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his guide to current tests for petroleum and petrochemical products identifies equipment needs and standards for many popular methods.

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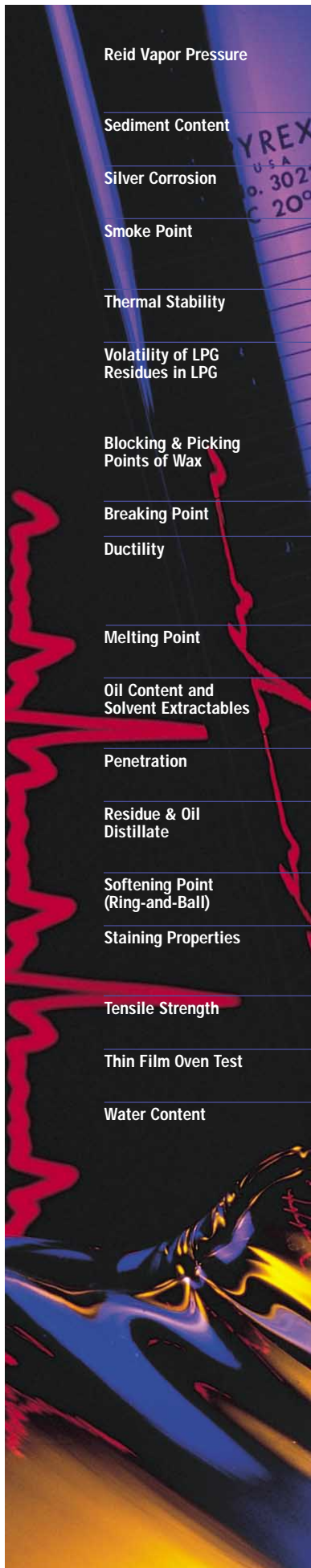
	TEST PURPOSE	EQUIPMENT	TEST STANDARDS
Aniline Point	Used to determine aromatic content of solvents, thinners, plant spray oils and other products.	Thin Film Apparatus; U-Tube Apparatus; Automatic Aniline Point Apparatus	ASTM D611, DIN 51775, FTM 791-3601, IP 2, ISO 2977
ASTM Color	Used for quality control, product identification and to detect product contamination.	ASTM Color Comparator	ASTM D1500, FTM 791-102, IP 196, ISO 2049
Autoignition Temperature	Determines the lowest temperature at which the vapor of a liquid or solid chemical sample will self-ignite.	Autoignition Furnace	ASTM E659
Density and Relative Density	A widely used product specification serving a variety of purposes.	Hydrometer, Thermo-hydrometer, Constant Temperature Bath	ASTM D287, D1298, D1657, API 2544, API 2547, E100, FTM 791-401, IP 160, IP235, ISO 3675, ISO 3993
Distillation	A key specification for wide range of volatile petroleum products.	Distillation Apparatus	ASTM D86, D216, D233, D447, D850, D1078, DIN 51751, E133, FTM 791 1001, 1015, IP 123, 191, 195, ESO 3405
Distillation at Reduced Pressures	The sample is distilled at a controlled, reduced pressure under conditions which provide approximately one theoretical plate fractionation.	Vacuum Distillation Apparatus	ASTM D1160
Film Thickness	Used to control thickness of protective coatings on metal surfaces.	Pfund Film Thickness Gauge	ASTM D1212
Flash Point	Used in shipping and safety regulations to determine "flammable" and "combustible" materials. Can also be used to detect product contamination.	Pensky-Martens Closed Tester; Tag Open and Closed Cup Testers; Cleveland Open Cup Tester	ASTM D56, D92, D93, D1310, D3143, ANSZ-11.6, AASHTO T48, AASHTO T73-811, DIN 51376, DIN 51758, FTM 791-1101, FTM 791-1102, FTM 791-1103, IP 34, IP 36, IP 304, ISO 2592, ISO 2719
Kinematic Viscosity	Critical characteristic in the design, manufacture and use of all types of petroleum products.	Capillary Viscometers, Constant Temperature Baths and Accessories	ASTM D445, D446, D2170, D2532, DIN 51550, FTM 791-305, IP 71, IP 319, ISO 3104
Penetration	Determines the consistency of semisolid petroleum products.	Penetrometer, Penetration Cones, Needles and Accessories	See "Lubricating Grease" and "Bitumens and Waxes"
Reid Vapor Pressure	Determines the volatility of gasoline and other petroleum products. Accessories	Reid Vapor Pressure Bombs, Gauges, Constant Temperature Bath, 161, ISO 3007, ISO 4256	ASTM D323, D1267, DIN 51616, DIN 51754, FTM 791-1201, IP 69,
Rust Protection	Used to test the ability of metal preservatives to prevent steel from rusting under conditions of high humidity.	Humidity Cabinet	ASTM D1748, FTM 791-5310, JAN-H-792
Salt in Crude	Part of the preliminary assay for crude oils.	Salts in Crude Determination Apparatus	ASTM D3230
Sampling	Obtaining liquid samples from storage tanks, tank cars, tank trucks, ship and barge tanks, drums, pipelines, etc.	Sampling Bombs and Beakers; Drum Thief; LPG Sampling Cylinders	ASTM D270, D923, D1085, D1265, D4057
Saybolt Color	Used for quality control and identification of highly refined products and for detection of product contamination.	Saybolt Chromometer; Saybolt Wax Chromometer	ASTM D156, DIN 51411, FTM 791-101
Saybolt Viscosity	Critical characteristic in the design, manufacture and use of all types of petroleum products.	Saybolt Viscometer Tubes, Universal and Furoil Orifices, Constant Temperature Baths and Accessories	ASTM D88, E102, D244, AASHTO T72, FTM 791-304
Sediment Content	Used to determine the amount of sediment contamination in crude and fuel oils.	Sediment Extraction Apparatus	ASTM D473, FTM 791-3002, IP 53, DIN 51789, ISO 3735
Sulfur Content (Wickbold Method)	Measures sulfur and trace sulfur content by burning a sample in an oxy-hydrogen burner.	Wickbold Apparatus	ASTM D2384, D2784, D2785, IP 243
Thermometer Calibration	Calibration of ASTM Thermometers	Constant Temperature Comparator (Calibration Bath)	ASTM E77
Unulfonated Residue	Evaluates the degree of refinement of plant spray oils.	Combined Shaking Machine and Steam Bath, Cooling Bath	ASTM D483, DIN 51362

	TEST PURPOSE	EQUIPMENT	TEST STANDARDS
Apparent Viscosity	Measures pumpability and handling characteristics of grease.	Apparent Viscosimeter; Refrigerated Apparent Viscosimeter	ASTM D1092, FTM 791-306
Copper Strip Corrosion	Used to evaluate the corrosivity of petroleum products.	Copper Strips, Corrosion Standards, Constant Temperature Bath, Polishing Equipment	ASTM D4048, FTM 791-5325
Corrosion Preventative Properties	Determines the ability of lubricating grease to prevent rusting of metal bearing surfaces.	Corrosion Preventative Properties Apparatus	ASTM D1743, FTM 791-4012
Dropping Point	Determines the temperature at which grease passes from a semisolid to a liquid state.	Dropping Point Apparatus; High Temperature Dropping Point Apparatus	ASTM D566, D2265, DIN 51801, FTM 791-1421, IP 132, ISO 2176
Evaporation Loss	Measures the tendency of components in oils or greases to evaporate at high temperature.	Evaporation Test Cell and Constant Temperature Bath; High Temperature Evaporation Loss Apparatus	ASTM D972, D2595, FTM 791-351, IP 183
Grease Mobility	Used to predict pumpability characteristics of lubricating grease under low temperature operating conditions.	Grease Mobility Tester	U.S. Steel/ASTM test currently in ballot
Leakage Tendencies	Evaluates the tendency of automotive wheel bearing greases to separate oil or grease (standard or accelerated methods).	Leakage Tendencies Tester; High Temperature Wheel Bearing Grease Tester	ASTM D1263, D4290, FTM 791-3454
Life Performance	Evaluates the high temperature stability of automotive wheel bearing greases.	High Temperature Wheel Bearing Grease Tester	ASTM D3527
Low Temperature Torque	Significant for the design and specification of greases for low temperature service.	Low Temperature Torque Apparatus, Low Temperature Wheel Bearing Torque Apparatus	ASTM D1478, D4693, FTM 791-334
Oil Separation	Determines the tendency of lubricating grease to bleed oil during storage.	Pressure Bleeding Test Cell and Constant Temperature Air Cabinet; Oil Separation Apparatus	ASTM D1742, FTM 791-321.2, FTM 791-322, IP 121
Oxidation Stability	An accelerated aging test for quality control.	Oxidation Bomb, Pressure Gauge, Constant Temperature Bath	ASTM D942, DIN 51808, FTM 791-3453, IP 142
Particle Contamination	A rapid test for determining the presence of deleterious particles in lubricating greases.	ASTM Deleterious Particles Determination Apparatus	ASTM D1404
Penetration	Determines the consistency of lubricating greases.	Penetrometer (Automatic, manual), Penetration Cone, Grease Worker, Constant Temperature Bath, Accessories	ASTM D217, D1403, DIN 51580, DIN 51804, FTM 791-311, 312, 313, IP 50, IP 179, IP 310, ISO 2137
Roll Stability	Used together with the ASTM D1403 Cone Penetration test to evaluate shear stability.	Roll Stability Tester, Quarter-Scale or Half-Scale Penetration Test Equipment	ASTM D1831, MIL-G-10924SA
Water Leaching	Determines the ability of silicone thread compounds to resist the washing action of water.	Gas Evolution/Water Leaching Test Apparatus	API (BUL 5A2)
Water Spray Off	Evaluates the tendency of a lubricating grease to adhere to a metal surface under direct water spray.	Water Spray Off Tester	ASTM D4049
Water Washout Characteristics	Evaluates the adhesion properties of grease when subjected to direct water stream.	Water Washout Tester	ASTM D1264, FTM 791-3252, IP 215

LUBRICATING OIL TESTS

Cloud & Pour Points	Determines low temperature flow characteristics of petroleum oils.	Cloud and Pour Point Chamber; Refrigerated Cloud & Pour Point Baths	ASTM D97, D2500, FTM 791-201, IP 15, DIN 51597, IP 219, ISO 3015, ISO 3016
Coking Tendency	Test the tendency of finished oils to form coke deposits in high temperature applications.	Panel Coker	FTM 791-3462
Copper Strip Corrosion	Used to evaluate the corrosivity of lubricants and other petroleum products.	Copper Strip Corrosion Test Bath, Strips, Standards, Polishing Equipment	ASTM D130, FTM 791-5325, FSPT DF-28-65, IP 154, DIN 51759, ISO 2160

	TEST PURPOSE	EQUIPMENT	TEST STANDARDS
Corrosion of Lead	Measures the corrosiveness of lubricating oils or lead in the presence of a copper catalyst.	Lead Corrosion Test Apparatus	FTM 791-5321
Corrosivity/Oxidation	Evaluates ability of lubricants to avoid thermal breakdown and formation of corrosive compounds.	Corrosivity/Oxidation Stability Test Apparatus	ASTM D4636, FTM 791-5308, DIN 51394, FTM 791-5307
Demulsibility Characteristics	Tests the ability of lubricating oils to separate from water when emulsions are formed.	Stirrer Assemblies, Constant Temperature Bath, Separatory Funnels, Accessories	ASTM D2711, DIN 51353
Evaporation Loss	Measures the tendency of components in oils or greases to evaporate at high temperatures.	Evaporation Test Cell and Constant Temperature Bath; High Temperature Evaporation Loss Apparatus	ASTM D972, FTM 791-351, IP 183
Foaming Characteristics	Evaluates suitability of lubricating oils for applications where foaming is encountered.	Foaming Characteristics Test Bath, High Temperature Foam Test Bath	ASTM D892, DIN 51566, FTM 791-3211, 3213, IP 146, ASTM High Temp. Foam Test Draft
Gear Oil Oxidation Test	Standard test method for evaluation of thermal and oxidative stability of lubricating oils used for manual transmissions and final drive axles.	L-60-1 test stand with complete instrumentation, test gears, bearings, seals and accessories.	ASTM D5704 (L-60-1 test method)
Oxidation Stability	Accelerated aging tests to determine oxidation stability of lubricants. See also: 'RBOT' & 'TFOUT'.	Oxidation Bath, Catalyst Coils, Accessories, Glassware	ASTM D943, D2440, D2893, D4310, DIN 51586, DIN 51587, IP 280, IP 306, IP 307, IP 335
Rotating Bomb Oxidation (RBOT)	An accelerated test for determining the oxidation stability of lubricants.	Oxidation Bombs, RBOT Bath, Pressure Recording Equipment, Data Acq. Software, Accessories	ASTM D2112, D2272, IP 229
Rust Preventing Characteristics	Used to determine the ability of lubricants to prevent rusting of metal parts in steam turbines.	Rust Prevention Characteristics Bath-Standard Method; Horizontal Disc Method	ASTM D665, D3603, DIN 51585, FTM 791-4011, IP 135, NACE TM01-72
Thermal Oxidation Stability	Used to determine the deterioration of lubricants under severe oxidation conditions.	Thermal Oxidation Stability Test Apparatus	FTM 791-2504
Thin Film Oxidation Uptake (TFOUT)	A variation of the 'RBOT' test - evaluates the oxidation stability of automotive engine oils.	Oxidation Bombs, RBOT Bath, TFOUT Adapters, Catalyst Pkgs. Data Acq. Software, Accessories	ASTM D4742
Water Separability	A variation of the 'Demulsibility Characteristics' test - used for light oils.	New multiple position Water Separability Tester	ASTM D1401, DIN 51599, FTM 791-3201, ISO 6614
F U E L T E S T S			
Antirust Properties of Pipeline Cargoes	Used to control corrosion in product pipelines by moisture condensed from gasoline & distillate fuels.	Rust Preventing Characteristics Bath and Accessories	NACE TM-01-72
Carbon Residue	Evaluates the deposit forming tendencies of fuels.	Ramsbottom Carbon Residue & Conradson Residue Apparatus	ASTM D189, D524, FTM 791-5001, FTM 791-5002, IP 13, IP 14, ISO 4262
Cold Filter Plugging Point	Determines the lowest temperature at which a lubricant will flow at a prescribed rate.	Cold Filter Plugging Point Apparatus, Cooling Bath, Vacuum System	DIN 51428, IP 309
Commercial Propane Dryness	Used for testing dryness of commercial propane & propane HD5.	Cobalt Bromide Test Apparatus	GPA Standard 2140
Copper Strip Corrosion	Used to evaluate the corrosivity of petroleum products.	Copper Strip Corrosion Test Bombs, Strips, Standards, Constant Temp. Bath, Polishing Equipment	ASTM D130, D1838, FTM 791-5325, ISO 6251, DIN 51759, FSPT DT-28-65, IP 154, IP 227, ISO 2160
Existent Gum Content	Determines amount of gum present in automotive & aviation fuels.	Evaporation Bath, Steam Superheater, Steam Generator	ASTM D381, DIN 51784, FTM 791-3302, IP 131, ISO 6246
Freezing Point	Used for evaluating low temperature flow characteristics.	Freezing Point Apparatus	ASTM D1177, D2386, D3117, D3799, DIN 51421, FTM 791-1411, IP 16, ISO 3013
Oxidation Stability	Evaluates the tendency of automotive and aviation fuels to form gum in storage.	Oxidation Bomb, Data Acq. Software, Constant Temperature Bath, and Accessories	ASTM D525, D873, DIN 51780, FTM 791-3352, FTM 791-3354, IP 40, IP 138
Oxidation Stability	Evaluates the storage stability of middle distillate fuels.	Oxidation Bath, Accessories	ASTM D2274, DIN 51799



TEST PURPOSE

EQUIPMENT

TEST STANDARDS

Reid Vapor Pressure

The basic test for volatility of automotive gasoline, LPG, and other fuels.

Reid Vapor Pressure Bombs, Gauges, Constant Temperature Bath

ASTM D323, D1267, DIN 51616, 51754, FTM 791-1201, IP 69, ISO 3007, 4256

Sediment Content

Determines amount of sediment present in crude & fuel oils by extraction.

Extraction Apparatus

ASTM D473, DIN 51789, FTM 791-3002, IP 53, ISO 3735

Silver Corrosion

Determines the corrosiveness of aviation fuels toward silver.

Silver Strips, Glassware, Corrosion Standard Constant Temp. Bath

IP 227

Smoke Point

Gives an indication of combustion qualities of aviation turbine oils and kerosene.

Smoke Point Lamp

ASTM D1322, DIN 51406, FTM 791-2107, IP 57, ISO 3014

Thermal Stability

Tests the preheater fouling tendencies of burner fuel oil.

Thermal Stability Apparatus

ASTM D1661, FTM 791-2506

Volatility of LPG Residues in LPG

Provides measure of least volatile fuel components present in product.

Precooling Apparatus and Accessories

ASTM D1837, D2158, GPA 2140

B I T U M E N A N D W A X T E S T S

Blocking & Picking Points of Wax

Indicates the lowest temperature at which surface film injury will occur when waxed surfaces come in contact.

Wax Coating Device, Blocking Plate

ASTM D1465, TAPPI T652

Breaking Point

For solid and semisolid bitumens.

Bending Apparatus

IP 80

Ductility

Evaluates the tensile properties of bituminous materials by pulling a briquet specimen apart under controlled conditions.

Ductility Testing Machine, Force Measuring Adapter

ASTM D113, D-4 Proposal P226, AASHTO T51, ANS A37.11, Federal Specification SS-R-406C, USDA method 51 (BUL 12-16), IP 32, DIN 52013

Melting Point

Used to determine the suitability of petroleum waxes for most applications.

Wax Melting Point Apparatus

ASTM D87, FTM 791-1402, IP 55, ISO 3841, TAPPI T630M-61

Oil Content and Solvent Extractables

Determines the oil or solvent extractables content of petroleum waxes.

Oil Solvent Extractables Content Apparatus

ASTM D721, D3235, DIN 51571/2, FTM 791-5431, IP 158, ISO 2908, TAPPI T636

Penetration

Determines the consistency of solid and semisolid bituminous materials.

Penetrometer, Wax Penetration Needle, Constant Temp. Bath Accessories

ASTM D5, D937, D1321, DIN 51579, IP 49

Residue & Oil Distillate

Determines the amounts and properties of asphalt cement in emulsified asphalts.

Aluminum Still, Ring Burner, Glassware

ASTM D244, AASHTO T59

Softening Point (Ring-and-Ball)

Used for determining the consistency of bituminous materials.

Ring-and-Ball Apparatus

ASTM D36, D2398, E28, AASHTO T53

Staining Properties

Used for asphalts having ring-and-ball softening points of 65.6 Degrees C (150 Degrees F) or greater.

Staining Properties Apparatus

ASTM D1328

Tensile Strength

Determines the tensile strength of paraffin waxes.

Wax Sample Molds, Curing Bath, Accessories

ASTM D1320, TAPPI 644M

Thin Film Oven Test

Used to determine changes in asphalt properties during hot-mixing.

Thin Film Oven Pans

ASTM D1754

Water Content

Used to determine the water content of emulsified asphalts and bituminous materials.

Metal Still, Ring Burner, Glassware, Accessories

ASTM D95, D244, AASHTO T55, T59, E123, IP 74, IP 291

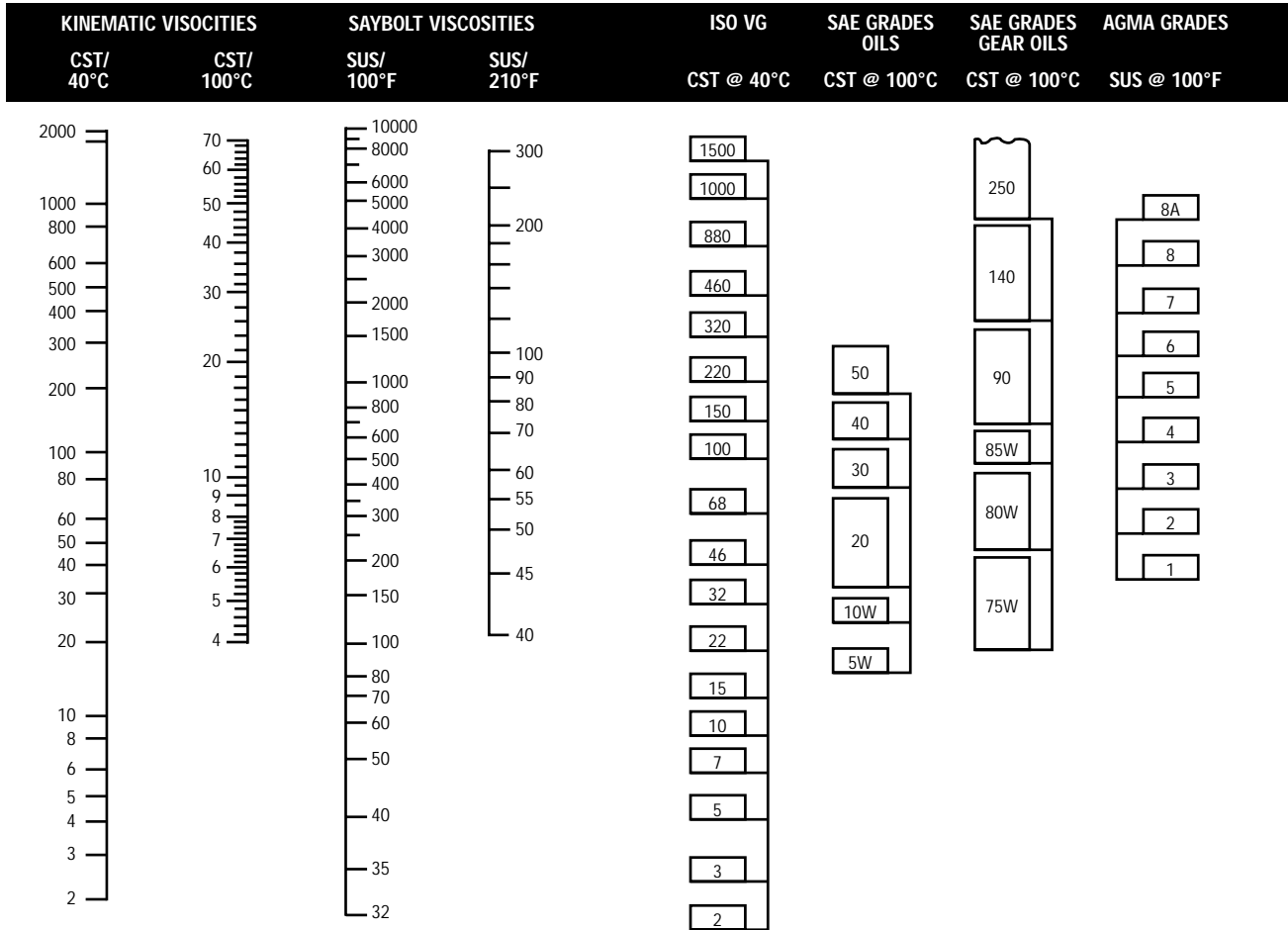
F L O W C O N V E R S I O N C H A R T

To convert the numerical value of a property expressed in one of the units in the left-hand column of the table to the numerical value expressed in one of the units in the top row of the table, multiply the former value by the factor in the block common to both units.

UNITS	gal (US)/min	cu ft/min	liters/sec	cu m/hr
gal (US)/min	1	0.134	0.063	0.227
cu ft/min	7.48	1	0.472	1.69
liters/sec	15.85	2.12	1	3.6
cu m/hr	4.40	0.588	0.277	1

COMPARISON OF VISCOSITY CLASSIFICATIONS

Approximate equivalents. Viscosities can be related horizontally only. Viscosities based on 95 VI single grade oils.



VISCOSITY

Approximate equivalents at same temperature

KINEMATIC (CENTISTOKES) (SECONDS)	SAYBOLT UNIVERSAL (SECONDS)	SAYBOLT FUROL (SECONDS)	KINEMATIC (CENTISTOKES) (SECONDS)	SAYBOLT UNIVERSAL (SECONDS)	SAYBOLT FUROL (SECONDS)	KINEMATIC (CENTISTOKES) (SECONDS)	SAYBOLT UNIVERSAL (SECONDS)	SAYBOLT FUROL (SECONDS)
1.8	32	-	40.6	190	-	205	950	96
2.7	35	-	42.8	200	23.0	215	1,000	100
4.2	40	-	47.2	220	25.3	259	1,200	121
5.8	45	-	51.8	240	27.0	302	1,400	141
7.4	50	-	55.9	260	28.7	345	1,600	160
8.9	55	-	60.2	280	30.5	388	1,800	180
10.3	60	-	64.5	300	32.5	432	2,000	200
11.7	65	-	69.9	325	35.0	541	2,500	250
13.0	70	-	75.3	350	37.2	650	3,000	300
14.3	75	-	80.7	375	39.5	758	3,500	350
15.6	80	-	86.1	400	42.0	866	4,000	400
16.8	85	-	91.5	425	47.0	974	4,500	450
18.1	90	-	96.8	450	47.0	1,082	5,000	500
19.2	95	-	102.2	475	49	1,190	5,500	550
20.4	100	-	107.6	500	51	1,300	6,000	600
22.8	110	-	118.4	550	56	1,405	6,500	650
25.0	120	-	129.2	600	61	1,515	7,000	700
27.4	130	-	140.3	650	66	1,625	7,500	750
29.6	140	-	151.0	700	71	1,730	8,000	800
31.8	150	-	162.0	750	76	1,840	8,500	850
34.0	160	-	173.0	800	81	1,950	9,000	950
36.0	170	-	183.0	850	86	2,055	9,500	950
38.4	180	-	194.0	900	91	2,165	10,000	1,000

P R E S S U R E C O N V E R S I O N S

To convert the numerical value of a property expressed in one of the units in the left-hand column of the table to the numerical value expressed in one of the units in the top row of the table, multiply the former value by the factor in the block common to both units.

UNITS	Bars	Atmospheres	Dynes/sq cm	mmHg (1 Torr) at OC	lb (Force)/sq in	Pascals
Bars	1	0.987	10 ⁶	750.06	14.50	1X10 ⁵
Atmospheres	1.013	1	1.013X10 ⁶	760	14.696	1.013X10 ⁵
Dynes/sq cm	10 ⁻⁶	0.986X10 ⁻⁶	1	7.50X10 ⁻⁴	1.45X10 ⁻⁵	0.10
mmHg (1 Torr) at OC	1.33X10 ⁻³	1.31X10 ⁻³	1,333.2	1	0.0193	133.32
lb (Force)/sq in	0.0689	0.0680	68.94	51.715	1	6,894.7
Pascals	1X10 ⁻⁵	9.869X10 ⁻⁶	10.0	7.5X10 ⁻³	1.45X10 ⁻⁴	1

F A X U S T O R E C E I V E O U R F U L L - L I N E C A T A L O G

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