage transformers undergo prolonged drying processes, using electrical self-heating, the application of a vacuum, or both to ensure that the transformer is completely free of water vapor before the cooling oil is introduced. This helps prevent corona formation and subsequent electrical breakdown under load.



Transformer

Relevant VPS products:

Rymco® Cratos I (Transformer Oil BS 148:1998 Class I)

Rymco® Cratos II (Transformer Oil BS 148:1998 Class I)

Gas Generator & Diesel Engine Lubricants

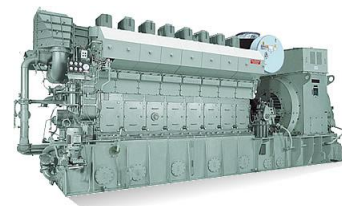
Gas Engine oils are high performance, specially inhibited oils for the lubrication of heavy-duty stationary gas and steam turbines. They are also ideal for lubrication of rotating machinery in combined-cycle cogeneration units. Incorporating an ashless, low volatility, antioxidant package, they offer excellent oxidation stability, low deposit forming capabilities in high temperature areas, protect against rust and corrosion, and offer rapid separation of water and release of entrained air.



Smaller Diesel Generator

For smaller generators with heavy-duty, turbo-charged diesel engines a range of automotive engine oils can be applied. Different API classifications apply such as CD for smaller and older generators, CF, CG-4 and CI-4 for newer models with higher output. For smaller two stroke diesel engines, an API CF-2 is recommended.

Larger Medium Speed Diesel generators require marine like lubricants with a high TBN. Mostly in a monograde SAE 40 with a total base number varying from 6 to 40. The oils should be compatible with different qualities of residual fuel, have an excellent thermal and oxidation stability and have a high load carrying capacity.



Large Diesel Generator

Cylinder Oils are the most high TBN oils in the range (TBN 70). Preventing corrosive wear, avoiding deposit formation, protecting against scuffing, minimizing piston ring and liner wear, minimizing fuel consumption.

Relevant VPS products:

Rymco® Frya Gaz MA (Medium Ash Gas Engine Oil)

Rymco® Erato M (Mineral Turbine Oil (Group I))

Rymco® Erato S (Mineral Turbine Oil (Group II))

Rymco® Universal HD (CF-4 Engine Oil)

Rymco® Endurox LD (CI-4 Engine Oil)

Rymco® Marlub series (High TBN Monograde Medium Speed Diesel Engine Oils)

Rymco® Marlub Cyn 70 (TBN 70 cylinder oil)

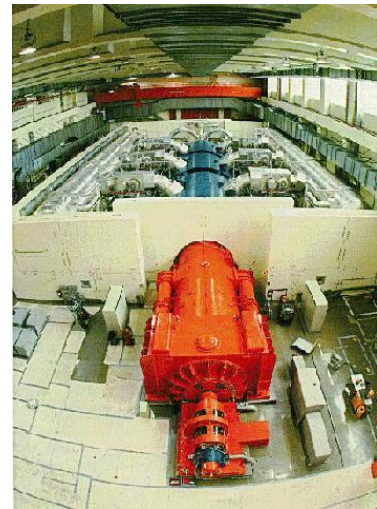
Turbine Oil

Under normal conditions, the lubricating oil for a hydroelectric unit's guide and thrust bearings experiences relatively mild service, but it is expected to have a long service life. To have a long life, a high quality oil with various additives to enhance and maintain its quality is required. In most powerplants, a highly refined turbine oil is used for bearing lubrication. Table 1 lists some typical properties of a Group I turbine oil. A Group II oil would have better oxidation stability. The oil should be rust and oxidation inhibited with an antifoam additive. The oil should also be resistant to emulsification and separate readily from water. Antiwear or extreme pressure additives are not required or desired.



Sulzer Turbine Generator

The recommended oil viscosity is usually specified by the equipment manufacturer and depends on the operating speed, load, and temperature as well as the bearing clearances. The most common viscosities used in turbines are the ISO viscosity grades 32, 46, and 68.



Large Turbine Generator

Relevant VPS products:

Rymco® Erato M (Mineral Turbine Oil (Group I))

Rymco® Erato S (Mineral Turbine Oil (Group II))

Hydraulic Oil

The primary purpose of hydraulic fluid is to transmit power. To accomplish this effectively, the fluid must be incompressible and flow readily through the system. The fluid must also have sufficient viscosity to seal and lubricate the components of the hydraulic system. There are a variety of fluids capable of performing these functions, but the most satisfactory hydraulic fluid is usually oil.

A hydraulic oil has many of the same requirements as a lubricating oil used in the unit bearings, and, in many cases, the same oil can be used. If the system uses a gear pump, operates at pressures less than 1,000 pounds per square inch (psi), and has similar viscosity requirements, the bearing lubricating oil can function very well as a hydraulic oil. In systems that operate over 1,000 psi or use a piston or sliding vane pump, a fluid with an antiwear additive is usually required. Where the system operates in an area of great temperature extremes, a multigrade oil may be required to provide desirable high and low temperature viscosity characteristics.

In some instances, a fire-resistant hydraulic fluid may be required. These fluids are usually either a water-based or a synthetic fluid. In either case, the system must be designed specifically for the fluid it will use. Water-based fluids have a very low viscosity, and the synthetic fluids are not compatible with many seal materials found in hydraulic systems.



Hydraulic System

Relevant VPS products:

Rymco® Hydra AW (HLP Hydraulic fluids in a range of ISO grades)

Rymco® Hydra HVI (HVI Hydraulic fluids in a range of ISO grades)

Grease

Grease for the slow moving, highly loaded, bronze bushings such as those found on wicket gates, radial gates, and butterfly valves should be adhesive, water resistant, able to withstand high bearing pressures, and of a consistency that can be pumped at the lowest temperature encountered. Usually, a grease with extreme pressure or antiwear capabilities is specified. It should be noted that the term, “extreme pressure,” is used fairly liberally by grease manufacturers, and the presence of extreme pressure additives and extreme pressure properties should be verified. Because the grease is lubricating a bronze bearing, it should not be corrosive to copper. The dropping point of the grease has little relevance in this case.



Ball Bearing

Relevant VPS products:

Caldax (Calcium Grease)

Caldax GR (Calcium & Graphite Grease)

Caldax SI (Calcium Silicon Grease)

Comdax 2 (Lithium Complex Grease)

Lindax EP1-2-3 (Lithium Grease EP)

Lindax MP2-3 (Lithium Grease MP)

Moldax 2 (MoS₂ Grease)



Interior of a Powerhouse

Gear Oil

Gears vary greatly in design and in their requirements for lubrication. When selecting a lubricant for any gear application, the type of gearing and the operating conditions, such as speed, load, and temperature, must be considered. Enclosed gears (i.e., gears encased in an oil tight housing) usually use a mineral oil with rust, oxidation, and foam inhibitors and, where loads are severe, extreme pressure additives.

Worm gears are a special case because the action between the worm and its mating gear is sliding rather than the rolling action found in most gears. The sliding action allows fluid film lubrication to take place. Worm gears are also different in that the mating gears (the worm and the bull gears) are usually made of dissimilar materials. The use of dissimilar material reduces the friction and the chance of galling. Extreme pressure additives are usually not required for worm gears, but lubrication can be improved by lubricity additives.



Worm Gear

A highly adhesive lubricant is required for most open gear applications. An open gear lubricant must resist being thrown off by centrifugal force or being scraped off by the action of the gear teeth. Most open gear lubricants are heavy oils, many times asphalt based, or soft greases. Depending on the service conditions, oxidation inhibitors or extreme pressure additives may be added.

Because these lubricants are very adhesive, they also attract dust and dirt. These contaminants can act as abrasives if the gears are not periodically cleaned.



Closed Gear



Open Gear

Relevant VPS products:

Rymco® Gevitro TWS (Mineral Industrial Gear Oil in a variety of ISO Grades)

Rymco® Gevitro TWS FS (Full synthetic PAO Industrial Gear Oil in a variety of ISO Grades)

Wire Rope Lubricant

The life of a wire rope can be extended through the proper application of the correct lubricant. The individual wires in a wire rope are subject to abrasive wear as they move relative to each other any time the rope is bent, such as when it goes over a sheave or is wound on a drum. Unless the rope is constructed of stainless steel, it is also subject to corrosion damage. Corrosion is especially a problem for wire ropes that are exposed to the elements.



Samples of Wire Ropes

To be effective, the lubricant must penetrate into the rope to provide lubrication between the individual wires and strands. It also must provide lubrication externally to reduce friction between the rope and sheaves or drum, and it should act as a sealant to prevent corrosion. The lubricant coating should not prevent the visual inspection of the rope for broken wires or other damage.

Many times, a light mineral oil, such as an SAE 10 motor oil, is used to lubricate wire rope.

The advantages of such a light oil is that it can be applied cold and it will penetrate into the rope easily. The main disadvantage is that it will work out of the rope just as easily as it works in, and frequent application will be required.

Heavy, adhesive lubricants can provide longer lasting protection, but most require heating before application to provide proper penetration. A heavy lubricant, when properly applied, will not only provide internal lubrication, but also provide a durable outer coating to prevent corrosion and keep dust and abrasives out of the rope. Heavy adhesive lubricants usually must be heated or thinned with a solvent to ensure they provide internal lubrication.



Large Wire Rope Application

Relevant VPS products:

Rymco® Hydra HD SAE 10W

Matrix® Grease Calcium Graphite RW

Disclaimer: Technical experiences on site may differ from theoretical advice. When visiting or contacting a site, please always verify the products that are currently used. This guideline is not ment to be a fixed recommendation. Fixed recommendations can only be made after inspecting the products that are currently used as well as a close look at the application and its circumstances.