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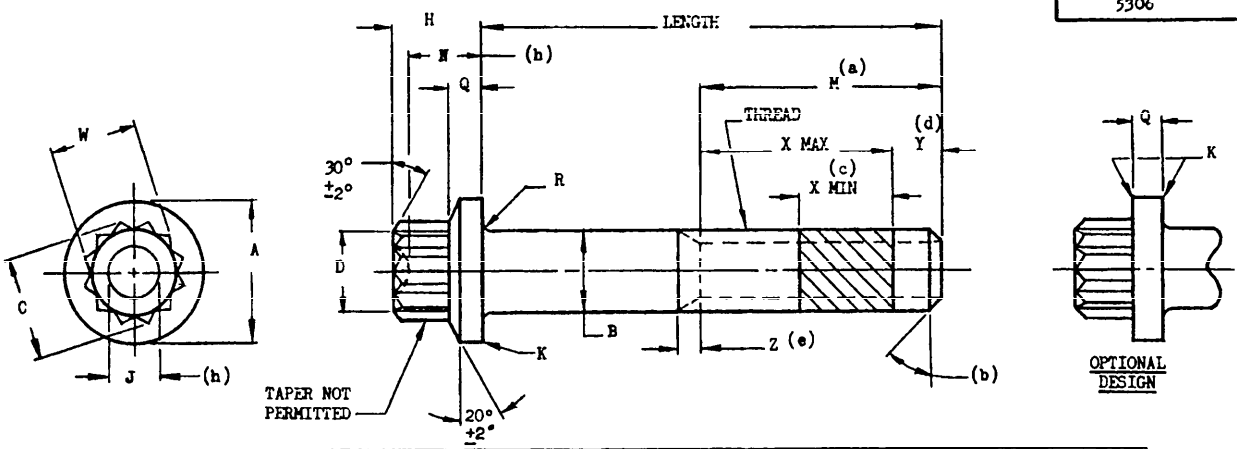


| (f) THREAD | A DIA | B DIA | C MIN | D | H | J | K CHAMFER OR RAD MAX | M MIN | N | Q | R | W | X MIN | ULTIMATE (g) TENSILE STRENGTH POUNDS (FTU) MIN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/4 - 28 UNF - 3A | .375 .365 | .2500 .2435 | .277 | .250 .235 | .250 .244 | .155 .115 | .008 | 1.000 | .229 | .072 .052 | .011 .009 | .251 .243 | .178 | 5,800 |
| 5/16-24 UNF -3A | .468 .457 | .3125 .3053 | .347 | .312 .297 | .312 .306 | .190 .150 | | 1.125 | .291 | .103 .083 | .017 .012 | .313 .304 | .208 | 9,300 |
| 3/8 -24 UNF -3A | .562 .550 | .3750 .3678 | .419 | .375 .360 | .375 .368 | .225 .185 | | 1.250 | .353 | .135 .115 | .020 .015 | .376 .367 | | 14,050 |
| 7/16-20 UNF -3A | .656 .642 | .4375 .4294 | .491 | .437 .422 | .437 .430 | .270 .230 | .010 | 1.375 | .415 | .166 .146 | .023 .018 | .439 .430 | .250 | 19,000 |
| 1/2 -20 UNF -3A | .750 .735 | .5000 .4919 | .561 | .500 .485 | .500 .492 | .307 .267 | | 1.500 | .477 | .197 .177 | .026 .020 | .502 .492 | | 25,000 |
| 5/8 -18 UNF -3A | .937 .921 | .6250 .6163 | .703 | .625 .610 | .625 .616 | .390 .350 | | 1.750 | .601 | .228 .208 | .032 .024 | .627 .616 | .278 | 41,000 |

(a) THREAD LENGTH. THE LENGTH OF THE BOLT THREAD IS MEASURED FROM THE EXTREME POINT TO THE LAST PITCH OF COMPLETE THREAD. ON SHORT BOLTS THE COMPLETE (FULL FORMED) THREADS SHALL EXTEND TO WITHIN TWO THREAD PITCH LENGTHS OF THE HEAD.

(b) THE POINT SHALL BE FLAT AND CHAMFERED. THE FLAT SHALL BE NORMAL TO THE AXIS OF THE BOLT AND THE CHAMFER SHALL BE AT AN ANGLE OF 35° TO 45° WITH THE PLANE OF THE FLAT. THE CHAMFER SHALL EXTEND SLIGHTLY BELOW THE ROOT OF THE THREAD, AND THE EDGE BETWEEN FLAT AND CHAMFER SHALL BE SLIGHTLY ROUNDED.

(c) X MIN REPRESENTS THE MINIMUM LENGTH OF EXTERNAL THREAD REQUIRED FOR ENGAGEMENT WITH COMPLETE INTERNAL THREAD PITCHES. THE ELEMENT SHALL ENGAGE WITHIN THIS MINIMUM LENGTH AND MEET REQUIREMENTS OF MIL-F-18240. X MIN IS EQUAL TO 5 THREAD PITCHES. X MAXIMUM EQUALS THE LENGTH OF COMPLETE THREAD BETWEEN Y AND Z.

(d) Y MIN SHALL HAVE AT LEAST ONE PITCH OF COMPLETE THREAD. Y MAXIMUM EQUALS 2 PITCHES OF COMPLETE THREAD PLUS 2 PITCHES WHICH INCLUDES THE INCOMPLETE THREAD AND CHAMFER. THE LOCKING ELEMENT SHALL NOT BE EFFECTIVE WITHIN THE AREA OF Y MINIMUM.

(e) Z EQUALS INCOMPLETE THREAD AND/OR EXTRUSION ANGLE PERMISSIBLE UP TO 2 THREAD PITCHES LENGTH MAXIMUM. THE ELEMENT OR ANY MACHINE HOLES OR GROOVES FOR THE ELEMENT SHALL NOT PENETRATE THIS AREA.

(f) THREADS SHALL BE FULLY FORMED BY ANY SINGLE ROLLING PROCESS, AND IN ACCORDANCE WITH SPECIFICATION MIL-S-7742.

(g) BASED ON 160,000 PSI ULTIMATE STRENGTH, AND STRESS AREA = $3.1416\left(\frac{E_{min}}{2} - \frac{3H}{16}\right)^2$ (SEE HANDBOOK H28 1957) PART I.

(h) INDENTATION IN HEAD MAY BE OMITTED AT MANUFACTURER'S OPTION.

INTERCHANGEABILITY RELATIONSHIP: MS21098 SELF LOCKING EXTERNAL DRIVE BOLTS CAN UNIVERSALLY REPLACE MS21262 SELF LOCKING INTERNAL DRIVE BOLTS OF LIKE DASH NUMBERS, AND MS24678 NON SELF LOCKING INTERNAL DRIVE BOLTS OF LIKE THREAD SIZE AND LENGTH, IN APPLICATIONS NOT TO EXCEED 250°F. THESE MS21262 INTERNAL DRIVE SELF LOCKING BOLTS ARE UNIVERSALLY INTERCHANGEABLE WITH MS21098 EXCEPT FOR TYPE OF DRIVE. BUT MS24678 INTERNAL DRIVE NON SELF LOCKING BOLTS CANNOT UNIVERSALLY REPLACE MS21098 EXTERNAL DRIVE SELF LOCKING BOLTS.

DIMENSIONS IN INCHES.
THIS STANDARD TAKES PRECEDENCE OVER DOCUMENTS REFERENCED HEREIN.
REFERENCED DOCUMENTS SHALL BE OF THE ISSUE IN EFFECT ON DATE OF INVITATION FOR BID.

Reviewers:
Navy - WP
USAF - 11

APPROVED 24 Mar 65 REVISED

This standard has been approved by the Bureau (Department of the Navy) and the Department of the USAF and is mandatory for use by her activity. All other military activities are required o employ this standard where suitable.

| P.A. Navy - WP<br>Other Cust<br>USAF - 11 | TITLE<br>BOLT, SELF LOCKING, STEEL, 160 KSI, Ftu 250°F, 12 POINT, EXTERNAL WRENCHING<br>(EXTERNALLY WRENCHING CAP SCREWS) | MILITARY STANDARD<br>MS21098(ASG) |
|---|---|---|
| PROCUREMENT SPECIFICATION<br>FF-S-86 & MIL-F-18240 | SUPERSEDES: | SHEET 1 OF 2 |

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MATERIAL: ALLOY STEEL; PROCUREMENT SPECIFICATION FF-S-86.

HARDNESS: RC36 - 45 UP TO AND INCLUDING 1/2 INCH, RC36 - - 43 OVER 1/2 INCH.

PLATING: CADMIUM PLATING, QQ-P-416, TYPE II, CLASS 3.

SURFACE ROUGHNESS: THE SURFACE OF THE SHANK, FILLET AND BEARING AREA SHALL NOT EXCEED 125 IN ACCORDANCE WITH MIL-STD-10.

LOCKING ELEMENT: IN ACCORDANCE WITH SPECIFICATION MIL-F-18240. LOCKING ELEMENT AREA MUST PASS THRU A PLAIN RING GAGE, EQUAL TO THE MAXIMUM MAJOR THREAD DIAMETER + .010 INCH, FREELY OR WITH FINGER PRESSURE.

DESIGN AND USAGE LIMITATIONS: SEE MS15981.

EXAMPLE OF PART NUMBER: MS21098-58 = 3/8 UNF-3A, BOLT, SELF LOCKING, STEEL, 1 INCH LONG.

| NOMINAL SIZE | | 1/4 - 28 UNF - 3A | 5/16 - 24 UNF - 3A | 3/8 - 24 UNF - 3A | 7/16 - 20 UNF - 3A | 1/2 - 20 UNF - 3A | 5/8 - 18 UNF - 3A |
|---|---|---|---|---|---|---|---|
| 1: LENGTH TOLERANCE | | DASH NO | DASH NO | DASH NO | DASH NO | DASH NO | DASH NO |
| .375 | | 17 | 18 | | | | |
| .437 | | 23 | 24 | 25 | | | |
| .500 | | 30 | 31 | 32 | | | |
| .625 | ±.016 | 37 | 38 | 39 | | | |
| .750 | | 44 | 45 | 46 | | | |
| .875 | | 50 | 51 | 52 | | | |
| 1.000 | | 56 | 57 | 58 | 59 | 60 | 61 |
| 1.250 | (a) | 64 | 65 | 66 | 67 | 68 | 69 |
| 1.500 | +.031 -.016 | 72 | 73 | 74 | 75 | 76 | 77 |
| 1.750 | | 79 | 80 | 81 | 82 | 83 | 84 |
| 2.000 | | 85 | 86 | 87 | 88 | 89 | 90 |
| 2.250 | | 91 | 92 | 93 | | 94 | 101 |
| 2.500 | ±.031 | | 95 | 96 | | 97 | 98 |
| 3.000 | | | | 99 | | 100 | 102 |

(a) MINIMUM THREAD LENGTH: BOLTS ABOVE HEAVY LINE SHALL, FOR SIZES 1/4 THROUGH 5/8 INCLUSIVE, HAVE COMPLETE (FULL FORM) THREADS EXTENDING TO WITHIN TWO THREADS OF THE HEAD .

Reviewers:
Navy - WP
USAF - 11

APPROVED 24 Mar 65 REVISED



| | | |
|---|---|---|
| P.A. Navy - Weps<br>Other Cust<br>USAF - 11 | TITLE<br>BOLT, SELF-LOCKING, STEEL, 160 KSI Ftu, 250° F, 12-POINT, EXTERNAL WRENCHING<br>(EXTERNALLY WRENCHING CAP SCREWS) | MILITARY STANDARD<br>MS21098(ASG) |
| PROCUREMENT SPECIFICATION<br>FF-S-86 AND MIL-F-18240 | SUPERSEDES: | SHEET 2 OF |