The Engineering Society For Advancing Mobility Land Sea Air and Space®
INTERNATIONAL
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INDUSTRIAL LUBRICANT STANDARD

SAE MS1000

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Lubricants, Industrial Oils, and Related Products—Classification

Foreword—The Society of Automotive Engineers (SAE) Industrial Lubricants Committee has developed a number of industrial, non-production, lubricant performance specifications.

The purpose of these voluntary SAE documents is to:

a. Define minimum performance requirements for industrial lubricants, where tests are available.
b. Provide lubricant suppliers with performance targets for key industrial lubricants.
c. Promote the availability of these lubricants to member companies and others who may wish to use these specifications.
d. Provide a user friendly classification system using common test standards and properties.

ISO Standard 6743 - Lubricants, industrial oils and related products (class L) - Classification is the foundation for these documents.

a. Performance properties, requirements, and test procedures are specified.
b. For information, equivalent ISO, DIN, CEN, BSI, ASTM, AFNOR, CETOP, VDMA, and IP test methods are referenced. [1]

See References, Section 2.

1. International Standards Organization, (ISO)
Deutsches Institut fur Normung e. V. (DIN)
European Committee for Standardization (CEN)
American Society for Testing and Materials (ASTM)
Association Francaise de Normalisation (AFNOR)
The Institute of Petroleum (IP) Note: Now combined with BSI
British Standards Institution (BSI), BS 2000: XXX where XXX is the corresponding IP number
European Committee on Oil Hydraulic Pneumatic Committee (CETOP)
German Association of Machine and Plant Construction (VDMA)

TO PLACE A DOCUMENT ORDER; (724) 776-4970 FAX: (724) 776-0790
SAE WEB ADDRESS http://www.sae.org

Industrial lubricant classifications targeted:

a. Lubricants, Industrial Oils and Related Products - Classification (SAE MS1000)
b. Hydraulic fluids (SAE MS1004)
c. Fire resistant hydraulic fluids (SAE MS1005)
d. Lubricating oils (various applications)
e. Lubricating greases
f. Metal Removal Fluids
g. Metal Forming Fluids

NOTE 1—Environmental and/or health and safety regulations will present additional specifications to these standards. Contact individual end users regarding requirements in these areas.

NOTE 2—There can be issues related to the quality of industrial lubricants that fall outside of the scope of this specification.

1. Scope

1.1 Designation of Lubricants, and Marking of Containers and Equipment Lube Points—This index provides a overview of lubricants and symbols for the purpose of assisting the user in the identification of the appropriate product and relevant SAE specification. The aim is to better determine he best lubricant to be used for a particular application.

If containers used for shipping lubricants are also to be marked, the same identification and symbols should be used.

See also ISO 5169 Machine tools - Presentation of lubrication instructions.

1.1.1 Examples for the Marking of Lubrication Points on Equipment and/or Shipping Containers

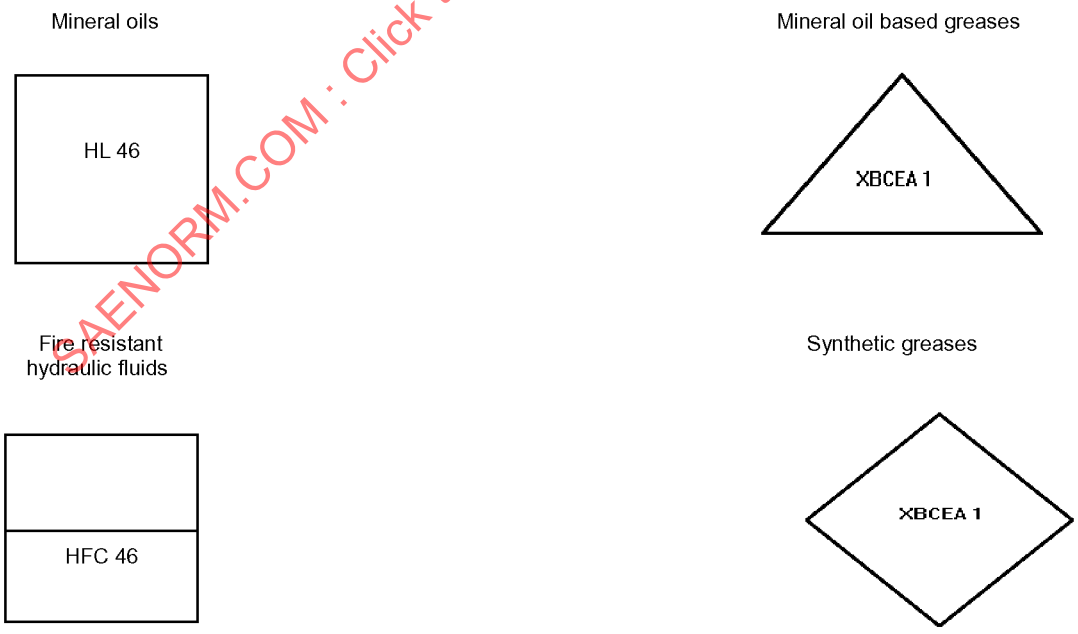
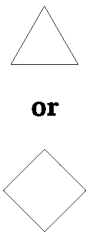


FIGURE 1—EXAMPLES FOR THE MARKING OF LUBRICATION POINTS ON EQUIPMENT AND/OR SHIPPING CONTAINERS

1.2 Index of Lubricants and Symbols—See Table 1.

TABLE 1—INDEX OF LUBRICANTS AND SYMBOLS

Item	Type of Lubricant	Symbol	SAE Specification	Type(s) Specified	Marking Symbol
Mineral oils	General purpose lubricating oils for total loss systems	A	TBD	AB, AN	
	Spindle bearings	F	TBD	FD	
	Slideways	G	TBD	G	
	Pneumatic tools	P	TBD	PAA, PAB, PAC, PBA, PBB, PBC	
	Turbines	T	TBD	TSA, TSC, TSE	
	Compressors	D	TBD	DAA, DAB, DAC, DAG, DAH, DAJ	
	Gears	C	TBD	CKB, CKC, CKE	
	Hydraulic Fluids	H	SAE MS1004	HL, HM, HR, HV	
	Fire resistant hydraulic fluids	HF	SAE MS1005	HFAE, HFB, HFC, HFDR, HFDU	
	Metal Removal Fluids	M	TBD	MAA, MAB, MAC, MAD, MAE, MAF, MAG, MAH MHA, MHB, MHC MHD, MHE, MHF	
	Greases	X	TBD	Based on operating conditions	

1.3 Recommendations for the Choice of Lubricants for Machine Tools—See Table 2.

TABLE 2—RECOMMENDATIONS FOR THE CHOICE OF LUBRICANTS FOR MACHINE TOOLS

Symbol	General Application	Particular Application	More specific Application	Product type and/or performance requirements	SAE classification	Examples of applications	Remarks
A	Total loss systems			Refined mineral oils	AN 68 AN 220	Lightly loaded parts	
C	Gears	Enclosed gears	Continuous lubrication by splash, circulation or spray	Refined mineral oils with oxidation stability, anti-corrosion (ferrous and non-ferrous metal) and anti-foam properties	CKB 32 CKB 68 CKB 100 CKB 150	Enclosed gears operating under light load (bearings associated with headstocks, feed-boxes, carriages)	CKB 32 and CKB 68 can also be used for flood lubricated, mechanically controlled clutches. CKB 68 may replace AN 68
				Refined mineral oils with oxidation stability, anti-corrosion (ferrous and non-ferrous metal) anti-foam, extreme pressure and anti-wear properties	CKC 100 CKC 150 CKC 220 CKC 320 CKC 460	Enclosed gears operating at a stabilized temperature of oil that remains normal or medium and under high load. Enclosed gears of any type (except hypoid gears) and associated bearings	These oils can also be used for manual or centralized lubrication of lead and feed screws and lightly loaded slideways.
				Refined mineral oils with oxidation stability, anti-corrosion (ferrous and non-ferrous metal), anti-foam and anti-wear properties with friction modifier	CKE 320 CKE 460 CKE 680 CKE 1000	Worm gears	
D	Air compressors			Refined mineral oil with oxidation stability, anti-corrosion (ferrous and non-ferrous metal) antifoam and demulsibility	DAA, DAB, DAC, DAG, DAH, DAJ	Recriprocating and rotary compressors	
F	Spindle bearings		Spindle bearings, and associated bearings	Refined mineral oils with improved properties, for example: anti-corrosion, anti-oxidation, anti-wear, which may be obtained by additives	FD 2 FD 5 FD 10 FD 22	Pressure bath and oil/air lubrication of plain or rolling bearings	These oils can also be used for applications requiring particularly low viscosity oils, such as fine mechanisms, hydraulic or hydropneumatic mechanisms, electromagnetic clutches, air line lubricators and hydrostatic bearings.

TABLE 2—RECOMMENDATIONS FOR THE CHOICE OF LUBRICANTS FOR MACHINE TOOLS (CONTINUED)

Symbol	General Application	Particular Application	More specific Application	Product type and/or performance requirements	SAE classification	Examples of applications	Remarks
G	Slides & Ways			Refined mineral oils with improved lubricity and tackiness properties to prevent stick-slip	G 68 G 100 G 150 G 220	Lubrication of plain bearing slideways. They should be particularly useful at low traverse speeds to minimize vibrations due to discontinuous sliding (stick-slip).	These oils can be used for the lubrication of all sliding parts such as lead and feed screws, cams, ratchets, and lightly loaded worm gears with intermittent service.
H	Hydraulic systems	Hydrostatic systems		Refined mineral oils with improved anti-rust and anti-oxidation properties	HL 32 HL 46 HL 68		
				Refined mineral oils with improved anti-rust, anti-oxidation and anti-wear properties	HM 15 HM 32 HM 46 HM 68		
				Refined mineral oils with improved anti-rust, anti-oxidation, anti-wear and viscosity/ temperature properties	HV 22 HV 32 HV 46		
			Applications where fire-resistant fluids are required	Oil-in-water emulsions	HFAE		ISO 7745 shall be used for providing operational characteristics, advantages, disadvantages and factors affecting the choice among fire resistant fluids.
				Water-in-oil emulsions	HFB		
				Water polymer (glycol) solutions	HFC		
				Synthetic fluids containing no water and consisting of phosphate esters	HFDR		
				Synthetic fluids containing no water and of other compositions	HFDU		

TABLE 2—RECOMMENDATIONS FOR THE CHOICE OF LUBRICANTS FOR MACHINE TOOLS (CONTINUED)

Symbol	General Application	Particular Application	More specific Application	Product type and/or performance requirements	SAE classification	Examples of applications	Remarks
M	Metal Removal	Metal Removal by Cutting, Abrasion	Applications Mainly Needing Lubrication - (Straight Oils)	Fluids differing in anti-corrosion, friction reducing, or E.P. properties (chemically active or non-active)	MHA, MHB, MHC, MHE, MHD, MHF	Milling, Drilling, Tapping, Grinding, Honing, Hobbing	
			Applications Mainly Requiring Cooling -- (Soluble)	Milky emulsions differing in anti-corrosion, friction reducing, or E.P. properties (chemically active or non-active)	MAA, MAB MAC, MAD		
			(Semi – synthetic)	Micro-emulsions differing in E.P.	MAE, MAF .		
			(Synthetic)	Transparent Solutions differing in E.P.	MAG, MAH .		
P	Pneumatic tools and machinery	Rotary pneumatic tools and air-driven machines	Automatic or manual lubrication	Mineral oil with anti-corrosion properties	PBB	Tools operating under low to moderate load conditions and with condensate present in the air.	
				Mineral oil with anti-corrosion and anti-wear, emulsifying and foam inhibiting properties.	PBC	Tools subject to extended service cycles, operating under moderate to severe load conditions and with condensate present in the air.	
T	Turbines			Refined mineral oils with oxidation stability, anti-corrosion (ferrous and non-ferrous metal), anti-foam and demulsibility	TSA, TSC, TSE	Steam turbine oils	
X	Applications requiring grease	Multi-purpose grease		Greases with improved anti-oxidation and anti-corrosion properties	XBCEA 00 XBCEA 0 XBCEA 1 XBCEA 2 XBCEA 3	Plain rolling bearings, open gears and general greasing of miscellaneous parts	Grease XBCEA 1 is used in centralized systems, while greases XBCEA 2 and XBCEA 3 are dispensed preferably by cup or hand gun. The equipment manufacturer should identify the grease used for the initial filling of each item to ensure that the grease subsequently introduced is compatible with it.

1.4 ISO Viscosity Grades—See Table 3.

TABLE 3—ISO VISCOSITY GRADES

ISO viscosity grade[1]	Approximate Kinematic viscosity[2] in mm^2/s at 20 °C	Approximate Kinematic viscosity[2] in mm^2/s at 40 °C	Approximate Kinematic viscosity[2] in mm^2/s at 60 °C	Approximate Dynamic viscosity[2] in mPa/s at 40 °C
ISO VG 2	3.3	2.2	1.3	2.0
ISO VG 3	5	3.2	2.7	2.9
ISO VG 5	8	4.6	3.7	4.1
ISO VG 7	13	6.8	5.2	6.2
ISO VG 10	21	10	7	9.1
ISO VG 15	34	15	11	13.5
ISO VG 22	-	22	15	18
ISO VG 32	-	32	20	29
ISO VG 46	-	46	30	42
ISO VG 68	-	68	40	61
ISO VG 100	-	100	60	90
ISO VG 150	-	150	90	135
ISO VG 220	-	220	130	200
ISO VG 320	-	320	180	290
ISO VG 460	-	460	250	415
ISO VG 680	-	680	360	620
ISO VG 1000	-	1000	510	900
ISO VG 1500	-	1500	740	1350

1. The viscosity grade numbers relate to the mid-point viscosity, to within ±10%.
2. Conversion from the kinematic viscosity to the dynamic viscosity is based on the mean density of the lubricants. The SI unit of the kinematic viscosity is the m^2/s ($1\ mm^2/s = 10^{-6}\ m^2/s$), and that of the dynamic viscosity is the Pascal second, Pa–s ($1\ mPa–s = 10^{-3} PA–s$).

1.5 NLGI Consistency numbers for lubricating greases—See Table 4.

TABLE 4—CONSISTENCY NUMBERS FOR GREASES

Consistency number (DIN 51818)	Worked penetration measured as described in ISO 2137, expressed in mm units
000	445 to 475
00	400 to 430
0	355 to 385
1	310 to 340
2	265 to 295
3	220 to 250
4	175 to 205
5	130 to 160
6	85 to 115

2. References

2.1 Applicable Publications—The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest version of SAE publications shall apply.

2.1.1 AFNOR PUBLICATIONS—Referenced, AFNOR, ASTM, BS, CEN, DIN, IP, ISO, and VDMA Standard hardcopies are available from the ILI Website (http://www.ili-info.com) or by contacting ILI at:

Europe
ILI, Index House, Ascot, Berkshire, SL5 7EU, UK
Tel: +44 (0)1344 636400 Fax: +44 (0)1344 291194
Email: databases@ili.co.uk

USA
ILI, 610 Winters Avenue, Paramus, NJ 07652, USA
Tel: 201-986-1131 Fax: 201-986-7886
Email: sales@ili-info.com

AFNOR NFT60-183—Lubrifiants, Huiles Industrielles Et Produits Connexes Pour Glissieres De Machines - Outils - Pouvoir Lubrifiant Antisaccade (Test Method for Stick-Slip Properties of Lubricating Oils)
AFNOR NFT60-187—Liquides D'usinage Aqueux - Aptitude A La Mise En Emulsion Ou En Solution Et Stabilite Au Repos (Test method for Emulsion Stability)

2.1.2 ASTM PUBLICATIONS—Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM D 92—Test Method for Flash and Fire Points by Cleveland Open Cup
ASTM D 94—Test Methods for Saponification Number of Petroleum Products
ASTM D 95—Test Method for Water in Petroleum Products and Bituminous Materials By Distillation
ASTM D 97—Test Methods for Pour Point of Petroleum Products
ASTM D 128—Test Methods for Analysis of Lubricating Grease
ASTM D 129—Test Method for Sulfur in Petroleum Products (General Bomb Method)
ASTM D 130—Method for Detection of Copper Corrosion from Petroleum Products by Copper Strip Tarnish Test
ASTM D 217—Test Methods for Cone Penetration of Lubricating Grease
ASTM D 287—Test Method for API Gravity of Crude Petroleum and Petroleum Products (Hydrometer Method)
ASTM D 445—Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)
ASTM D 471—Test Method for Rubber Property - Effect of Liquids
ASTM D 482—Test Method for Ash from Petroleum Products
ASTM D 566—Test Method for Dropping Point of Lubricating Grease
ASTM D 611—Test Methods for Aniline Point and Mixed Aniline Point Of Petroleum Products And Hydrocarbon Solvents
ASTM D 664—Test Method for Neutralization Number of Petroleum Products by Potentiometric Titration
ASTM D 665A—Test Method for Rust-Preventing Characteristics of Inhibited Mineral Oil in the Presence of Water
ASTM D 665B—Test Method for Rust-Preventing Characteristics of Inhibited Mineral Oil in the Presence of Synthetic Sea Water
ASTM D 808—Test Method for Chlorine in New and Used Petroleum Products (Bomb Method)
ASTM D 892—Test Method for Foaming Characteristics of Lubricating Oils
ASTM D 942—Test Method for Oxidation Stability of Lubricating Greases by the Oxygen Bomb Method
ASTM D 943—Standard Test Method for Oxidation Characteristics of Inhibited Mineral Oils
ASTM D 974—Test Method for Acid and Base Number by Color-Indicator Titration
ASTM D 1264—Test Method for Water Washout Characteristics of Lubricating Greases

ASTM D 1298—Test Method for Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method
ASTM D 1401—Test Method for Water Separability of Petroleum Oils and Synthetic Fluids
ASTM D 1479—Standard Test Method for Emulsion Stability of Soluble Cutting Oils (CANCELLED)
ASTM D 1500—Test Method for ASTM Color of Petroleum Products (ASTM Color Scale)
ASTM D 1662—Test Method for Active Sulfur in Cutting Oils
ASTM D 1742—Test Method for Oil Separation From Lubricating Grease During Storage
ASTM D 1743—Test Method for Corrosion Preventive Properties of Lubricating Greases
ASTM D 1744—Test Method for Determination of Water in Liquid Petroleum Products by Karl Fischer Reagent
ASTM D 1833—Test Method for Odor of Petroleum Wax
ASTM D 2068—Test Method for Filter Blocking Tendency of Distillate Fuel Oils
ASTM D 2070—Standard Test Method for Thermal Stability of Hydraulic oils
ASTM D 2140—Test Method for Carbon-Type Composition of Insulating Oils of Petroleum Origin
ASTM D 2265—Test Method for Dropping Point of Lubricating Grease Over Wide-Temperature Range
ASTM D 2266—Test Method for Wear Preventive Characteristics Of Lubricating Grease (Four-Ball Method)
ASTM D 2270—Practice for Calculating Viscosity Index from Kinematic Viscosity at 40°C And 100°C
ASTM D 2273—Test Method for Trace Sediment in Lubricating Oils
ASTM D 2369—Test Method for Volatile Content of Coatings
ASTM D 2422—Classification of Industrial Fluid Lubricants By Viscosity System
ASTM D 2509—Standard Test Method For Measurement of Load-Carrying Capacity of Lubricating Grease (Timken Method)
ASTM D 2595—Test Method for Evaporation Loss of Lubricating Greases Over Wide-Temperature Range
ASTM D 2596—Test Method for Measurement of Extreme-Pressure Properties of Lubricating Grease (Four-Ball Method)
ASTM D 2619—Test Method of Hydrolytic Stability of Hydraulic Fluids (Beverage Bottle Method)
ASTM D 2622—Test Method for Sulfur in Petroleum Products by X-Ray Spectrometry
ASTM D 2711—Test Method for Demulsibility Characteristics of Lubricating Oils
ASTM D 2782—Test Method for Measurement of Extreme-Pressure Properties of Lubricating Fluids (Timken Method)
ASTM D 2783—Method for Measurement of Extreme-Pressure Properties of Lubricating Fluids (Four-Ball Method)
ASTM D 2877—Methods of Test for Measuring Frictional Properties of Slideway Lubricants (DISCONTINUED 1975)
ASTM D 2882—Method for Indicating the Wear Characteristics of Petroleum And Non-Petroleum Hydraulic Fluids in a Constant Volume Vane Pump
ASTM D 2893—Test Method for Oxidation Characteristics of Extreme-Pressure Lubrication Oils
ASTM D 2896—Test Method for Base Number of Petroleum Products by Potentiometric Perchloric Acid Titration
ASTM D 3233—Method for Measurement of Extreme Pressure Properties of Fluid Lubricants (Falex Pin and Vee Block Methods)
ASTM D 3238—Method for Calculation of Carbon Distribution and Structural Group Analysis of Petroleum Oils by the N-D-M Method
ASTM D 3427—Test Method for Air Release Properties of Petroleum Oils
ASTM D 3519—Test Method for Foam in Aqueous Media (Blender Test)
ASTM D 3705—Test Method for Misting Properties of Lubricating Fluids
ASTM D 3707—Test Method for Storage Stability of Water-in-Oil Emulsions by the Oven Test Method
ASTM D 3945—Test Method for Shear Stability of Polymer-Containing Fluids Using a Diesel Injector Nozzle (CANCELLED)
ASTM D 4048—Test Method for Detection of Copper Corrosion From Lubricating Grease
ASTM D 4052—Test Method for Density and Relative Density of Liquids by Digital Density Meter
ASTM D 4055—Test Method for Pentane Insolubles by Membrane Filtration
ASTM D 4172—Test Method for Wear Preventive Characteristics of Lubricating Fluid (Four-Ball Method)

ASTM D 4290—Test Method for Determining the Leakage Tendencies of Automotive Wheel Bearing Grease Under Accelerated Conditions
ASTM D 4294—Test Method for Sulfur in Petroleum Products by Energy-Dispersive X-Ray Fluorescence Spectrometry
ASTM D 4425—Test Method for Oil Separation from Lubricating Grease by Centrifuging (Koppers Method)
ASTM D 4627—Test Method for Iron Chip Corrosion Test for Water-Dilutable Metalworking Fluids
ASTM D 4927—Test Method for Elemental Analysis of Lubricant & Additive Components - Barium, Calcium, Phosphorus, Sulfur & Zinc By Wavelength-Dispersive X-Ray Fluorescence Spectroscopy
ASTM D 4951—Test Method for the Determination of Additive Elements in Lubricating Oils by Inductively Coupled Plasma Atomic Emission Spectrometry
ASTM D 5182—Test Method for Evaluating the Scuffing (Scoring) Load Capacity of Oils (FZG Visual Method)
ASTM D 5183—Test Method for Determination of the Coefficient of Friction of Lubricants Using the Four-Ball Wear Test Machine
ASTM D 5621—Test Method for Sonic Shear Stability of Hydraulic Fluid
ASTM E 70—Test Method for PH of Aqueous Solutions With the Glass Electrode
ASTM E 659—Test Method for Autoignition Temperature of Liquid Chemicals
ASTM E 1131—Test Method for Compositional Analysis by Thermogravimetry
ASTM E 1687—Standard Test Method for Determining Carcinogenic Potential of Virgin Base Oils in Metalworking Fluids
ASTM F 1110—Test Method for Sandwich Corrosion Test (Corrosive Effect on Aluminum)

2.1.3 BS PUBLICATIONS—Available from ILI as referenced in 2.1.1.

BS 188—Determination of the Viscosity of Liquids
BS 903:PTA 35—Physical Testing of Rubber – Temperatures, Humidities and Times for Conditioning And Testing of Test Pieces
BS 2000:PTA226—Methods of Test for Petroleum and Its Products – Petroleum Products – Calculation of Viscosity Index from Kinematic Viscosity
BS 4231—Classification for Viscosity Grades of Industrial Liquid Lubricants
BS 4385—Methods for Determination of Water in Crude Petroleum, Petroleum Products and Bituminous Materials By Distillation (Superseded by ISO 9029)
BS 4450—Determination of Ash from Petroleum Products (Superseded by ISO 6245)
BS 4832—Determination of the Behavior of Rubber and Elastomers When Exposed to Liquids, Vapors and Gases (Superseded by ISO 6072)

2.1.4 CEN PUBLICATIONS—Available from ILI as referenced in 2.1.1.

CEN EN7—Determination of Ash from Petroleum Products

2.1.5 CETOP PUBLICATIONS—Hardcopies of referenced Standards are not in the ILI database but may be special ordered by contacting ILI as referenced in 2.1.1 or by contacting the European Oil Hydraulic and Pneumatics Committee (Website: http://www.cetop.org) at:

British Fluid Power Association
Cheriton House
Cromwell Business Park
Banbury Road
Chipping Norton
GB-Oxfordshire OX7 5SR
Phone: +44 (1608) 647900
Fax: +44 (1608) 647919
E-Mail: enquiries@BFPA.co.uk
http://www.BFPA.co.uk.

CETOP R 39 H—Schedule of Required Data for Hydraulic Fluids
CETOP R 48 H—Procedure for Determining Corrosion Resistant Characteristics of Water Base Fire Resistant Fluids
CETOP RP 65 H—Manifold Ignition Test for Fire-Resistant Fluid
CETOP RP 67 H—Anti Wear Vane Pump Test for Hydraulic Fluids
CETOP RP 110 H—Hydraulic Fluids for Hydraulic Transmission - Fire Resistant Fluids - Group HFA – Specifications
CETOP RP 112 H—Fluids for Hydraulic Transmission - Mineral Oils Category HV - Method for Determination of Shear Stability

2.1.6 DENISON PUBLICATION—Available from Denison Hydraulics, 14 Route du bois blanc – B.P. 539, 18105 Vierzon Cedex, France.

Denison P-46—Denison Piston Pump Test.

2.1.7 DIN PUBLICATIONS—Available from ILI as referenced in 2.1.1.

DIN 38 404/5—German Standard Methods for Examination of Water, Waste Water and Sludge; Physical and Physico-Chemical Characteristics (Group C); Determination of PH Value (C5)
DIN 38 405/1—German Standard Methods for the Examination of Water, Waste Water and Sludge; Anions (Group D); Determination of Chloride Ions (D 1)
DIN 38 405/5—German Standard Methods for the Examination of Water, Waste Water and Sludge; Anions (Group D); Determination of Sulfate Ions (D 5)
DIN 38 405/9—German Standard Methods for the Examination of Water, Sewage and Sludge; Anions (Group D), Determination of Nitrate Ions (D9)
DIN 38 406/1—German Standard Methods for the Examination Of Water, Waste Water and Sludge; Cations (Group E); Determination of Iron (E1)
DIN 38 406/3—German Standard Methods for the Examination of Water, Sewage and Sludge; Cations (Group E), Determination of Calcium and Magnesium (E3)
DIN 38 409/7—German Standard Methods for the Examination of Water, Sewage and Sludge; Summary of Indices of Actions and Substances (Group H), Determination of Acid and Base Capacity (H7)
DIN 51 345—Testing the Compatibility of Fire Resistant Hydraulic Fluids with Metals
DIN 51 346—Testing the Stability of Fire Resistant Hydraulic Fluids
DIN 51 348—Test of Fire Resistant Governor Fluid - Determination of Hydrolytic Stability
DIN 51 350/4—Testing of Lubricants - Testing by the Shell Four-Ball Tester; Determination of Welding Load of Consistent Lubricants
DIN 51 350/5—Testing of Lubricants - Testing by the Shell Four-Ball Tester; Determination of Wear Characteristics of Consistent Lubricants
DIN 51 354/2—Mechanical Testing of Lubricants by The FZG Gear Rig Test Method; Method A/8,3/90 for Testing Lubricating Oils
DIN 51 360/1—Testing of Cooling Lubricants; Determination of Corrosion Preventing Characteristics of Cooling Lubricants Mixed with Water; Herbert Corrosion Test
DIN 51 360/2—Testing of Cooling Lubricants; Determination of Corrosion Preventing Characteristics of Cooling Lubricants Mixed with Water; Chip/Filter Paper Method
DIN 51 368—Determination of Fraction Separated by Hydrochloric Acid from Water Mix Metal Working Fluids
DIN 51 369—Testing of Cooling Lubricants; Determination of the PH Value of Water-Mixed Cooling Lubricants
DIN 51 373—Testing of Fire Resistant Heat Transfer Fluids - Determination of Resistance to Oxidation Including an Assessment of the Catalyst Plates
DIN 51 381—Testing of Lubricating Oils, Governor Oils & Hydraulic Fluids; Determination of Air Release Properties
DIN 51 382—Determination of Shear Stability of Polymer-Containing Lubricating Oils by the Diesel Injector Nozzle Method

DIN 51 389/2—Determination of Lubricants; Mechanical Testing of Hydraulic Fluids in the Vane-Cell-Pump; Method a for Anhydrous Hydraulic Fluids
DIN 51 519—Lubricants; ISO Viscosity Classification for Industrial Liquid Lubricants
DIN 51 558/1—Testing of Mineral Oils; Determination of the Neutralization Number, Colour Indicator Titration
DIN 51 561—Testing of Mineral Oils, Liquid Fuels and Related Liquids; Measurement of Viscosity Using the Vogel-Ossag Viscometer; Temperature Range: Approximately 10 to 150-Deg C (CANCELLED)
DIN 51 562/1—Viscometry - Determination of Kinematic Viscosity Using the Ubbelohde Viscometer - Part 1: Apparatus and Measurement Procedure
DIN 51 566—Testing of Lubricants; Determination of Foaming Characteristics (CANCELLED)
DIN 51 569—Determination of Viscosity Of Mineral Oils, Liquid Fuels and Related Liquids at Temperatures from –55°C to Approximately 10°C Using the Vogel-Ossag Viscometer
DIN 51 575—Testing of Petroleum Products; Determination of Sulfated Ash
DIN 51 585—Testing of Lubricants; Testing of Corrosion Protection Properties of Steam Turbine Oils and Hydraulic Oils Containing Additives
DIN 51 587—Testing of Lubricants; Determination of the Ageing Behaviour of Steam Turbine Oils and Hydraulic Oils Containing Additives
DIN 51 592—Testing of Lubricants; Determination of the Content of Undissolved Matter in Lubricating Oils; Membrane Filter Method
DIN 51 599—Testing of Lubricating Oils; Determination of Demulsification Capacity According to the Stirring Method
DIN 51 757—Testing of Mineral Oils and Related Materials; Determination of Density
DIN 51 759/1—Testing of Liquid Mineral Oil Products; Method of Test for Copper Corrosion; Copper Strip Test (SUPERSEDED BY ISO 2160)
DIN 51 775—Testing of Mineral Oil Hydrocarbons; Determination of Aniline Point & Mixed Aniline Point of Bright Mineral Oil Hydrocarbons (SUPERSEDED BY ISO 2977)
DIN 51 787—Testing of Mineral Oil Hydrocarbons; Determination of Aniline Point and Mixed Aniline Point of Dark Mineral Oil Hydrocarbons (SUPERSEDED BY ISO 2977)
DIN 51 794—Testing of Mineral Oil Hydrocarbons; Determination of Ignition Temperature
DIN 51 802—Testing Lubricating Greases for their Corrosion-Inhibiting Properties by SKF Emcor Method
DIN 51 803—Testing of Lubricants; Determination of Ash in Lubricating Greases
DIN 51 805—Testing of Lubricants; Determination of Flow Pressure of Lubricating Greases, Kesternich Method
DIN 51 807/2—Testing of Lubricants; Test on the Behavior of Greases in the Presence of Water under Dynamic Tests
DIN 51 808—Testing of Lubricants; Determination of Oxidation Stability of Greases; Oxygen Method
DIN 51 811—Testing of Lubricants; Testing of Corrosiveness to Copper of Greases; Copper Strip Tarnish Test
DIN 51 813—Determination of Solid Matter Content of Lubricating Greases (Particle Sizes above 25 µm)
DIN 51 817—Determination of Oil Separation from Lubricating Grease under Static Conditions
DIN 51 818—Lubricants; Consistency Classification of Lubricating Greases; NLGI Grades
DIN 53 505—Testing of Rubber, Elastomers, and Plastics; Shore Hardness Testing A and D
DIN 53 521—Determination of the Behaviour of Rubber and Elastomers when Exposed to Fluids and Vapours
DIN 53 538/1—Standard Reference Elastomers; Acrylonitrile-Butadiene Rubber (NBR); Peroxide-Cured, for Characterizing Service Fluids with Respect to Their Action on NBR
DIN 53 538/2—Standard Reference Elastomers; Acrylonitrile Butadiene Rubber (NBR) with Low Acrylonitrile Content for Characterizing Test Liquids and Greases Bases on Mineral Oil
DIN EN 23015—Determination of Cloud Point of Petroleum Products

2.1.8 EPA PUBLICATIONS—Standard test methods of the U. S. Environmental Protection Agency. SW-846 Methods are available on-line (Website: http://www.epa.gov/epaoswer/hazwaste/test/8xxx.htm). Method 24 available in the Code of Federal Regulations in 40 CFR, Part 60, Appendix A).

EPA Method 24—Determination Of Volatile Matter Content, Water Content, Density, Volume Solids, And Weight Solids Of Surface Coatings (See also ASTM 2369)
EPA SW 846, Method 8082—Polychlorinated Biphenyls (PCB's) By Gas Chromatography
EPA SW 846, Method 8121—Chlorinated Hydrocarbons by Gas Chromatography: Capillary Column Technique
EPA SW 846, Method 8270C—Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry

2.1.9 FEDERAL TEST METHOD PUBLICATIONS—Standard test methods of the U. S. Department of Defense. FTM methods are available on-line (Website: http://stinet.dtic.mil/). Department of Defense Index of Specifications and Standards (DODISS) fielded search. Enter FED-STD-791C in "DODISS ID NUMBER" search field. Available in PDF format (Acrobat Reader Software required).

FTM 3005.4—Dirt Content of Grease; Federal Test Method Standard 791C Lubricants, Liquid Fuels and Related Products
FTM 6052.1—High-Temperature --High Pressure Spray Flammability; Federal Test Method Standard 791C Lubricants, Liquid Fuels and Related Products
FTM 6053.1—Manifold Ignition Test; Federal Test Method Standard 791C Lubricants, Liquid Fuels and Related Products

2.1.10 IP PUBLICATIONS—Available from ILI as referenced in 2.1.1.

IP 2—Petroleum Products and Hydrocarbon Solvents - Determination of Aniline Point and Mixed Aniline Point
IP 4—Petroleum Products - Determination of Ash
IP 15—Petroleum Products - Determination of Pour Point
IP 19—Determination of Demulsibility Characteristics of Lubricating Oil
IP 36—Determination of Open Flash and Fire Point - Cleveland Method
IP 37—Determination of Acidity and Alkalinity of Lubricating Grease
IP 50—Test Methods for Cone Penetration of Lubricating Grease
IP 61—Determination of Sulfur - Bomb Method
IP 71(Sect. 1)—Petroleum Products - Transparent and Opaque Liquids - Determination of Kinematic Viscosity And Calculation of Dynamic Viscosity
IP 74—Determination of Water Content of Petroleum Products - Distillation Method
IP 112—Determination of Corrosiveness to Copper of Lubricating Grease - Copper Strip Method
IP 121—Determination of Oil Separation Characteristics of Lubricating Grease - Pressure Filtration Method
IP 125—Determination of Cast Iron Corrosion Characteristics of Petroleum Products
IP 132—Petroleum Products - Lubricating Grease - Determination of Dropping Point
IP 134—Determination of Foreign Particulate Matter In Lubricating Grease - Microscopic Counting Method (CANCELLED)
IP 135—Determination of Rust-Preventing Characteristics Of Steam Turbine Oil in the Presence of Water
IP 136 (Sect. 1)—Petroleum Products - Determination of Saponification Number - Colour-Indicator Titration Method
IP 139—Petroleum Products and Lubricants - Determination of Acid or Base Number - Colour-Indicator Titration Method
IP 142—Oxidation Stability of Lubricating Grease - Oxygen Bomb Method
IP 146—Determination of Foaming Characteristics of Lubricating Oils
IP 154—Petroleum Products - Corrosiveness to Copper - Copper Strip Test
IP 157—Determination of the Oxidation Stability Of Inhibited Mineral Oils (The TOST Test)

IP 160—Determination of Density - Hydrometer Method
IP 166—Determination of Load-Carrying Capacity Of Lubricants - IAE Gear Machine Method
IP 177—Test Method for Acid Number by Potentiometric Titration
IP 185—Determination of Odour of Petroleum Wax
IP 196—Petroleum Products – Determination of Colour (ASTM Scale)
IP 215—Determination of Water Washout Characteristics of Lubricating Grease
IP 220—Petroleum Products and Lubricants - Determination of Rust-Prevention Characteristics of Lubricating Greases
IP 226—Petroleum Products - Calculation of Viscosity Index From Kinematic Viscosity
IP 239—Determination of Extreme Pressure and Antiwear Properties of Lubricants - Four Ball Machine Method
IP 240—Determination of Extreme-Pressure Properties of Lubricating Fluids (Timken Method)
IP 263—Determination of Stability of Water Mix Metal Working Fluids
IP 276—Petroleum Products - Determination of Base Number - Perchloric Acid Potentiometric Titration Method
IP 278—Determination of Seal Compatibility Index of Petroleum Oils
IP 281—Determination of Anti-Wear Properties of Hydraulic Fluids - Vane Pump Method
IP 284—Determination of Saponifiable and Unsaponifiable Matter in Oils, Fats and Waxes
IP 287—Determination of Rust Prevention Characteristics of Water Mix Metal Working Fluids - Chip Filter Paper Method
IP 294—Determination of Shear Stability of Polymer-Containing Oils - Diesel Injection Rig Method
IP 313—Determination of Air Release Value of Hydraulic, Turbine and Lubricating Oils
IP 326—Determination of Extreme Pressure Properties of Grease - Timken Method
IP 334—Determination of Load Carrying Capacity of Lubricants - FZG Gear Machine Method

2.1.11 ISO PUBLICATIONS—Available from ANSI, 11 West 42nd Street, New York, NY 10036-8002.

ISO 471—Rubber—Standard temperatures, humidities and times for conditioning and Testing
ISO 868—Plastics and ebonite—Determination of indentation hardness by means of a durometer (Shore Hardness)
ISO 1817—Rubber vulcanized—Determination of the effect of liquids
ISO 2049—Petroleum products—Determination of colour (ASTM Scale)
ISO 2137—Petroleum products—Lubricating grease and petrolatum—Determination of cone Penetration
ISO 2160—Petroleum products—Corrosiveness to copper—Copper strip test
ISO 2176—Petroleum products—Lubricating grease and petrolatum—Determination of dropping point
ISO 2592—Petroleum products—Determination of flash and fire points—Cleveland open cup method
ISO 2909—Petroleum products—Calculation of viscosity index from kinematic viscosity
ISO 2977—Petroleum products and hydrocarbon solvents—Determination of aniline point and mixed aniline point
ISO 3015—Petroleum oils—Determination of cloud point
ISO 3016—Petroleum products—Determination of pour point
ISO 3104—Petroleum products—Transparent and opaque liquids—Determination of kinematic viscosity and calculation of dynamic viscosity
ISO 3448—Industrial liquid lubricants—ISO viscosity classification
ISO 3675—Crude petroleum and liquid petroleum products—Laboratory determination of density or relative density—Hydrometer method
ISO 3733—Petroleum products and bituminous materials—Determination of water; distillation method
ISO 3771—Petroleum products—Determination of base number—Perchloric acid potentiometric titration method
ISO 4259—Petroleum products—Determination and application of precision data in relation to methods of test
ISO 4263—Petroleum products—Inhibited mineral oils—Determination of oxidation characteristics
ISO 4404—Petroleum and related products—Determination of the corrosion resistance of water containing fire-resistant fluids for hydraulic systems

ISO 4406—Hydraulic fluid power—Fluids—Method for coding level of contamination by solid particles
ISO 4407—Hydraulic fluid power—Fluid contamination—Determination of particulate contamination by the counting method using a microscope
ISO 5169—Machine tools—Presentation of lubrication instructions
ISO 6072—Hydraulic fluid power—Compatibility between elastomeric materials and fluids
ISO 6245—Petroleum products—Determination of ash
ISO 6247—Petroleum products—Lubricating oils—Determination of foaming characteristics
ISO 6293/1&2—Petroleum products—Determination of saponification number—Colour-indicator titration method petroleum products—Determination of saponification Number—potentiometric titration method
ISO 6614—Petroleum products—Determination of water separability of petroleum oils and synthetic fluids
ISO 6618—Petroleum products and lubricants—Determination of acid or base number—Colour-indicator titration method
ISO 6743/0—Lubricants, industrial oils and related products (Class L)—Classification; general
ISO 7120—Petroleum products and lubricants—Petroleum oils and other fluids—Determination of rust—Preventing characteristics in the presence of water
ISO 7619—Rubber—Determination of indentation hardness by means of pocket hardness meters
ISO 7745—Hydraulic fluid power—Fire-resistant (FR) fluids—Guidelines for use
ISO 9120—Petroleum and related products—Determination of air-release properties of steam turbine and other oils—Impinger method
ISO 11500—Hydraulic fluid power—Determination of particulate contamination by automatic counting using the light extinction principle
ISO 11158—Lubricants, industrial oils and related products (Class L)—Family H (hydraulic systems)—Specifications for categories HH, HL, HM, HV and HG
ISO 12922—Lubricants, industrial oils and related products (Class L)—Family H (hydraulic systems)—Specifications for categories HFAE, HFAS, HFB, HFC, HFDR and HFDU

2.1.12 VDMA PUBLICATIONS—Available from ILI as referenced in 2.1.1.

VDMA 24314—Fluidtechnik-Hydraulik; Wechsel Von Druckfluessigkeiten; Richtlinien (Hydraulic oil Equipment; Changing Hydraulic Fluids; Guidelines)
VDMA 24317—Fluidtechnik; Hydraulik; Schwerentflammbare Druckfluessigkeiten; Richtlinien (Hydraulic Oil Equipment; Fire Resistant Hydraulic Fluids; Guidelines)

3. Properties and Tests—See Table 6.

TABLE 5—PROPERTIES AND TESTS

PROPERTIES	HYD	FIRE RESIST	LUBE	GREASE	METAL REMOVAL	ISO	DIN	ASTM	IP/BS/OTHER	REMARKS
Viscosity classification	X	X	X		X	3448	51519	D 2422	BS 4231	
Kinematic viscosity	X	X	X		X	3104	51561 51562 part 1 or 51569	D 445	IP 71(Sec. 1) BS 188	
Pour point	X	X	X		X	3016	3016	D 97	IP 15	
Flash point	X	X	X	X	X	2592	2592	D 92	IP 36	
Contents of undissolved matter	X	X					51592	D 4055		
Water content	X	X	X	X		3733	3733	D 95 D 1744	IP 74 BS 4385	
Rust	X	X	X		X	7120 4404	51345 51585	D 665A or B	CETOP R48H IP 135	
Copper corrosion	X	X	X		X	2160	51759/1	D 130	IP 154	
Oxidation stability (1000 hrs)	X	X	X			4263	51373 51587	D 943	IP 157	
Oxidation stability (EP oils)			X					D 2893		
Behavior toward SRE-NBR 1 Seal : Relative change in % volume	X	X	X		X	1817 6072 471	53521 53538/1&2	D 471	BS 903 PTA 35	
Change in shore hardness	X	X	X		X	1817 868 7619	53521 with 53505	D 471	IP 278 BS 4832	
Air release	X	X				9120	51381	D 3427	IP 313	
Foam	X	X	X		X	6247	51566	D 892	IP 146	
Water separability/ Demulsibility	X		X			6614	51599	D 1401 D 2711	IP 19	
Emulsion stability		X				6614	51346	D 3707 (water in oil)		
Density	X	X	X		X	3675	51757	D 1298 D 4052	IP 160	
Ash	X	X	X			6245	51575	D 482	IP 4 BS 4450 CEN EN7	
Neutralization number	X	X	X		X	6618	51558 part 1	D 664 D 974	IP 139 IP 177	

TABLE 5—PROPERTIES AND TESTS

PROPERTIES	HYD	FIRE RESIST	LUBE	GREASE	METAL REMOVAL	ISO	DIN	ASTM	IP/BS/OTHER	REMARKS
FZG gear rig test	X	X	X				51534 part 2	D 5182	IP 166 IP 334	
Vane pump test	X	X					51389 part 2	D 2882	CETOP RP67H IP 281	
Piston Pump test	X	X							Denison P-46	
Shear stability	X	X					51382	D 3945 D 5621	CETOP RP112H IP 294	
PH		X			X		51369	E 70		
Viscosity index	X	X	X		X	2909	2909	D 2270	IP 226	
									BS 2000:PTA226	
High pressure spray flammability		X							FTM 6052.1	
Hot manifold		X							FTM 6053.1 CETOP RP65H	
Autoignition		X					51794	E 659	BS 4056	
Hydrolytic stability	X	X					51348	D 2619		
Fire point	X	X	X			2592	2592	D 92	IP 36	
Timken OK load			X					D 2782	IP 240	
Stick slip			X					D 2877	AFNOR NF T 60-183	
Misting			X					D 3705		
API gravity			X					D 287		
Four ball wear (20 kg load) wear scar dia.			X					D 2783 D 4172		
Thermal stability	X		X					D 2070		
Worked penetration				X		2137	2137	D 217	IP 50	
Drop point				X		2176	2176	D 2265 D 566	IP 132	
Lower operating temperature				X			51805			
Water washout				X			51807 part 2	D 1264	IP 215	
Rust prevention				X			51802	D 1743	IP 220	
Copper corrosion				X		2160	51811	D 4048	IP 112	
Oxidation stability; pressure drop				X			51808	D 942	IP 142	
NLGI grade				X			51818			

TABLE 5—PROPERTIES AND TESTS

PROPERTIES	HYD	FIRE RESIST	LUBE	GREASE	METAL REMOVAL	ISO	DIN	ASTM	IP/BS/OTHER	REMARKS
EMCOR rust test				X			51802		IP 220	
Evaporation loss				X				D 2595		
Oil separation				X				D 4290		
Four ball wear				X			51350/4&5	D 2596		
Ash				X			51803	D 128	IP 4	
Aniline point				X		2977	51775 51787	D 128 X1 D 611 A2	IP 2	
Centrifugal separation				X				D 4425		
Pressure separation				X			51817	D 1742	IP 121	
Timken load				X				D 2509	IP 326	
Four ball wear (20 kg load) wear scar dia.				X			51350 part 4 51350 part 5	D 2266	IP 239	
Dirt content				X			51813		FTM 3005.4 IP 134	
Color					X	2049		D 1500	IP 196	
Base Number					X	3771		D 2896	IP 276	
Saponification Number					X	6293		D 94	IP 136 (sec. 1)	
Total Sulfur					X			D 129 D 2622 D 4294	IP 61	
Active Sulfur					X			D 1662		
Total Chlorine					X			D 808		
Total Phosphorus					X			D 4927 D 4951		
Fatty Acids, & Esters (% Content)					X				IP 284	
Odor					X			D 1833	IP 185	
Filterability					X			D 2068		
Emulsion Stability					X				IP 263 AFNOR NFT 60-187	
Falex EP					X			D 3233		
Foam, by Blender					X			D 3519		
Paraffinic, Naphthenic, Aromatic Content	X				X			D 3238 D 2140		

TABLE 5—PROPERTIES AND TESTS

PROPERTIES	HYD	FIRE RESIST	LUBE	GREASE	METAL REMOVAL	ISO	DIN	ASTM	IP/BS/OTHER	REMARKS
Four Ball Coefficient of Friction					X			D 5183		
Corrosive Effect on Iron Chips					X		51 360/1&2	D 4627	IP 287 & 125	
Corrosive Effect on Aluminum					X			F 1110		
Total PCB's	X		X	X	X				EPA Meth. 8082	(As found in
Total Organic Halogens	X		X	X	X				EPA Meth. 8121	EPA SW 846)
Total PNA's	X		X	X	X				EPA Meth. 8270C	(")
Ames Mutagenicity	X		X	X	X			E 1687		
% Volatile Organics, by TGA or Oven Method					X			D 2369 E 1131	EPA Meth 24	
Sticking/Gumming tendency					X					TBD
Level of Contamination by Particles	X		X			4406		D 2273		

PREPARED BY THE SAE INDUSTRIAL LUBRICATION COMMITTEE

Rationale—Not applicable.

Relationship of SAE Standard to ISO Standard—Not applicable.

Application—The Society of Automotive Engineers (SAE) Industrial Lubricants Committee has developed a number of industrial, non-production, lubricant performance specifications.

The purpose of these voluntary SAE documents is to:

a. Define minimum performance requirements for industrial lubricants, where tests are available.
b. Provide lubricant suppliers with performance targets for key industrial lubricants.
c. Promote the availability of these lubricants to member companies and others who may wish to use these specifications.
d. Provide a user friendly classification system using common test standards and properties.

ISO Standard 6743 - Lubricants, industrial oils and related products (class L) - Classification is the foundation for these documents.

a. Performance properties, requirements, and test procedures are specified.
b. For information, equivalent ISO, DIN, CEN, BSI, ASTM, AFNOR, CETOP, VDMA, and IP test methods are referenced. [1]

Reference Section

AFNOR NFT60-183—Lubrifiants, Huiles Industrielles Et Produits Connexes Pour Glissieres De Machines - Outils - Pouvoir Lubrifiant Antisaccade (Test Method for Stick-Slip Properties of Lubricating Oils)

AFNOR NFT60-187—Liquides D'usinage Aqueux - Aptitude A La Mise En Emulsion Ou En Solution Et Stabilite Au Repos (Test method for Emulsion Stability)

ASTM D 92—Test Method for Flash and Fire Points by Cleveland Open Cup

ASTM D 94—Test Methods for Saponification Number of Petroleum Products

ASTM D 95—Test Method for Water in Petroleum Products and Bituminous Materials By Distillation

ASTM D 97—Test Methods for Pour Point of Petroleum Products

ASTM D 128—Test Methods for Analysis of Lubricating Grease

ASTM D 129—Test Method for Sulfur in Petroleum Products (General Bomb Method)

ASTM D 130—Method for Detection of Copper Corrosion from Petroleum Products by Copper Strip Tarnish Test

1. International Standards Organization, (ISO)
Deutsches Institut fur Normung e. V. (DIN)
European Committee for Standardization (CEN)
American Society for Testing and Materials (ASTM)
Association Francaise de Normalisation (AFNOR)
The Institute of Petroleum (IP) Note: Now combined with BSI
British Standards Institution (BSI), BS 2000: XXX where XXX is the corresponding IP number
European Committee on Oil Hydraulic Pneumatic Committee (CETOP)
German Association of Machine and Plant Construction (VDMA)

ASTM D 217—Test Methods for Cone Penetration of Lubricating Grease

ASTM D 287—Test Method for API Gravity of Crude Petroleum and Petroleum Products (Hydrometer Method)

ASTM D 445—Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and Calculation of Dynamic Viscosity)

ASTM D 471—Test Method for Rubber Property - Effect of Liquids

ASTM D 482—Test Method for Ash from Petroleum Products

ASTM D 566—Test Method for Dropping Point of Lubricating Grease

ASTM D 611—Test Methods for Aniline Point and Mixed Aniline Point Of Petroleum Products And Hydrocarbon Solvents

ASTM D 664—Test Method for Neutralization Number of Petroleum Products by Potentiometric Titration

ASTM D 665A—Test Method for Rust-Preventing Characteristics of Inhibited Mineral Oil in the Presence of Water

ASTM D 665B—Test Method for Rust-Preventing Characteristics of Inhibited Mineral Oil in the Presence of Synthetic Sea Water

ASTM D 808—Test Method for Chlorine in New and Used Petroleum Products (Bomb Method)

ASTM D 892—Test Method for Foaming Characteristics of Lubricating Oils

ASTM D 942—Test Method for Oxidation Stability of Lubricating Greases by the Oxygen Bomb Method

ASTM D 943—Standard Test Method for Oxidation Characteristics of Inhibited Mineral Oils

ASTM D 974—Test Method for Acid and Base Number by Color-Indicator Titration

ASTM D 1264—Test Method for Water Washout Characteristics of Lubricating Greases

ASTM D 1298—Test Method for Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method

ASTM D 1401—Test Method for Water Separability of Petroleum Oils and Synthetic Fluids

ASTM D 1479—Standard Test Method for Emulsion Stability of Soluble Cutting Oils (CANCELLED)

ASTM D 1500—Test Method for ASTM Color of Petroleum Products (ASTM Color Scale)

ASTM D 1662—Test Method for Active Sulfur in Cutting Oils

ASTM D 1742—Test Method for Oil Separation From Lubricating Grease During Storage

ASTM D 1743—Test Method for Corrosion Preventive Properties of Lubricating Greases

ASTM D 1744—Test Method for Determination of Water in Liquid Petroleum Products by Karl Fischer Reagent

ASTM D 1833—Test Method for Odor of Petroleum Wax

ASTM D 2068—Test Method for Filter Blocking Tendency of Distillate Fuel Oils

ASTM D 2070—Standard Test Method for Thermal Stability of Hydraulic oils

ASTM D 2140—Test Method for Carbon-Type Composition of Insulating Oils of Petroleum Origin

ASTM D 2265—Test Method for Dropping Point of Lubricating Grease Over Wide- Temperature Range

ASTM D 2266—Test Method for Wear Preventive Characteristics Of Lubricating Grease (Four-Ball Method)

ASTM D 2270—Practice for Calculating Viscosity Index from Kinematic Viscosity at 40°C And 100°C

ASTM D 2273—Test Method for Trace Sediment in Lubricating Oils

ASTM D 2369—Test Method for Volatile Content of Coatings

ASTM D 2422—Classification of Industrial Fluid Lubricants By Viscosity System

ASTM D 2509—Standard Test Method For Measurement of Load-Carrying Capacity of Lubricating Grease (Timken Method)

ASTM D 2595—Test Method for Evaporation Loss of Lubricating Greases Over Wide-Temperature Range

ASTM D 2596—Test Method for Measurement of Extreme-Pressure Properties of Lubricating Grease (Four-Ball Method)

ASTM D 2619—Test Method of Hydrolytic Stability of Hydraulic Fluids (Beverage Bottle Method)

ASTM D 2622—Test Method for Sulfur in Petroleum Products by X-Ray Spectrometry

ASTM D 2711—Test Method for Demulsibility Characteristics of Lubricating Oils

ASTM D 2782—Test Method for Measurement of Extreme-Pressure Properties of Lubricating Fluids (Timken Method)

ASTM D 2783—Method for Measurement of Extreme-Pressure Properties of Lubricating Fluids (Four-Ball Method)

ASTM D 2877—Methods of Test for Measuring Frictional Properties of Slideway Lubricants (DISCONTINUED 1975)

ASTM D 2882—Method for Indicating the Wear Characteristics of Petroleum And Non-Petroleum Hydraulic Fluids in a Constant Volume Vane Pump

ASTM D 2893—Test Method for Oxidation Characteristics of Extreme-Pressure Lubrication Oils

ASTM D 2896—Test Method for Base Number of Petroleum Products by Potentiometric Perchloric Acid Titration

ASTM D 3233—Method for Measurement of Extreme Pressure Properties of Fluid Lubricants (Falex Pin and Vee Block Methods)

ASTM D 3238—Method for Calculation of Carbon Distribution and Structural Group Analysis of Petroleum Oils by the N-D-M Method

ASTM D 3427—Test Method for Air Release Properties of Petroleum Oils

ASTM D 3519—Test Method for Foam in Aqueous Media (Blender Test)

ASTM D 3705—Test Method for Misting Properties of Lubricating Fluids

ASTM D 3707—Test Method for Storage Stability of Water-in-Oil Emulsions by the Oven Test Method

ASTM D 3945—Test Method for Shear Stability of Polymer-Containing Fluids Using a Diesel Injector Nozzle (CANCELLED)

ASTM D 4048—Test Method for Detection of Copper Corrosion From Lubricating Grease

ASTM D 4052—Test Method for Density and Relative Density of Liquids by Digital Density Meter

ASTM D 4055—Test Method for Pentane Insolubles by Membrane Filtration

ASTM D 4172—Test Method for Wear Preventive Characteristics of Lubricating Fluid (Four-Ball Method)

ASTM D 4290—Test Method for Determining the Leakage Tendencies of Automotive Wheel Bearing Grease Under Accelerated Conditions

ASTM D 4294—Test Method for Sulfur in Petroleum Products by Energy-Dispersive X-Ray Fluorescence Spectrometry

ASTM D 4425—Test Method for Oil Separation from Lubricating Grease by Centrifuging (Koppers Method)

ASTM D 4627—Test Method for Iron Chip Corrosion Test for Water-Dilutable Metalworking Fluids

ASTM D 4927—Test Method for Elemental Analysis of Lubricant & Additive Components - Barium, Calcium, Phosphorus, Sulfur & Zinc By Wavelength-Dispersive X-Ray Fluorescence Spectroscopy

ASTM D 4951—Test Method for the Determination of Additive Elements in Lubricating Oils by Inductively Coupled Plasma Atomic Emission Spectrometry

ASTM D 5182—Test Method for Evaluating the Scuffing (Scoring) Load Capacity of Oils (FZG Visual Method)

ASTM D 5183—Test Method for Determination of the Coefficient of Friction of Lubricants Using the Four-Ball Wear Test Machine

ASTM D 5621—Test Method for Sonic Shear Stability of Hydraulic Fluid

ASTM E 70—Test Method for PH of Aqueous Solutions With the Glass Electrode

ASTM E 659—Test Method for Autoignition Temperature of Liquid Chemicals

ASTM E 1131—Test Method for Compositional Analysis by Thermogravimetry

ASTM E 1687—Standard Test Method for Determining Carcinogenic Potential of Virgin Base Oils in Metalworking Fluids

ASTM F 1110—Test Method for Sandwich Corrosion Test (Corrosive Effect on Aluminum)

BS 188—Determination of the Viscosity of Liquids

BS 903:PTA 35—Physical Testing of Rubber – Temperatures, Humidities and Times for Conditioning And Testing of Test Pieces

BS 2000:PTA226—Methods of Test for Petroleum and Its Products – Petroleum Products – Calculation of Viscosity Index from Kinematic Viscosity

BS 4231—Classification for Viscosity Grades of Industrial Liquid Lubricants

BS 4385—Methods for Determination of Water in Crude Petroleum, Petroleum Products and Bituminous Materials By Distillation (Superseded by ISO 9029)

BS 4450—Determination of Ash from Petroleum Products (Superseded by ISO 6245)

BS 4832—Determination of the Behavior of Rubber and Elastomers When Exposed to Liquids, Vapors and Gases (Superseded by ISO 6072)

CEN EN7—Determination of Ash from Petroleum Products

CETOP R 39 H—Schedule of Required Data for Hydraulic Fluids

CETOP R 48 H—Procedure for Determining Corrosion Resistant Characteristics of Water Base Fire Resistant Fluids

CETOP RP 65 H—Manifold Ignition Test for Fire-Resistant Fluid

CETOP RP 67 H—Anti Wear Vane Pump Test for Hydraulic Fluids

CETOP RP 110 H—Hydraulic Fluids for Hydraulic Transmission - Fire Resistant Fluids - Group HFA – Specifications

CETOP RP 112 H—Fluids for Hydraulic Transmission - Mineral Oils Category HV - Method for Determination of Shear Stability

Denison P-46—Denison Piston Pump Test.

DIN 38 404/5—German Standard Methods for Examination of Water, Waste Water and Sludge; Physical and Physico-Chemical Characteristics (Group C); Determination of PH Value (C5)

DIN 38 405/1—German Standard Methods for the Examination of Water, Waste Water and Sludge; Anions (Group D); Determination of Chloride Ions (D 1)

DIN 38 405/5—German Standard Methods for the Examination of Water, Waste Water and Sludge; Anions (Group D); Determination of Sulfate Ions (D 5)