



SURFACE VEHICLE STANDARD

J2295™

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Superseding J2295 MAY2006

(R) Fastener Part Standard - Cap Screws, Hex, Heavy Hex
and Heavy Hex Structural Bolts, and Hex Nuts (Inch Dimensioned)

RATIONALE

Title: Clarified title that heavy hex and structural bolts are covered herein but their preference is limited.

Section 1: Added caution statement about hazardous materials.

Section 2: Added several new referenced standards.

Section 3: Added Definitions is new.

Figure 1: Field 3 deleted Designator 9. Field 4 added Hex Flange Screws and Heavy Hex Bolts. Field 5 added nominal size designators for socket head cap screws less than 1/4 inch nominal diameter. Field 7 Deleted Designators A, G (with H or M), P, V, W, X and Y; Added Designators AH, F, N, NA, NC, ZA and ZC.

Table 1: Identified coverage of zinc coated ASTM A193 fasteners. Corrected referenced yield strength values for ASTM A354 Grade BD. To be in accordance with ASTM A307 corrected that Grade A is preferred to be Hex Bolts not Hex Cap Screws. ASTM F468 added Aluminum Alloys and Titanium Alloy 23. Added Socket Button Head Cap Screw configurations for ASTM F835 and ASTM F879. Added Hex Flange Screws for SAE J429. Revised coatings/finishes from "Recommended" to "Cited by Fastener Standard" but this change has no effect on users choices.

Figure 2: Field 4 added Hex Flange and Large Hex Flange Nuts. Field 7 deleted Designators A, G (with H or M), P, V, W and Y; Added Designators AH, F, N, NA, NC, S, ZA and ZC.

Table 2: ASTM A194 identified marking for zinc coated nuts and hex slotted nuts in Note. ASTM A563 added Hex Flange and Large Hex Flange Nuts. ASTM F467 added Heavy Hex nuts, Aluminum Alloys and Titanium Alloy 23. ASTM F594 added Hex, Heavy Hex, Hex Flange and Large Hex Flange Nuts. Revised coatings/finishes from "Recommended" to "Cited by Fastener Standard" but this change has no effect on user choices.

Table 3: Adjusted length increments for longer lengths.

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Section 4: Added specific thread fits for socket type cap screws. Revised coating notes due to coatings changes. Designator F, in accordance with ISO 10683 is added as an option to allow multiple manufacturers to supply that coating type. Hexavalent chromium has been prohibited due to environmental and regulatory concerns. Replaced canceled SAE J121 with superseding ASTM F2328 for decarburization to reflect same change in SAE J429. Revised Quality Assurance requirements. Addressed flat countersunk head cap screw wedge tensile testing. Added max hardness to NiCuAl.

Section 5: Added selection guidance for heavy hex screws, heavy hex nuts, Nickel Alloy 686 and Titanium Ti-5-1-1-1.

Table A1: Added 2-1/4 inch bolt blank.

Editorial changes have been made throughout.

1. SCOPE

This SAE Part Standard covers selected inch screws, bolts, structural bolts, and nuts manufactured in accordance with ASTM International and SAE fastener standards. Appendix A covers bolt blanks to manufacture fitted bolts of specific materials. This document covers fastener materials often used in ship systems and equipment but its use may be applied wherever fasteners of the covered materials are used. This document permits the fasteners to be identified and ordered by a part identification number (PIN) as defined in this document.

1.1 Purpose

The purpose of this document is to assist the designer and other personnel by providing requirements and PINs for the most commonly used fasteners for ship systems and equipment. A PIN is normally required for all military applications and provides a useful means of communicating all fastener requirements in this standard to suppliers and manufacturers in a very succinct manner.

1.2 Part Identification Numbers (PINs)

This document provides PINs that can be used to identify the capscrews, structural bolts and hex nuts covered by this document. The PINs identify material, material strength, coatings and special features, nominal diameter, thread configuration, fastener length, marking requirements, along with the applicable ASTM or SAE fastener specification. The fasteners covered by this document are to be manufactured in accordance with fastener standards issued by the SAE and ASTM with dimensions as identified in ASME and other industry standards cited herein, e.g., coatings.

1.3 Hazardous Materials

While the materials, methods, applications, and processes described or referenced in this standard may involve the use of hazardous materials, this standard does not address the hazards that may be involved in such use. It is the responsibility of manufacturers and users to consult with appropriate authorities on the applicable health and environmental regulations regarding the handling, use and disposal of hazardous materials. For fasteners, some of the hazardous materials concerns are the application of the materials in platings (coatings), release of toxic vapors due to heat (for example, welding) and environmental regulations for disposal.

2. REFERENCES

2.1 Applicable Publications

The following documents form a part of this specification to the extent specified herein. The latest issue of the documents shall be used except in those cases where an invitation for bid or procurement contract specifically identifies the issues in effect on a particular date.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE AMS2412	Plating, Silver Copper Strike, Low Bake
SAE AMS2485	Coating, Black Oxide
SAE AMS2487	Anodic Treatment of Titanium and Titanium Alloys Solution pH 12.4 Maximum
SAE AMS2488	Anodic Treatment - Titanium and Titanium Alloys Solution pH 13 or Higher
SAE AS1701	Lubricant, Solid Film
SAE J429	Mechanical and Material Requirements for Externally Threaded Fasteners
SAE J995	Mechanical and Material Requirements for Steel Nuts
SAE J2270	Ship Systems and Equipment—Threaded Fasteners—Inspection, Test, and Installation Requirements
SAE J2271	Ship Systems and Equipment—Part Standard for Studs—Continuous and Double End (Inch Series)
SAE J2280	Ship Systems and Equipment—Fasteners—Selection and Identification Requirements
SAE J2295M	Fasteners—Part Standard—Cap Screws, Hex Bolts, and Hex Nuts (Metric)
SAE J2484	Fastener Part Standard—Machine Screws
SAE J2485	Fastener Part Standard—Machine Screw Nuts (Inch and Metric)

2.1.2 NAS Publications

Available from the Aerospace Industries Association, 1000 Wilson Boulevard, Suite 1700, Arlington, VA 22209-3901; Tel: 703-358-1000, www.aia-aerospace.org.

NAS 1283	Fasteners, Male, Threaded, Self-locking
NAS 1351	Screw, Cap, Socket Head Undrilled and Drilled, Plain and Self-Locking Alloy Steel, Corrosion-Resistant Steel and Heat-Resistant Steel, UNRF-3A
NAS 1352	Screw, Cap, Socket Head Undrilled and Drilled, Plain and Self-Locking, Alloy Steel, Corrosion-Resistant Steel and Heat-Resistant Steel, UNRC-3A and UNRC-2A

2.1.3 ASME Publications

Available from the American Society of Mechanical Engineers, 22 Law Drive, PO Box 2900, Fairfield, NJ 07007-2900, Tel: 973-882-1170, www.asme.org.

ASME B1.1 Unified Inch Screw Threads (UN and UNR Thread Form)

ASME B16.5 Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard

ASME B18.2.1 Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series)

ASME B18.2.2 Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)

ASME B18.2.6 Fasteners for Use in Structural Applications

ASME B18.3 Socket Cap, Shoulder and Set Screws, Hex and Spline Keys (Inch Series)

ASME B18.12 Glossary of Terms for Mechanical Fasteners

ASME B18.18 Quality Assurance for Fasteners

2.1.4 ASTM Publications

Available from American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, Tel: (610) 832-9585, www.astm.org.

ASTM A193/A193M Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications

ASTM A194/A194M Carbon and Alloy Steel Nuts for Bolts for High-Pressure or High-Temperature Service, or Both

ASTM A307 Carbon Steel Bolts and Studs, 60 000 psi Tensile Strength

ASTM A325 Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength

ASTM A342 Standard Test Methods for Permeability of Feebly Magnetic Materials

ASTM A354 Quenched and Tempered Alloy Steel Bolts, Studs and Other Externally Threaded Fasteners

ASTM A380 Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment and Systems

ASTM A449 Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use

ASTM A453/A453M High-Temperature Bolting Materials, with Expansion Coefficients Comparable to Austenitic Stainless Steels

ASTM A490 Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength

ASTM A563	Carbon and Alloy Steel Nuts
ASTM A574	Alloy Steel Socket Head Cap Screws
ASTM B580	Anodic Oxide Coatings on Aluminum
ASTM F467	Nonferrous Nuts for General Use
ASTM F468	Nonferrous Bolts, Hex Cap Screws and Studs for General Use
ASTM F593	Stainless Steel Bolts, Hex Cap Screws, and Studs
ASTM F594	Stainless Steel Nuts
ASTM F788/F788M	Surface Discontinuities of Bolts, Screws, and Studs, Inch and Metric Series
ASTM F812/F812M	Surface Discontinuities of Nuts, Inch and Metric Series
ASTM F835	Alloy Steel Socket Button and Flat Countersunk Head Cap Screws
ASTM F837	Stainless Steel Socket Head Cap Screws
ASTM F879	Stainless Steel Socket Button and Flat Countersunk Head Cap Screws
ASTM F1136	Zinc/Aluminum Corrosion Protective Coatings for Fasteners
ASTM F1470	Fastener Sampling for Specified Mechanical Properties and Performance Inspection
ASTM F1789	Terminology for F16 Mechanical Fasteners
ASTM F1941	Electrodeposited Coatings on Threaded Fasteners (Unified Inch Screw Threads (UN/UNR))
ASTM F2328	Test Method for Determining Decarburization and Carburization in Hardened and Tempered Threaded Steel Bolts, Screws, and Studs
ASTM F2833	Corrosion Protective Fastener Coatings with Zinc Rich Base Coat and Aluminum Organic/Inorganic Type
ASTM G98	Standard Test Method for Galling Resistance of Materials

2.1.5 U.S. Government Publications

Available online at <http://assist.daps.dla.mil/quicksearch/> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094MIL-DTL-13924Coating, Oxide, Black, For Ferrous Metals

MIL-DTL-16232	Phosphate Coating, Heavy, Manganese or Zinc Base
MIL-DTL-83488	Coating, Aluminum, High Purity
MIL-S-901	Shock Tests, H. I. (High Impact) Shipboard Machinery, Equipment, and Systems, Requirements for
QQ-N-281	Nickel-Copper Alloy Bar, Rod, Plate, Sheet, Strip, Wire, Forgings, and Structural and Special Shaped Sections
QQ-N-286	Nickel-Copper-Aluminum Alloy, Wrought (UNS N05500)

2.1.6 International Standards Publications (ISO)

Available from the American National Standards Institute (ANSI) at www.ansi.org or from the ISO national member for your country. A list of members and their contact information is available at www.iso.org/iso/home/store

ISO 10683 Fasteners - Non-Electrolytically Applied Zinc Flake Coatings

ISO 16047 Fasteners - Torque/clamp force testing

3. DEFINITIONS

3.1 FASTENER TERMS

For definition of terms used in this standard see ASME B18.12 and ASTM F1789. In event of conflict, the definitions of ASME B18.12 take precedence.

3.2 PIN

Represents Part Identification Number as described in 1.2. PINs are identified in Figures 1 and 2.

3.3 HIGH IMPACT SHOCK

High Impact Shock (HI-Shock) is the acceleration induced loads on components in Navy ships as defined in MIL-S-901.

4. FASTENER REQUIREMENTS

4.1 SAE Fastener Part Standards

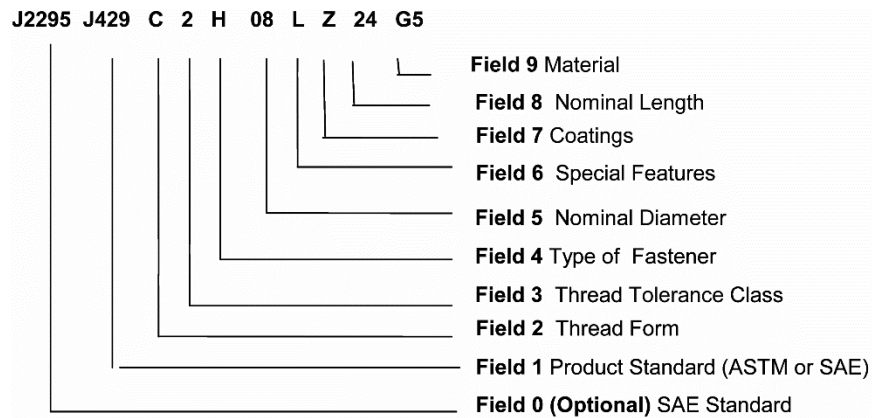
This SAE part standard is for fasteners manufactured to ASTM and SAE fastener standards in accordance with the requirements defined herein. ASTM has issued many fastener standards but generally has not established PINs for fasteners to these standards. When using the ASTM or SAE standards, it is necessary to identify the applicable dimensional, configuration, coating requirements and supplemental quality assurance requirements. This SAE part standard provides for the identification of many frequently used fasteners by identifying the applicable dimensional, coating, and other special features with PINs that can be easily recognized by both manufacturers and users.

4.2 PINs

PINs for Selected Fasteners - PINs are provided herein for selected cap screws, bolts, structural bolts and hex nuts for the purpose of common logistics fastener identification between designers, builders, repair activities and equipment operators. Part numbers are provided for only those fastener configurations and materials most likely to be needed. Industry or military specifications and standards with PINs already exist for many types of fasteners and therefore part numbers to cover similar fasteners in this standard have usually not been developed.

4.2.1 PINs for Screws and Bolts

Figure 1 provides PINs for hex and socket head screws and structural bolts in accordance with selected ASTM and SAE product standards. See Appendix A for details on bolt blanks to manufacture fitted bolts. Table 1 is a listing of the standards with the selected materials identified for inch screws and bolts. The PIN consists of a number of fields as identified in Figure 1:



Field 0—J2295 – Identifies this SAE Standard (This prefix may be omitted when drawing or computer limitations cannot accommodate the extra characters. See 5.2 for guidance when this prefix is omitted.)

Field 1—Product Standard (ASTM or SAE) – The applicable standards and the Field 1 identification are contained in the first column of Table 1.

Field 2—Thread Form

- C** = UNC/UNRC (ASME B1.1)
- F** = UNF/UNRF (ASME B1.1)
- N** = No Thread for Bolt Blank (See Appendix A)
- U** = 8UN/8UNR (ASME B1.1)

Field 3—Thread Tolerance Class (See 4.3.3)

- 2** = 2A (ASME B1.1)
- 3** = 3A (ASME B1.1)
- 8** = No Thread for Bolt Blank (See Appendix A)
- 9** = No longer used. (See 5.13)

Field 4—Type of Headed Fastener

- A** = Hex Head Bolt Blank, Oversize Shank (See Appendix A)
- B** = Heavy Hex Structural Bolt (See ASME B18.2.6)
- C** = Hex Socket Button Head Cap Screw (See ASME B18.3)
- F** = Hex Socket Flat Countersunk Head Cap Screw (82° countersunk) (See ASME B18.3)
- G** = Hex Flange Screw (See ASME B18.2.1)
- H** = Heavy Hex Screw (See ASME B18.2.1)
- R** = Regular Hex Cap Screw (See ASME B18.2.1)
- S** = Socket Head Cap Screw (See ASME B18.3)
- V** = Heavy Hex Bolt (See ASME B18.21.1)

Field 5—Nominal Diameter (See 4.3.2)

Inch - Diameters larger than 5/8 are designated by two digits reflecting the diameter in 16ths of an inch (For example 09.) Diameters 9/16 inch and smaller use two characters, as identified below. Diameters less than 1/4 inch are only applicable to socket drive type screws. See SAE J2484 for other small diameter screws.

Dia PIN	Diam Size	Dia PIN	Diam Size
#4	No. 4 (0.112)	05	5/16 (0.3125)
#5	No. 5 (0.125)	06	3/8 (0.375)
#6	No. 6 (0.138)	07	7/16 (0.4375) ¹
#8	No. 8 (0.164)	08	1/2 (0.500)
03	No. 10 (0.190)	09	9/16 (0.5625) ¹
04	1/4 (0.250)		

¹ – Not recommended for new design.

Figure 1 - PIN system for selected hex and socket head screws and bolts



Field 6—Special Features

- = No special features
- C = Continuous Threaded Shank (See 4.3.4)
- E = Continuous Threaded Shank with Locking Element
- L = Locking Element (See 4.7 for location and testing of locking elements)

Note: See 5.14 for earlier PIN's when Fields 6 and 7 were combined.

Field 7—Coatings/Finishes

- N = None (No Coating) (See 4.4.1 for Aluminum, Stainless Steel and Titanium fasteners required finishes)
- A = No longer used (See 5.13)
- AH = Aluminum Coating, High Purity with Chromate Overcoat (Hexavalent chromium prohibited) – MIL-DTL-83488 (See 4.4.9)
- B = Black Oxide - SAE AMS2485 (See 4.4.2 and 5.12)
- D = Dry Film Lubricant - SAE AS1701 (See 4.4.6)
- F = Zinc Flake, Non-electrolytically applied, with topcoat (chromium prohibited) - ISO 10683 (see 4.4.8)
- G = No longer used (See 5.11)
- K = Manganese Phosphate Coating - MIL-DTL-16232 (See 4.4.4)
- N = Zinc-nickel - Supplier may furnish either designation NA or NC - ASTM F1941 (See 4.4.3)
- NA = Zinc-nickel with clear topcoat (Hexavalent chromium prohibited) - ASTM F1941 (See 4.4.3)
- NC = Zinc-nickel with yellow topcoat (Hexavalent chromium prohibited) - ASTM F1941 (See 4.4.3)
- P = No longer used (see 5.13)
- S = Silver Plating - SAE AMS2412 (See 4.4.5)
- V = No longer used (See 5.13)
- W = No longer used (See 5.13)
- X = Zinc/Aluminum Inorganic Coating-No Chromium Permitted - ASTM F1136 or ASTM F2833 (See 4.4.7)
- Y = No longer used (See 5.13)
- Z = Zinc Electroplate - Supplier may furnish either designation ZA or ZC - ASTM F1941 (See 4.4.3)
- ZA = Zinc with clear topcoat (Hexavalent chromium prohibited) - ASTM F1941 (See 4.4.3)
- ZC = Zinc with yellow topcoat (Hexavalent chromium prohibited) - ASTM F1941 (See 4.4.3)

Note 1: If dry film lubricant is used over another coating, list the other coating first, then the dry film lubricant. Example: ZD for dry film over zinc electroplating.

Field 8—Nominal Length (See 4.3.1 for length increments)

Inch = 16ths of an inch (For 9/16th inch and shorter use two digits. Example: 09) Use 3 digits for lengths over 6 inches.

Field 9—PIN Suffix to Designate Material – Select applicable PIN Suffix from Table 1. If applicable suffix is a number, a dash prefix must be used; i.e. "-660". (This suffix usually consists of the mechanical property marking for the material except that the portion of the mechanical property marking containing the number of the fastener product standard is not included.)

Examples of PINs

The PIN used as an example in Figure 1, **J2295J429C2H08LZ24G5**, is as identified below:

The optional "J2295" indicates the standard for the applicable PIN. "J429" is the standard to which the fastener conforms. "C" indicates UNC/UNCR Coarse threads and the "2" indicates a 2A thread tolerance class. "H" indicates a Heavy Hex Screw configuration per the J429 standard. The "08" indicates a nominal diameter of 8/16ths or 1/2 inch. The "L" for the special features code indicates a self-locking element and the "Z" indicates zinc electroplate coating, clear or yellow topcoat. The "24" indicates a length of 24/16ths or 1-1/2 inches. The material designator "G5" indicates Grade 5 as defined in J429 and identified in Table 1.

J2295A193U2H20-N72B16 The "J2295" indicates the standard for the applicable part number PIN. "A193" is the applicable ASTM standard to which the part fastener conforms. "U" indicates 8UN threads. The "2" indicates a 2A thread tolerance class. "H" indicates a Heavy Hex Screw configuration per the A193 standard. The "20" indicates a nominal diameter of 20/16ths or 1-1/4 inches. The "-" indicates no special features and the "N" indicates no coating. The "72" indicates a length of 72/16ths or 4-1/2 inches. The material designator "B16" indicates Grade B16 as defined in ASTM A193 as identified in Table 2.

Figure 1 - PIN system for selected hex and socket head screws and bolts (continued)

Table 1 - Hex and socket screw and structural bolt materials and PIN designators

Product Standard Figure 1 Field 1	Alloy Groups and Dimensional Standards with Preferred Configuration (See 5.9) (ASME B18.2.1 unless otherwise indicated)	Coatings/Finishes Cited by Fastener Standard unless otherwise noted (check for specific fastener Alloy/Grade applicability)	Permitted Size Range (inches) ⁴	Yield/Tensile Strength (ksi) ¹ (Values are Yield except T.S. = Tensile)	Mechanical Property Marking	Material PIN Suffix (Designator) Figure 1 Field 9
A193 (See 5.10)	Hex Cap Screws Heavy Hex Screws Chromium-molybdenum, Grade B7	Z (Caution: Grades B7, B7M and B16 can be used in applications which can exceed temperature limits of some coatings. Users should check the max coating limit and application temperatures.) (G with H or M is now deleted per J2295) (See 5.11)	¼ to 2-1/2 ⁶	105 min.	B7, or B7ZN (zinc coated, See 5.10.2.3)	B7
	Chromium-molybdenum, Grade B7M		¼ to 2-1/2 ⁶	80 min.	B7M, or B7ZN (zinc coated, See 5.10.2.3)	B7M
	Chromium-molybdenum-vanadium, Grade B16		¼ to 2-1/2 ⁶	105 min.	B16 or B16ZN (zinc coated, See 5.10.2.3)	B16
	Hex cap screw diameters are from 1/4 to 1-1/2 inches and availability may be limited for diameters above 1 inch.					
A307	Hex Bolt, Carbon Steel, Grade A (See 5.9.1)	None (G with H or M is now deleted per J2295) (See 5.11)	¼ to 1-1/2	60 min T.S.	307A	A
	Heavy Hex Bolt Carbon Steel, Grade B	None (G with H or M is deleted per J2295) (See 5.11)	1/2 to 4	60 - 100 T.S.	307B	B
A325	Heavy Hex Structural Bolt (ASME B18.2.6)					
	Type 1, Medium Carbon Steel	X, (G with H or M is now deleted per J2295) (See 5.11)	½ to 1-1/2	½ to 1 – 92 min	A325	T1
	Type 3, Weathering Steel (See 4.11)	None	5/8 to 1-1/4	> 1 in - 81 min	A325	T3
A354	Heavy Hex Screws, Hex Cap Screws Alloy Steel, Grade BD (See 5.9)	None-(G with H or M is now deleted per J2295) (See 5.11)	Over 1-1/2	130 min.	BD (See note)	BD
			Over 2-1/2	115 min.		
Note: See 4-5 5.5 for smaller diameters						
A449	Hex Cap Screws, Heavy Hex Screws, Type 1 Medium Carbon Steel	None,	1-3/4 to 3	55 min	A449	T1
A453	Hex Cap Screws (See 5.9) Grade 660 (often designated. A286) (UNS S66286)	None	¼ to 3	85 min.	660A, B or C	660 Add A, B or C if required
A490	Heavy Hex Structural Bolts (ASME B18.2.6), Type 1 Alloy Steel	X	½ to 1-1/2	130 min.	A490	T1
A574	Socket Head Cap Screws (ASME B18.3) – Alloy Steel (See 4.12.1 for special hardness requirements)	None	1/8 to 1/2	180 min. T.S.	A574 (See 4.12.1)	None
			5/8 to 4	170 min. T.S.		