

Designation: D6158 - 10 D6158 - 14

Standard Specification for Mineral Hydraulic Oils¹

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 (\$\epsilon\$) indicates an editorial change since the last revision or reapproval.

1. Scope Scope*

- 1.1 This specification covers mineral oils used in hydraulic systems, where the performance requirements demand fluids with one of the following characteristics:
 - 1.1.1 A refined base oil (Class HH),
 - 1.1.2 A refined mineral base oil with rust and oxidation inhibitors (Class HL), and
 - 1.1.3 A refined mineral base oil with rust and oxidation inhibitors plus antiwear characteristics (Class HM).
- 1.2 This specification defines the requirements of mineral oil-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.
 - 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 and health practices and determine the applicability of regulatory limitation prior to use.

2. Referenced Documents

2.1 ASTM Standards:²

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

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 and 100°C

D2422 Classification of Industrial Fluid Lubricants by Viscosity System

¹ 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.N0.10 on Specifications.

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² 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.



D2619 Test Method for Hydrolytic Stability of Hydraulic Fluids (Beverage Bottle Method)

D2983 Test Method for Low-Temperature Viscosity of Lubricants Measured by Brookfield Viscometer

D3427 Test Method for Air Release Properties of Petroleum 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

D6080 Practice for Defining the Viscosity Characteristics of Hydraulic Fluids

D7043 Test Method for Indicating Wear Characteristics of Non-Petroleum and Petroleum Hydraulic Fluids in a Constant Volume Vane Pump

3. Classification

- 3.1 *Type HH Hydraulic Oils*—Non-inhibited refined mineral oils 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 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.

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.
- 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.

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; viscosity index

TABLE 1 Requirements for Type HH Mineral Oil Hydraulic Fluids

				Type IIII III		.,				
Properties	Test Method ASTM (Other)	Parameters				Lim	its			
Physical ISO viscosity grade Viscosity	D2422 D445	kinematic viscosity at	10 9.0-11.0	15 13.5-16.5	22 19.8-24.2	32 28.8-35.2	46 41.4-50.6	68 61.2-74.8	100 90.0-110	150 135-165
Viscosity	<u>D445</u>	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 cP Viscosity, ≤ 750 cP	D2983 ^A D2983	temperature, °/C temperature, °C	report	report report	report report	report report	report report	report report	report report	report report
Viscosity index	D2270		report	report	report	report	report	report	report	report
Specific gravity Specific gravity	D1298 ^B		report report	report report	report report	report report	report report	report report	report report	report report
Appearance	Visual		clear and bright	clear and bright	clear and bright	clear and bright	clear and bright	clear and bright	clear and bright	clear and bright
Flash point Pour point Pour point	D92 D97 <u>D97</u>	temperature, °C, min temperature, °C, max temperature, °C, max	125 -15 <u>-15</u>	145 - 12 - <u>12</u>	165 - 9 - <u>9</u>	175 - 6 - <u>6</u>	185 - 6 - <u>6</u>	195 -6 <u>-6</u>	205 - 6 - <u>6</u>	215 -6 <u>-6</u>
Chemical Acid number	D974/D 664	mg KOH/g, max	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Performance -Elastomer compatibi ity	l D471	100 ± 1°C/288 ± 2h ± 2h SRE-NBR 1 Elasto mer (DIN53 538, Part 1	report ►	report	report	report	report	report	report	report
Elastomer compatibil-D471 10		er 100 °C ± 1 °C/288 h ± 2 h SRE-NBR 1 Elastomer	report	report	report	report	report	report	report	report
		(DIN53 538, Part 1 or AMA 524, Part 1) relative volume change, % C	/sta	no al	0 to 15	0 to 12	0 to 12	0 to 10	0 to 10	0 to 10
		relative volume change,	report	report	0 to 15	0 to 12	<u>0 to 12</u>	<u>0 to 10</u>	<u>0 to 10</u>	<u>0 to 10</u>
		change in Shore A hardness.	report	report	0 to -8	0 to -7	0 to -7	0 to -6	0 to -6	0 to -6
		rating C								

A Precision of the test method for hydraulic oils at low temperatures is being improved by Subcommittee D02.07.C0, but the test method is applicable.

A Test Method D4052 can also be used.

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Physical: ISO-viscosity grade Viscosity Viscosity Viscosity Viscosity Viscosity, ≤ 750 cP Viscosity index Specific gravity Appearance Appearance Flash point Pour point Pour point Chemical: Acid Number Performance: Rust prevention	ASTM (Other) 02422 0445 0445 02983 02270 01298 ^A 01298 ^A visual, at 20 °C 092 097	kinematic viscosity at 40°C, mm²/s kinematic viscosity at 40°C, mm²/s temperature, °C, max min	10 9.0-11.0 9.0-11.0 -33 -33 90 report report elear and bright bright	15 13.5-16.5 13.5-16.5 -23 -23 90 report report elear and bright	22 19.8-24.2 <u>19.8-24.2</u> -15 -15 90 report report clear and	32 28.8-35.2 28.8-35.2 -8 -8 90 report report	45 41.4-50.6 41.4-50.6 -2 -2 90 report report	68 61.2-74.8 61.2-74.8 4 4 90	100 90.0-110 90.0-110 10 10 90 report	150 135-165 135-165 16 16 90 report
SÓ-viscosity grade Viscosity Viscosity Viscosity, ≤ 750 eP Viscosity, ≤ 750 eP Viscosity index Specific gravity Appearance Appearance Viscosity index Specific gravity Appearance Appearance Appearance Viscosity index Specific gravity Specific gravity Appearance Appearance Viscosity index Specific gravity Specific gravity Specific gravity Appearance Appearance Viscosity index Specific gravity Specific g	0445 0445 02983 02983 02270 01298 ^a 01298 ^a visual, at 20 °C visual, at 20 °C	kinematic viscosity at 40 °C, mm²/s temperature, °C, max temperature, °C, max min temperature, °C, min	9.0-11.0 9.0-11.0 -33 -33 90 report report clear and bright clear and	13.5-16.5 13.5-16.5 -23 -23 90 report report elear and bright	19.8-24.2 19.8-24.2 -15 -15 90 report report elear and	28.8-35.2 28.8-35.2 -8 -8 90 report report	41.4-50.6 41.4-50.6 -2 -2 90 report	61.2-74.8 61.2-74.8 4 4 90 report	90.0-110 90.0-110 10 90 report	135-165 135-165 16 16 90
Viscosity Viscosity Viscosity Viscosity, ≤ 750 eP Viscosity, ≤ 750 eP Viscosity index Specific gravity Specific gravity Appearance Appearance Viscosity index Viscosity inde	0445 0445 02983 02983 02270 01298 ^a 01298 ^a visual, at 20 °C visual, at 20 °C	kinematic viscosity at 40 °C, mm²/s temperature, °C, max temperature, °C, max min temperature, °C, min	9.0-11.0 9.0-11.0 -33 -33 90 report report clear and bright clear and	13.5-16.5 13.5-16.5 -23 -23 90 report report elear and bright	19.8-24.2 19.8-24.2 -15 -15 90 report report elear and	28.8-35.2 28.8-35.2 -8 -8 90 report report	41.4-50.6 41.4-50.6 -2 -2 90 report	61.2-74.8 61.2-74.8 4 4 90 report	90.0-110 90.0-110 10 90 report	135-165 135-165 16 16 90
Viscosity Viscosity, ≤ 750 eP Viscosity, ≤ 750 eP Viscosity, ≤ 750 cP Viscosity index Specific gravity Appearance Appearance Viscosity index Specific gravity Appearance Viscosity index Specific gravity Appearity Appearance Viscosity, ≤ 750 cP Ciscosity, ≤ 750 cP C	0445 02983 ^A 02270 04298 ^B 01298 ^A visual, at 20°C visual, at 20°C	kinematic viscosity at 40 °C, mm²/s temperature, °C, max temperature, °C, max min temperature, °C, min	9.0–11.0 -33 90 report report clear and bright clear and	13.5–16.5 -23 -23 90 report report elear and bright	19.8–24.2 -15 90 report report clear and	28.8–35.2 -8 -8 90 report report	41.4–50.6 -2 -2 90 report	61.2–74.8 4 4 90 report	90.0–110 10 10 90 report	135–165 16 16 90
Viscosity, ≤ 750 eP Viscosity, ≤ 750 eP Viscosity, ≤ 750 cP Viscosity index Specific gravity Appearance Appearance Flash point Pour point Chemical: Acid Number Performance: Rust prevention	2983 ^A 22983 22270 21298 ^B 21298 ^A Aisual, at 20°C 292	temperature, °C, max temperature, °C, max min temperature, °C, min	-33 -33 90 report report elear and bright clear and	-23 90 report report elear and bright	-15 -15 90 report report clear and	-8 -8 90 report report	-2 -2 90 report	4 4 90 report	10 10 90 report	16 16 90
Viscosity, ≤ 750 cP Viscosity index Specific gravity Specific gravity Appearance Appearance V Flash point Pour point Chemical: Acid Number Performance: Rust prevention	02983 02270 01298 ⁸ 01298 ^A visual, at 20°C visual, at 20 °C	temperature, °C, max min temperature, °C, min	-33 90 report report elear and bright clear and	90 report report elear and bright	-15 90 report report clear and	-8 90 report report	<u>-2</u> 90 report	4 90 report	10 90 report	16 90
Viscosity index Specific gravity Specific gravity Appearance Appearance Pour point Pour point Chemical: Acid Number Performance: Rust prevention	02270 01298 ⁸ 01298 ^A visual, at 20°C visual, at 20 °C 092	min temperature, °C, min	90 report report elear and bright clear and	90 report report clear and bright	90 report report clear and	report report	report	90 report	90 report	90
Viscosity index Specific gravity Specific gravity Appearance Appearance Pour point Pour point Chemical: Acid Number Performance: Rust prevention	02270 01298 ⁸ 01298 ^A visual, at 20°C visual, at 20 °C 092	min temperature, °C, min	90 report report elear and bright clear and	90 report report clear and bright	90 report report clear and	report report	report	90 report	90 report	90
Specific gravity Specific gravity Appearance Appearance Appearance Flash point Pour point Chemical: Acid Number Performance: Rust prevention	01298 ⁸ 01298 ^A visual, at 20°C visual, at 20 °C	temperature, °C, min	report report elear and bright clear and	report report clear and bright	report report clear and	report report	report	report	report	
Specific gravity Appearance Appearance V Appearance V Flash point Pour point Chemical: Acid Number Performance: Rust prevention D D D D D D D D D D D D D	01298 ^A visual, at 20°C visual, at 20 °C 092 097		report elear and bright clear and	report clear and bright	report clear and	report	•	•		тороп
Appearance Appearance V Flash point Pour point Chemical: Acid Number Performance: Rust prevention	visual, at 20°C visual, at 20 °C 092 097		elear and bright clear and	clear and bright	clear and				report	report
Appearance v Flash point D Pour point D Chemical: Acid Number D Performance: Rust prevention	visual, at 20 °C 092 097		bright clear and	bright				report		
Flash point Pour point Pour point Dihemical: Acid Number Performance: Rust prevention	D92 D 97		clear and	-		clear and	elear and	clear and	clear and	clear an
Flash point Pour point Pour point Dihemical: Acid Number Performance: Rust prevention	D92 D 97				bright	bright	bright	bright	bright	bright
Pour point B Pour point D Chemical: Acid Number D Performance: Rust prevention B	997		hriaht	clear and	clear and	clear and	clear and	clear and	clear and	clear an
Pour point E Pour point C Chemical: Acid Number C Performance: Rust prevention E	997			bright	bright	bright	bright	bright	bright	bright
Pour point D Chemical: Acid Number D Performance: Rust prevention		tamana ratura OC mas:	125	145	165	175	185	195	205	215
Pour point D Chemical: Acid Number D Performance: Rust prevention	<u>097</u>	temperature, °C, max	-33	-24	-21	-18	-15	-12	-12	-12
Chemical: Acid Number Derformance: Rust prevention		temperature, °C, max	-33	-24	-21	-18	-15	<u>-12</u>	-12	-12
Acid Number Performance: Rust prevention										
Performance: Rust prevention	D974/D 664	mg KOHg	report	report	report	report	report	report	report	report
Rust prevention D	J374/D 004	ing Kong	Тероп	тероп	тероп	тероп	тероп	тероп	тероп	тероп
	0665A €	visual evaluation nace or fail		2000					2000	
Rust prevention		visual evaluation pass or fail	pass	pass	pass	pass	pass	pass	pass	pass
	0665A ^B	visual evaluation pass or fail	pass	pass	pass	pass	pass	pass	pass	pass
	0665B €		pass	pass	pass	pass	pass	pass	pass	pass
	D665B ^B		pass	pass	pass	pass	pass	pass	pass	pass
Corrosion E)130	copper corrosion, 3 h at 100°C, visual,	2010 m	2010	2	2	2	2	2	2
		max								
Corrosion	D130	copper corrosion, 3 h at 100 °C, visual,	2	2	2	2	2	<u>2</u>	2	2
<u> </u>		max		. 1 D.	=	_=	=	=	=	=
Water separation E)1401	time (mins) to 3 mL emulsion at 54°C, max	v 30	30	30	30	30	30		
•										
Water separation	<u> </u>	time (mins) to 3 mL emulsion at 54 °C,	<u>30</u>	<u>30</u>	<u>30</u>	<u>30</u>	<u>30</u>	<u>30</u>		
		max								
		time (mins) to 3 mL emulsion at 82°C, max	*	7.150 14					60	60
		time (mins) to 3 mL emulsion at 82 °C,	<u> AS INI I</u>	7 <u>0</u> 138-14	<u></u>	<u></u>	<u></u>	<u></u>	<u>60</u>	<u>60</u>
		max (/standonds								
Elastomer compatibility D)471	100 ± °C/288, ± 2 h								
		SRE-NBR 1 Elastomer 1/4 // 5/ho 0								
Elastomer compatibility D	0471	100 °C ± 1 °C/288 h ± 2 h								
<u> </u>		SRE-NBR 1 Elastomer								
		(DIN 53 538, Part 1 or AAMA 524 Part 1)	uanaut	40 10 0 H	0 to 15	0 to 10	0 to 10	0 to 10	0 to 10	0 +- 10
		relative volume change, % ^D	report	report	0 to 15	0 to 12	0 to 12	0 to 10	0 to 10	0 to 10
		relative volume change, percent	report	report	0 to 15	0 to 12	0 to 12	0 to 10	0 to 10	0 to 10
		change in Shore A hardness, rating ^D	report	report	0 to -8	0 to -7	0 to -7	0 to -6	0 to -6	0 to -6
		change in Shore A hardness, rating	report	report	<u>0 to –8</u>	<u>0 to −7</u>	<u>0 to −7</u>	<u>0 to −6</u>	<u>0 to –6</u>	<u>0 to −6</u>
Foam D	D892	Sequence I, tendency/stability, mL, max	150/0	150/0	150/0	150/0	150/0	150/0	150/0	150/0
		Sequence II, tendency/stability, mL, max	75/0	75/0	75/0	75/0	75/0	75/0	75/0	75/0
		Sequence III, tendency/stability, mL, max	150/0	150/0	150/0	150/0	150/0	150/0	150/0	150/0
Air release B)3427	time, (mins. at 50°C, max)	5	5	5	5	10	10		
	D3427	time, (mins. at 50 °C, max)					10	10		
Air release	JU421		<u>5</u>	<u>5</u>	<u>5</u>	<u>5</u>			····	···
		time, (mins. at 75°C, max)							report	report
		time, (mins. at 75 °C, max)	=	=	=	=	=	=	report	report
Oxidation stability D	D943	time for acid number of 2 mg KOH/g, h,	1000	1000	1000	1000	1000	1000	1000	1000
		min								
Sludge tendency D	D4310	total insoluble sludge, mg, max	200	200	200	200	200	200	200	200
· -		copper in oil/water/sludge, mg	report	report	report	report	report	report	report	report
T1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	02070	copper appearance, visual max	report	report	report	5	5	5	report	report
Thermal stability	2	steel appearance, visual max	report	report	report	1	1	1	report	report
I nermai stability		sludge, mg/100 mL, max	report	report	report	25	25	25	roport	Toport

^A Precision of the test method for hydraulic fuels at low temperatures is being improved by Subcommittee D02.07.C0, but the test method is applicable.

^A Test Method D4052 can also be used.

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^B Test Method D665 — soak time is 24 h.

^B Test Method D665 — soak time is 24 h.

Description These numbers are provisional; ASTM is trying to establish a technical consensus for possible revision.

Properties	Test Method ASTM (Other)	Parameters					Limits			
Physical:				<u> </u>		<u> </u>		<u> </u>		
ISO-viscosity grade	D2422		10	15	22	32	46	68	100	150
-Viscosity	D445	kinematic viscosity at 40°C, mm ² /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	D445	kinematic viscosity at 40 °C, mm ² /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 cP	D2983 ^A	temperature, °C, max	-33	-23	-15	(-8)	-2	4	10	16
Viscosity ≤ 750 cP	D2983	temperature, °C, max	-33	-23	-15	<u>(–8)</u>	<u>-2</u>	4	10	16
Viscosity index	D2270	*min	90	90	90	90	90	90	90	90
Specific gravity	D1298 ^B		report	report	report	report	report	report	report	report
Specific gravity	D1298 ^A		report	report	report	report	report	report	report	report
-Appearance	Visual, at 20°C		clear and	clear and	clear and	clear and	clear and	clear and	clear and	clear and
Appearance	V13001, 01 20 0		bright	bright	bright	bright	bright	bright	bright	bright
Appearance	Visual, at 20 °C		clear and bright	clear and bright	clear and bright	clear and bright	clear and bright	clear and bright	clear and bright	clear and bright
Flash point	D92	temperature, °C, min	125	145	165	175	185	195	205	215
-Pour point	D97	temperature, °C, max	-33	-24	-21	-18	-15	-12	-12	-12
Pour point	D97	temperature, °C, max	-33	-24	_21	-18	-15	-12	-12	-12
Chemical:	<u> </u>	tomporatoro, o, max						_ <u></u>		
Acid number Performance	D974/D 664	mg KOH/g, max	report	report	report	report	report	report	report	report
Rust prevention	D665AC	visual evaluation, pass or fail	pass	pass	pass	pass	pass	pass	pass	pass
	D665A ^B						•	•	•	•
Rust prevention	D665BC	visual evaluation, pass or fail	pass	pass	pass	pass	pass	pass	pass	pass
		visual evaluation, pass or fail	pass	pass	pass	pass	pass	pass	pass	pass
0 .	D665B ^B	visual evaluation, pass or fail	pass	pass	pass	pass	pass	pass	pass	pass
-Corrosion	D130	copper corrosion, 3 h at 100°C, visual,		2 41	2	2	2	2	2	2
Corrosion	<u>D130</u>	copper corrosion, 3 h at 100 °C, visual	<u>, 2</u>	2	2	2	2	<u>2</u>	2	2
Water separability	D1401	max time (mins) to 3 mL emulsion max at 54°C	30 M en	30	30 / Le	30	30	30	•••	•••
		max at 54 °C time (mins) to 3 mL emulsion max at 82°C	ASTM I	D ö 158-14	ļ				60	60
Elastomer compatibility	D471	may at 92 °C								
Elastomer compatibility	D471	100 1 1 0/200 12 11								
		(DIN53 538, Part 2 or AAMA 524,								
		Part 2)								
		, _							0.1.40	
		relative volume change, % ^D	report	report	0 to 15	0 to 12	0 to 12	0 to 10	0 to 10	0 to 10
		relative volume change, percent	report	report	0 to 15	0 to 12	0 to 12	0 to 10	0 to 10	0 to 10
		change in Shore A hardness, rating ^D	report	report	0 to -8	0 to -7	0 to -7	0 to -6	0 to -6	0 to -6
_		change in Shore A hardness, rating	report	report	0 to -8	0 to -7	0 to -7	<u>0 to −6</u>	0 to -6	0 to -6
Foam	D892	Sequence I tendency/stability mL max	150/0	150/0	150/0	150/0	150/0	150/0	150/0	150/0
		Sequence II tendency/stability mL max		75/0	75/0	75/0	75/0	75/0	75/0	75/0
		Sequence III tendency/stability mL max		150/0	150/0	150/0	150/0	150/0	150/0	150/0
Air release	D3427	time (mins) at 50°C, max	5	5	5	5	10	13		
Air release	D3427	time (mins) at 50 °C, max	<u>5</u>	<u>5</u>	<u>5</u>	<u>5</u>	10	13	<u></u>	<u></u>
		time (mins) at 75°C max	-	_	_	_			report	report
		time (mins) at 75 °C max	<u></u>	<u></u>	<u></u>	<u></u>	<u></u>	<u></u>	report	report
Oxidation stability	D943	time for acid number of 2 mg	1000	1000	1000	1000	1000	1000	1000	1000
,		KOH/g, h, min								
					000	000	000	000	000	
Sludge tendency	D4310	total insoluble sludge mg may	200	200	200	200			200	200
Sludge tendency	D4310	total insoluble sludge, mg, max	200 report	200 report	200 report	200 report	200 report	200 report	200 report	200 report
Sludge tendency Thermal stability	D4310 D2070	total insoluble sludge, mg, max copper oil/water/sludge, mg copper appearance, visual	report report	report report	report report	report 5	report 5	report 5	report report	200 report report