SAE The Engineering Society For Advancing Mobility Land Sea Air and Space®
INTERNATIONAL
400 Commonwealth Drive, Warrendale, PA 15096-0001

SURFACE VEHICLE STANDARD

SAE J2360

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Submitted for recognition as an American National Standard

Lubricating Oil, Gear Multipurpose (Metric) Military Use

1. ***Scope—***This SAE Standard covers multipurpose gear-lubricating military oils (see 6.1). This document is equivalent to MIL-PRF-2105 when all requirements are met.

1.1 Classification—The gear lubricating oils shall be of the following grades, as specified (see 6.2).

TABLE 1—VISCOSITY GRADES

SAE Grade	Military Symbol	NATO Code
75W	GO-75	O-186
80W-90	GO-80/90	O-226
85W-140	GO-85/140	O-228

2. ***References***

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

In the event of a conflict between the text of this specification and the references cited herein, (except for associated detail specifications, specifications sheets, or MS standards), the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 SAE PUBLICATION—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J306—Automotive Gear Lubricant Viscosity Classification

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

ASTM D 92—Flash and Fire Points by Cleveland Open Cup
ASTM D 94—Saponification Number of Petroleum Products
ASTM D 97—Pour Point
ASTM D 129—Sulfur in Petroleum Products by the Bomb Method
ASTM D 130—Detection of Copper Corrosion from Petroleum Products, by the Copper Strip Tarnish Test
ASTM D 287—API Gravity of Crude Petroleum and Petroleum Products (Hydrometer Method)
ASTM D 445—Kinematic Viscosity of Transparent and Opaque Liquids (Kinematic and Dynamic Viscosity)
ASTM D 524—Ramsbottom Carbon Residue of Petroleum Products
ASTM D 664—Standard Test Method for Acid Number of Petroleum Products by Potentiometric Titration

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ASTM D 808—Chlorine in New and Used Petroleum Products (Bomb Method)
ASTM D 874—Sulfated Ash from Lubricating Oils and Additives
ASTM D 892—Foaming Characteristics of Lubricating Oils
ASTM D 893—Insolubles in Used Lubricating Oils
ASTM D 1091—Phosphorus in Lubricating Oils and Additives
ASTM D 1500—ASTM Color of Petroleum Products (ASTM Color Scale)
ASTM D 1552—Sulfur in Petroleum Products (High-Temperature Method)
ASTM D 2270—Calculating Viscosity Index from Kinematic Viscosity at 40 and 100 °C
ASTM D 2622—Sulfur in Petroleum Products (X-Ray Spectrographic Method)
ASTM D 2887—Boiling Range Distribution of Petroleum Fractions by Gas Chromatography
ASTM D 2983—Low-Temperature Viscosity of Automotive Fluid Lubricants Measured by Brookfield Viscometer
ASTM D 3228—Total Nitrogen in Lubricating Oils and Fuel Oils by Modified Kjeldahl Method
ASTM D 4047—Phosphorus in Lubricating Oils and Additives by Quinoline Phosphomolybdate Method
ASTM D 4057—Manual Sampling of Petroleum and Petroleum Products
ASTM D 4177—Automatic Sampling of Petroleum and Petroleum Products
ASTM D 4294—Sulfur in Petroleum Products by Non-Dispersive X-Ray Fluorescence Spectrometry
ASTM D 4628—Analysis of Barium, Calcium, Magnesium and Zinc in Unused Lubricating Oils by Atomic Absorption Spectrometry
ASTM D 4629—Trace Nitrogen in Liquid Petroleum Hydrocarbons by Syringe/Inlet Oxidative Combustion and Chemiluminescence Detection
ASTM D 4927—Elemental Analysis of Lubricants and Additive Components—Barium, Calcium, Phosphorus, Sulfur, and Zinc by Wavelength-Dispersive X-Ray Fluorescence Spectroscopy
ASTM D 4951—Determination of Additive Elements in Lubricating Oils by Inductively-Coupled Plasma Atomic Emission Spectrometry
ASTM D 5185—Determination of Additive Elements, Wear Metals and Contaminants in Used Lubricating Oils by Inductively-Coupled Plasma Emission Spectrometry
ASTM D 5579—Cyclic Durability—Test Method for Evaluating the Thermal Stability of Manual Transmission Lubricants in a Cyclic Durability Test
ASTM D 5662—Test Method for Determining Automotive Gear Oil Compatibility with Typical Oil Seal Elastomers
ASTM D 5704—Test Method for Evaluating the Thermal and Oxidative Stability of Lubricants used for Manual Transmissions and Final Drive Axles
ASTM D 5760—Standard Specifications for Peformance of Normal Transmission Gear Lubricants
ASTM D 6121—L-37 Test—Performance Test for Evaluating the Load Carrying Capacity of Automotive Gear Lubricants Under Conditions of Low Speed and High Torque
ASTM Special Technical Publication (STP) 512A including:
L-33 Test—Performance Test for Evaluating the Moisture Corrosion Tendencies of Automotive Gear Lubricants
L-42 Test—Performance Test for Evaluating the Load Carrying Capacity of Automotive Gear Lubricants Under Conditions of High Speed Shock Loading

2.1.3 DEPARTMENT OF LABOR (OSHA)—Available from OSHA Publication Office, Room S-4203, 200 Constitution Avenue, NW, Washington, DC 20210.

OSHA 29 CFR 1910.1200—Hazard Communication Interpretation Regarding Lubricating Oils

2.1.4 GOVERNMENT DOCUMENTS

2.1.4.1 *Federal and Military*—Available from U.S. Army Tank Automotive and Armament Commands, Attn: AMSTA-TR-D/210, Warren, MI 48397-5000.

FED-STD-791—Lubricants, Liquid Fuels and Related Products; Methods of Testing
FED-STD-313—Material Safety Data Sheets Preparation and the Submission of
MIL-PRF-2105—Lubricating Oil Gear Mulitpurpose Metric
MIL-STD-105—Sampling Procedures and Table for Inspection by Attributes
MIL-STD-290—Packaging of Petroleum and Related Products
NATO STANAG 1135
NATO STANAG 2845

3. Requirements

3.1 Qualification

3.1.1 QUALIFICATION—GENERAL—Gear oils furnished under this specification shall be products which are qualified for listing on the applicable qualified products list at the time for opening of bids (see 4.5.1 and 6.4).

3.1.2 COMPANION LUBRICANTS—When companion gear lubricants in grades SAE 80W-90 and SAE 85W-140 are submitted for qualification, testing prescribed in 3.4.7 is not required on the SAE 85W–140 Grade, provided the additive type and concentration used, base stock source and refining treatment are identical for both products. Additionally, testing prescribed in 3.4.9 is required only on the grade with the poorer carbon varnish rating result in the ASTM D 5704 (L-60-1) test.

3.1.3 QUALIFICATION PERIOD—Each grade of oil which satisfies all the requirements of this specification will be qualified for a period not to exceed five years from the date of its original qualification. The qualification period for each grade SAE 85W-140 oil qualified in accordance with 3.1.2 shall not exceed that of the companion grade SAE 80W-90 product used in the qualification procedure.

3.1.4 REQUALIFICATION—When the qualification period has expired, each product must be requalified if the supplier wishes to maintain the formulation as a current product and be eligible to bid on prospective procurements. If a product is submitted for requalification and there has been no change in the specification requirements, the qualifying activity may, at its discretion, waive complete retesting or require only partial retesting of the product to determine its continued acceptability. Whenever there is a change in the base stock, refining treatment, or additives used in the formulation, requalification will be required. When the proposed changes are minor and may not be expected to significantly affect performance, the qualifying activity may, at its discretion, waive complete requalification or may require only partial requalification in order to determine the significance and acceptability of the proposed changes.

3.1.5 TOLERANCES—The gear oil supplied under contract shall be identical, within permissible tolerances assigned by the qualifying activity, to the product receiving qualification. The values resulting after application of tolerances shall fall within the maximum and minimum limits specified herein (see Table 2 and 3.4.1 through 3.4.10).

3.1.6 MATERIAL SAFETY DATA SHEETS—When applying for qualification, the manufacturer shall submit to the qualifying activity (see 6.4) a sample of the product tested and include material safety data sheets prepared in accordance with FED-STD-313 and OSHA 29 CFR 1910.1200. When FED-STD-313 is at variance with the CFR, 29 CFR 1910.1200 shall take precedence, modify and supplement FED-STD-313.

TABLE 2—FINISHED OIL REQUIREMENTS

Property[1]	SAE 75W	SAE 80W-90	SAE 85W-140
Viscosity	Per SAE J306	Per SAE J306	Per SAE J306
Channel Point, °C, max	–45	–35	–20
Flash Point, °C, min	150	165	180
Gravity, API	X	X	X
Viscosity Index	X	X	X
Pour Point, °C	X	X	X
Pentane Insolubles, % wt	X	X	X
Sulfur, % wt	X	X	X
Phosphorus, % wt	X	X	X
Nitrogen, % wt	X	X	X
Boron, % wt	X	X	X
Zinc, % wt	X	X	X
Potassium, % wt	X	X	X
Chlorine, % wt	X	X	X
Organo-metallic components, % wt	X	X	X

1. Values shall be reported for all requirements (X indicates report).

3.2 Materials—The gear lubricating oil shall be derived from petroleum fractions, synthetically prepared compounds or a combination of the two types of products. They may be virgin or rerefined stocks or combination thereof. The stocks shall be compounded with such functional additives (extreme pressure agents, corrosion inhibitors, friction modifiers, etc.) as are necessary to meet the performance requirements specified in this standard. The stocks used shall not be considered carcinogenic or potentially carcinogenic as defined under the Hazardous Communication Standard OSHA 29 CFR 1910.1200.

3.2.1 POUR POINT DEPRESSANTS—Not more than 2.0% (by volume) of any type of pour point depressant or combination thereof is allowed in the final formulation.

3.3 Physical and Chemical Requirements

3.3.1 REQUIREMENTS FOR FINISHED OIL—The oils shall conform to the requirements specified in Table 2 and 3.4.1 through 3.4.10.

3.3.2 REQUIREMENTS FOR BASE STOCK—A one liter sample of each base stock component used in formulating the finished oil, accompanied by the following property data, shall be submitted to the qualifying activity (see 6.4) at the time of qualification. Annually thereafter, a one liter production sample of each base stock component used in formulating the finished oil, accompanied by the property data, shall be submitted to the qualifying activity.

a. Viscosity, Kinematic
   at 100 °C, centistokes (mm^2/s)
   at 40 °C, centistokes (mm^2/s)
b. Viscosity Index
c. Gravity, °API
d. Flash point, °C
e. Pour point, °C
f. Carbon residue, mass %
g. Sulfated ash, mass %
h. Saponification number
i. Elemental content, mass %
j. Nitrogen, mass %

k. Chlorine, mass %
l. Sulfur, mass %
m. Color
n. Boiling point, °C at 1%, 5%, 10%, 50% & 90% points
o. Total acid number

3.4 Performance Requirements—The oils shall conform to the requirements specified in 3.4.1 through 3.4.10.

3.4.1 CHANNEL POINT—The gear oil shall be non-channeling at the temperature indicated by Table 2 when tested in accordance with Table 3 (method 3456, FED-STD-791).

TABLE 3—TEST METHOD

Test	ASTM Test Method	FED-STD-791 Method No.
Viscosity, Kinematic	D 445	
Viscosity, Apparent	D 2983	
Viscosity, Index	D 2270	
Channel Point		3456
Flash Point	D 92	
Gravity, API	D 287	
Pour Point	D 97	
Pentane Insolubles	D 893	
Carbon Residue	D 524	
Color	D 1500	
Total Acid Number	D 664	
Saponification Number	D 94	
Boiling Range Distribution	D 2887	
Sulfated Ash	D 874	
Sulfur	D 1552(1), D 2622, D 129, D 4294 D 4927, D 4951, D 5185	
Phosphorus	D 1091(1), D 4047, D 4927, D 4951, D 5185	
Chlorine	D 808	
Nitrogen	D 3228(1), D 4629	
Metallic Components	D 4628, D 4927, D 4951(1) D 5185	
Foaming	D 892	
Storage Stability		3440
Compatibility(2)		3430
Copper Corrosion	D 130	
Moisture Corrosion(3)	L-33	
Thermal and Oxidative Stability(3) and Deposition Characteristics	D 5704 (L-60-1)	
Gear Scoring(3),(4)	L-42	
Gear Distress and Deposits(3)	D 6121 (L-37)	
Cyclic Durability	D 5579 (Mack Cyclic Durability)	
Elastomer Compatibility	D 5662	

1. Denotes preferred method.
2. See 4.6.1.
3. In accordance with ASTM STP 512A.
4. See 4.6.2.

3.4.2 FOAMING—All grades of oil shall demonstrate the following foaming characteristics when tested in accordance with 4.6, Table 3 (ASTM D 892).

a. Initial test at 24 °C ± 0.5 °C—Not more than 20 mL of foam shall remain immediately following the 5-min blowing period.
b. Intermediate test at 93.5 °C ± 0.5 °C—Not more than 50 mL of foam shall remain immediately following the 5-min blowing period.
c. Final test at 24 °C ± 0.5 °C—Not more than 20 mL of foam shall remain immediately following the 5-min blowing period.

3.4.3 STORAGE STABILITY—The gear oil shall demonstrate the following characteristics for separated solid material, liquid material, or a combination of the two materials when tested in accordance with 4.6, Table 3 (Method 3440, FED-STD-791).

3.4.3.1 *Solid Material*—When the separated material is solid, the average increase in the weight of each centrifuge tube and residue over the initial weight of the clean tube shall not exceed 0.25 mass percent of the additive material originally contained in the sample.

3.4.3.2 *Liquid Material*—When the separated material is liquid, it shall not exceed 0.50 volume percent of the additive material originally contained in the sample.

3.4.4 COMPATIBILITY—The gear oil shall be compatible with other gear lubricants previously qualified under this specification or MIL-PRF-2105 and/or MIL-L-2105 when tested against selected reference oils in accordance with 4.6, Table 3 (Method 3430, FED-STD-791) and 4.6.1.

3.4.5 MOISTURE CORROSION—The oil shall prevent or minimize corrosion to gear unit components in the presence of moisture. Satisfactory performance shall be demonstrated when the oil is tested in accordance with 4.6, Table 3 (ASTM STP 512A, L-33 Test) and exhibits test results of one percent or less rust on the test cover plate and no rust on gear teeth, bearings, and functional components.

3.4.6 THERMAL AND OXIDATIVE STABILITY—The oil shall resist thermal and chemical oxidation. Satisfactory performance shall be demonstrated when the oil is tested in accordance with 4.6, Table 3 (ASTM D 5704, L-60-1 Test) for 50 h and meets the criteria in Table 4. A maximum of three tests may be conducted. If more than one test is conducted, the average of any two test results must meet the limits described in Table 4, and the results from the third test, if conducted, may be excluded.

TABLE 4—ASTM D 5704, L-60-1 TEST LIMITS

Parameters	Limits
Kinematic Viscosity Increase %, @100 °C, cSt	100 max
N-Pentane Insolubles, wt %	3.0 max
Toluene Insolubles, wt %	2.0 max
Carbon/Varnish Rating	7.5 min
Sludge Rating	9.4 min

3.4.7 LOAD-CARRYING, EXTREME-PRESSURE, AND DEPOSITION CHARACTERISTICS—The oil shall prevent or minimize gear distress and lubricant deposits under conditions of high-speed and shock-loading and conditions of high-speed, low-torque and low-speed, high-torque operation.

3.4.7.1 *Gear Scoring*—Satisfactory performance shall be demonstrated when the oil is tested in duplicate in accordance with 4.6, Table 3 (ASTM STP 512A, L-42 Test) and exhibits scoring less than or equal to Reference Oil TMC 114, or most recent approved blend, under conditions of high-speed and shock-loading.

3.4.7.2 *Gear Distress and Deposits*—Satisfactory performance shall be demonstrated when the oil is tested in accordance with 4.6, Table 3 (ASTM D 6121, L-37 Test) using untreated and phosphate-treated gear assemblies and prevents gear-tooth ridging, rippling, pitting, welding, spalling, and excessive wear or other surface distress and objectionable deposits and does not produce excessive wear, pitting or corrosion of bearing rollers, or races under conditions of high-speed, low-torque and low-speed, high-torque and meets the criteria in Table 5.

TABLE 5—ASTM D 6121, L-37 TEST LIMITS

Category	ASTM Rating	Comments
Ridging	8 or greater	Compare overall appearance to closest gear on rating board
Rippling	8 or greater	Same as above
Wear	5 or greater	Same as above
Spalling/ Pitting	9.3 or greater	At heel end of pinion tooth only—elsewhere not allowed
Scoring	10	Not allowed

3.4.8 COPPER CORROSION—The oil shall minimize copper corrosion. Satisfactory performance shall be demonstrated when the oil is tested in accordance with 4.6, Table 3 (ASTM D 130) for 3-h at 121 °C ± 1 °C and exhibits copper strip discoloration not exceeding ASTM No. 2a when compared to ASTM Copper Strip Corrosion Standard.

3.4.9 CYCLIC DURABILITY—Satisfactory performance shall be demonstrated when the oil is tested in accordance with 4.6, Table 3 (ASTM D 5579, Cyclic Durability). The number of tests conducted shall be in accordance with Section 6.3 of ASTM D 5760. The test evaluates the thermal stability of gear lubricants when subjected to cyclic operating conditions of high-low range and high temperature. The oil shall avoid deteriorating the synchronizer performance by preventing two unsynchronized shifts from occurring at cycles equal to or lower than the mean of the prior five passing reference oil results in the same test stand.

3.4.10 ELASTOMER COMPATIBILITY—The gear lubricants shall minimize deterioration of elastomer materials. Satisfactory performance shall be demonstrated when the oils are tested and rated in accordance with 4.6, Table 3 (ASTM D 5662, Elastomer Compatibility) and exhibit test results meeting the nominal criteria in Table 6 as adjusted to accommodate slight changes in individual elastomer batches:

TABLE 6—ASTM D 5662 ELASTOMER COMPATIBLITY TEST LIMITS

Parameters	Minimum	Maximum
Polyacrylate @150 °C, 240 h:		
Elongation Change, %	No limit	–60
Hardness Change, points	–35	+5.0
Volume Change, %	–5	+30
Fluoroelastomer @ 150 °C, 240 h		
Elongation Change, %	No limit	–75
Hardness Change, points	–5	+10
Volume Change, %	–5	+15

3.5 Other Requirements and Tolerances for Quality Conformance Testing—The following physical and chemical properties shall be tested in accordance with the appropriate methods listed in 4.6 to ensure that purchased products are of the same compositions as the respective qualification samples and to identify the products. No specific values or limits are assigned in qualification testing, except as otherwise specified in Table 2 and 3.4.1 through 3.4.10, but test results shall be reported for all properties listed. The qualifying activity (see 6.4) shall establish specific values and tolerances for subsequent quality conformance testing of the finished lubricant for these properties (see 6.3 and 6.4):

a. Viscosity
b. Viscosity Index
c. Pour point
d. Flash point
e. Gravity, °API
f. Channel point
g. Copper corrosion
h. Pentane insolubles
i. Sulfur
j. Phosphorus
k. Nitrogen
l. Chlorine
m. Boron
n. Potassium
o. Zinc
p. Metallic components

4. Quality Assurance Provisions

4.1 Responsibility for Inspection—Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.1.1 RESPONSIBILITY FOR COMPLIANCE—All items must meet all requirements of Sections 3 and 5. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.2 Lot

4.2.1 BULK LOT—A bulk lot is an indefinite quantity of a homogeneous mixture of one grade of oil offered for acceptance in a single, isolated container; or manufactured in a single plant run (not to exceed 24 h), through the same processing equipment, with no change in the ingredient materials.

4.2.2 PACKAGED LOT—A packaged lot is an indefinite number of 55-gal drums or smaller unit containers of identical size and type, offered for acceptance, and filled with a homogeneous mixture of one grade of oil from a single, isolated container; or filled with a homogeneous mixture of one grade of oil, manufactured in a single plant run (not to exceed 24 h), through the same processing equipment, with no change in the ingredient materials.

4.3 Sampling

4.3.1 SAMPLING FOR THE EXAMINATION OF FILLED CONTAINERS—Take a random sample of filled containers from each lot in accordance with MIL-STD-105, at inspection level II.

4.3.2 SAMPLING FOR TESTS—Take samples from bulk or packaged lots for tests in accordance with ASTM D 4057 or D 4177.

4.4 Inspection—Perform inspection in accordance with Method 9601 of FED-STD-791.

4.4.1 EXAMINATION OF FILLED CONTAINERS—Examine samples taken in accordance with 4.3.1 for compliance with MIL-STD-290 with regard to fill, closure, sealing, and leakage. Reject any container having one or more defects or under the required fill. If the number of defective or underfilled containers exceeds the acceptance number for the appropriate sampling plan of MIL-STD-105, reject the lot represented by the sample.

4.5 Classification of Tests

a. Qualification tests (see 4.5.1).
b. Quality conformance tests (see 4.5.2).

4.5.1 QUALIFICATION TESTS—Qualification tests consist of tests for all of the requirements specified in Section 3 and may be conducted in any plant or laboratory approved by the qualifying activity (see 6.4). These tests have been correlated with field performance. New lubricant technology must have demonstrated correlation with field performance for these tests to apply as required by the qualifying activity. The Lubricant Review Institute Procedures outline the requirements for field testing. Copies of these procedures may be obtained by contacting the Secretary of the LRI at the Performance Review Institute. Once correlation has been demonstrated, only the tests specified herein will be required for further qualification. In addition the manufacturer shall provide certification of noncarcinogenicity (i.e., materials are not considered carcinogenic or potentially carcinogenic) and shall provide material safety data sheets.

4.5.2 QUALITY CONFORMANCE TESTS—Tests for quality conformance of individual lots shall consist of tests for all of the requirements in Section 3, except for the following (see Table 3):

a. Requirements for base stocks
b. Storage stability
c. Compatibility
d. Moisture corrosion
e. Thermal oxidation stability
f. Load-carrying, extreme-pressure, and deposition characteristics
g. Cyclic Durability
h. Elastomer Compatibility

4.6 Test Methods—Perform tests in accordance with Table 3, 4.6.1, and 4.6.2.

4.6.1 COMPATIBILITY—Determine compatibility by subjecting separate mixtures of the oil with six selected reference oils designated by the qualifying activity to the procedure specified by method 3430 of FED-STD-791.

4.6.2 GEAR SCORING—For grade SAE 75W oil, the L-42 gear scoring test shall be modified such that the sequence II (high-speed) portion of the test shall be commenced at a temperature of 79 °C and sequence IV (shock-loading) run with water sprays on commencing at 93 °C with a maximum rise of 5.5 to 8.3 °C.

4.7 Inspection of Packaging

4.7.1 QUALITY CONFORMANCE INSPECTION OF PACK

4.7.1.1 Unit of Product—For the purpose of inspection, a complete pack prepared for shipment shall be considered a unit of product.

4.7.1.2 Inspection Lot—The inspection lot shall be as defined in 4.2 packed for shipment.

4.7.1.3 Sampling—Samples for examination of packaging shall be selected at random from each inspection lot in accordance with procedures prescribed in MIL-STD-105.

4.7.1.4 *Examination*—Samples selected in accordance with 4.7.1.3 shall be examined for the defects listed as follow:

a. 101—Unit container not as specified and not in accordance with the requirements of MIL-STD-290.
b. 102—Intermediate container when required, not as specified in MIL-STD-290.
c. 103—Quantity and arrangement of unit containers packed in intermediate containers not as specified in MIL-STD-290.
d. 104—Exterior container not as specified in MIL-STD-290.
e. 105—Quantity and arrangement of intermediate containers packed in exterior containers not as specified in MIL-STD-290.
f. 106—Marking not as specified in MIL-STD-290.

5. Packaging

5.1 Packing and Marking—Packing and marking shall be as specified by the procuring agency.

6. Notes—General Requirements

6.1 Intended Use—The gear lubricants covered by this specification exceed American Petroleum Institute (API) Service Classification GL-5 and MT-1 and are intended for automotive gear units, heavy-duty industrial type enclosed gear units, steering gear units, heavy-duty nonsynchronized class 7 and 8 heavy duty truck manual transmissions, and fluid lubricated universal joints of automotive equipment. The lubricants covered by this specification are intended for use as defined by appropriate lubrication orders when ambient temperatures are above –54 °C. Recommended ambient temperature ranges for use of specific viscosity grade lubricants are shown by Figure 1.

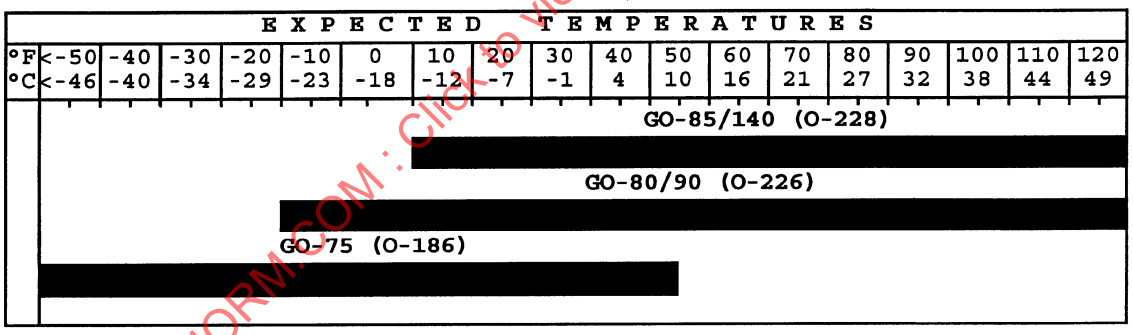

FIGURE 1—RECOMMENDED AMBIENT TEMPERATURE RANGES FOR USAGE OF GEAR LUBRICANTS

6.2 Ordering Data—Acquisition documents should specify the following information:

a. Title, number, and date of this specification.
b. Date of issue of DoDISS applicable to this contract and exceptions thereto.
c. Grade of oil required (see 1.1).
d. Quantity of oil required.
e. Type and size of containers required (see 5.1).
f. Level of packaging required (see 5.1).

6.3 Other Requirements and Tolerances for Quality Conformance Testing—Definite numerical values are not specified for certain of the physical and chemical properties listed in 3.5, and for which corresponding test methods are given in Section 4. Values of some properties vary from one commercial brand of oil to another for the same grade. These values are influenced by the source of the base stock, the identities and quantities of additives, etc. Definite numerical values are not always functionally important except, for some properties, within specified maximum and minimum limits. It is not possible (or necessary) to assign restrictive values in the specification before the testing of qualification samples. During qualification, test values will be determined which are characteristic of a particular product and which can serve thereafter to identify the product. Using the results of qualification testing, the qualifying activity (see 6.4) can set values, including permissible tolerances, for future quality conformance testing.

6.4 Qualification—Lubricating oils covered under this standard must be submitted for qualification. Awards will be made only for products which are at the time set for opening of bids, qualified for inclusion in the applicable qualified products list (QPL) whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or purchase orders for the products covered by this specification. The activity responsible for the qualified products list is the US Army Tank Automotive and Armament Command, ATTN: AMSTA–TR–D/210, Warren, MI 48397-5000, and information pertaining to qualification of products may be obtained from this activity. Additionally, qualification information may be obtained by contacting the Performance Review Institute, Attn: Secretary of the LRI, 161 Thornhill Road, Warrendale, PA 15086, (724) 772-1616.

6.5 Material Safety Data Sheets—Contracting officers will identify those activities requiring copies of completed Material Safety Data Sheets prepared in accordance with 3.1.5. The pertinent government mailing addresses for submission of data are listed in appendix B of FED-STD-313.

6.6 Military Part Number—Gear lubricants furnished under this specification shall be identified by a military part number consisting of; a "M" prefix and specification number, a single digit "Dash Number" taken from Table 7 which indicates the container size, and the viscosity grade of the lubricant. The military part number from Grade 80W-90 lubricant to be furnished in 1-pt containers is shown in the example in Figure 2:

TABLE 7—DASH NUMBER DESIGNATIONS FOR USE IN MILITARY PART NUMBERS

Dash Number	Container size
1	1-pt
2	1-qt
3	1-gal
4	5-gal
5	55-gal drum
6	bulk

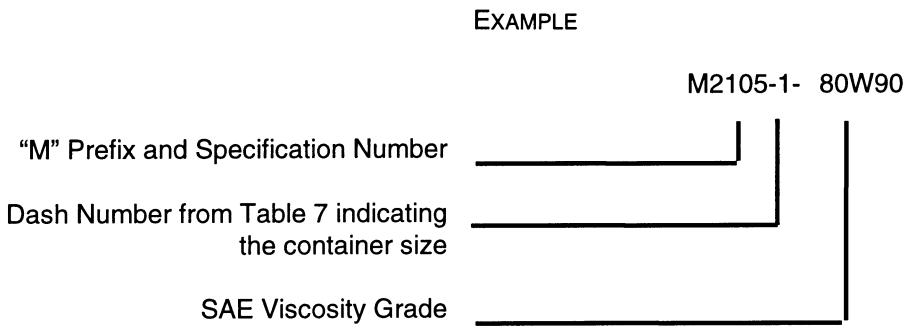

FIGURE 2—EXAMPLE MILITARY PART NUMBER

6.7 Subject Term (Key Word) Listing

a. Axles
b. Gear
c. Heavy-Duty
d. Enclosed Gears
e. Steering Units
f. Non-Synchronized
g. Manual Transmissions

6.8 International Standardization Agreements—Certain provisions of this specification are the subject of international standardization agreements STANAGs 2845 and 1135. When amendment, revision, or cancellation of this specification is proposed which would affect or violate the international agreement concerned, the preparing activity will take appropriate reconciliation action through international channels, including departmental standardization offices, if required.

6.9 Changes from Previous Issue—Asterisks (or vertical lines) are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

PREPARED BY THE SAE MILITARY/INDUSTRY LUBRICANTS COMMITTEE