

Designation: D6158 - 18

# Standard Specification for Mineral Hydraulic Oils<sup>1</sup>

This standard is issued under the fixed designation D6158; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon  $(\varepsilon)$  indicates an editorial change since the last revision or reapproval.

# 1. Scope\*

- 1.1 This specification covers mineral and synthetic oils of the types API groups I, II, III, and IV used in hydraulic systems, where the performance requirements demand fluids with one of the following characteristics:
  - 1.1.1 A refined base oil or synthetic base stock (Class HH),
- 1.1.2 A refined mineral base oil or synthetic base stock with rust and oxidation inhibitors (Class HL),
- 1.1.3 A refined mineral base oil or synthetic base stock with rust and oxidation inhibitors plus anti-wear characteristics (Class HM).
- 1.1.4 A refined mineral base oil or synthetic base stock with rust and oxidation inhibitors, anti-wear characteristics, and increased viscosity index higher than 140 (Class HV),
- 1.1.5 A refined mineral base oil or synthetic base stock with rust and oxidation inhibitors plus anti-wear characteristics meeting a higher performance level than an HM fluid to address higher demanding hydraulic systems (Class HMHP), and
- 1.1.6 A refined mineral base oil with rust or synthetic base stock and oxidation inhibitors, anti-wear characteristics, and increased viscosity index higher than 140 meeting a higher performance level than an HV fluid to address higher demanding hydraulic systems (Class HVHP).
- 1.2 This specification defines the requirements of mineral oil-based or synthetic-based hydraulic fluids that are compatible with most existing machinery components when there is adequate maintenance.
- 1.3 This specification defines only new lubricating oils before they are installed in the hydraulic system.
- 1.4 This specification defines specific types of hydraulic oils. It does not include all hydraulic oils. Some oils that are not included may be satisfactory for certain hydraulic applications. Certain equipment or conditions of use may permit or require a wider or narrower range of characteristics than those described herein.
- <sup>1</sup> This specification is under the jurisdiction of ASTM Committee D02 on Petroleum Products, Liquid Fuels, and Lubricants and is the direct responsibility of Subcommittee D02.N0 on Hydraulic Fluids.
- Current edition approved Oct. 1, 2018. Published October 2018. Originally approved in 1997. Last previous edition approved in 2016 as D6158 16. DOI: 10.1520/D6158-18.

- 1.5 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.
- 1.5.1 *Exception*—In X1.3.9 on Wear Protection, the values of pump pressure are in MPa, and the psi follows in brackets as a reference point immediately recognized by a large part of the industry.
- 1.6 The following safety hazard caveat pertains to the test methods referenced in this specification. This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.
- 1.7 This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

#### 2. Referenced Documents

2.1 ASTM Standards:<sup>2</sup>

D92 Test Method for Flash and Fire Points by Cleveland Open Cup Tester

D97 Test Method for Pour Point of Petroleum Products

D130 Test Method for Corrosiveness to Copper from Petroleum Products by Copper Strip Test

D445 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)

D471 Test Method for Rubber Property—Effect of Liquids
D664 Test Method for Acid Number of Petroleum Products
by Potentiometric Titration

D665 Test Method for Rust-Preventing Characteristics of Inhibited Mineral Oil in the Presence of Water

D892 Test Method for Foaming Characteristics of Lubricating Oils

<sup>&</sup>lt;sup>2</sup> For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.



- D943 Test Method for Oxidation Characteristics of Inhibited Mineral Oils
- D974 Test Method for Acid and Base Number by Color-Indicator Titration
- D1298 Test Method for Density, Relative Density, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method
- D1401 Test Method for Water Separability of Petroleum Oils and Synthetic Fluids
- D2070 Test Method for Thermal Stability of Hydraulic Oils D2270 Practice for Calculating Viscosity Index from Kinematic Viscosity at 40 °C and 100 °C
- D2422 Classification of Industrial Fluid Lubricants by Viscosity System
- D2619 Test Method for Hydrolytic Stability of Hydraulic Fluids (Beverage Bottle Method)
- D2983 Test Method for Low-Temperature Viscosity of Automatic Transmission Fluids, Hydraulic Fluids, and Lubricants using a Rotational Viscometer
- D3427 Test Method for Air Release Properties of Hydrocarbon Based Oils
- D4052 Test Method for Density, Relative Density, and API Gravity of Liquids by Digital Density Meter
- D4310 Test Method for Determination of Sludging and Corrosion Tendencies of Inhibited Mineral Oils
- D5182 Test Method for Evaluating the Scuffing Load Capacity of Oils (FZG Visual Method)
- D5950 Test Method for Pour Point of Petroleum Products (Automatic Tilt Method)
- D6080 Practice for Defining the Viscosity Characteristics of Hydraulic Fluids
- D6973 Test Method for Indicating Wear Characteristics of Petroleum Hydraulic Fluids in a High Pressure Constant Volume Vane Pump
- D7042 Test Method for Dynamic Viscosity and Density of Liquids by Stabinger Viscometer (and the Calculation of Kinematic Viscosity)
- D7043 Test Method for Indicating Wear Characteristics of Non-Petroleum and Petroleum Hydraulic Fluids in a Constant Volume Vane Pump
- D7752 Practice for Evaluating Compatibility of Mixtures of Hydraulic Fluids
- 2.2 Other Standards:
- ISO 13357-1 Petroleum Products—Determination of the Filterability of Lubricating Oils—Part 1: Procedure for Oils in the Presence of Water<sup>3</sup>
- ISO 13357-2 Petroleum Products—Determination of the Filterability of Lubricating oils—Part 2: Procedure for Dry Oils<sup>3</sup>
- DIN 51350-6 Testing of Shear Stability of Lubricating Oils Containing Polymers<sup>4</sup>

CEC L-45-A-99 Viscosity Shear Stability of Transmission Lubricants (KRL Taper Roller Bearing Rig)<sup>5</sup>

# 3. Classification

- 3.1 *Type HH Hydraulic Oils*—Non-inhibited refined mineral oils or synthetic base stock for hydraulic systems that do not have specific requirements of oxidation stability, rust protection, or anti-wear properties. Type HH oils are usually intended for total loss systems or very light-duty equipment.
- 3.2 Type HL Hydraulic Oils—Refined mineral oils or synthetic base stock with improved rust protection and oxidation stability for hydraulic systems where relatively high temperatures and long periods of operation time are expected, and where there is the possibility of water or humidity that could rust metal parts of the machinery. These oils are intended for use in systems where no metal-to-metal contact is expected between the moving parts. Usually, systems working at low pressures specify HL oils. Some high-pressure piston pumps can operate satisfactorily on these oils.
- 3.3 Type HM Hydraulic Oils—Oils of HL type with improved anti-wear properties, for general hydraulic systems, especially for those working at high pressures and where the possibility of metal-to-metal contact between the moving parts exists. Type HM oils are usually specified for hydraulic systems with vane pumps, or when the system is intended to work at maximum pump capacity for long periods of time.
- 3.4 *Type HV Hydraulic Oils*—Oils of HM type with improved viscosity/temperature properties, for general hydraulic systems where equipment is intended to operate over a wide range of ambient temperatures.
- 3.5 Type HMHP Hydraulic Oils—Oils of HM meeting a higher performance level to meet the changing needs of hydraulic systems, especially for those working at high pressures and temperatures intended to work at maximum pump capacity for long periods of time.
- 3.6 *Type HVHP Hydraulic Oils*—Oils of HMHP type with improved viscosity/temperature properties, for more demanding hydraulic systems where equipment is intended to operate over a wide range of ambient temperatures.

#### 4. Classification Requirements

- 4.1 *Type HH*—The requirements for this type of oil are presented in Table 1 and include Viscosity Grades ISO VG from 10 to 150, in accordance with Classification D2422.
- 4.2 *Type HL*—The requirements for this type of oil are presented in Table 2 and include Viscosity Grades ISO VG from 10 to 150, in accordance with Classification D2422.
- 4.3 *Type HM*—The requirements for this type of oil are presented in Table 3 and include Viscosity Grades ISO VG from 10 to 150, in accordance with Classification D2422.

<sup>&</sup>lt;sup>3</sup> Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036, http://www.ansi.org.

<sup>&</sup>lt;sup>4</sup> Available from Deutsches Institut für Normung e.V.(DIN), Am DIN-Platz, Burggrafenstrasse 6, 10787 Berlin, Germany, http://www.din.de.

<sup>&</sup>lt;sup>5</sup> Available from Coordinating European Council (CEC), Services provided by Kellen Europe, Avenue Jules Bordet 142 - 1140, Brussels, Belgium, http://www.cectests.org.

TABLE 1 Requirements for Type HH Mineral Oil or Synthetic Base Stock Hydraulic Fluids

			1 2 2		o diministra	too occor in a				
	Test Method		cai	Ų-						
;	ASTM									
Properties	(Other)	Parameters	08	l	4	₫	Limits			
Physical:										
ISO-viscosity grade	D2422		10	15	22	32	46	89	100	150
Viscosity	D445 <sup>A</sup>	kinematic viscosity at 40 °C, mm²/s	9.0–11.0	13.5–16.5	19.8–24.2	28.8–35.2	41.4–50.6	61.2–74.8	90.0–110	135–165
Viscosity, ≤750 mPa·s	D2983	temperature, °C	report	report	report	report	report	report	report	report
Viscosity index	D2270		report	report	report	report	report	report	report	report
Specific gravity	D1298 <sup>B</sup>		report	report	report	report	report	report	report	report
Appearance	Visual		clear and	clear and	clear and	clear and	clear and	clear and	clear and	clear and
			D6	bright	bright	bright	bright	bright	bright	bright
Flash point	D92	temperature, °C, min	152	145	165	175	185	195	205	215
Pour point	D97 <sup>c</sup>	temperature, °C, max	8-1 127	-12	06-	9-	9–	9	9–	9–
Chemical:										
Acid number	D974/D664	KOH, mg/g, max	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Performance:										
Elastomer compatibility	D471	$100  ^{\circ}\text{C} \pm 1  ^{\circ}\text{C}/288  \text{h} \pm 2  \text{h}$ NBR-1 Flastomer								
		relative volume change,	report	report	0 to 15	0 to 12	0 to 12	0 to 10	0 to 10	0 to 10
		percent	25	1	9	1	7	0	4	0
		cilarige III Sriore A hardness	node)	node	0- 01 n	/- 01 0	/- 01 0	9-010	0 0	0 0 0
		rating								

<sup>A</sup> Test Method D7042 may be used with bias correction for formulated oils. D445 is the referee method.

<sup>B</sup> Test Method D4052 can also be used.

<sup>C</sup> Test Method D5950 can also be used.

TABLE 2 Requirements for Type HL Mineral Oil or Synthetic Base Stock Hydraulic Fluids (Rust and Oxidation)

kinematic viscosity at 40 °C, 9.0–11.0 15 22 22 32 40 mm²/s temperature, °C, max 90 90 min report re		Toot 1404		sta				sta			
stly grade	Properties	ASTM (Other)	Parameters	and				Limits			
March   Marc	Physical: ISO-viscosity grade	D2422		ards	7.	23	32	46	89	100	150
avity D2883 temperature, °C, max  avity D12886  avity D12886  avity D12886  avity D12886  avity D12886  avity D97  temperature, °C, max  avity D97  temperature, °C, max  ber D974/D664 KOH, mg/g  aration D1401 from the following temporal report re	Viscosity	D445 <sup>A</sup>	kinematic viscosity at 40 °C,	9.0–11.0	13.5–16.5	19.8–24.2	28.8–35.2	41.4–50.6	61.2–74.8	90.0–110	135–165
15			mm <sup>2</sup> /s	eh			,	,			,
Obegan         Min         90         90         90           ordex         D1290         Min         90         90         90           ever         D1290         Franch         Clear and clea	Viscosity, ≤750 mPa·s	D2983	temperature, °C, max	င္က	-23	-15	φ	-5	4	10	16
Political Part   Poli	Viscosity index	D2270	min	i/ 06	06	06	06	06	06	06	06
t 1092 temperature, °C, mix 125 temperature, °C, mix 23 temperature, °C, mix 24 temperature, °C, mix 25 temperature, °C, mix 2	Specific gravity	D1298 <sup>B</sup>		report	report	report	report	report	report	report	report
t 20 °C temperature, °C, min bright b	Appearance	visual,		clear and	clear and	clear and	clear and	clear and	clear and	clear and	clear and
ter D997C temperature, °C, max -33 -24 -21 165 175  ber D974/D664 KOH, mg/g report rep		at 20 °C		bright	bright	bright	bright	bright	bright	bright	bright
Deg C         temperature, °C, max         −33         −24         −21         −18           cet:         De6 SA         visual evaluation pass or fall pass         pass         pass         pass           nntion         D66 SB         visual evaluation pass or fall pass         pass         pass         pass           D66 SB         visual evaluation pass or fall pass         pass         pass         pass         pass           D66 SB         visual evaluation pass or fall pass         pass         pass         pass         pass           D130         visual evaluation pass or fall pass         pass         pass         pass         pass           D130         visual evaluation pass or fall pass         pass         pass         pass         pass           D130         visual max         mine (mins) to 3 mL emulsion at max         30         30         30         30           Go C, max         gard c, max         mine mine change, percent report         mine change, percent report         mine change	Flash point	D92	temperature, °C, min	125	145	165	175	185	195	205	215
ber         D974/D864         KOH, mg/g         report         rep	Pour point	D97 <sup>c</sup>	temperature, °C, max	-33	-24	-21	-18	-15	-12	-12	-12
cer:         D974/D664         KOH, mg/g         report         r											
De65A   Visual evaluation pass or fall pass pass pass pass pass pass pass p	Cnemical:										
De65AP visual evaluation pass or fail pass pass bess pass pass or fail pass or fail pass pass pass pass or fail pass or fail pass pass pass pass pass or fail pass or fail pass or fail pass pass pass pass pass pass pass pas	Acid Number	D974/D664	KOH, mg/g	report	report	report	report	report	report	report	report
D665A	Dorformanco.										
1985   1985	Duct proposition	Degrad	light to accer acitatilate lancity	Sign	0000				0	0	0
separation         D130         Visual availation pass of rail         pass	lionilleveld tend	40000	Visual evaluation pass of fail	Dass	pass	Dass	Dass	Dass	pass	Dass	Dass
separation D1401 time (mins) to 3 mL emulsion at 300 ms. at time (mins) to 3 mL emulsion at 300 ms. at time (mins) to 3 mL emulsion at 300 ms. at time (mins) to 3 mL emulsion at 300 ms. at time (mins) to 3 mL emulsion at 300 ms. at time (mins) to 3 mL emulsion at 300 ms. at time (mins) to 3 mL emulsion at 300 ms. at 100° C ± 1°C/288 h ± 2 h 300 ms. at 100° C ± 1°C/288 h ± 10°C/288		Doode	Visual evaluation pass or rail	pass	pass	pass	pass	pass	pass	pass	pass
separation D1401 time (mins) to 3 mL emulsion at 300 mer compatibility D471 100 °C ± 1 °C ∠88 h ± 2 h  NBR-1 Elastomer relative volume change, percent report report relative volume change in Shore A hardness, report report report relative volume change in Shore A hardness, report	Corrosion	DI 30	copper corrosion, 3 n at 100 °C,	11 11	e	S	N	7	N	7	N
### (mins) to 3 mL emulsion at most of the films) to 3 mL emulsion at me (mins) to 3 mL emulsion at most of the films) to 3 mL emulsion at most of the films to 3 mL emulsion at most of the films to 3 mL emulsion at most of the films to 3 mL emulsion at most of the films to 3 mL emulsion at most of the films to 3 mL emulsion at most of the films to 3 mL emulsion at most of the films to 3 mL emulsion at most of the films to 3 mL emulsion at the films to 4 mL max at 75 °C must of the films, mins at 50 °C, max at most of the films, mins at 50 °C, max at most of the films, mins at 50 °C, max at most of the films, mins at 75 °C must of the films of the films films at 75 °C must of the films of the films films at 75 °C must of the films	30:10:000000000000000000000000000000000	5	Visual, max	1(		t	C	C	Ċ		
time (mins) to 3 mL emulsion at of the compatibility D471 100 °C ± 1 °C / 288 h ± 2 h  NBR-1 Elastomer relative volume change, percent report report report relative volume change in Shore A hardness, report report report report relative volume change in Shore A hardness, report	water separation	5	FA °C max	De le		200	5	3	3	:	:
mer compatibility D471 100 °C ± 1 °C /288 h ± 2 h  NBR-1 Elastomer relative volume change, percent report report report relative volume change, percent report repo			134 C, Illax							C	
mer compatibility D471 100 °C ± 1°C /288 h ± 2 h  NBR-1 Elastomer relative volume change, percent report report report relative volume change, percent report report report report report relative volume change, percent report 150/0 mL, max  Sequence II, tendency/stability, 150/0			60 °C mession at	5		1 :	:	:	:	8	0
NBR-1 Elastomer relative volume change, percent report report report repor	Flastomer compatibility	D471	82 C, IIIax 100 °C + 1 °C ∕288 h + 2 h								
rating change in Shore A hardness, report 150/0 150	Elastonici compatibility	5	NBB-1 Flastomer								
change in Shore A hardness, report report report report report report rating sequence I, tendency/stability, 150/0			volotivo volumo obosso possost	8	1000	1	0+0+0	0+0	0	0	0
rating rating and argument of the marginal rating rating rating sequence I, tendency/stability, 150/0			leignive volunie change, percent		i epoil	0.00	0.0	1000	0 0 0	0 0 0	0 0 0
Beguence I, tendency/stability, 150/0 150/			cnange in Snore A nardness,	report -	report	2 2 0	/- o1 0	U to -/	0 0 0	0 0 0	0 10 -6
Sequence II, tendency/stability, 75/0 75/0 75/0 75/0 75/0 75/0 75/0 75/0		0000	Sociosos Landones (otopility		0/04	0/014	0/0	0,0	0/0	0/0	0/04
Sequence II, tendency/stability, 75/0 75/0 75/0 75/0 75/0 75/0 75/0 mL, max  Sequence III, tendency/stability, 150/0 150	Toget	7697	Sequence I, tendency/stability, ml max	261	000	0/061	0000	0/061	0000	0000	0/00
mL, max Sequence III, tendency/stability, 150/0 150/0 150/0 150/0 150/0 150/0 150/0 150/0 150/0 150/0 150/0 150/0 150/0 150/0 150/0 150/0 150/0 150/0 150/0 100/0			Sequence II tendency/stability	75/0	75/0	75/0	75/0	75/0	75/0	75/0	75/0
Sequence III, tendency/stability, 150/0 15			mL. max	-2	y		) i	) i	)	) i	) i
mL, max time, mins. at 50 °C, max time, mins. at 50 °C, max time, mins. at 75 °C  y D943 time for KOH acid number of 1000 1000 1000 1000  D4310 total insoluble sludge, mg, max 200 200 200  copper in oil/water/sludge, mg report report report report steel appearance, visual max report report report 200 200 200  D2070 copper appearance, visual max report report 200 200 200 200 200 200 200 200 200 20			Sequence III. tendency/stability	150/0	150/0	150/0	150/0	150/0	150/0	150/0	150/0
y D943 time, mins. at 50 °C, max 5 °C, mins. at 75 °C, mins. a			mL. max								
time, mins. at 75 °C  time for KOH acid number of 1000 1000 1000 1000  2 mg/kg, h, min  1000 200 200 200 200  2000 copper in oil/water/sludge, mg report 5 steel appearance, visual max report report 2000 2000 2000 2000 2000 2000 2000 20	Air release	D3427	time mins at 50 °C max	of co	rc	ιc	ιc	10	10		
y D943 time for KOH acid number of 1000 1000 1000 1000 1000  2 mg/kg, h, min total insoluble sludge, mg, max 200 200 200 200 200 copper in oil/water/sludge, mg report report report report report report steel appearance, visual max report report report 200 200 200 200 200 200 200 200 200 20			time, mins. at 75 °C	e3	, :		. :	: :	: :	report	report
2 mg/kg, h, min copper in oil/water/sludge, mg report report report report report report report report steel appearance, visual max report report report copper appearance, visual max report report report copper special max report report copper cop	Oxidation stability	D943		1000	1000	1000	1000	1000	1000	1000	1000
b4310 total insoluble sludge, mg, max 200 200 200 200 200 copper in oil/water/sludge, mg report report report report report steel appearance, visual max report report report 5 steel appearance, visual max report report 20 copper appearance, visual max report report 20 copper appearance, visual max report report 20 copper appearance, visual max report 20 copper 20		!	2 ma/kg. h. min	76						!	
copper in oil/water/sludge, mg report report report report copper appearance, visual max report report report 5 steel appearance, visual max report report 2 control max/100 ml max report report 2 control max/100 ml max report 2 control max/100 ml max report 2 control max/100 ml max/100	Sludge tendency	D4310	total insoluble sludge, mg, max		200	200	200	200	200	200	200
Steel appearance, visual max report report 5 steel appearance, visual max report report 2 steel appearance, visual max report report 2			copper in oil/water/sludge, mg		report	report	report	report	report	report	report
steel appearance, visual max report report 2	Thermal stability	D2070	copper appearance, visual max		report	report	2	2	2	report	report
trongs			steel appearance, visual max		report	report	2	2	2	report	report
			sludge, ma/100 mL, max		report	report	25	25	25	report	report

A Test Method D7042 may be used with bias correction for formulated oils. D445 is the referee method.

B Test Method D4052 can also be used.

C Test Method D5950 can also be used.

D Test Method D665—soak time is 24 h.

TABLE 3 Requirements for Type HM Mineral Oil or Synthetic Base Stock Hydraulic Fluids (Anti-wear)

Properties	Test Method ASTM (Other)	Parameters	s://sta				Limits			
Physical: ISO-viscosity grade Viscosity Viscosity ≤750 mPa·s Viscosity index Specific gravity Appearance	D2422 D445 <sup>4</sup> D2983 D2270 D1298 <sup>8</sup> Visual, at 20 °C	kinematic viscosity at 40 °C, mm²/s temperature, °C, max min	10 9.0–11.0 –33 90 report clear and bright	15 13.5–16.5 –23 90 report clear and bright	22 19.8–24.2 –15 90 report clear and bright	32 28.8–35.2 (–8) 90 report clear and bright	46 41.4–50.6 –2 90 report clear and bright	68 61.2–74.8 4 90 report clear and bright	100 90.0–110 10 90 report clear and bright	150 135–165 16 90 report clear and bright
Flash point Pour point Chemical:	D92 D97 <sup>c</sup>	temperature, °C, min temperature, °C, max	t 52 E8 /star	145 -24 dttb	165 -21	175 -18	185 -15	195 -12	205	215 -12
Acid number  Performance: Rust prevention	D974/D664	KOH, mg/g visual evaluation, pass or fail	report pass	report	report	report pass	report pass	report pass	report pass	report pass
Corrosion	D665B <sup>D</sup> D130	visual evaluation, pass or fail copper corrosion, 3 h at 100 °C, visual max	AS 5 7 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	pass 2	pass 2	pass 2	pass 2	pass 2	pass 2	pass 2
Water separability	D1401	time (mins) to 3 mL emulsion time (mins) to 3 mL emulsion time (mins) to 3 mL emulsion max at 82°C	TM D6 4 10 ed	and ent	Set a	30 ::	30	30 ::	: 09	09
Elastomer compatibility	D471	100 °C ± 1 °C /288 h ± 2 h NBR-1 Elastomer relative volume change, percent	158-1 c-ff8ea	report	0 to 15	0 to 12	0 to 12	0 to 10	0 to 10	0 to 10
Foam	D892	change in Shore A hardness, rating Sequence I tendency/stability mL max Sequence II tendency/stability mL max	report 150/0 75/0	report 150/0 75/0	0 to -8 150/0 75/0	0 to -7 150/0 75/0	0 to -7 150/0 75/0	0 to –6 150/0 75/0	0 to –6 150/0 75/0	0 to –6 150/0 75/0
Air release	D3427	Sequence III tendency/stability mL max time (mins) at 50 °C, max time (mins) at 50 °C, max	120/0	150/0	150/0	150/0	150/0	150/0	150/0	150/0
Oxidation stability	D943	time (mins) at 75 C time for KOH acid number of mg/kg, h, min	1000	1000	1000	1000	1000	1000	1000	1000
Sludge tendency Thermal stability	D2070	copper oil/water/sludge, mg copper appearance, visual steel appearance, visual	report report report	report	report report report	report 5 2 25	200 5 2 2 25	report 5 2 25	report report report	report report report
Wear protection	D7043	mass loss vanes + ring, mg, max at 65.6 °C./100 h mass loss vanes + ring, mg, max at 79.4 °C./100 h	stm-d61		report ::	report	report 	 report	report	report
A Toot Mothod D7040 may be need with bigg	ooid dtim boot or	dt oi 3000 olio botoliimaot aot doitooraoo	Caroforota	Po 4+						

<sup>&</sup>lt;sup>A</sup> Test Method D7042 may be used with bias correction for formulated oils. D445 is the referee method.

<sup>B</sup> Test Method D4052 can also be used.

<sup>C</sup> Test Method D5950 can also be used.

<sup>D</sup> Test Method D665—soak time is 24 h.



- 4.4 *Type HV*—The requirements for this type of oil are presented in Table 4 and include Viscosity Grades ISO VG from 10 to 150, in accordance with Classification D2422.
- 4.5 *Type HMHP*—The requirements for this type of oil are presented in Table 5 and include Viscosity Grades ISO VG from 22 to 150 in accordance with Classification D2422.
- 4.6 *Type HVHP*—The requirements for this type of oil are presented in Table 6 and include Viscosity Grades ISO VG from 22 to 150 in accordance with Classification D2422.

# 5. Inspection

5.1 Inspection of the material shall be agreed upon between the purchaser and the supplier.

# 6. Packaging and Package Marking

6.1 The material shall be suitably packaged to permit acceptance by the carrier and to afford adequate protection

from normal hazards of handling and shipping. Packaging shall conform to applicable carrier rules and regulations.

- 6.2 Packaging and labeling shall comply with state or federal regulations.
- 6.3 Each container shall be plainly marked with the manufacturer's name and brand, production code or lot number, type of material, volume content, and any other information required by state or federal law.

# 7. Keywords

7.1 antiwear protection; guideline; hydraulic oils; mineral oils; rust and oxidation protection; synthetic base stocks; viscosity index

# iTeh Standards (https://standards.iteh.ai) Document Preview

ASTM D6158-18

https://standards.iteh.ai/catalog/standards/sist/34110edc-ff87-49ce-b6b2-25cbfc3d76e2/astm-d6158-18