

INCH-POUND

MIL-DTL-10215K
20 November 2003
SUPERSEDING
MIL-PRF-10215J
16 January 2001

DETAIL SPECIFICATION

SPEEDOMETERS; TACHOMETERS; FLEXIBLE SHAFT ASSEMBLIES; FLEXIBLE SHAFT ASSEMBLY CORES AND ADAPTERS

This specification is approved for use by all departments and agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This specification covers mechanical speedometers and tachometers, flexible shaft assemblies, flexible shaft assembly cores, and adapters.

1.2 Classification. The speedometers, tachometers, shaft assemblies, cores, and adapters are of the following type, groups, and classes as specified below (see 6.2).

1.2.1 Type. The type of speedometers and tachometers is as follows:

Type I - Mechanical

1.2.2 Groups. The groups of speedometers, tachometers, flexible shaft assemblies, cores, and adapters are as follows:

Group A - Speedometer, 0-60 miles per hour (mph), fixed mounting

Group B - Tachometer, fixed mounting

Group E - Speedometer, 0-100 kilometers per hour (k/hr), fixed mounting

Group F - Flexible shaft assemblies, flexible shaft assembly cores, and adapters

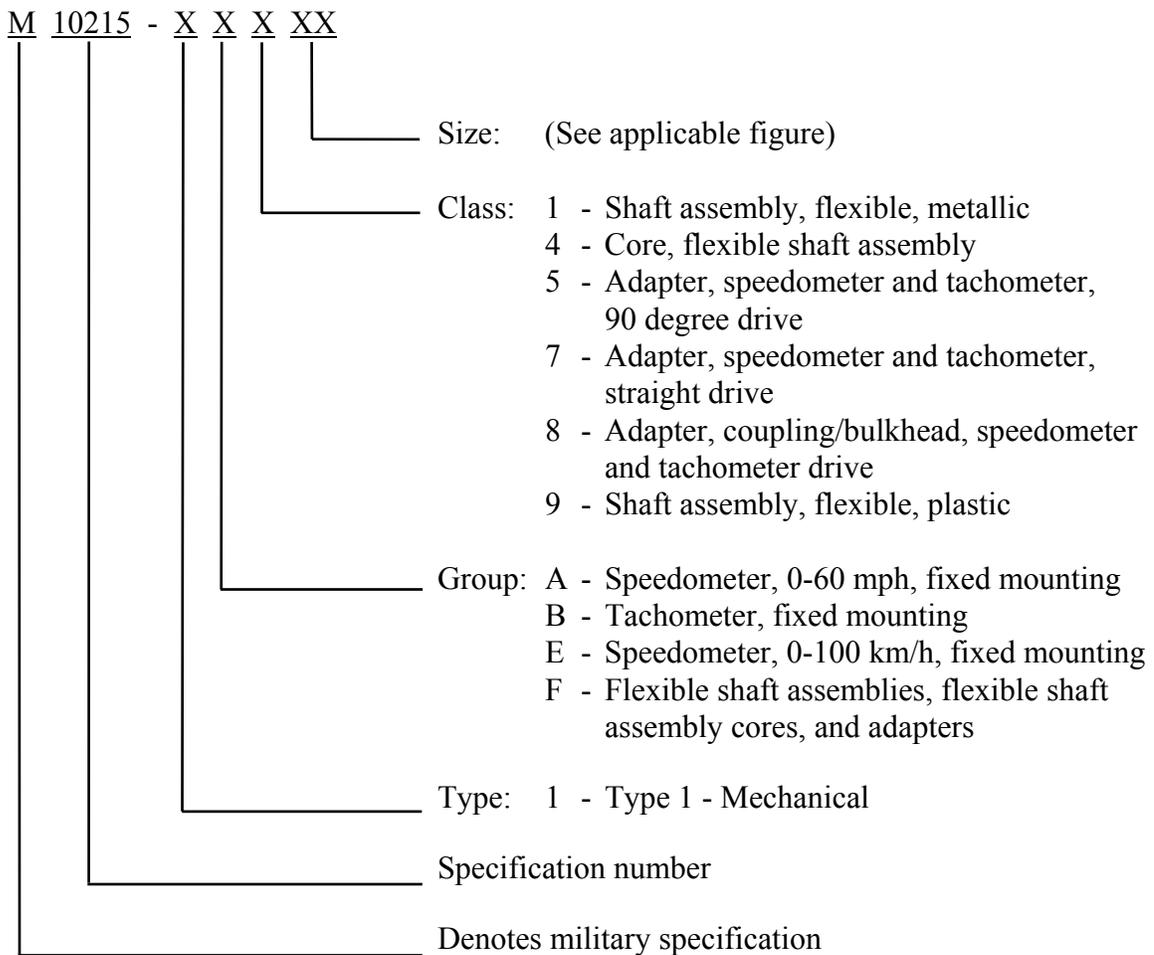
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1.2.3 Classes. The classes of shaft assemblies (flexible, metallic, or plastic), cores, and adapters are as follows:

- Class 1 - Shaft assembly, flexible, metallic
- Class 4 - Core, flexible shaft assembly
- Class 5 - Adapter, speedometer, and tachometer, 90 degree drive
- Class 7 - Adapter, speedometer, and tachometer, straight drive
- Class 8 - Adapter, coupling/bulkhead, speedometer and tachometer drive
- Class 9 - Shaft assembly, flexible, plastic

1.3 Part or identifying number (PIN). The PIN to be used for instruments acquired to this specification is created as follows:



2. APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3 and 4 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of the documents cited in sections 3 and 4 of this specification, whether or not they are listed.

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2.2 Government documents.

2.2.1 Specifications and standards. The following specifications and standards form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract (see 6.2).

FEDERAL SPECIFICATIONS

L-P-380 - Plastic Molding Material Methacrylate.

FEDERAL STANDARDS

FED-STD-595 - Colors Used in Government Procurement.

DEPARTMENT OF DEFENSE SPECIFICATIONS

MIL-W-80 - Window, Observation, Acrylic Base, Antielectrostatic, Transparent (for Indicating Instrument).
DOD-P-15328 - Primer (Wash), Pretreatment (Formula No. 117 for Metals) (Metric).
MIL-PRF-22750 - Coating, Epoxy, High-Solids.
MIL-C-46168 - Coating, Aliphatic Polyurethane, Chemical Agent Resistant.

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-130 - Identification Marking of U.S. Military Property.
MIL-STD-202 - Test Method Standard - Electronic and Electrical Component Parts.

(Copies of these documents are available online at <http://assist.daps.dla.mil/quicksearch/> or www.dodssp.daps.mil or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2.2 Other government documents, drawings, and publications. The following other government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation or contract (see 6.2).

DRAWINGS

ARMY

12369000 - Chemical Agent Resistant Coatings (CARC) Paint Systems Index.

(Copies of the drawing are available from US Army Tank-Automotive & Armaments Command, Attn: AMSTA-TR-E/ESA, 6501 East 11 Mile Road, Warren, MI 48397-5000.)

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2.3 Non-government publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract (see 6.2).

ASTM INTERNATIONAL

- ASTM A 380 - Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems (DoD adopted).
- ASTM B 117 - Standard Practice for Operating Salt Spray (Fog) Apparatus (DoD adopted).
- ASTM D 3935 - Standard Specification for Polycarbonate (PC) Unfilled and Reinforced Material (DoD adopted).
- ASTM G 21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi (DoD adopted).

(Copies of these documents are available online at <http://www.astm.org/> or from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.)

2.4 Order of precedence. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Qualification. Components furnished under this specification shall be products that are authorized by the qualifying activity for listing on the applicable qualified products list (QPL) before contract award (see 4.3 and 6.3).

3.2 Materials. Unless otherwise specified herein, materialS shall be in accordance with the manufacturer's standard practice.

3.2.1 Dial. The dial shall be fabricated from metal.

3.2.2 Case window. The case window shall be fabricated from clear plastic conforming to MIL-W-80 or, if molded, conforming to type I, class 3 of L-P-380 or group 1, class 1 of ASTM D 3935.

3.2.3 Recycled, recovered, or environmentally preferable materials. Recycled, recovered, or environmentally preferable materials should be used to the maximum extent possible provided that the material meets or exceeds the operational and maintenance requirements and promotes economically advantageous life cycle costs.

3.3 Design and construction. The design and construction of the instruments and components shall be in accordance with the interface and envelope dimensions in figures 1 through 10, however, the figures are not intended to limit the manufacturer's design.

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3.3.1 Speedometer and tachometer.

3.3.1.1 Mounting and connector. The instruments shall be provided with a bezel, a means for mounting, and a connector for attachment of a flexible drive shaft assembly.

3.3.1.2 Case.

3.3.1.2.1 Case window. A case window shall be provided to facilitate illumination of the dial from an outside source.

3.3.1.2.2 Dehumidifier. Means shall be provided to dehumidify trapped air after the speedometer or tachometer is sealed. The dehumidification component shall be secured so that it will not become loose when the speedometer or tachometer is subjected to vibration.

3.3.1.3 Dial.

3.3.1.3.1 Marking. The face of the dial shall include the markings specified in figures 8 through 10. The printing shall be commercial style lettering of the size specified in table I. The dial face shall have a black background with numerals, letters, and graduations conforming to color number 37875 of FED-STD-595.

TABLE I. Dial face marking.

Marking	Height (inches)	Height (mm)
Numerals for mph scale	7/32	5.6
Numerals for k/hr scale	5/32	4.0
Graduations, major, mph scale	7/32	5.6
Graduations, major, k/hr scale	1/8	3.2
Graduations, minor, mph scale	1/8	3.2
"Miles per hour" or "MPH"	1/8	3.2
"Kilometers per hour" or "KM/H"	5/32	4.0
"Revolutions per minute" or "RPM"	1/8	3.2
"Hours" and "10th" or "100th"	3/32	2.4
"Miles" and "10th"	3/32	2.4
MS or military part number	3/32	2.4
Manufacturer's identification	1/16 (max.)	1.6

3.3.1.3.2 Fastening. The dial shall be secured to the body of the speedometer or tachometer in such a position that the marking on the face of the dial and the numerals on the odometer or engine hour meter shall be legible when illuminated through the case window from an outside source.

3.3.1.4 Pointer. The pointer shall be attached to the indicator movement and shall be damped to reduce oscillation from vibration. The pointer shall not touch the dial or window. The shape of the pointer shall facilitate reading of any point in the range of the dial. Not less than the top half of the visible portion of the pointer shall be white conforming to color number 37875 of FED-STD-595.

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3.3.1.4.1 Damping. The pointer shall be damped to prevent an oscillation of more than ± 0.5 mph above 10 mph or ± 1 km/h above 15 km/h on the speedometer dial, or ± 30 revolutions per minute (rpm) above 500 rpm on the tachometer dial when the speedometer or tachometer is operated directly off a drive shaft, with no fluctuation in speed.

3.3.1.5 Recording devices.

3.3.1.5.1 Odometer. The instrument, when furnished for use with a speedometer, shall be of the nonreset-type odometer, consisting of six numeral wheels located in the dial as shown in figure 8 or 9. The odometer shall register actual mileage within ± 1 percent. The odometer shall totalize and record up to 99,999.9 in multiples of 0.1 mile or 0.1 kilometer before automatically turning to zero.

3.3.1.5.2 Engine hour meter. The engine hour meter shall accurately record hours of engine operation within ± 2 percent. The engine hour meter shall totalize and record up to 9,999.9 hours in multiples of 0.1 hour or up to 9,999.99 hours in multiples of 0.01 hour before automatically turning to zero.

3.3.2 Drive mechanism. A flexible shaft assembly shall drive mechanical speedometers and tachometers, with adapters as required.

3.3.2.1 Flexible shaft assembly. The flexible shaft assembly shall consist of a flexible outer casing and a flexible inner core. The outer casing shall be equipped with reusable means for attaching the assembly to both the instrument and the take-off point. The configuration shall fall within the envelope limits indicated in figures 1, 2, or 3, as applicable. End connections affecting interchangeability shall conform to the interface requirements in figures 1, 2, and 3. A means shall be provided in the assembly to prevent the core from falling out.

3.3.2.1.1 Flexible shaft assembly, oscillation. When the flexible shaft assembly is tested as specified in 4.6.3.2.1, pointer oscillation shall not exceed 1 mph at speeds above 10 mph (2 km/h at speeds above 16 km/h) on the speedometer dial and shall not exceed 50 rpm on the tachometer dial at rotating speeds above 500 rpm.

3.3.2.1.2 Core. The flexible shaft assembly core shall conform to figure 4. The outer layer of core wires shall be wound in the direction of right hand lay.

3.3.2.2 Adapters. Adapters shall conform to figures 5, 6, or 7, as applicable.

3.4 Performance.

3.4.1 Calibration. When tested as specified in 4.5.2.1, calibration of the instruments shall be such as to meet the following performance requirements.

3.4.1.1 Speedometers (mechanical). When tested as specified in 4.5.2.1.1, the speedometer pointer shall accurately indicate the vehicle speed specified in table II within the specified calibration limits when the drive shaft is driven at the specified speeds after the speedometer temperature has been stabilized at ambient air temperatures of $77^{\circ}\text{F} \pm 15^{\circ}\text{F}$ ($25^{\circ}\text{C} \pm 8^{\circ}\text{C}$), and $160^{\circ}\text{F} \pm 5^{\circ}\text{F}$ ($71^{\circ}\text{C} \pm 3^{\circ}\text{C}$). An additional 3 mph (5.0 km/h) tolerance above or below the

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recorded speed at 77 °F (25 °C) shall be allowed when the speedometer is tested at 160 °F (71 °C). The pointer shall leave the stop at or before the moment when the drive shaft is being driven at a speed for which the correct indicated speed is 3 mph (5 km/h).

TABLE II. Mechanical speedometer calibration limits.

Drive shaft speed (rpm)	Correct indicated speed		Calibration limits at 77 °F ± 15 °F (25 °C ± 8 °C)
	mph	km/h	
167	10	16	+1 to -1
500	30	48	+2 to -1
1,000	60	96	+3 to -0

3.4.1.2 Odometer (performance). When tested as specified in 4.5.2.1.2, the odometer shall register within a tolerance of plus 1 percent.

3.4.1.3 Tachometers (mechanical). When tested as specified in 4.5.2.1.3, the tachometer pointer shall accurately indicate a rotating speed on the dial twice that of the drive shaft within a tolerance of ±60 rpm. The drive shaft shall be rotated at 250, 1,000, and 1,500 rpm. The test shall be conducted with the tachometer temperature stabilized at ambient air temperatures of 77 °F ± 15 °F (25 °C ± 8 °C), and 160 °F ± 5 °F (71 °C ± 3 °C). When tested at 160 °F, an additional tolerance is required. These calibration tolerances are determined by multiplying the initial reading by 5 percent and adding and subtracting it to/from the initial tolerance upper and lower limits. The pointer shall leave the stop at or before the moment when the drive shaft is being driven at a speed for which the correct indicated speed is 100 rpm.

3.4.1.4 Engine hour meter (performance). When tested as specified in 4.5.2.1.4, the total limit of engine operation during each phase of testing shall be recorded in hours by the engine hour meter on the tachometer within ±2 percent.

3.4.1.5 Flexible shaft and core assemblies (performance). When tested as specified in 4.5.2.1.5, the flexible shaft and core assemblies shall not exceed ±2 mph (±3 km/h) speedometer pointer oscillation.

3.4.2 Resistance to wear.

3.4.2.1 Speedometers and tachometers. After testing as specified in 4.6.3.1, the speedometers and tachometers shall meet the previously recorded readings obtained under 3.4.1 within ±3 percent.

3.4.2.2 Flexible shaft assembly. When tested as specified in 4.6.3.2, the flexible shaft assembly shall withstand operation for 500 hours without failure.

3.4.2.3 Adapters. When tested as specified in 4.6.3.2.2, adapters shall withstand operation for 500 hours without failure.

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3.4.3 Flexible shaft assembly and adapters (operating torque).

3.4.3.1 Flexible shaft assembly. When tested as specified in 4.6.4.1 at an ambient air temperature of $-65\text{ }^{\circ}\text{F} \pm 5\text{ }^{\circ}\text{F}$ ($-54\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$), the torque required to rotate the flexible drive shaft core (see 4.2.2) while starting and uniformly accelerating from 0 to 1,000 rpm in 15 seconds shall at no time exceed 80 ounce-force inches (ozf inches) (0.56 Newton meter (Nm)).

3.4.3.2 Flexibility (flexible shaft assembly, non-metallic). When tested as specified in 4.6.4.2, the casing of the flexible shaft assembly shall be able to bend 180 degrees in a 10-inch diameter with no greater than 8 pounds (lbs.) (3.6 kilograms (kg)) of force.

3.4.3.3 Adapters. When tested as specified in 4.6.4.3 at an ambient air temperature of $-65\text{ }^{\circ}\text{F} \pm 5\text{ }^{\circ}\text{F}$ ($-54\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$), the torque required to rotate adapters of each class while uniformly accelerating from 0 to 1,000 rpm in 15 seconds shall at no time exceed 80 ozf inches (0.56 Nm).

3.4.3.4 Torsional strength (flexible shaft assembly). When tested as specified in 4.6.4.4, the flexible shaft assembly core shall have a torsional breaking strength of not less than 15 pound-force inches (lbf inches) (1.7 Nm).

3.4.3.4.1 Pull strength, end fittings. When tested as specified in 4.6.4.4, end fittings attached to the core shall withstand an applied load of 50 lbs. (22.7 kg).

3.5 Environmental.

3.5.1 Lubrication leakage (lubricated flexible shaft assembly only). The flexible drive shaft assembly shall withstand the test specified in 4.6.5.1 and show no evidence of lubricant leakage. Subsequent to the test, the drive shaft assembly shall meet the requirements of 3.4.3.1.

3.5.2 Vibration resistance. When tested in accordance with 4.6.5.2, the speedometers and tachometers shall withstand vibration for one hour in each direction of the three major axes without evidence of disintegration of component materials or assemblies. At the conclusion of the test, the components shall meet the previously recorded reading obtained under 3.4.1 within ± 3 percent.

3.5.3 Shock resistance. When tested in accordance with 4.6.5.3, the speedometers and tachometers shall show no evidence of pointer sticking, no delay of functioning, and no disintegration of component materials or assemblies. At the conclusion of the test, the components shall meet the previously recorded reading obtained under 3.4.1 within ± 3 percent.

3.5.4 Waterproofness, speedometers, tachometers, flexible shaft assemblies and adapters. When tested in accordance with the requirements in 4.6.5.4.2 through 4.6.5.4.4, the speedometers, tachometers, flexible shaft assemblies, and adapters shall show no evidence of leakage. The saline solution content shall be in accordance with 4.6.5.4.1.

3.5.5 Corrosion resistance. When tested in accordance with 4.6.5.5, the speedometers, tachometers, flexible shaft assemblies, and adapters shall show no evidence of corrosion affecting operation and shall meet the requirements of 3.4.1.

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3.5.6 Fungus resistance. When tested as specified in 4.6.5.6, the speedometers, tachometers, flexible shaft assemblies, and adapters shall show no evidence of fungus growth affecting operation and shall subsequently meet the applicable requirements of 3.4.1.

3.5.7 Ozone resistance. When tested as specified in 4.6.5.7, the flexible shaft assembly shall show no evidence of cracking, rupture, or other deterioration.

3.6 Painting. Unless otherwise specified (see 6.2), cleaning, pretreatment, priming, and painting shall conform to the appropriate CARC paint system selected from U.S. Army drawing number 12369000. When instrument bezels made of stainless steel are used, they shall be passivated in accordance with ASTM A 380, primer washed in accordance with DOD-P-15328, and finish painted in accordance with MIL-C-46168, color Green 383, to a dry film thickness of 1.8 to 3.2 mils. When mechanical speedometers and tachometers (figures 8, 9, and 10) are used in the interior of a vehicle or system, they shall be finish painted with an epoxy topcoat in accordance with MIL-PRF-22750, colors Green 34094 or 34095, to a dry film thickness of 1.3 to 1.7 mils.

3.7 Identification and marking. Unless otherwise specified (see 6.2), identification and marking of the items shall be in accordance with MIL-STD-130. As a minimum, it shall consist of the manufacturer's CAGE code and the applicable military part number. All markings shall be permanently and legibly printed or stamped on the dial of the speedometers and tachometers, on the casings of the flexible shaft assemblies, and on the housing of the adapters. The drive ratio and date of manufacture shall be marked on the housing of all adapters. The flexible shaft assembly cores shall be tagged.

3.8 Workmanship. Components shall be free of defects such as rust, burrs, and sharp edges that may result in injury of personnel (see 4.5.1). All solder cleaning agents and flux shall be non-corrosive. All trace of flux shall be chemically neutralized and removed from soldering.

4. VERIFICATION

4.1 Classification of inspections. The inspection requirements specified herein are classified as follows:

- a. Qualification inspection (see 4.3).
- b. Conformance inspection (see 4.4).

4.2 Inspection conditions. Unless otherwise specified (see 6.2), all inspections shall be conducted under the following conditions.

4.2.1 Conditions. Tests shall be conducted under general laboratory conditions acceptable to the Federal Government. Unless otherwise specified herein, all tests shall be conducted at ambient room temperature. The ambient room temperature shall be maintained at $77\text{ }^{\circ}\text{F} \pm 15\text{ }^{\circ}\text{F}$ ($25\text{ }^{\circ}\text{C} \pm 8\text{ }^{\circ}\text{C}$). Unless otherwise specified herein, the test specimen shall be thermally stabilized for one hour prior to being subjected to tests.

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4.2.2 Standard specimens. Unless otherwise specified (see 6.2), and excepting acceptance tests, the shaft assembly shall conform to size no. -5 of figure 1 or size no. -5 of figure 2.

4.2.3 Apparatus. In addition to the standard measuring equipment, the test apparatus shall include a temperature controlled air chamber, a submersion tank, and a test stand with suitable drives for rotating the drive shaft at controlled speeds.

4.3 Qualification inspection. Qualification inspection (see 3.1) shall include examination of the product (see 4.5.1) and the applicable tests of table III.

TABLE III. Classification of inspections.

Title	Requirement	Inspection	Qualification	Conformance
Performance and calibration:	3.4, 3.4.1	4.5.2, 4.5.2.1		
Speedometers	3.4.1.1	4.5.2.1.1	X	
Odometer	3.4.1.2	4.5.2.1.2	X	
Tachometers	3.4.1.3	4.5.2.1.3	X	
Engine hour meter	3.4.1.4	4.5.2.1.4	X	
Flexible shaft and core assemblies	3.4.1.5	4.5.2.1.5	X	
Resistance to wear:	3.4.2	4.6.3		
Speedometer and tachometer	3.4.2.1	4.6.3.1	X	
Flexible shaft assembly	3.4.2.2	4.6.3.2	X	
Flexible shaft assembly, oscillation	3.3.2.1.1	4.6.3.2.1	X	
Adapters	3.4.2.3	4.6.3.2.2	X	
Operating Torque:	3.4.3	4.6.4		
Flexible shaft assemblies	3.4.3.1	4.6.4.1	X	
Flexibility (non-metallic only)	3.4.3.2	4.6.4.2	X	
Adapters	3.4.3.3	4.6.4.3	X	X
Torsional strength	3.4.3.4	4.6.4.4	X	
Pull strength	3.4.3.4.1	4.6.4.4	X	X
Environmental:	3.5	4.6.5		
Lubrication leakage	3.5.1	4.6.5.1	X	
Vibration resistance	3.5.2	4.6.5.2	X	
Shock resistance	3.5.3	4.6.5.3	X	
Waterproofness:	3.5.4	4.6.5.4		
Speedometers, tachometers Flexible shaft assembly, and adapters	3.5.4.1	4.6.5.4.2, 4.6.5.4.2.1 4.6.5.4.3, 4.6.5.4.4	X X	X X
Corrosion resistance:	3.5.5	4.6.5.5		
Speedometers, tachometers, flexible shaft assembly, and adapters		4.6.5.5.1	X	
Fungus resistance:	3.5.6	4.6.5.6		
Speedometers, tachometers, flexible shaft assembly, and adapters		4.6.5.6.1	X	
Ozone resistance:	3.5.7	4.6.5.7		
Flexible shaft assembly		4.6.5.7.1	X	

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4.3.1 Qualification sample. Qualification sampling shall be in accordance with table IV.

TABLE IV. Qualification sample and sample size.

Sample item	Sample size
Type I, group A and E mechanical speedometers	3
Type I, group B mechanical tachometer	3
Type I, class 1 or class 9 shaft assembly, flexible, mechanical speedometer and tachometer	4
Type I, class 5 adapter, mechanical speedometer and tachometer, 90 degree drive	4
Type I, class 7 adapter, mechanical speedometer and tachometer, straight drive	4
Type I, class 8 adapter, coupling/bulkhead, mechanical speedometer and tachometer drive	4

4.3.2 Qualification test sequence. The qualification sample selected from table IV shall be tested in accordance with the sequence specified in tables V-A through V-C for the applicable component.

TABLE V-A. Qualification test sequence for speedometers and tachometers.

Specimen	Paragraph	Test
A	4.6.3.1 and table IX	Resistance to wear
	4.6.5.4.2, 4.6.5.4.2.1, 4.6.5.4.4	Waterproofness
	4.5.2.1.1	¹
B	4.5.2.1.1	¹
	4.6.5.3	Shock resistance
	4.6.5.6	Fungus resistance
C	4.5.2.1.1	¹
	4.6.5.2	Vibration resistance
	4.6.5.5	Corrosion resistance

¹Test at ambient temperature ((77 °F ± 15 °F) (25 °C ± 8 °C)).

TABLE V-B. Qualification test sequence for flexible shaft assemblies.

Specimen	Paragraph	Test
A	4.6.5.4.3, 4.6.5.4.4	Waterproofness
	4.6.3.2	Resistance to wear
	4.6.5.5	Corrosion resistance
B	4.6.5.1	Lubrication leakage
	4.6.4.1	Operating torque
C	4.6.4.2	Flexibility (non-metallic)
	4.6.3.2.1	Oscillation
	4.6.5.6	Fungus resistance
D	4.6.4.4	Torsional strength
	4.6.5.7	Ozone resistance

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TABLE V-C. Qualification test sequence for adapters.

Specimen	Paragraph	Test
A	4.6.3.2.2	Resistance to wear
	4.6.5.4.3, 4.6.5.4.4	Waterproofness
B	4.6.5.5	Corrosion resistance
C	4.6.5.6	Fungus resistance
D	4.6.4.3	Operating torque

4.3.4 Maintenance of qualification. To maintain qualification status, the manufacturer shall contact the qualifying activity at two-year intervals. The qualifying activity will establish the initial contact date and request the appropriate documentation from the manufacturer to demonstrate that the capability to produce the items is still available. Failure to contact the qualifying activity within 30 days after the end of each two-year period may result in the loss of qualification.

4.4 Conformance inspections. Conformance inspection shall include the examination of the product (see 4.5.1) and the applicable tests of table III.

4.4.1 Sampling plan. Unless otherwise specified (see 6.2), the sampling plan for conformance inspection examination and tests shall be random selection from the inspection lot in accordance with table VI.

TABLE VI. Sampling plan for conformance inspection.

Inspection lot size	Sample size examination		
	Major	Minor	Test
2 to 8	*	5	5
9 to 15	13	5	5
16 to 25	13	5	5
26 to 50	13	5	5
51 to 90	13	7	7
91 to 150	13	11	11
151 to 280	20	13	13
281 to 500	29	16	16
501 to 1,200	34	19	19
1,201 to 3,200	42	23	23
3,201 to 10,000	50	29	29
10,001 to 35,000	60	35	35
35,001 to 150,000	74	40	40
150,001 to 500,000	90	40	40
500,001 and over	102	40	40

*Indicates entire lot must be inspected (100 percent inspection).

4.4.1.1 Lot formation. An inspection lot shall consist of all speedometers, tachometers, and flexible shaft assemblies of a single type, group, class, and part identification number (PIN), from an identifiable production period, from one manufacturing location submitted at the same time for acceptance.

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4.5 Methods of inspection.

4.5.1 Examination of product. Instruments and components shall be examined for the defects listed in table VII. Examination shall be visual, tactile, or by measurement with standard inspection equipment.

TABLE VII. Classification of defects.

Defect	Method of examination	Category	
		Major	Minor
Design, materials and construction affecting interchangeability (see 3.3)	Standard inspection equipment and functional	101	
Design, material and construction not affecting interchangeability (see 3.3)	Standard inspection equipment and functional		201
Painting not as specified (see 3.6)	Visual		202
Identification and marking not as specified (see 3.7)	Visual		203
Workmanship (see 3.8)	Visual		204

4.5.2 Performance.4.5.2.1 Calibration.

4.5.2.1.1 Mechanical speedometers. To determine conformance to 3.4.1.1, the speedometers and tachometers shall be mounted in an air chamber with the dial face tilted 10 degrees backward from the vertical while connected to a flexible shaft assembly. The air chamber shall be maintained at each of the following temperatures for 4 hours: 77 °F ± 15 °F (25 °C ± 8 °C) and 160 °F ± 5 °F (71 °C ± 3 °C). After each 4-hour period and while still maintaining the temperature, the drive shaft shall be rotated at 167 rpm, 500 rpm, and 1,000 rpm.

4.5.2.1.2 Odometer. To determine conformance to 3.4.1.2, rotation of the drive shaft shall be continued for 6 hours at a speed of 1,000 rpm in an ambient air temperature of 77 °F ± 15 °F (25 °C ± 8 °C) at the conclusion of the test specified in 4.5.2.1.1. The odometer-indicated mileage or kilometers for the 6-hour period shall be compared with the correct mileage or kilometers.

4.5.2.1.3 Tachometers. To determine conformance to 3.4.1.3, tachometers shall be tested as specified in 4.5.2.1.1, except that the drive shaft shall be rotated at 250 rpm, 1,000 rpm, and 1,500 rpm.

4.5.2.1.4 Engine hour meter. To determine conformance to 3.4.1.4, the drive shaft shall be rotated at one of the optional speeds and for the time length specified in table VIII at the conclusion of the test specified in 4.5.2.1.3. During and after the test, the engine hour meter reading shall be observed.

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TABLE VIII. Tachometer hour meter optional test speeds.

Tachometer type	rpm	Time
I	1,000	6 hours, 9.6 minutes
I	1,026	6 hours

4.5.2.1.5 Flexible shaft and core assemblies. To determine conformance to 3.4.1.5, the flexible shaft and core assemblies shall be connected to a previously calibrated speedometer and shall be rotated to indicate 35 mph (56 km/h) for a period of 10 minutes. The speedometer shall be observed for any deviations from the requirements of 3.4.1.5.

4.6.3 Resistance to wear.

4.6.3.1 Speedometers and tachometers. To determine conformance to 3.4.2.1, the speedometers and tachometers shall be operated for 1,000 hours at the speeds and temperatures specified in table IX. At the conclusion of the 1,000-hour test period, the speedometers and tachometers shall be subjected to the applicable calibration test specified in 4.5.2.1 at $77\text{ }^{\circ}\text{F} \pm 15\text{ }^{\circ}\text{F}$ ($25\text{ }^{\circ}\text{C} \pm 8\text{ }^{\circ}\text{C}$).

TABLE IX. Speedometer and tachometer wear test.

Hours	Temperature	Speed
750	$77\text{ }^{\circ}\text{F} \pm 15\text{ }^{\circ}\text{F}$ ($25\text{ }^{\circ}\text{C} \pm 8\text{ }^{\circ}\text{C}$)	Equal indicating period for 1/3, 2/3, and full scale reading
250	$160\text{ }^{\circ}\text{F} \pm 5\text{ }^{\circ}\text{F}$ ($71\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$)	(Same as above)

4.6.3.2 Flexible shaft assembly. To determine conformance to 3.4.2.2, a flexible shaft assembly 10 feet (3.05 meters (m)) long shall be mounted in a test fixture in such a manner that the shaft is confined in a S-shape having two bends of 180 degrees in the same plane, with each bend having a 5-inch (12.7-centimeter (cm)) radius. With a constant load of 22 ± 2 ozf inches, (0.16 ± 0.01 Nm) at the speedometer and tachometer end of the shaft core, the core shall be operated at the speeds, temperatures, and times specified in table X.

TABLE X. Flexible shaft assembly and adapter wear test.

Hours	Temperature	Speed (rpm)
100	$77\text{ }^{\circ}\text{F} \pm 15\text{ }^{\circ}\text{F}$ ($25\text{ }^{\circ}\text{C} \pm 8\text{ }^{\circ}\text{C}$)	750
100	$77\text{ }^{\circ}\text{F} \pm 15\text{ }^{\circ}\text{F}$ ($25\text{ }^{\circ}\text{C} \pm 8\text{ }^{\circ}\text{C}$)	1,250
200	$77\text{ }^{\circ}\text{F} \pm 15\text{ }^{\circ}\text{F}$ ($25\text{ }^{\circ}\text{C} \pm 8\text{ }^{\circ}\text{C}$)	2,000
25	$160\text{ }^{\circ}\text{F} \pm 5\text{ }^{\circ}\text{F}$ ($71\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$)	750
25	$160\text{ }^{\circ}\text{F} \pm 5\text{ }^{\circ}\text{F}$ ($71\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$)	1,250
50	$160\text{ }^{\circ}\text{F} \pm 5\text{ }^{\circ}\text{F}$ ($71\text{ }^{\circ}\text{C} \pm 3\text{ }^{\circ}\text{C}$)	2,000

4.6.3.2.1 Flexible shaft assembly, oscillation. To determine conformance to 3.3.2.1.1, a flexible shaft assembly 10 feet (3.05 m) long shall be connected to a previously calibrated speedometer and shall be rotated at indicated speedometer speeds from 10 to 60 mph at 10 mph intervals or 20 to 100 km/h at 20 km/h intervals. Running time at each speed shall then be

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repeated with a previously calibrated tachometer. The indicated tachometer rpm shall be between 500 and 4,000 at 500 rpm intervals with a running time of 10 minutes at each rotating speed.

4.6.3.2.2 Adapter. To determine conformance to 3.4.2.3, the adapter shall be mounted in a fixture with a constant load of 22 ± 2 ozf inches (0.16 ± 0.01 Nm) and operated at the speeds, temperatures, and times specified in table X.

4.6.4 Operating torque.

4.6.4.1 Flexible shaft assemblies. To determine conformance to 3.4.3.1, the flexible shaft assembly (see 4.2.2) shall be placed in a test fixture with the test sample temperature and air temperature maintained constant at $-65 \text{ }^\circ\text{F} \pm 5 \text{ }^\circ\text{F}$ ($-54 \text{ }^\circ\text{C} \pm 3 \text{ }^\circ\text{C}$) for 7 hours. At the conclusion of the 7-hour period and while still at the above specified temperature, the core shall be rotated without load. The torque required to rotate the core in starting and accelerating shall be measured.

4.6.4.2 Flexibility (non-metallic only). To determine conformance to 3.4.3.2, a section of flexible shaft assembly approximately 17 inches (43 cm) from one end shall be bent 180 degrees around a 10-inch (25.4-cm) diameter mandrel in an ambient air temperature of $77 \text{ }^\circ\text{F} \pm 15 \text{ }^\circ\text{F}$ ($25 \text{ }^\circ\text{C} \pm 8 \text{ }^\circ\text{C}$). A spring scale or other suitable measuring device shall be used at the fitting end to record the maximum pull required.

4.6.4.3 Adapters. To determine conformance to 3.4.3.3, the adapter shall be placed in a test fixture with the test sample temperature and air temperature maintained constant at $-65 \text{ }^\circ\text{F} \pm 5 \text{ }^\circ\text{F}$ ($-54 \text{ }^\circ\text{C} \pm 3 \text{ }^\circ\text{C}$) for 7 hours. At the conclusion of the 7-hour period and while still held at the above specified temperature, the core shall be rotated without load. The torque required to rotate the core in starting and accelerating shall be measured.

4.6.4.4 Torsional strength (flexible shaft assembly). To determine compliance to 3.4.3.4, the flexible shaft assembly core shall be placed in a torsion-testing machine in a straight position without slack so that 10 inches (25.4 cm) of the speedometer and tachometer end of the core will be subjected to torsion. The core shall be twisted in a clockwise direction. The test shall be repeated with the drive end of the core in the machine. The core end fittings shall then be subjected to a pull test with the fittings anchored and the load applied to the core to determine conformance to 3.4.3.4.1.

4.6.5 Environmental.

4.6.5.1 Lubrication leakage (lubricated flexible shaft assembly only). To determine conformance to 3.5.1, the flexible shaft assembly shall be carefully sealed at both ends and placed in a temperature controlled air chamber at a constant temperature of $250 \text{ }^\circ\text{F} \pm 5 \text{ }^\circ\text{F}$ ($121 \text{ }^\circ\text{C} \pm 3 \text{ }^\circ\text{C}$) for 2 hours. At the conclusion of the 2-hour period, the assembly shall be removed from the oven and suspended from the transmission end in a vertical position. The flexible shaft assembly shall be observed for evidence of leakage of lubricant. Subsequently, the flexible shaft assembly shall be subjected to the test specified in 4.6.4.1 to determine conformance to 3.4.3.1.

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4.6.5.2 Vibration resistance. To determine conformance to 3.5.2, the speedometer and tachometer shall be mounted as if in operation and subjected to the vibration test as specified in MIL-STD-202, method 201, except that motion shall be applied for 1 hour in each direction of the three major axes. During vibration, the speedometer and tachometer shall be operated in such a manner that the speedometer and tachometer pointer shall be at midscale, and observation shall be made for oscillation. At the conclusion of the test, the speedometer and tachometer shall be subjected to the applicable performance tests specified in 4.5.2.1 at $77\text{ }^{\circ}\text{F} \pm 15\text{ }^{\circ}\text{F}$ ($25\text{ }^{\circ}\text{C} \pm 8\text{ }^{\circ}\text{C}$).

4.6.5.3 Shock resistance. To determine conformance to 3.5.3, the speedometer and tachometer shall be mounted as if in operation and subjected to the shock (specified pulse) test as specified in MIL-STD-202, method 213, test condition I (using the sawtooth waveform). The test shall be repeated 10 times and applied in the vertical axis. During shock, the speedometer and tachometer shall be operated in such a manner that the speedometer and tachometer pointer shall be at midscale, and observation shall be made for oscillation. At the conclusion of the test, the speedometer and tachometer shall be subjected to the applicable performance tests specified in 4.5.2.1 at $77\text{ }^{\circ}\text{F} \pm 15\text{ }^{\circ}\text{F}$ ($25\text{ }^{\circ}\text{C} \pm 8\text{ }^{\circ}\text{C}$).

4.6.5.4 Waterproofness.

4.6.5.4.1 Saline solution. The salt used shall be sodium chloride containing on a dry basis not more than 0.1 percent of sodium iodide and not more than 0.2 percent of total impurities. The solution shall be prepared by dissolving 5 parts by weight of salt in 95 parts by weight of distilled water. The solution shall be kept free of sediment by filtration or decantation when used in the waterproofness tests specified in 3.5.4.

4.6.5.4.2 Vacuum test for speedometers and tachometers. To determine conformance to 3.5.4, the speedometers and tachometers shall be subjected to a vacuum test. The test chamber shall be evacuated to a pressure 6 pounds below atmospheric to create a minimum of 6 psi (0.42 kg/cm^2) of internal pressure to all voids within the component while totally immersed in the saline solution for 30 minutes during qualification testing and 5 minutes during conformance testing. The component shall be operated and carefully observed for air bubbles from the interior of the device during the specified time period. Bubbles that are the result of entrapped air on the various exterior surfaces of the device shall not be considered a leak. The speedometer and tachometer connectors shall be sealed with caps simulating the mating flexible cable connectors or as otherwise specified. The flexible shaft assemblies and adapters shall be sealed against leakage.

4.6.5.4.2.1 Pressure test for speedometers and tachometers. Following the first test in 4.6.5.4.2, the speedometers and tachometers shall be subjected to a pressure test. The test chamber shall then be pressurized to 6 pounds above atmospheric to create a minimum of 6 psi (0.42 kg/cm^2) of internal pressure to all voids within the component while totally immersed in the saline solution for 30 minutes during qualification testing and 5 minutes during conformance testing. The component shall be operated and carefully observed for air bubbles from the interior of the device during the specified time period. Bubbles that are the result of entrapped air on the various exterior surfaces of the device shall not be considered a leak. The speedometer and tachometer connectors shall be sealed with caps simulating the mating flexible cable connectors. Test results obtained shall be compared with the data from the vacuum test in 4.6.5.4.2.

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4.6.5.4.3 Internal pressure test for flexible shaft assemblies, and adapters. To determine conformance to 3.5.4, the flexible shaft assemblies and adapters shall be subjected to an internal pressure test of 6 psi (0.42 kg/cm²) while totally immersed in tap water for 30 minutes during qualification testing and 5 minutes during conformance testing. The component shall be operated and carefully observed for air bubbles from the interior of the device during the specified time period. Bubbles that are the result of entrapped air on the various exterior surfaces of the device shall not be considered a leak. The flexible shaft assemblies and adapters shall be sealed against leakage.

4.6.5.4.4 Speedometers, tachometers, flexible shaft assemblies, and adapters (post inspection). Following the application of the external and internal pressure tests, the components shall be disassembled and inspected for the presence of water. If water is present, the component shall be rejected. If the component is dry, it shall be reassembled and subjected to 15 hours of dry operation (three five-hour periods) at full rated output. Damage that would impair mechanical operation of the component shall be considered evidence of failure.

4.6.5.5 Corrosion resistance.

4.6.5.5.1 Speedometers, tachometers, flexible shaft and core assemblies, and adapters. To determine compliance to 3.5.5, the speedometers, tachometers, flexible shaft and core assemblies, and adapters shall be subjected to the corrosion resistance test specified in ASTM B 117 for 200 hours. At the conclusion of the 200-hour period, the speedometer and tachometer shall be subjected to the applicable test specified in 4.5.2.1. The speedometer and tachometer and both ends of the flexible shaft assemblies and adapters shall be sealed against leakage with connectors simulating the applicable mating parts or as otherwise specified.

4.6.5.6 Fungus resistance.

4.6.5.6.1 Speedometers, tachometers, flexible shaft and core assemblies, and adapters. To determine conformance to 3.5.6, the speedometers, tachometers, flexible shaft and core assemblies, and adapters shall be tested as specified in ASTM G 21. After the tests, the speedometers, tachometers, flexible shaft and core assemblies, and adapters shall be subjected to the applicable test specified in 4.5.2.1. The speedometer and tachometer and both ends of the flexible shaft assemblies and adapters shall be sealed against leakage with connectors simulating the applicable mating parts or as otherwise specified.

4.6.5.7 Ozone resistance.

4.6.5.7.1 Flexible shaft assembly. To determine conformance to 3.5.7, the flexible shaft assembly shall be conditioned at ambient room temperature for 45 minutes. The flexible shaft assembly shall then be placed in a test exposure chamber containing air mixed with ozone in the proportion of 50 ± 5 parts per 100 million parts of atmospheric air by volume for 168 hours at a temperature of $100 \text{ }^\circ\text{F} \pm 5 \text{ }^\circ\text{F}$ ($38 \text{ }^\circ\text{C} \pm 3 \text{ }^\circ\text{C}$). Immediately after the completion of the test period, each sample shall be examined for evidence of cracking using 7X magnification, with the specimen coiled in a 12-inch (30-cm) inside diameter loop.

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5. PACKAGING

5.1 Packaging. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain requisite packaging requirements. Packaging requirements are maintained by the inventory control point's packaging activity within the military department or defense agency, or within the military department's system command. Packaging data retrieval is available from the managing military department's or defense agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but is not mandatory.)

6.1 Intended use. The speedometers, tachometers, flexible shaft assemblies, flexible shaft assembly cores, and adapters covered by this specification are intended for use in indicating speed in miles per hour or kilometers per hour, or engine speed in revolutions per minute, and to record total distance in miles or kilometers traveled by the vehicle or total hours of operation of the engine.

6.1.1 Military unique. The speedometers, tachometers, and related parts covered by this specification are intended for use in military motor vehicles. These devices are subjected to severe conditions including vibration, shock, saltwater submersion, and temperature extremes.

6.2 Acquisition requirements. Acquisition documents should specify the following:

- a. Title, number, and date of this specification.
- b. Type (see 1.2.1), group (see 1.2.2), class (see 1.2.3), and quantity required.
- c. Specific issue of individual documents referenced (see 2.2.1, 2.2.2, and 2.3).
- d. Painting, if other than as specified (see 3.6).
- e. Identification and marking, if other than as specified (see 3.7).
- f. Inspection conditions, if other than specified (see 4.2).
- g. Standard specimens, if other than specified (see 4.2.2).
- h. Sampling plan, if other than specified (see 4.4.1).
- i. Packaging requirements (see 5.1).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in QPL-10215 whether or not such products have actually been 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 orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from Defense Supply Center Richmond, Attn: DSCR-VEB, 8000 Jefferson Davis Highway, Richmond, VA 23297-5616.

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6.4 Subject term (key word) listing.

distributor
 engine
 mechanical
 vehicle

6.5 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extent of the changes.

6.6 Supersession. This specification supersedes the documents listed in table XI.

Table XI. Supersession data.

Document	Date
MIL-PRF-10215J	16 January 2001
MIL-S-10215H	4 November 1992
MS35916D	11 July 1991
MS39021F	11 July 1991
MS39130D	14 November 1985
MS39132G	27 January 1988
MS51071H	12 August 1987
MS51072F	4 August 1987
MS52116A	19 January 1988
DS52140	28 September 1977
MS53099A	24 June 1970

6.7 Cross-reference data. Instruments and components conforming to this specification are interchangeable/substitutable with instruments and components conforming to the documents listed in table XII.

Table XII. Cross-reference data.

Document	Date	MIL-DTL-10215K
MIL-PRF-10215J	16 January 2001	N/A
MIL-S-10215H	4 November 1992	N/A
MS35916D	11 July 1991	Figure 10
MS39021F	11 July 1991	Figure 8
MS39130D	14 November 1985	Figure 5
MS39132G	27 January 1988	Figure 6
MS51071H	12 August 1987	Figure 1
MS51072F	4 August 1987	Figure 4
MS52116A	19 January 1988	Figures 2 and 3
DS52140	28 September 1977	Figure 9
MS53099A	24 June 1970	Figure 7

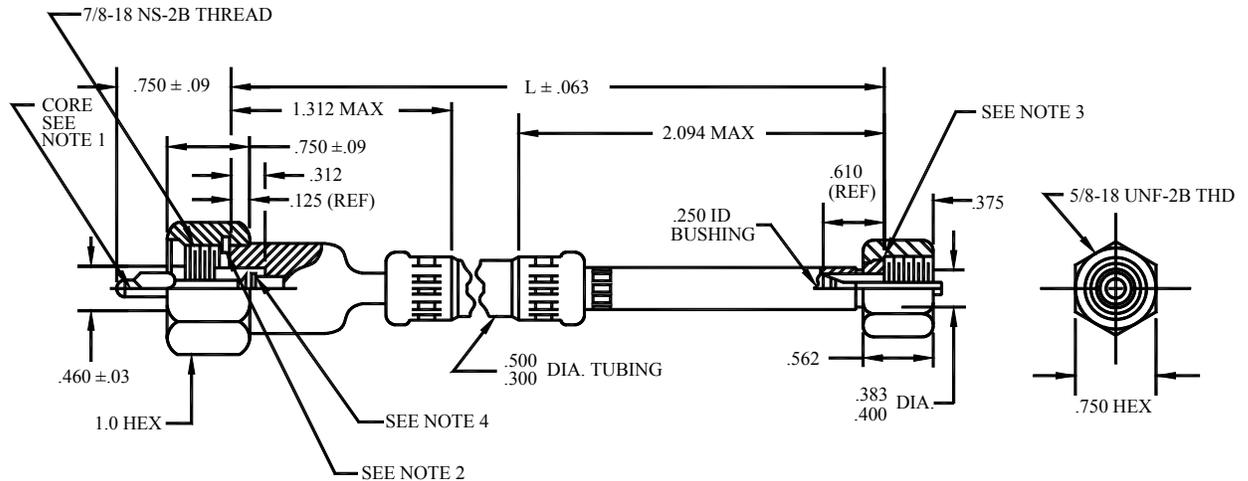
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6.8 Cross-reference classification data. Table XIII displays the revised classification data between MIL-PRF-10215J and MIL-DTL-10215K.

Table XIII. Cross-reference classification data.

MIL-PRF-10215J	MIL-DTL-10215K
Type I	Type I
Type II	Deleted
Group A	Group A - Speedometer (0-60 miles per hour), fixed mounting
Group B	Group B - Tachometer, fixed mounting
Group C	Deleted
Group D	Deleted
	Group E - Speedometer (0-100 k/hr), fixed mounting
	Group F - Flexible shaft assemblies, flexible shaft core assemblies and adapters
Class 1	Class 1
Class 2	Deleted
Class 3	Deleted
Class 4	Class 4
Class 5	Class 5
Class 7	Class 7
Class 8	Class 8
Class 9	Class 9

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Dimensions are in inches.

Unless otherwise specified, tolerances are $\pm 1/64$ for fractional values and ± 0.010 for decimal values.

Size no.	Former MS part no.	Former Army part no.	Shaft length
-01	MS 51071-1	8735736	17.5
-02	MS 51071-2	7976738	22.5
-03	MS 51071-3	7983060	40
-04	MS 51071-4	7527480	55
-05	MS 51071-5	7320561	62.5
-07	MS 51071-7	7064526	67.5
-08	MS 51071-8	7415912	72.5
-09	MS 51071-9	7096559	77.5
-10	MS 51071-10	7526039	85
-11	MS 51071-11	7412913	90
-12	MS 51071-12	7983059	95
-13	MS 51071-13	7527479	100
-14	MS 51071-14	7983213	107.5
-15	MS 51071-15	7983057	144
-16	MS 51071-16	7954735	156
-17	MS 51071-17	7987478	168
-18	MS 51071-18	8340482	216
-19	MS 51071-19	7344191	120
-20	MS 51071-20	8345795	138
-21	MS 51071-21	-----	13

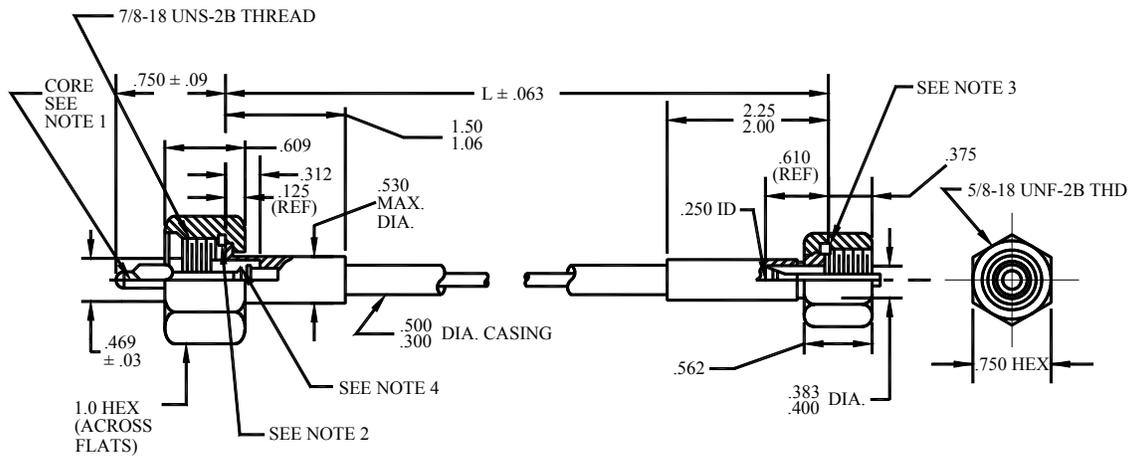
NOTES:

1. For core assembly details and associated core assemblies, see figure 4.
2. For gasket material and dimensions, see former Army part number 7539688.
3. For gasket material and dimensions, see former Army part number 7539689.
4. For washer material and dimensions, see former Army part number 5329467.
5. Tubing shall be metal covered with rubber or plastic to meet performance requirements of procurement specification.

FIGURE 1. Shaft assembly, flexible metallic, tachometer and speedometer.

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PREFERRED CONSTRUCTION
(See FIGURE 3 for optional construction)



Dimensions are in inches.

Unless otherwise specified, tolerances are $\pm 1/64$ for fractional values and ± 0.010 for decimal values.

Size no.	Former MS part no.	Shaft length
-01	MS 52116-1	17.5
-02	MS 52116-2	22.5
-03	MS 52116-3	40
-04	MS 52116-4	55
-05	MS 52116-5	62.5
-07	MS 52116-7	67.5
-08	MS 52116-8	72.5
-09	MS 52116-9	77.5
-10	MS 52116-10	85
-11	MS 52116-11	90
-12	MS 52116-12	95
-13	MS 52116-13	100
-14	MS 52116-14	107.5
-15	MS 52116-15	144
-16	MS 52116-16	156
-17	MS 52116-17	168
-18	MS 52116-18	216
-19	MS 52116-19	120
-20	MS 52116-20	138

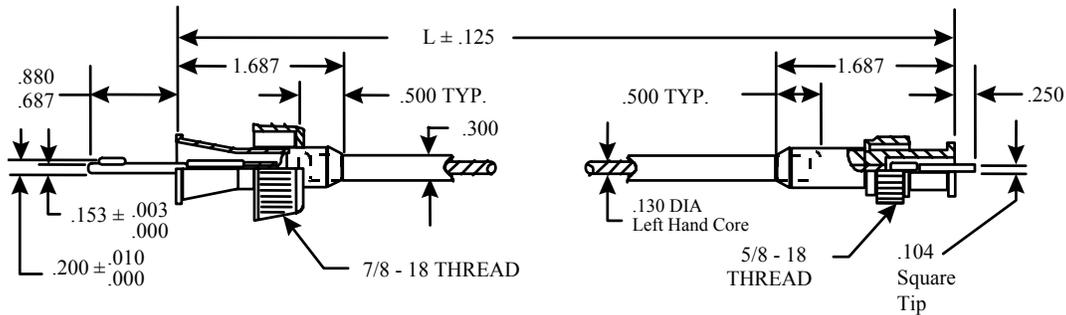
NOTES:

1. For core assembly details and associated core assemblies, see figure 4.
2. For gasket material and dimensions, see former Army part number 7539688.
3. For gasket material and dimensions, see former Army part number 7539689.
4. For washer material and dimensions, see former Army part number 5329467.
5. Tubing shall be metal covered with rubber or plastic to meet performance requirements of procurement specification.

FIGURE 2. Shaft assembly, flexible, plastic, tachometer and speedometer.

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OPTIONAL CONSTRUCTION
(See FIGURE 2 for preferred construction)



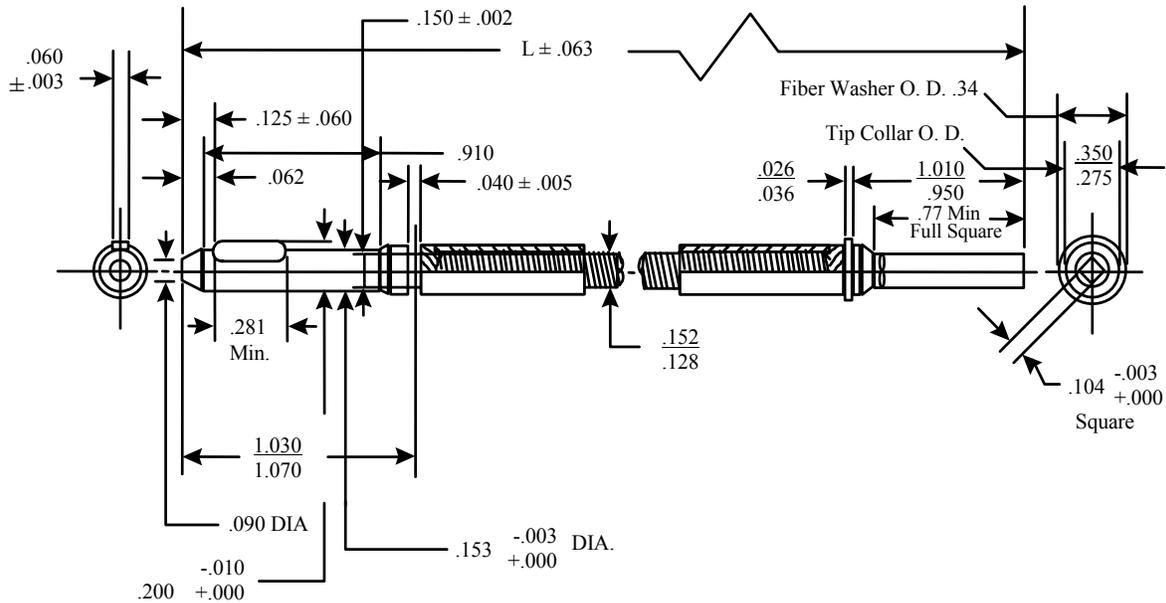
Dimensions are in inches.

Unless otherwise specified, tolerances are $\pm 1/64$ for fractional values and ± 0.010 for decimal values.

Size no.	Former MS part no.	Shaft length
-21	MS 52116-21	72
-22	MS 52116-22	84
-23	MS 52116-23	96
-24	MS 52116-24	108
-25	MS 52116-25	120
-26	MS 52116-26	132
-27	MS 52116-27	144
-28	MS 52116-28	156
-29	MS 52116-29	168
-30	MS 52116-30	180
-31	MS 52116-31	192
-32	MS 52116-32	204
-33	MS 52116-33	216
-34	MS 52116-34	228
-35	MS 52116-35	240
-36	MS 52116-36	252
-37	MS 52116-37	264
-38	MS 52116-38	276
-39	MS 52116-39	288
-40	MS 52116-40	300

FIGURE 3. Shaft assembly, flexible, plastic, tachometer and speedometer - optional construction.

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Dimensions are in inches.

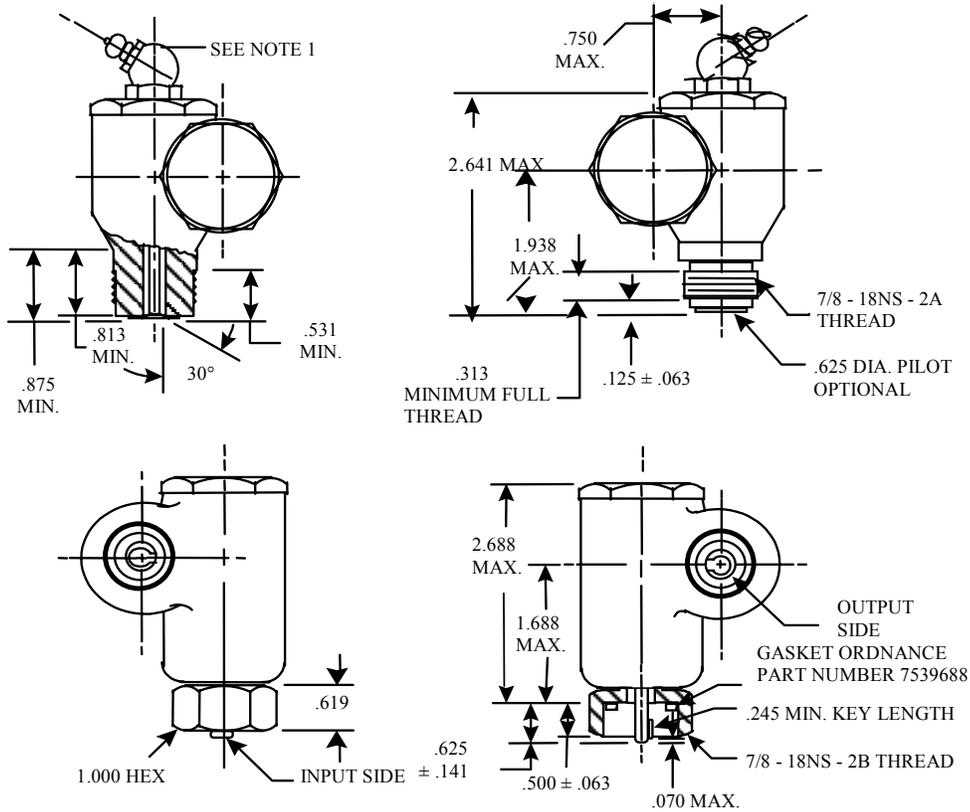
Unless otherwise specified, tolerances are $\pm 1/64$ for fractional values and ± 0.010 for decimal values.

Size no.	Former MS part no.	Former Army part no.	Core length
-01	MS 51072-1	8749985	18.7
-02	MS 51072-2	7976737	23.7
-03	MS 51072-3	7418497	41.2
-04	MS 51072-4	7527483	56.2
-05	MS 51072-5	7064607	63.7
-07	MS 51072-7	7064520	68.7
-08	MS 51072-8	7418498	73.7
-09	MS 51072-9	7418491	78.7
-10	MS 51072-10	7527481	86.2
-11	MS 51072-11	7415830	91.2
-12	MS 51072-12	7418490	96.2
-13	MS 51072-13	7527482	101.2
-14	MS 51072-14	7984852	108.7
-15	MS 51072-15	7984853	145.2
-16	MS 51072-16	7064524	157.2
-17	MS 51072-17	8366051	169.2
-18	MS 51072-18	8741685	217.2
-19	MS 51072-19	7355827	121.2
-20	MS 51072-20	8345796	139.2
-21	MS 51072-21		14.2

NOTE: For associated shaft assemblies see figure 1. Outer layer of core wire shall be wound in the direction of right hand lay.

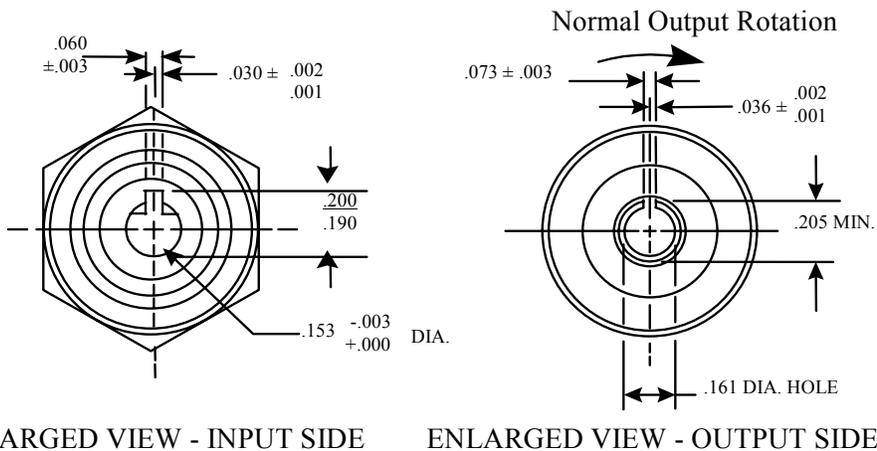
FIGURE 4. Core, flexible shaft assembly, tachometer and speedometer.

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LEFT HAND HOUSING

RIGHT HAND HOUSING



ENLARGED VIEW - INPUT SIDE

ENLARGED VIEW - OUTPUT SIDE

Dimensions are in inches.

Unless otherwise specified, tolerances are $\pm 1/64$ for fractional values and ± 0.010 for decimal values.

NOTE: Lubricate with grease conforming to MIL-G-3278. Sealed lubrication or lubrication fittings are optional.

FIGURE 5. Adapter, speedometer and tachometer, 90 degree drive.

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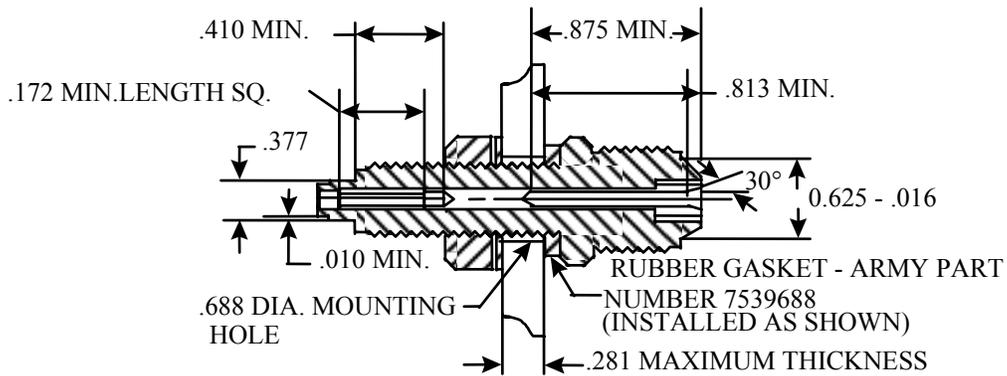
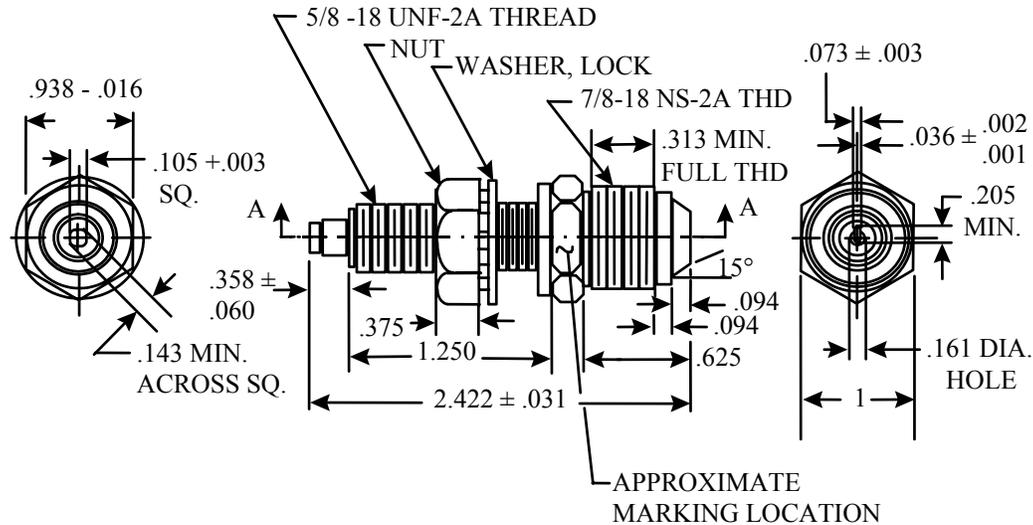
Size no.	Former MS part no.	Former Army part no.	RPM ratio output/input	Input shaft rotation when output shaft is rotated clockwise ^{1,2}	Housing type
-01	MS 39130-1		0.158	clockwise	right hand
-02	MS 39130-2		0.166	counter-clockwise	right hand
-03	MS 39130-3	7372726	0.200	clockwise	right hand
-04	MS 39130-4		0.200	counter-clockwise	right hand
-05	MS 39130-5	10900477	0.210	clockwise	left hand
-06	MS 39130-6	10917230	0.222	clockwise	right hand
-07	MS 39130-7		0.250	clockwise	right hand
-08	MS 39130-8		0.250	counter-clockwise	right hand
-09	MS 39130-9		0.300	clockwise	right hand
-10	MS 39130-10		0.300	counter-clockwise	right hand
-11	MS 39130-11	10900443	0.364	clockwise	right hand
-12	MS 39130-12	10921625	0.364	counter-clockwise	right hand
-13	MS 39130-13		0.416	clockwise	right hand
-14	MS 39130-14		0.421	counter-clockwise	right hand
-15	MS 39130-15	8340483	0.500	clockwise	right hand
-16	MS 39130-16		0.500	counter-clockwise	right hand
-17	MS 39130-17	6228369	0.500	clockwise	left hand
-18	MS 39130-18	6228367	0.500	counter-clockwise	left hand
-19	MS 39130-19		0.611	clockwise	right hand
-20	MS 39130-20		0.611	counter-clockwise	right hand
-21	MS 39130-21		0.705	clockwise	right hand
-22	MS 39130-22		0.714	counter-clockwise	right hand
-23	MS 39130-23		0.833	counter-clockwise	right hand
-24	MS 39130-24		0.909	clockwise	right hand
-25	MS 39130-25	7983058	1.000	clockwise	right hand
-26	MS 39130-26		1.000	counter-clockwise	right hand
-27	MS 39130-27	7987721	1.000	clockwise	left hand
-28	MS 39130-28	6209787	1.000	counter-clockwise	left hand
-29	MS 39130-29		1.100	clockwise	right hand
-30	MS 39130-30		1.100	counter-clockwise	right hand

¹Shaft rotation is determined when looking into the input or output connector.

²Previous revisions of this table referred to the input shaft rotation with respect to output side as "same" (counter-clockwise) and "reverse" (clockwise).

FIGURE 5. Adapter, speedometer and tachometer, 90 degree drive - Continued.

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SECTION A-A

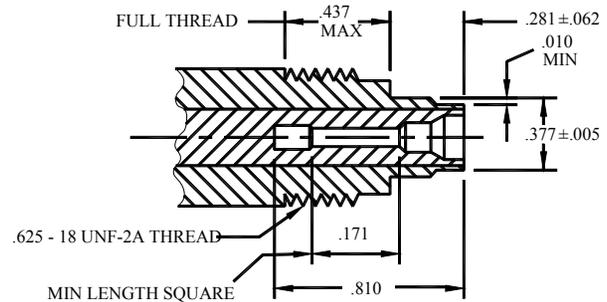
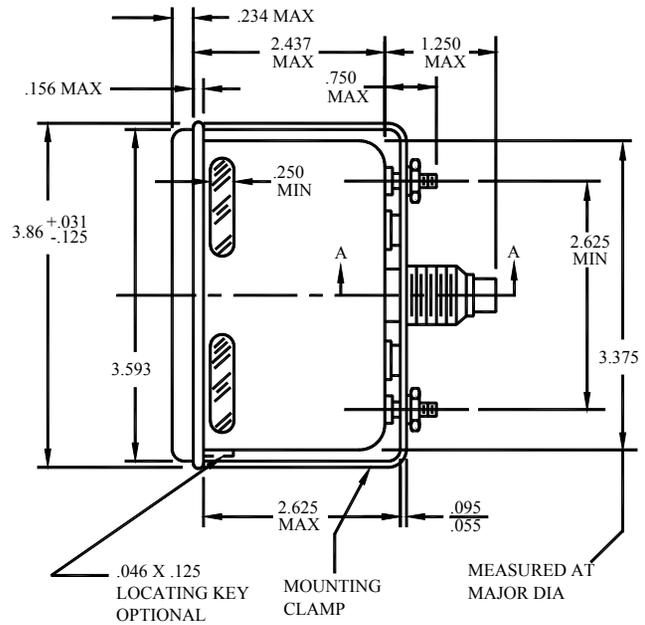
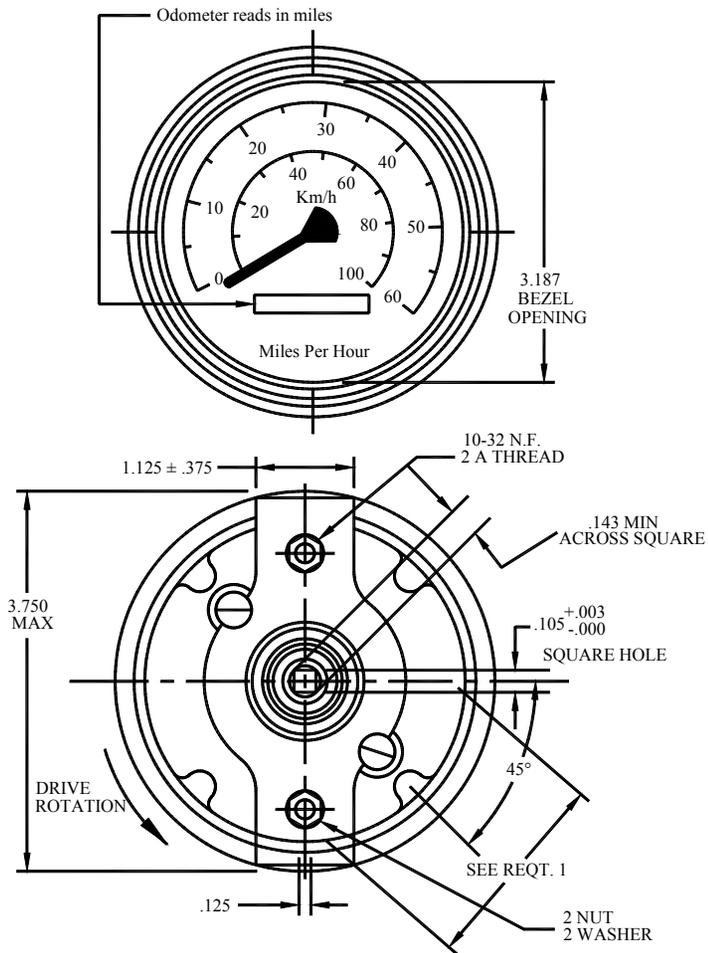
Dimensions are in inches.

Unless otherwise specified, tolerances are $\pm 1/64$ for fractional values and ± 0.010 for decimal values.

Size no.	Former MS part no.	Former Army part no.	Description	Application
-01	MS 53099-1	7983056	Without rubber gasket	Non-waterproof
-02	MS 53099-2	None	With rubber gasket	Waterproof

FIGURE 7. Adapter, coupling/bulkhead, tachometer and speedometer drive.

FIGURE 8. Speedometer, mechanical (0-60 mph).

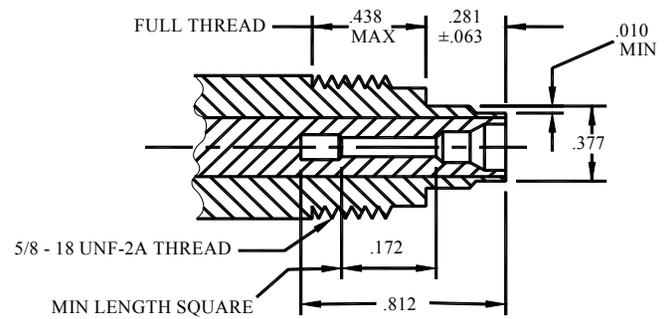
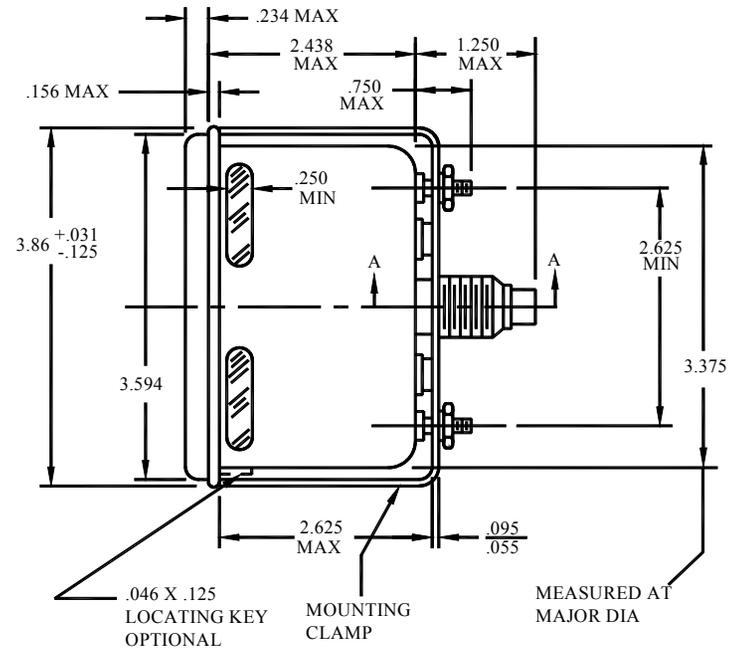
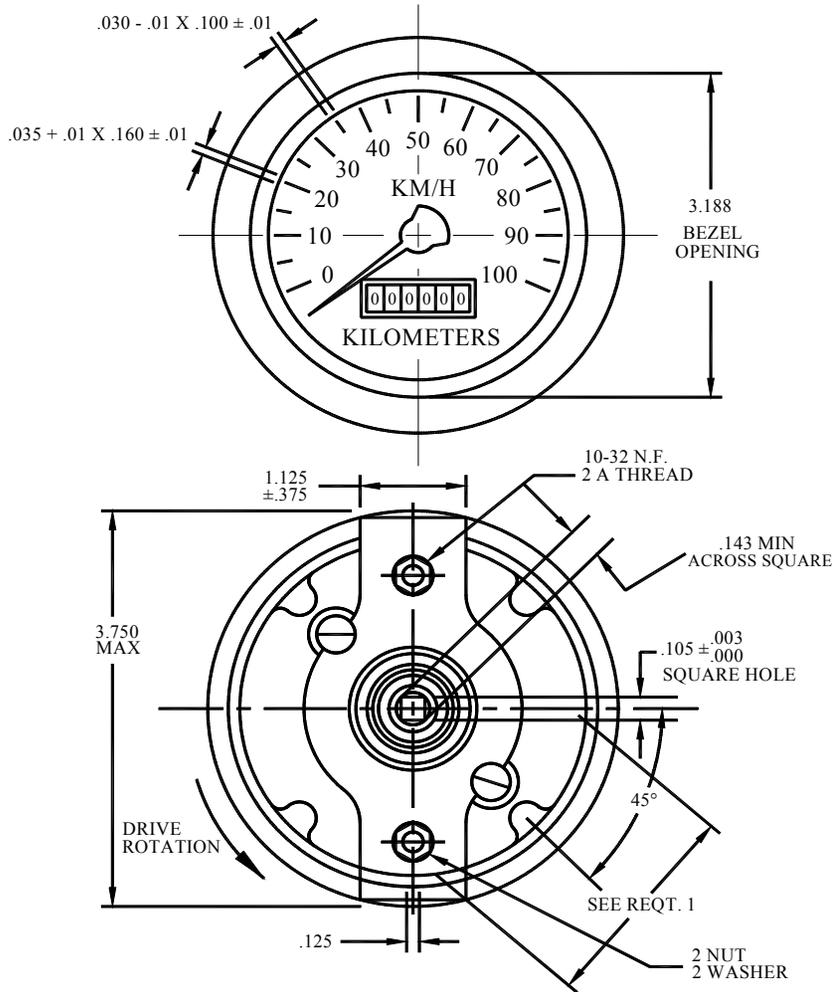


SECTION A-A
INSTRUMENT CONNECTION

REQUIREMENTS: 1. FOUR (4) ILLUMINATING WINDOWS SHALL BE 1.86 MIN. CHORDAL LENGTH, EQUALLY SPACED 45° OFF HORIZONTAL CENTERLINE.
OPTIONAL CONSTRUCTION: 360° ILLUMINATING WINDOW.

NOTE: UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES, TOLERANCES ARE ±.015 ON DECIMALS, ±1° ON ANGULAR DIMENSIONS.

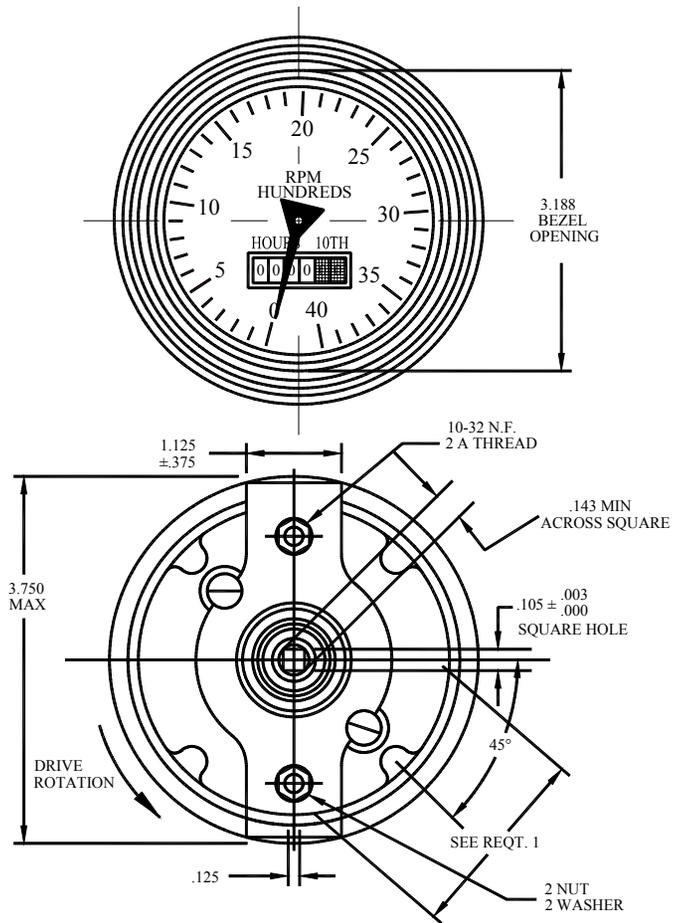
FIGURE 9. Speedometer, mechanical (0-100 km/h).



REQUIREMENTS: 1. FOUR (4) ILLUMINATING WINDOWS SHALL BE 1.86 MIN. CHORDAL LENGTH, EQUALLY SPACED 45° OFF HORIZONTAL CENTERLINE.

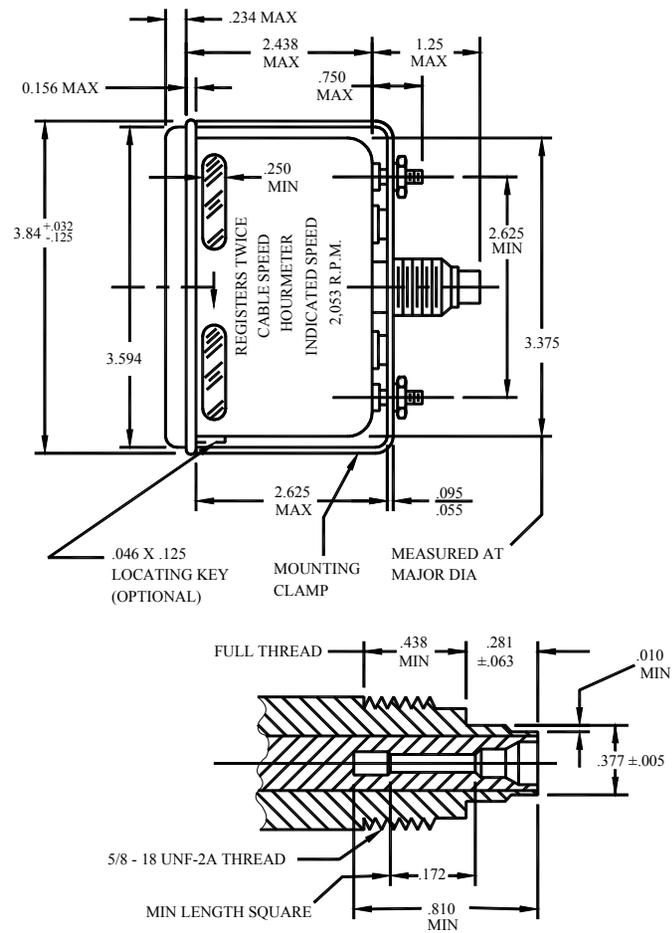
NOTE: UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES, TOLERANCES ARE $\pm .015$ ON DECIMALS, $\pm 1^\circ$ ON ANGULAR DIMENSIONS.

FIGURE 10. Tachometer, mechanical, fixed mounting (4,000 rpm).



REQUIREMENTS: 1. FOUR (4) ILLUMINATING WINDOWS SHALL BE 1.86 MIN. CHORDAL LENGTH, EQUALLY SPACED 45° OFF HORIZONTAL CENTERLINE. OPTIONAL CONSTRUCTION: 360° ILLUMINATING WINDOW.

2. UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES, TOLERANCES ARE ±.015 ON DECIMALS, ±1° ON ANGULAR DIMENSIONS.



SECTION A-A
INSTRUMENT CONNECTION

MIL-DTL-10215K

Custodians:
Army - AT
Navy - MC

Preparing Activity:
DLA - GS1

(Project 6680-0283)

Review Activity:
Army - MI

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at www.dodssp.daps.mil.