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Global Marine Products

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5 Marine Lubricants Information Bulletin

Cleanliness of Hydraulic Oils

The hydraulic systems onboard every vessel range from small systems for operating the engine room skylight to huge central systems to operate cargo pumps, deck machinery, and steering gears. Common in these systems is the hydraulic oil used to transport "fluid power" to the equipment.

Characteristics of hydraulic oils

Along with transporting "fluid power," hydraulic oil must adequately lubricate the moving parts, such as the pumps, motors, and valves, present in hydraulic systems.

A critical property of a hydraulic fluid is its viscosity. Low internal friction is desirable, and an oil with a low viscosity at the system operating temperature is usually recommended. However, each hydraulic system has individual viscosity requirements based on the requirements of the hydraulic pump.

Other important characteristics of hydraulic oils are:

Oxidation Stability: Enables operation of the oil during long periods of time, even under severe conditions

Rust Prevention: Protects vital system parts against corrosion in the presence of water

Demulsibility: Rapidly separates any water from the oil

Antiwear: Provides adequate lubrication of moving parts, even under boundary lubrication conditions

Air Release: Readily releases entrained air

Antifoam: Prevents buildup of a stable foam layer, especially in the reservoir

Low Pour Point: Permits low temperature operations

High Viscosity Index: Minimizes viscosity changes with temperature and allows a wider operating temperature range

Oil cleanliness

Taking care of the oil in the system will prevent the untimely replacement of the oil, save considerable costs, and protect the hydraulic equipment. Selecting the proper viscosity grade is best done in cooperation with the equipment manufacturer and the lubricant supplier.

New systems often need to be flushed before entering service to remove the system debris accumulated during construction and the oil-soluble rust preventatives applied onsite. If flushing is prescribed, do not overlook or take shortcuts in the procedure because system debris may result in pump failures within a very short operating time. Additionally, oil-soluble rust preventatives negate some hydraulic oil characteristics such as foam, air release, and demulsibility properties.

After commissioning, hydraulic systems must be checked on a regular basis for the presence of water, especially in the oil reservoir. A considerable amount of water can accumulate there from the air-breathing action that occurs in varying temperatures. Free water should be thoroughly drained to avoid the buildup of a water bottom, which can result in corrosion, sludge formation, and, possibly, the hydrolysis of the oil's additive components. Also, hydraulic oils must be kept as clean as possible before and during use.

It can safely be stated that the cleaner the oil, the longer the system will function. Not only do large, hard particles cause detrimental effects, such as abrasive wear leading to pump failures, but the buildup of small, soft particles (silt) eventually results in pump wear or valve sticking.

To avoid the buildup of particulate matter in hydraulic systems, most systems are equipped with filters to protect vital components from damage by particulate matter. These filters should be serviced and/or changed frequently in accordance with the manufacturer's instructions. Using dirty or malfunctioning filters results in undesirable system wear. Small systems, without filters, require more frequent oil changes to avoid the buildup of particulate matter and provide prolonged equipment life.

Monitoring hydraulic oil cleanliness

The cleanliness of the hydraulic oils in use must be monitored on a regular basis. Large systems should be sampled once a year to monitor the oil condition and contamination level and the basic properties to check are: viscosity, water content, and amount of particulate matter.

There are several methods available to establish the amount of particulate matter present in hydraulic oils: gravimetric analysis for particulate matter (filter residue), microscopic examination (sizing and counting of particles) of filter residues, and automatic particle counting in a representative oil sample.

Some generally accepted warning limits for contamination levels are shown in Table 1.

The following particle count limits are generally accepted for high-pressure systems:

NAS 1638 Class: 8 or 9
ISO Code: 16/12

Seventy-five percent of hydraulic system failures

are related to particulate matter contamination of the hydraulic oil. Contact your Chevron marine sales representative for detailed information about our line of hydraulic oils. ■

TABLE 1: WARNING LIMITS FOR CONTAMINATION LEVELS

Filter residue (using 0.8-micron membrane filters)	
0 to 50 mg/kg	Oil is clean
50 to 150 mg/kg	Oil is generally acceptable
150 to 300 mg/kg	Oil is suspect; filters need to be changed; monitoring recommended
300 to 400 mg/kg	Oil is heavily contaminated and should be severely filtered
Above 400 mg/kg	Oil is heavily contaminated and should be replaced
High-pressure system (above 70 bar) limits	
0 to 30 mg/kg	Oil is clean
30 to 100 mg/kg	Oil is suspect; filters should be changed; monitoring recommended
Above 100 mg/kg	Particulate matter content is too high. Oil should be changed unless the amount of particulate matter can be rapidly reduced by filtration.