MECHANICAL AND METALLURGICAL REQUIREMENTS FOR METRIC SERIES STEEL NUTS

GM510M

1 SCOPE. This standard covers the mechanical and chemical requirements for 3 property classes of metric series steel hex nuts in sizes 1.6 to 36 mm, inclusive, which have dimensions conforming to Page E-1.101M of the GM Engineering Standards (American National Standards, ANSI B18.2.4.1-Metric Style 1 Hex Nuts and ANSI B18.2.4.2-Metric Style 2 Hex Nuts) and implement the 10 mm size with a 15.00 mm hexagon width across flats that differs from the ISO standard 10 mm size having a 16.00 mm hexagon width. The minimum nut thicknesses applicable to the respective nut sizes and styles are specified in Table 2.

1.1 Appendix A provides data on the properties of metric series hex flange nuts, slotted hex nuts and hex jam nuts.

NOTE: These specifications do not apply to parts welded in place or otherwise subjected to any heat which alters the microstructure.

2 DESIGNATION. Property classes are designated by numbers 5, 9 and 10 representing the approximate proof load stresses, respectively, and are intended to be used in combination with the GM510M specification number as follows:

GM510M(5): This property class shall apply to all sizes of Style 1 non-heat treated carbon steel hex nuts. They are intended for assembly with mating components conforming to GM500M (5.8) or lowest strength levels.

GM510M (9): This property class shall apply to all sizes of Style 2 non-heat treated carbon steel hex nuts. Nuts in sizes M3 through M16 are intended for assembly with mating components conforming to GM500M (9.8) or lower strengths. Nuts in sizes M20 through M36 are intended for use with mating components having strengths no greater than those specified for GM500M (8.8).

GM510M (10): This property class shall apply to all sizes of Style 1 heat treated carbon steel hex nuts. They are intended for assembly with mating components conforming to GM500M (10.9) or lower strength levels.

3 CHEMICAL REQUIREMENTS.

3.1 Steel for hex nuts of each property class shall conform in chemical composition to the limits given in Table 1.

3.2 Resulfurized steel is not subject to rejection based on product analysis for sulfur unless misapplication is clearly indicated. Rephosphorized steel is not subject to rejection based on product analysis for phosphorus unless misapplication is clearly indicated.

3.3 Application of heats of steel to which bismuth, selenium, tellurium, or lead has been intentionally added shall not be permitted for property class 10.

4 MANUFACTURING PROCESSES.

4.1 Hex nuts in sizes M1.6 through M4 may be made by cold punching, cold forming or milled-from-bar-processes. Unless otherwise authorized by the purchaser nuts in sizes M5 through M16, inclusive, shall be produced by cold or hot forming methods and nuts of M20 size or larger may be made by cold or hot forging or milled-from-bar-stock.

4.2 Property class 10 hex nuts shall be heat treated in a furnace having a protective neutral or slightly decarburizing atmosphere, maintained at temperature for thorough grain refinement, quenched in a liquid medium and tempered at a temperature of 425 C min Quenchants whose principal constituent is water shall not be used unless approved by the purchaser.

4.3 Case hardening of any property class of nut is not permitted.

4.4 Threads shall be formed, tapped or machined.

4.5 When heat treated nuts are electroplated or phosphate coated, appropriate processes should be employed to avoid hydrogen embrittlement. If necessary, the product shall be suitably treated as soon as practicable after plating or coating to remove detrimental hydrogen embrittlement.

TABLE 1 – CHEMICAL COMPOSITION REQUIREMENTS

Property Class of Nut	Composition, percent				
	Analysis	Carbon Max	Manganese Min	Phosphorus Max	Sulfur Max
5, 9	Heat Product	0.55 0.58	- -	0.04 0.048	0.15[1] -
10[2]	Heat Product	0.55 0.58	0.30 0.27	0.04 0.048	0.05 0.058

4.6 In cases where nuts are plated or coated following delivery to the purchaser (or where such processes are under control of the purchaser), the nut producer is not responsible for failure of the nut to meet requirements traceable to the plating or coating practice.

5 MECHANICAL REQUIREMENTS.

5.1 The hardness of nuts of each Class shall not exceed the maximum hardness specified for the Class in Table 2. This shall be the only hardness requirement for nuts that are proof

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load tested except for Class 10 nuts for which the minimum hardness requirement shall also apply.

5.2 Unless proof load testing is specified in the inquiry or purchase order, nuts of all property classes, sizes 1.6 through 4 mm and nuts of all property classes with proof loads greater than 530 kN as specified in Table 2, may be furnished on the basis of meeting the hardness limits specified in Table 2.

5.3 Nuts of all property classes, except those covered in 5.2, shall withstand the proof load stress specified for the diameter and property class of nut in Table 2.

5.4 All GM510M (9) and GM510M (10) nuts in sizes 5 through 36 mm shall conform with GM6103M which specifies allowable limits for the various types of surface discontinuities that may occur during manufacturing and processing such products.

6 TESTING.

6.1 PROOF LOAD TEST. The nut shall be assembled on a test bolt or on a hardened and threaded mandrel, as described below and illustrated in Figure 1. The specified proof load for the nut shall be applied against the nut in an axial direction. (See footnote 6 of Table 2 for method for computing the proof load in kiloncwtons for a nut.) The nut shall resist this load without failure by stripping or rupture and shall be removable from the test bolt or mandrel by the fingers after the load is released. If the threads of the test bolt or mandrel are damaged during the test, the test shall be discarded.

NOTE: Occasionally it may be necessary to use a manual wrench or other means to start the nut in motion. Use of such means is permissible, providing the nut is removable by the fingers following an initial loosening of not more than one-half turn of the nut.

6.1.1 When testing nuts having general purpose threads as specified in Table 2, test bolts shall have threads conforming to standards covering such threads [e.g.: GM Engineering Standards, Metric Screw Threads for Mechanical Fasteners (Section X) and American National Standards, ANSI B1.13M-Metric Screw Threads-M Profile]. Mandrels shall have threads conforming to such standards, except the minimum major diameter shall be the specified minimum major diameter and the maximum major diameter shall be the minimum major diameter plus 0.25 times the major diameter tolerance.

TABLE 2

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	
Nut Property Class[1]	Nut Size and Thread Pitch[2] mm	Specified Minimum Nut Thickness[3,4] mm		Treatment	Proof Load Stress[5] MPa	Proof Load[6] kN	Rockwell Hardness	
		Style 1	Style 2				Min	Max
5	M1.6x0.35	1.05		Not Heat Treated	520	0.66	HRB70	HRC30
	M2x0.4	1.35			520	1.08	HRB70	HRC30
	M2.5x0.45	1.75			520	1.76	HRB70	HRC30
	M3x0.5	2.15			520	2.62	HRB70	HRC30
	M3.5x0.6	2.55			520	3.53	HRB70	HRC30
	M4x0.7	2.90			520	4.57	HRB70	HRC30
	M5x0.8	4.40			580	8.23	HRB70	HRC30
	M6x1	4.90			580	11.7	HRB70	HRC30
	M8x1.25	6.44			590	21.6	HRB70	HRC30
	M10x1.5	8.74			590	34.2	HRB70	HRC30
	M12x1.75	10.37			610	51.4	HRB70	HRC30
	M14x2	12.10			610	70.2	HRB70	HRC30
	M16x2	14.10			610	95.8	HRB70	HRC30
	M20x2.5	16.90			630	154	HRB78	HRC30

Notes listed on following page.

(Table 2–Continued)

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