

## #112M MARINE HTC OIL ISO GRADES 32 THROUGH 220

Marine HTC Oil is a premium quality non-detergent, anti-wear, rust and oxidation inhibited oil that is specially formulated for use in those critical marine gear drives and mobile type low pressure and high pressure hydraulic systems, rotary vane, rotary screw, reciprocating, axial and centrifugal type air compressor systems and vacuum pumps and blower applications.

Marine HTC Oil has Ortlinghaus-Werke GmbH ON 9.2.10 approval for use in wet running clutches in marine gear drives (ISO 150).

Marine HTC Oil is formulated from the finest high viscosity index severely solvent refined, severely hydrofinished base stocks available which provide the following benefits:

- Excellent thermal stability.
- Excellent resistance to oxidation and thermal degradation.
- A naturally high viscosity index which provides a minimum change in viscosity that helps prevent excessive leakage, sluggish operation, lower overall efficiency and other deficiencies attributed to low viscosity index oils over wide operating temperature ranges.
- Excellent film strength for increased wear protection.
- Excellent operating temperature reduction. 100% base oils have better specific heat values, (less heat is absorbed) and better thermal conductivity that conventional base oils. These combined properties help reduce operating temperatures.
- Superior chemical stability.
- Low volatility which allows lower makeup requirements from evaporation loss and fewer deposits.
- Low carbon forming tendencies.

**VarniShield™** is patented hydraulic fluid additive technology designed to prevent the formation and build-up of varnish deposits, while providing exceptional anti-wear performance, outstanding thermal and oxidation stability, rust and corrosion protection and rapid water separation. The **VarniShield™** additive system provides Marine HTC Oil with a high degree of thermal and oxidative stability thus minimizing the formation of sludge and varnish. If any varnish particles do form, the dispersancy of the **VarniShield™** additive will keep these particles suspended to prevent them from depositing on critical internal components. This helps eliminate the replacement of components such as filters and valves and the costs associated with these activities.

In addition to protecting against the formation of varnish deposits and keeping the system clean and operating longer, the **VarnishShield™** additive technology provides the following performance benefits:

- Exceptional and long lasting anti-wear protection to protect system components
- Extended pump life and bearing life.
- Enhanced thermal and oxidative stability.
- Superior hydrolytic stability.
- Excellent demulsibility characteristics so water separates quickly.
- Excellent rust and corrosion protection that extends component life and protects multi-metallurgy components.
- Excellent anti-foaming and air release properties.
- Reduced sludge, varnish and deposit formation.
- Improved durability of non-ferrous parts.
- Reduced filter blockage and excellent filterability.

- Enhanced compatibility with existing fluids.
- Excellent fluid quality reserve to maintain its performance features even under severe service conditions and extended drain intervals.
- Enhanced fluid and seal life which provides reduced system maintenance.

The trend by hydraulic pump manufacturers to employ higher speeds, higher pressures, reduced cycling times and smaller systems along with the fact that in many applications the equipment may be operating beyond its design capacity can result in thin film lubrication conditions. These thin film lubrication conditions can result in increased wear conditions and rates, which can lead to a loss in system efficiency, reduced equipment life and potentially catastrophic system failure.

Marine HTC Oil also contains Micron Moly®, a liquid soluble type of moly that plates itself to sliding, rolling and rubbing metal surfaces of hydraulic and compressor systems. This plating action forms a long lasting solid lubricant film on surfaces that will withstand pressures up to 500,000 pounds per square inch. Micron Moly® not only produces a smooth finish surface, but also reduces friction between the moving parts which results in less heat being generated, lower operating temperatures, and a reduction in downtime.

Marine HTC Oil can also be used as an airline oil for pneumatic systems, as a circulating oil and in those bearing and gearbox applications, where the use of a non-extreme pressure oil is specified.

Marine HTC Oil meets and exceeds the following specifications and manufacturer's requirements: Denison HF-O, Eaton-Vickers I-286-S and M-2950-S; JCMAS HK specification, Eaton-Char-Lynn, Haldex Barnes, Husky, Linde, Rexnord, Bosch Rexroth, Parker Hannifin, Commercial Shearing HD 2/900, Commercial InterTech, Cincinnati Machine P-54, P-68, P-69, P-70, DIN 51 524 Part 2 ; ISO 6743/4 Type HM, Sauer-Sundstrand, Sauer Danfoss U.S. Steel 126,127 and 136, AFNOR E 48-603, Ingersoll Rand, Joy, Kaeser, Gardner Denver, Sullair, Worthington, LeRoi, Quincy and Atlas Copco compressor specifications.

**TYPICAL PROPERTIES**

<b>ISO Grade</b>	<b>32</b>	<b>46</b>	<b>68</b>	<b>100</b>	<b>150</b>	<b>220</b>
<b>AGMA Grade</b>	<b>----</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Specific Gravity 60°F/15°C	.8626	.8625	.8669	.8862	.8866	.8623
Viscosity SUS 100°F (ASTM D-445)	133-163	191-234	283-346	416-509	625-764	917-1120
Viscosity cSt 40°C (ASTM D-445)	28.8-35.2	41.4-50.6	61.2-74.8	90-110	135-165	198-242
Viscosity cSt 100°C (ASTM D-445)	5.0-6.0	6.2-7.5	8.5-9.29	10.5-12.0	13.5-16.0	18.5-20.5
Viscosity Index (ASTM D-2270)	109	112	105	100	98	97
Flash Point °F/°C (ASTM D-92)	410°/210°	410°/210°	430°/221°	450°/232°	470°/243°	485°/252°
Pour Point °F/°C (ASTM D-97)	-10°/-23°	0°/-18°	0°/-18°	10°/-12°	20°/-7°	20°/-7°
Aniline Point °F/°C (ASTM D-611)	220°/104°	228°/109°	228°/109°	233°/112°	240°/116°	252°/122°
Total Acid Number (ASTM D-664)	0.91	0.91	0.91	0.91	0.91	0.91
Copper Strip Corrosion Test 3 hrs. (ASTM D-130)	1A	1A	1A	1A	1A	1A
Rust Test (ASTM D-665), Procedure A (Distilled Water)	Pass	Pass	Pass	Pass	Pass	Pass
Procedure B (St Water)	Pass	Pass	Pass	Pass	Pass	Pass
Four Ball EP Test (ASTM D-2783), Weld Point, kg	160	160	160	160	200	200
Four Ball Wear Test (ASTM D-4172)(1hr/40kg/130°) Mean Scar Diameter, mm	0.4	0.4	0.4	0.4	0.35	0.35
Four Ball Wear Test (ASTM D-4172) (1hr/20kg/130°) Mean Scar Diameter, mm	0.27	0.27	0.27	0.27	0.33	0.33
Falex Continuous Load lbs. (ASTM D-3233), Failure Load, lbs.	1250	1250	1250	1500	1500	1500
Conradson Carbon Residue (ASTM D-189), % Residue	0.3	0.3	0.3	0.3	0.3	0.3
Foam Tendency (ASTM D-892)						
Sequence I	0/0	0/0	0/0	0/0	0/0	0/0
Sequence II	0/0	0/0	0/0	0/0	0/0	0/0
Sequence III	0/0	0/0	0/0	0/0	0/0	0/0
FZG Test (ASTM D-5182), Load Stage Pass	12	12	12	12	12	12
Hydrolytic Stability (ASTM D-2619), Copper Wt. Loss mg/cm <sup>2</sup>	0.0566	0.0566	0.0566	0.0566	0.0566	0.0566
Acidity of Water mg/KOH	0	0	0	0	0	0
Demulsibility Test (ASTM D-1401), O-W-E	40-40-0	40-40-0	40-40-0	40-40-0	40-40-0	40-40-0
Time, min	15	15	15	15	15	15
Denison Filterability Test TP-02100						
Filtration Time, without water (seconds)	146	146	146	146	146	146
Filtration Time with 2% water (seconds)	163	163	163	163	163	163
Oxidation Stability Test (ASTM D-943), Hours to TAN of 2	3500+	3500+	3500+	3500+	3500+	3500+
Sludge Tendencies (ASTM D-4310)						
Neutralization Number after 1000 hours	0.34	0.34	0.34	0.34	0.34	0.34
Insoluble Sludge, Total Copper, mg.	39.4	39.4	39.4	39.4	39.4	39.4
Total Copper, mg	0.1	0.1	0.1	0.1	0.1	0.1
Thermal Stability Test (ASTM D-2070), 168 hr/135°C, copper/Steel Catalyst)						
Sludge (mg/100ml)	1.8	1.8	1.8	1.8	1.8	1.8
Copper weight loss,mg/100ml	0.2	0.2	0.2	0.2	0.2	0.2
Condition of Copper rod	3	3	3	3	3	3
Air Release (ASTM D-3427), Time, (Min. @ 122°F)	6.2	6.2	6.2	6.2	6.2	6.2
Denison T6H20C Hybrid Pump Test						
Phase 1 1700 rpm 230°F/110°C weight loss	5.1	5.1	5.1	----	----	----
Phase 2 1700 rpm 176°F/80°C + 1% water	5.8	5.8	5.8	----	----	----
Vickers 35VQ25 Pump Test						
Total Wt. Loss Vane, mg	5	5	5	5	5	----
Total Wt. Loss Ring, mg	11	11	11	11	11	----
Total Wt. Loss, mg	16	16	16	16	16	----