

CHOOSING A LUBRICANT

Use any of the following three methods to determine the proper standard lubricant for an application.

CAUTION These guidelines are provided as a reference for finding replacements for brand specific lubricants. They are general and should not be used alone for choosing lubricants. Manufacturer recommendations should be followed as closely as possible. Any substitution should be approved by the machine manufacturer.

Lubricant Type and Viscosity

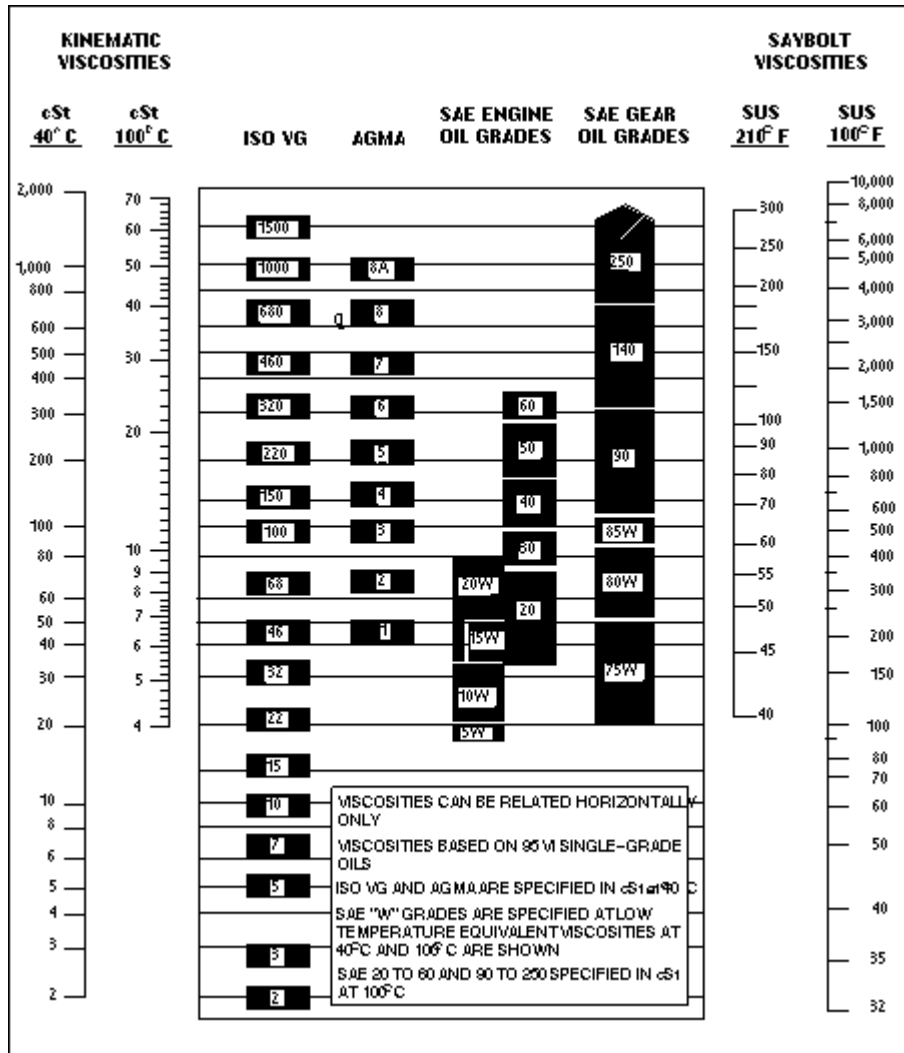
First, determine the general lubricant application (hydraulic system, gear box, etc.) or the type of lubricant recommended by the machine manufacturer. Then, look in the following pages to find the section that describes that type of lubricant.

Read the section to determine if the oil is appropriate for the application. Once you have determined the proper lubricant type determine the proper viscosity.

The viscosity of the lubricant should be the same as the machine manufacturer's recommended lubricant whenever possible. Industrial oils are usually specified by ISO viscosity grade but many older machine oils are specified by the ASTM viscosity grade. The following Figure provides a cross-reference for different viscosity specifications.

If the required viscosity is not available, choose the next higher or lower viscosity oil in the table. In general, higher viscosity lubricants are used for higher temperatures, higher loads and slower speeds. Lower viscosity is used for lower temperatures, lighter loads and higher speeds. Using a higher viscosity oil, or a thicker grease, than necessary can actually increase the temperature by churning the lubricant and increasing friction in high speed applications.

VISCOSITY EQUIVALENTS



- SUPPLIER CROSSREFERENCE -

CHEVRON	EXXON	MOBIL	SHELL	TEXACO	UNOCAL
Gear Compound EP 68	Spartan EP 68	Mobilgear 626	Omala 68	Meropa 68	Extra Duty NL Gear Lube 2 EP
Gear Compound EP 150	Spartan EP 150	Mobilgear 629	Omala 150	Meropa 150	Extra Duty NL Gear Lube 4 EP
Gear Compound EP 220	Spartan EP 220	Mobilgear 630	Omala 220	Meropa 220	Extra Duty NL Gear Lube 5 EP
Gear Compound EP 320	Spartan EP 320	Mobilgear 632	Omala 320	Meropa 320	Extra Duty NL Gear Lube 6 EP
Gear Compound EP 460	Spartan EP 460	Mobilgear 634	Omala 460	Meropa 460	Extra Duty NL Gear Lube 7 EP
Cylinder Oil W 460	Cylestic TK 460	600 W Cylinder Oil	Valvata Oil 460	Vanguard Cylinder Oil 460	Steaval B
Cylinder Oil W 680	Cylestic TK 680	600 W Super Cylinder Oil	Valvata Oil 680	Honor Cylinder Oil 680	---
Cylinder Oil W 1000	Cylestic TK 1000	Extra Hecta Super Cylinder Oil	---	650 "TM" Cylinder Oil 1000	---
---	---	Velocite Oil No. 3	---	---	---
Spin Oil 10	Spinesstic 10	Velocite Oil No. 6	Tellus 10	Spindura 10	---
Machine Oil R&O 22	Spinesstic 22	Velocite Oil No. 10	Tellus 22	Spindura 22	Turbine Oil 22
---	---	Vactra Oil No. 1	Tonna T 32	---	Way Oil HD 32
Vistac Way Oil 68X	Febis K 68	Vactra Oil No. 2	Tonna T 68	Way Lubricant 68	Way Oil HD 68
Vistac Way Oil 220X	Febis K 220	Vactra Oil No. 4	Tonna T 220	Way Lubricant 220	Way Oil HD 220
Turbine Oil GST 32	Teresstic 32	DTE Oil Light	Turbo T Oil 32	Regal R&O 32	Turbine Oil 32
Turbine Oil GST 46	Teresstic 46	DTE Oil Medium	Turbo T Oil 46	Regal R&O 46	Turbine Oil 46
Turbine Oil GST 68	Teresstic 68	DTE Oil Heavy Med	Turbo T Oil 68	Regal R&O 68	Turbine Oil 68
Turbine Oil GST 100	Teresstic 100	DTE Oil Heavy	Morfina 100	Regal R&O 100	Turbine Oil 100
Machine Oil R&O 150	Teresstic 150	DTE Oil Extra Heavy	Morfina 150	Regal R&O 150	Turbine Oil 150
Machine Oil R&O 220	Teresstic 220	DTE Oil BB	Morfina 220	Regal R&O 220	Turbine Oil 220
Hydraulic Oil AW 32	Humble Hydraulic H 32	DTE 24 or AW 32	Tellus 32	Rando Oil HD 32	Unax AW 32
Hydraulic Oil AW 46	Humble Hydraulic H 46	DTE 25 or AW 46	Tellus 46	Rando Oil HD 46	Unax AW 46
Hydraulic Oil AW 68	Humble Hydraulic H 68	DTE 26 or AW 68	Tellus 68	Rando Oil HD 68	Unax AW 68
Hydraulic Oil AW 100	Humble Hydraulic H 100	DTE 27 or AW 100	Tellus 100	Rando Oil HD 100	Unax AW 100
Synthetic Compressor Oils Tegra 32	Teresstic SHP 32	Rarus SHC 1024	Omala RL Oil 32	Cetus PAO 32	76 Triton Synthetic TGO 32

SUPPLIER CROSSREFERENCE

Description	Old Code	Wichita	Cincinnati	* Conoco	Conoco/Boeing MSDS#	Amoco
Anti-Wear Hydraulic Oil ISO VG 100	BAC #13		---	Super Hydraulic 100	110043	AW 100
Polyalphaolefin Synthetic Compressor Oil 32	N/A			Syncon Synthetic R&O Oil 32	110650	---
Polyalphaolefin Synthetic Compressor Oil 68	N/A			Syncon Synthetic R&O Oil 68	110650	---
Polyalphaolefin Synthetic Compressor Oil 100	N/A			Syncon Synthetic R&O Oil 100	110650	---
Polyalphaolefin Synthetic Compressor Oil 100	N/A			Syncon Synthetic R&O Oil 220	51HYDC0194	---
Polyalphaolefin Synthetic Worm Gear Oil 460	N/A			Syncon Synthetic R&O Oil 460	111009	---
SAE 10W	BAC #51			HD Fleet 10W	109324	300 10W
SAE 10W-30	BAC #57			HD Fleet Supreme 10W-30	109324	300 10W-30
SAE 15W-40	BAC #58			HD Fleet Supreme 15W-40	109324	300 15W-40
SAE 30	BAC #53			HD Fleet 30	109324	300 30
SAE 40	BAC #54			HD Fleet 40	109324	300 40
SAE 80W-90	BAC #55	B-9		UGL 80W-90	53436	MPGL 80W-90
SAE 85W-140	BAC #56			UGL 85W-140	53436	MPGL 85W-140
Dexron ATF	BAC #51			HC Dexron III & Mercon ATF	109328	MultiPurpose ATF
Tractor ATF	BAC #53			HC Powertran Fluid	109330	Amoco 1000 Fluid
Type F ATF	BAC #52			HC ATF Type F	110040	---
Lithium EP 1	BAC #81		P-72	Tacna Rx #1	110041	---
Lithium EP 2	BAC #82		P-64	Tacna Rx #2	109909	---
Polyurea NLGI 2	BAC #87			Polyurea #2	109728 / 109785	Rykon Premium 2

Gear Oil

These gear oils should be used in most gear boxes except hypoid gear boxes and some worm gear boxes. They have a mild EP (extreme pressure) additive to reduce wear under extreme loads and shock loads. Because EP additives can sometimes be corrosive to copper alloys, these lubricants should not be used for some worm gears where the manufacturer recommends a non-EP lubricant.

The selection should be made based on the viscosity recommended by the machine tool manufacturer, or by using the following guidelines for ambient temperatures between 50 °F – 125°F . AGMA 2 EP should be used for high speed gear boxes, operating at speed above 3600 rpm or above 5000feet/min. pitch line velocity.

AGMA 4 EP should be used in all planetary gear units, all gear motor and shaft mounted units, bevel gears with cone distance less than 12 inches, and parallel shaft gear sets with a center distance between the shafts of less than 20 inches.

AGMA 6 EP should be used in bevel gears with cone distances greater than 12 inches, and parallel shaft gear sets with a distance between shaft centers of greater than 20 inches.

AGMA 5 EP and AGMA 7 EP should only be used when the machine manufacturer insists on these particular viscosities of EP gear oil. We prefer to use one of the other viscosities

GEAR OIL

American Gear Man. Assoc. 250.04		AGMA 2 EP	AGMA 4 EP	AGMA 5 EP	AGMA 6 EP	AGMA 7 EP
ISO VISCOSITY GRADE	ASTMD 2422	68	150	220	320	460
cSt at 40 C	ASTMD 445	61.2/74.8	135/165	198/242	288/352	414/506
VISCOSITY INDEX MIN	ASTMD 2270	90	90	90	90	90
SUS at 100 F	ASTMD 2161	317/389	722/882	1047/1283	1533/1876	2214/2719
API GRAVITY at 60 F	ASTMD 287	22 MIN	22 MIN	22 MIN	22 MIN	22 MIN
FLASH POINT MIN F	ASTMD 92	340	380	380	380	400
POUR POINT MAX F	ASTMD 97	10	10	10	10 MAX	20
OXIDATION STABILITY	ASTMD 2893	10% MAX	10% MAX	10% MAX	10% MAX	10% MAX
RUST TEST	ASTMD 665 A	PASS	PASS	PASS	PASS	PASS
COPPER CORROSION	ASTMD 130	1	1	1	1	1
VISCOSITY CHANGE MAX	CINCINNATI PROCEDURE B ASTMD 2161	5%	5%	5%	5%	5%
SLUDGE MAX	CINCINNATI PROCEDURE B	NONE	NONE	NONE	NONE	NONE
STEEL COLOR MAX	CINCINNATI PROCEDURE B	1	1	1	1	1
STEEL DEPOSIT	CINCINNATI PROCEDURE B	NONE	NONE	NONE	NONE	NONE
Cu COLOR MAX	CINCINNATI PROCEDURE B	5	5	5	5	5
CLEANLINESS	ISO 4406	16/14	16/14	16/14	16/14	16/14
FOAMING mL MAX	ASTMD 892	20/0 20/0 20/0				
ADDITIVES	NONLEAD NONCORROSIVE E.P. AGENT					
CINCINNATI MILACRON SPECIFICATION	CINC P-63	CINC P-77	CINC P-74	CINC P-59	CINC P-35	
ISO 3498	C-68	C-150	C-220	C-320	C-460	
PLANT ENGINEERING MAGAZINE	PE-315-EP	PE-700-EP	---	PE-1500-EP	---	

TABLE 5 - WORM GEAR OIL

BOEING ID		CYL. 460	CYL. 680	CYL. 1000
AMERICAN GEAR MANUFACTURER'S ASSOC.		AGMA 7 COMP	AGMA 8 COMP	AGMA 8A COMP
ISO VISCOSITY GRADE	ASTMD 2422	460	680	1000
cSt at 40 C	ASTMD 445	414/506	612/748	900/1100
VISCOSITY INDEX MIN	ASTMD 2270	90	90	90
SUS AT 100 F	ASTMD 2161	1919/2346	2837/3467	4171/5098
API GRAVITY at 60 F	ASTMD 287	25.5	25.7	25.7
FLASH POINT MIN F	ASTMD 92	540	540	540
CARBON RESIDUE %	ASTMD 189	2.4 MAX	2.4 MAX	2.4 MAX
POUR POINT MAX F	ASTMD 97	15	15	15
ASTM RUST TEST	ASTMD 665 B	PASS	PASS	PASS
COPPER CORROSION MAX	ASTMD 130	1	1	1
FOAMING mL MAX	ASTMD 892	75/10, 75/10, 75/10		
ADDITIVES		RUST OXIDATION INHIBITORS, 3 TO 10% COMPOUNDING W/FATTY OILS		
PLANT ENGINEERING MAGAZINE		PE-2150-WG		

WORM GEAR OIL

Worm gear oils, also know as steam cylinder oils, should be used in worm gear boxes when the manufacturer recommends a compound gear oil instead of an EP gear oil. In some cases manufacturers allow EP gear oils to be used to lubricate enclosed worm gears. In those instances a gear oil of the proper viscosity in the Gear Oils should be selected.

NOTE: Conoco Inca Oils are not miscible with Unocal Compounded Gear Oils.

Since the oil in the gear box must be changed when switching brands, it is strongly recommended the oil be changed to PAO 460.

Compounded gear oils should be selected based on Table above First determine if the worm gear is cylindrical or double enveloping. (Cone drives are double enveloping.) Determine the distance between the center of the worm and the center of the drive gear.

Find the speed for the worm gear type and size in the Table. Follow the row across to find the standard oil. This table is good for ambient temperatures between 50 degrees F and 125 degrees F.

SPINDLE OIL

Spindle oils should be used in high speed rolling element bearings on machine tool spindles and other applications where heat do to fluid friction with more viscous fluids would cause an undesirable increase in operating temperature. Selection should be made based on the viscosity recommended by the spindle manufacturer.

SPINDLE OIL

ISO Viscosity Grade	ASTMD 2422-75	2	10	22
cSt @ 49 C	ASTMD 445	1.98/2.42	9.0/11.0	19.8/24.2
Viscosity Index Min	ASTMD 2270		90	90
SUS @ 100 F	ASTMD 2161	32.8/34.4	57.6/65.3	104.6/126.0
API Gravity @ 60 F	ASTMD 287	33/45	24/36	28.5 - 32.5
Flash Point Min F	ASTMD 92	175	275	360
Fire COC Min F	ASTMD 92	200	300	410
Pour Point Max F	ASTMD 97	-25	25	25
Neutralization No. Max Mg KOH/g	ASTMD 664	0.15	0.15	0.15
ASTM Rust Test	ASTMD 665 A	Pass	Pass	Pass
Viscosity Change Max	Cinc. Procedure A ASTMD 2161	---	---	+/-5.0% Inc
Neutralization No. Change Max	Cinc. Procedure A ASTMD 664	---	---	+/-0.10 Inc
Sludge Max	Cinc. Procedure A	---	---	25 mg. 100 ml
Steel Color Max	Cinc. Procedure A	---	---	1
Steel Deposit Max	Cinc. Procedure A	---	---	3.5 mg
Steel Removal Max	Cinc. Procedure A	---	---	1.0 mg Max
Copper Color Max	Cinc. Procedure A	---	---	5
Cu Removed Max	Cinc. Procedure A	---	---	10.0 mg
Viscosity Change Max	Cinc. Procedure B ASTMD 2161	5.0% Inc,	5.0% Inc	---
Color Change	Cinc. Procedure B	2 Max Inc.	2 Max Inc	---
Neutralization No. Change Max	Cinc. Procedure B ASTMD 664	0.05 Inc	0.05 Inc	---
Sludge Max	Cinc. Procedure B	None	None	---
Steel Color Max	Cinc. Procedure B	1	1	---
Steel Deposit Max	Cinc. Procedure B	None	None	---
Copper Color Max	Cinc. Procedure B	5	5	---
Cleanliness	ISO 4406-87	14/11	14/11	14/11
Water	ASTMD 95	< 150 PPM	< 150 PPM	< 150 PPM
Additives		Rust Inhibitor, Oxidation Inhibitor		
Cincinnati Milacron Specification		P-65	P-62	P-45

Way Oil

Way oils should be used for lubricating the ways on all types of machine tools and other equipment requiring tacky non-corrosive products having extreme pressure properties.

They reduce machine carriage chatter and possess the necessary adhesive characteristics to prevent squeezing out of the lubricant. The low coefficient of friction ratio (static/kinetic) provides freedom from stick-slip operation, allowing carriages to start easily and smoothly. The selection should be made based on the viscosity recommended by the machine tool manufacturer. (HG-32 should be used in integral hydraulic/way systems.)

ISO VISCOSITY GRADE	ASTM D 2422	32	68	220
cSt at 40 C	ASTM D 445	28.8/35.2	61.2/74.8	198/242
VISCOSITY INDEX MIN	ASTM D 2270	80	80	80
SUS at 100 F	ASTM D 2161	149/182	317/389	1047/1283
API GRAVITY at 60 F	ASTM D 287	20/30	18/27	18/27
FLASH POINT MIN F	ASTM D 92	315	350	350
FIRE COC F	ASTM D 92	355	360	410
POUR POINT MAX F	ASTM D 97	10	20	20
NEUTRALIZATION NO. MAX Mg KOH/g	ASTM D 664	0.6	1.7	1.7
RUST TEST	ASTM D 665 A	PASS	PASS	PASS
NEUTRALIZATION NO. CHANGE MAX	CINC PROCEDURE B ASTM D 664	0.2 Inc	0.5 Inc	0.5 Inc
SLUDGE MAX	CINC PROCEDURE B	NONE	NONE	NONE
STEEL COLOR MAX	CINC PROCEDURE B	1	1	1
COPPER COLOR MAX	CINC PROCEDURE B	5	5	5
STATIC/KINETIC FRICTION	CM STICK-SLIP TEST	0.80 MAX	0.80 MAX	0.80 MAX
ADDITIVES	NONCORROSIVE ANTI-STICK-SLIP ADDITIVE, TACKY AGENT			
CINCINNATI MILACRON SPECIFICATION	P-53	P-47	P-50	
ISO 3498	G-32	G-68	G-220	
PLANT ENGINEERING MAGAZINE	PE-150-W	PE-315-W	PE-1000-W	

R & O Oil

R & O (rust and oxidation inhibited) oils are also known as turbine oils and can be used in place of non-detergent motor oils. They are used as general lubricants for bearings, compressors, and vacuum pumps. Other uses include some lightly loaded gears that do not require extreme pressure additives, gearboxes that contain clutches or brakes, and hydraulic systems operating at pressures less than 1000 PSI and less than 90% of pump capacity. R & O oils should only be used for gear boxes and hydraulic systems where the manufacturer recommends their use. For most hydraulic systems an antiwear hydraulic oil should be used. For most gear systems a gear oil should be used. The selection should be made based on the viscosity recommended by the machine tool manufacturer.

R & O OIL

ISO VISCOSITY GRADE	ASTM D 2422	32	46	68	100
cSt at 40 C	ASTM D 445	28.8/35.2	41.4/50.6	61.2/74.8	90.0/110
VISCOSITY INDEX MIN	ASTM D 2270	100	100	100	95
SUS at 100 F	ASTM D 2161	149/182	214/262	317/389	470/575
API GRAVITY at 60 F	ASTM D 287	30/33	28/31.5	29/31	29/31
FLASH POINT MIN F	ASTM D 92	370	385	385	385
FIRE COC MIN F	ASTM D 92	420	425	425	425
POUR POINT MAX F	ASTM D 97	-10	-10	-10	-10
NEUTRALIZATION NO. MAX Mg KOH/g	ASTM D 664	1.5	1.5	1.5	1.5
RUST TEST	ASTM D 665 A	PASS	PASS	PASS	PASS
PUMP WEAR TEST MAX	ASTM D 2882	50 mg	50 mg	50 mg	50 mg
VISCOSITY CHANGE MAX	CINC. PROCEDURE A ASTM D 2161	+/- 0.05	+/- 0.05	+/- 0.05	+/- 0.05
NEUTRALIZATION NO. CHANGE MAX	CINC. PROCEDURE A ASTM D 664	+/- 50%	+/- 50%	+/- 50%	+/- 50%
SLUDGE MAX/100ml	CINC. PROCEDURE A	25 mg	25 mg	25 mg	25 mg
STEEL COLOR MAX	CINC. PROCEDURE A	1	1	1	1
STEEL DEPOSIT MAX	CINC. PROCEDURE A	3.5 mg	3.5 mg	3.5 mg	3.5 mg
STEEL REMOVAL MAX	CINC. PROCEDURE A	1.0 mg	1.0 mg	1.0 mg	1.0 mg
COPPER COLOR MAX	CINC. PROCEDURE A	5	5	5	5
Cu REMOVED MAX	CINC. PROCEDURE A	10.0 mg	10.0 mg	10.0 mg	10.0 mg
TOST Oxidation Hrs	ASTM D 943	5500	5500	5500	5500
FOAMING ml MAX	ASTM D 892	25/0, 50/0, 25/0			
CLEANLINESS	ISO 4406-87	14/11	14/11	14/11	14/11
WATER	ASTM D 95	<150 ppm	<150 ppm	<150 ppm	<150 ppm
ADDITIVES	RUST INHIBITOR, OXIDATION INHIBITOR, ANTIWEAR ADDITIVE No VI Improvers				
CINCINNATI MILACRON SPECIFICATION		P-68	P-70	P-69	- - -
ISO 3498		HM-32	HM-46	HM-68	HM-100
PLANT ENGINEERING MAGAZINE		PE-150-AW	PE-215-AW	PE-315-AW	- - -

Antiwear Hydraulic Oil

Antiwear hydraulic oils should be used in most all hydraulic power systems, especially those that run at more than 1000 PSI or at greater than 90% of the hydraulic pump capacity. They can also be used for some compressors, air line oilers, and way lube systems where the hydraulic system and way system are integral.

Some machine manufacturers recommend hydraulic oils in gear boxes, but gear oils or Rust and Oxidation (R & O) Inhibited oils of the same viscosity are almost always more appropriate for the application. Antiwear hydraulic oils can be used in most applications that require R & O oils except reciprocating compressor and some clutch plate applications. The selection should be made based on the viscosity recommended by the machine tool manufacturer.

ANTIWEAR HYDRAULIC OIL

ISO VISCOSITY GRADE	ASTM D 2422	32	46	68	100
CST at 40 C	ASTM D 445	28.8/35.2	41.4/50.6	61.2/74.8	90.0/110
VISCOSITY INDEX MIN	ASTM D 2270	100	100	100	95
SUS at 100 F	ASTM D 2161	149/182	214/262	317/389	470/575
API GRAVITY at 60 F	ASTM D 287	30/33	28/31.5	29/31	29/31
FLASH POINT MIN F	ASTM D 92	370	385	385	385
FIRE COC MIN F	ASTM D 92	420	425	425	425
POUR POINT MAX F	ASTM D 97	-10	-10	-10	-10
NEUTRALIZATION NO. MAX Mg KOH/g	ASTM D 664	1.5	1.5	1.5	1.5
RUST TEST	ASTM D 665 A	PASS	PASS	PASS	PASS
PUMP WEAR TEST MAX	ASTM D 2882	50 mg	50 mg	50 mg	50 mg
VISCOSITY CHANGE MAX	CINC. PROCEDURE A ASTM D 2161	+/- 0.05	+/- 0.05	+/- 0.05	+/- 0.05
NEUTRALIZATION NO. CHANGE MAX	CINC. PROCEDURE A ASTM D 664	+/- 50%	+/- 50%	+/- 50%	+/- 50%
SLUDGE MAX/100ml	CINC. PROCEDURE A	25 mg	25 mg	25 mg	25 mg
STEEL COLOR MAX	CINC. PROCEDURE A	1	1	1	1
STEEL DEPOSIT MAX	CINC. PROCEDURE A	3.5 mg	3.5 mg	3.5 mg	3.5 mg
STEEL REMOVAL MAX	CINC. PROCEDURE A	1.0 mg	1.0 mg	1.0 mg	1.0 mg
COPPER COLOR MAX	CINC. PROCEDURE A	5	5	5	5
Cu REMOVED MAX	CINC. PROCEDURE A	10.0 mg	10.0 mg	10.0 mg	10.0 mg
TOST Oxidation Hrs	ASTM D 943	5500	5500	5500	5500
FOAMING ml MAX	ASTM D 892	25/0, 50/0, 25/0			
CLEANLINESS	ISO 4406-87	14/11	14/11	14/11	14/11
WATER	ASTM D 95	<150 ppm	<150 ppm	<150 ppm	<150 ppm
ADDITIVES	RUST INHIBITOR, OXIDATION INHIBITOR, ANTIWEAR ADDITIVE No VI Improvers				
CINCINNATI MILACRON SPECIFICATION	P-68	P-70	P-69	---	
ISO 3498	HM-32	HM-46	HM-68	HM-100	
PLANT ENGINEERING MAGAZINE	PE-150-AW	PE-215-AW	PE-315-AW	---	

Polyalphaolefin (PAO) Synthetic R&O Oil

Polyalphaolefin synthetic R&O oils (also called synthetic hydrocarbons) are intended for use in rotary vane, rotary lobe and screw compressors and vacuum pumps. PAO's will last longer than conventional oils in compressors that run hot, and are compatible with seals used in compressors that are designed for conventional oils.

PAO 460 is intended to be used in worm gears that are currently lubricated with gear oils compounded with animal fat-these oils are known as steam cylinder oils or worm gear oils. The synthetic PAO will provide better lubricity and longer life and will not corrode the yellow metals found in most worm gears. The better lubricity and viscosity index allow PAO 460 to be used in applications requiring CYL 460, CYL 680 and CYL 1000. Worm gears should be converted to PAO 460 during PM's because the cylinder oils will be phased out in future updates of this standard.

POLYALPHAOLEFIN (PAO) SYNTHETIC R&O OIL

ISO Viscosity Grade	ASTMD 2422	32	68	100	220	460
Viscosity Index Min	ASTMD 2270	130	138	145	126	123
SUS @ 100 F	ASTMD 2161	149	320	460	1030	2131
API Gravity @ 60 F	ASTMD 287	38	37	37	30	29
Flash Point Min F	ASTMD 92	470	510	529	478	464
Pour Point Max F	ASTMD 97	-75	-60	-55	-36	-27
Oxidation Stability	ASTMD 943	11,500 Hrs	11,500 Hrs	11,500 Hrs	11,500 Hrs	11,500 Hrs
Rust Test	ASTMD 665 A/B	Pass	Pass	Pass	Pass	Pass
Copper Corrosion	ASTMD 130	1a	1a	1a	1a	1a
Four Ball Wear (mm)	ASTMD 2266	0.50	0.45	.045	0.40	0.40
Cleanliness	ISO 4406	14/11	14/11	14/11	14/11	14/11
Demulsibility	ASTMD 1401	40/37/3 10 Min.	40/37/3 10 Min.	40/37/3 10 Min.	40/40/0 30 Min.	40/40/0 30 Min.
Additives		Rust and Oxidation Inhibitors				

Motor Oil

Motor oil should be used in any application that requires a motor oil of one of the following SAE grades. It meets the performance requirements of most diesel and gasoline engines. If an application calls for a non detergent motor oil, use the proper viscosity R & O oil

SINGLE GRADE MOTOR OIL

cSt at 40 C	ASTM D 445	28.8/30.4	90.0/94.8	135/143
VISCOSITY INDEX MIN	ASTM D 2270	90	90	90
API GRAVITY at 60 F	ASTM D 287	30/33	25	24.8
FLASH POINT MIN F	ASTM D 92	400	440	450
POUR POINT MAX F	ASTM D 97	-22	-11	10
API ENGINE SERVICE CLASSIFICATION		CF	CF, CF-2, CF-4, SJ	CF, CF-2, SJ
MACK			EO-K/2	EO-K/2
ALLISON		C-4	C-4	
CATERPILLAR		TO-2	TO-2	TO-2

MULTIGRADE MOTOR OIL

BOEING ID		SAE 10W-30	SAE 15W-40
cSt at 40 C	ASTM D 445	61.2/74.8	90.0/110
VISCOSITY INDEX MIN	ASTM D 2270	120	120
API GRAVITY at 60 F	ASTM D 287	27/30	26.8
FLASH POINT MIN F	ASTM D 92	420	435
POUR POINT MAX F	ASTM D 97	-38	-27
API ENGINE SERVICE CLASSIFICATION		CF, CF-4, CG-4, CH-4, SH	CF-4, CG-4, CF, CH-4, SJ
MACK		EO-K/2	EO-K/2
CUMMINS		NTC-400	NTC-400

Hypoid Gear Oil

SAE 80W-90 and SAE 85W-140 are multipurpose, multiviscosity, heavy-duty extreme pressure gear lubricants. They are intended for hypoid drive axles, manual transmission, power dividers, final drives and other applications where SAE 80W-90 and 85W-140 viscosity, extreme pressure gear oils are required.

CAUTION

These gear oils can be corrosive to copper alloy gears and bearing materials. These oils should only be used when recommended by the machine manufacturer.

CAUTION

SAE 80W-90 and SAE 85W-140 are not compatible with the Gear Oils. These oils should not be mixed. If you are making a conversion, you must drain the old oil and flush the system before adding the new oil.

HYPOID GEAR OIL

BOEING ID		SAE 80W-90	SAE 85W-140
ISO VISCOSITY	ASTM D 2422	150	320
cSt at 40 C	ASTM D 445	135/145	288/352
VISCOSITY INDEX MIN	ASTM D 2270	85	85
SUS at 100 F	ASTM D 2161	626/675	1550/1850
API GRAVITY at 60 F	ASTM D 287	25/27	23/25
FLASH POINT MIN F	ASTM D 92	330	400
POUR POINT MAX F	ASTM D 97	-15	5
COPPER CORROSION	ASTM D 130	1 MAX	1 MAX
TIMKEN OK LOAD (MEAN LBS)	ASTM D 2782	50	50
FZG A/8.3/90 C		11 STAGES	11 STAGES
CHANNEL POINT DEGREES F	Fed Test 3456	0 MAX	0 MAX
FOAMING ml MAX	ASTM D 892	20/0, 20/0, 20/0	
ADDITIVES		RUST AND OXIDATION INHIBITORS, EXTREME PRESSURE AGENT, DEFOAMANT	
AMERICAN PETROLEUM INSTITUTE		API GL-5	API GL-5
MACK TRUCK		GO-H	GO-H
MILITARY STANDARD		MIL-L-2105D	MIL-L-2105D

Transmission Fluid

Dexron ATF is the automatic transmission fluid used in most modern automobiles and other applications where a DEXRON III or MERCON automatic transmission fluid is required. Transmission fluids that are equivalent to Dexron ATF are usually called Multi-Purpose ATF by manufacturers.

Type F ATF is an older type of transmission fluid used in Ford cars built before 1981. It is also used in some power steering units and other applications where a Type F transmission fluid is required.

Tractor ATF is a combination power transmission, final drive and hydraulic fluid. It is commonly called "tractor fluid" and is normally used in tractor and mobile equipment hydraulic systems.

TRANSMISSION FLUID

AUTOMATIC TRANSMISSION FLUID SPECIFICATION		DEXRON ATF	ATF	TRACTOR ATF
cSt at 40 C	ASTM D 445	34/38	34/41	51/61
VISCOSITY INDEX MIN	ASTM D 2270	160	160	120
API GRAVITY at 60 F	ASTM D 287	30/33	29/34	27/30
FLASH POINT MIN F	ASTM D 92	360	350	390
POUR POINT MAX F	ASTM D 97	-40	-40	-38
GENERAL MOTORS		DEXRON III		
FORD		MERCON	M2C33-F	M2C134D
ALLISON		C-4		C-4
CATERPILLAR		TO-2		TO-2

Grease

Lithium EP1 and Lithium EP2 are multipurpose, high performance greases for severe duty applications involving extreme pressure, water contamination, and shock loading.

Lithium complex greases can be used in place of other soap base greases such as calcium, calcium complex, aluminum, aluminum complex, barium, and white greases.

CAUTION Although lithium complex and polyurea greases can be used in place of many other types of grease, they are not necessarily compatible with the other types. Ask your Grease supplier if the new grease can be mixed with the grease already being used.

Polyurea 2 is an ashless polyurea and Polyurea based, non-EP grease used in high speed, high temperature bearings. This polyurea grease is particularly well suited for applications such as electric motors, generators, alternators, fans, where heat or water contamination is a problem, and where frequent equipment re-lubrication may be difficult or impossible to achieve in service.

Polyurea 2 has replaced Bentonite EP2 for high temperature applications.

The two greases are not compatible, however, every effort should be made to flush the old grease out. Polyurea 2 can be used for temperatures up to 350 degrees F continuous duty, or 500 degrees F intermittent duty. For higher temperature applications consult the lubricant supplier.

Finding a standard grease to replace a brand specific grease is not easy. If the base type and NLGI number of the two greases are the same, then they are equivalent. For any other types of greases contact the supplier and ask for the equivalent grease.

The greases in this standard should be adequate to cover nearly all machinery applications.

GREASE

BOEING ID		LITHIUM EP1	LITHIUM EP2	POLYUREA 2
BASE		LITHIUM COMPLEX	LITHIUM COMPLEX	POLYUREA
NATIONAL LUBRICATING GREASE INSTITUTE		NLGI 1 EP	NLGI 2 EP	NLGI 2
cSt at 40 C	ASTM D 445	150/250	150/250	99/129
SUS at 100 F	ASTM D 2161	750/1000	750/1250	517/677
DROPPING POINT MIN F	ASTM D 566	450	450	470
PENETRATION 60 STROKES	ASTM D 217	310/340	265/295	272
PENETRATION 10K STROKES	ASTM D 217	15% MAX INC	15% MAX INC	15% MAX INC
OXIDATION STABILITY	ASTM D 942	10 MAX	8 MAX	18 MAX
WATER CONTENT	ASTM D 95	NIL	NIL	NIL
TIMKEN LOAD (LBS)	ASTM D 2509	45	45	---
FOUR BALL WEAR	ASTM D 2266	0.4 MAX	0.4 MAX	0.3 MAX
LOAD WEAR INDEX	ASTM D 2596	56	56	27
WELD POINT (kg) MIN	ASTM D 2596	315	315	126
RUST TEST	ASTM D 1743	PASS	PASS	PASS
STEEL COLOR MAX	CINCINNATI PROCEDURE B	1	1	1
COPPER COLOR MAX	CINCINNATI PROCEDURE B	5	5	5
ADDITIVES		RUST INHIBITOR, OXIDATION INHIBITOR, EXTREME PRESSURE AGENT		RUST & OXIDATION INHIBITOR
CINCINNATI MICRON SPECIFICATION		P-72	P-64	---
ISO 6743		XBGEB 1	XBGEB 2	---