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MATERIAL MANUAL						
FIRST ISSUED 3-04-58	MATERIAL SPECIFICATION ELECTRO-MOTIVE DIESEL LA GRANGE, ILLINOIS			SPECIFICATION NO EMS 82		
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APPROVED B.L.Braglia				E	11/08/06	D702547
NAME: BOLT, CAPSCREW AND STUD STEEL (280M AND 300M)						

REQUIREMENTS:

1. Standards and Practices:

This specification covers the mechanical and material requirements for medium to medium high strength, carbon steel and alloy steel, externally threaded fasteners. EMS 82 will cover bolts and studs up to 2 1/2 inches in diameter and other externally threaded fasteners through 1 1/2 inches in diameter. The requirements contained in this document are essentially equivalent to the requirements of SAE J429 (Grades 5 and 8) as herein amended.

2. Chemical Composition (weight percent)

Grade Number	Material Description	Chemical Composition Limits, %			
		Carbon		P	S
		Min.	Max.	Max.	Max.
280M	Medium Carbon Steel	0.28	0.55	0.030	0.050
300M ^{1,2}	Medium Carbon Alloy Steel ³	0.28	0.55	0.030	0.050

¹ The steel shall be fine grain and have hardenability sufficient to achieve a structure of approximately 90% martensite at the center of the cross section, one diameter from the threaded end, in the 'as-hardened' condition before tempering.

² SAE 1541 or SAE 1541H may be used.

³ Alloy steel shall contain one or more of the alloying elements chromium, molybdenum, nickel or vanadium.

3. Heading Practice:

Bolts and screws in sizes up to 3/4 inch diameter (inclusive) and in lengths up to 6 inches (inclusive), shall be cold headed, unless otherwise specified on the engineering drawing.

Larger sizes and/or lengths shall be upset or extruded, unless otherwise specified on the engineering drawing.

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4. Threading Practice:

Bolts and screws in sizes up to 3/4 inch diameter (inclusive) and in lengths up to 6 inches (inclusive), shall be roll threaded, unless otherwise specified on the engineering drawing.

Larger sizes and/or lengths of bolts and screws, may be rolled, cut or ground at the option of the manufacturer, unless otherwise specified on the engineering drawing.

Threads of all sizes of studs may be rolled, cut or ground at the option of the manufacturer, unless otherwise specified on the engineering drawing.

5. Heat Treatment:



Bolts, screws and studs shall be austenitized and quenched to obtain a structure of 90 percent martensite minimum and then tempered at a temperature of 800°F minimum to meet the properties required in Section 6.

6. Mechanical Properties:

Property Description	Full Size Product Diameter, Inches			Machined Test Specimen Diameter, Inches		
	280M		300M	280M		300M
	1/4 thru 1	>1 thru 1 1/2	1/4 thru 2 1/2	1/4 thru 1	>1 thru 1 1/2	1/4 thru 2 1/2
Proof Load Stress, KSI, Min.	85	74	120			
Tensile Stress, KSI, Min.	120	105	150	120	105	150
Yield Stress (0.2% offset), KSI, Min.				92	81	120
Elongation, % Min.				14	14	12
Reduction of Area, % Min.				35	35	35
Surface Hardness, HR30N, Max.	54	50	59	54	50	59
Base Metal Hardness, HRC	25 - 34	19 - 30	33 - 39	25 - 34	19 - 30	33 - 39

7. Head Markings:

Hex head bolts and screws shall be clearly marked with the grade identification symbol shown in the following table and with the manufacturer's identification symbol.

Grade Number	Grade Identification Marking	SAE Grade Number
280M		5
300M		8

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Unless otherwise specified on the engineering drawing, markings shall be located on the top of the head and may be either raised or depressed at the option of the manufacturer.

8. Manufacturing Quality:

Fasteners made to this specification shall be free from burrs, loose scale, sharp edges and all other defects that might affect their serviceability. In addition, they shall conform to the allowable limits for surface discontinuities as specified in SAE J123 and the decarburization limits contained in SAE J121. The same limits for discontinuities stated in SAE J123 shall also apply to fasteners greater than 1 1/2 inches that are specified as EMS 82. For decarburization, Class C and Class B shall apply to 280M (Grade 5) and 300M (Grade 8) fasteners respectively per SAE J121.

GENERAL INFORMATION:

EMS 82 covers two grades of heat treated steel bolts, studs and capscrews. Steel composition is broadly defined in order to allow the manufacturer flexibility in meeting stipulated requirements for hardenability and mechanical properties.

On 300M grade parts, improved fatigue resistance can be obtained in threaded sections by rolling threads after heat treatment. Where such properties are required, this method of fabrication should be specified on the engineering drawing.

Parts made to this specification which are classified as "critical fasteners", are covered in ETI 506.

This specification previously identified the grade designations differently. The following table lists the new grade designation versus the previous:

<u>Old Designation</u>	<u>New Designation</u>	<u>SAE Grade Number</u>
GM280M	280M	5
GM300M	300M	8

DRAFTING INFORMATION:

Where use of this material is specified, it shall be designated as:

MATERIAL: *EMS 82 STEEL, Grade _____

Followed by 280M or 300M

Density of this material is 0.2829 lb/in³

NOTE: These specifications were developed without considering whether patents may or may not be involved. In all cases, therefore, the supplier shall be required to assume patent liability.