

CAIN BOLT & GASKET TECHINICAL MANUAL

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*DISCLAIMER: Properties and application parameters shown in this manual are presented in good faith but no warranty is expressed or implied. Failure to properly use gasket material could result in serious injury or death.



CAIN BOLT & GASKET, INC.

7724 7th AVENUE SOUTH * SEATTLE, WA. 98108 PHONE: (206)763-6460 * FAX: (206) 763-6878

* DOMESTIC & IMPORT INVENTORIES * * FLANGE BOLT & GASKET KITS * * METRIC FASTENERS AVAILABLE *

FASTENER PRODUCTS

PLAIN, ZINC PLATED, CAD PLATED, MILD STEEL, STAINLESS, GRADE 5 & 8

* BOLTS *	* NUTS *	* WASHERS *	* SPECS *	* SPECIALS *
HEX HEAD	FINISHED HEX	USS	B7 / L7	U- BOLTS
STAINLESS STEEL	HEAVY HEX	SAE	A307A & B	J- BOLTS
ANCHOR	COUPLING	HARD	B8 / B8M	LOW CARBON
STUDS	LOCKING NUTS	BEVEL	GR 5	STRUCTURAL
BENT BOLTS	ALL GRADES	LOAD	GR 8	ALLOYS
SOCKETS	STRUT	LOCK	A325	STAINLESS STEEL
SPECIALS		FENDER	A36	EXOTICS
STRUCTURALS		SQUARE	304SS	ANCHOR BOLTS
FLANGE BOLT KITS		PLATE	316SS	ALL THREAD

GASKETS & GASKETING MATERIALS

ELASTOMERIC, NON-ASBESTOS, HIGH TEMPERATURE, FDA APPROVED

* GASKETS & CUT PARTS *

* SHEET GOODS *

* FLANGE INSULATION*

IN - HOUSE MANUFACTURING DIE MAKING SPECIAL GASKETS CUSTOM PARTS HEADS/ PUMPS HEAT EXCHANGER/ VALVES CYLINDERS METAL GASKETS

SPONGE PLASTICS FELT HIGH-TEMP GARLOCK

RUBBER

TEXTILES CORK GRAPHOIL EXOTICS TEFLON NON-ASBESTOS SLEEVING INSULATING WASHERS ONE PIECE KITS TYPE "F" & TYPE "E" PHENOLIC NEMA

PIPE PENETRATION SEALS

INNERLYNX

EXPANSION JOINTS

METAL * FABRIC * COUPLINGS * CONNECTORS

API, ASTM, ANSI, AWWA, FEDERAL & MILITARY SPECS * CALL 24 HOURS A DAY, 7 DAYS A WEEK * (206) 763-6460 ASK ABOUT OUR DELIVERY SERVICE & "KIT" PACKAGING

TECHNICAL MANUAL

LINECARD.DOC



HEX BOLT



CAP SCREW



ALL THREAD STUDS

NUTS



CAIN BOLT & GASKET, INC

TECHNICAL MANUAL

GASKET MATERIAL SPECIFICATIONS

RUBBER SHEET PRODUCTS:	COMMERCIAL NEOPRENE	COMMERCIAL BUNA	WHITE FDA NITRILE
	GOOD OIL/GAS RESIST	GOOD RESISTANCE TO OILS	GOOD FOR ALL TYPES
	GOOD FOR BUMPERS,	& AROMATIC FUELS	OF FOOD PROCESSING
		SUPERIOR CHEMICAL	PHARMACEUTICAL AND COSMETIC
APPLICATIONS:	PADS & SEALING, RESISTS	RESISTANCE	PRODUCTS RESISTANT TO OILY
	ROT, CHECKING & CRACKING	GOOD RESISTANCE TO	& GREASY FOODS, NON-TOXIC
	,	BOTH OIL & WATER	NON-MARKING, NON-ALLERGENIC
COLOR:	BLACK	BLACK	WHITE
THICKNESS (INCHES):	1/32 - 2	1/32 - 1	1/16 - 1/4
DUROMETER HARDNESS /SHORE A+/- 5:	60	60	60
TENSILE:	1300	900	1000
ELONGATION:	500	300	650
TEMPERATURE MAX:	170 F	170 F	220 F
WEIGHT PER LINEAL FOOT(36" WIDE):	1/8 - 2.7	1/8 - 2.6	1/8 - 2.8
FINISH:	SMOOTH	SMOOTH	SMOOTH
SPECIFICATIONS:	-ASTM D-2000-86e	-ASTM D-2000-86e	FDA APPROVED/ NON-TOXIC
	-SAE J200, 1 BC 609	-SAE J200, 1 BE 609	NON-ALLERGENIC/ NON-MARKING
	-MIL R-3065, SC 609		GOOD OIL RESISTANCE

	RED RUBBER	COMMERCIAL EPDM	CLOTH INSERTED RUBBER
APPLICATIONS:	RECOMMENDED FOR LOW	EXCELLENT FOR EXTREME	
	PRESSURE HEATING &	TEMP / WEATHER	
	PLUMBING (LOW COST)	OZONE & CHEMICAL RESIST.	EXCELLENT FOR AIR, HOT & COLD WATER,
	AGING, ABRASION &	EXCELLENT ELECTRICAL	
	TEAR RESISTANCE	& DYNAMIC PROP'S	SATURATED STEAM, LOW PRESSURE HYDRAULIC
	CONFORMS TO UNEVEN	EXCELLENT RESISTANCE TO	-EXCELLENT FOR CUSTOM CUTTING
	FLANGE SURFACES	HIGH TEMP, ANIMAL & VEG	
		OILS, STEAM &	& OFF-SIZE APPLICATIONS
		OXYGENATED SOLVENTS	
COLOR:	RED	BLACK	BLACK
THICKNESS (INCHES):	1/8 - 3.5	1/16 - 1/4	1/16 - 1/4
DUROMETER HARDNESS /SHORE A+/- 5:	75	60	65
TENSILE:	600	1000	400
ELONGATION:	200	500	200
TEMPERATURE MAX:	170 F	220 F	170 F
WEIGHT PER LINEAL FOOT(36" WIDE):	1/8 - 3.5	1/8 - 2.2	N/A
FINISH:	FABRIC FINISH	SMOOTH	SMOOTH
SPECIFICATIONS:	ASTM D-1330-66	-ASTM D-2000-86e	FABRIC WEIGHT: 4 OZ
	CLASS II	-SAE J200, 3BA (608, 708), C12	FABRIC TYPE: POLYESTER
	ASTM D-2000	-MIL R-3065	OIL RESISTANCE: NONE
	TYPE AA	-RS 608, C12	

GRAPHOIL

-ASBESTOS-FREE, NO FIBERS,

BINDERS OR ADDITIVES IMPERMEABLE TO GASES & LIDQUIDS,RESISTS THERMAL

SOFT-CHEM

EXCELLENT RESISTANCE

TO CHEMICALS, MOSTLY UNAFFECTED BY STEAM FIBROUS STRUCTURE



CAIN BOLT & GASKET, INC

	HIGH COMPRESSIBILITY	SHOCK, EXC. SEALAB	ILITY		, · -	
	EXCELLENT CORROSION	DOES NOT AGE, SHR	INK			
	RESISTANCE	OR HARDEN, HIGH	LY			
	& IMPERMEABILITY	CHEMICAL RESISTA	ANT			
		HOMOGENEOU	S		TANG INSERTED (316SS)	
CREEP ASTM F38B 212 F:	35% (1/32")	0.05			0.1	
SEALABILITY ASTM F37B FUEL A:	.002 ml/min					
GAS LEAKAGE DIN 3535/6:	.02 ml/min					
HOT COMPRESSION:						
THICKNESS DECREASE AMBIENT						
3625 psi	37%					
THICKNESS DECREASE 572 F	29%					
COMPRESSIBILITY ASTM F36J:	60%	45% (5000 psi)			35% (5000 psi)	
RECOVERY ASTM F36A:	12% min	20%(5000PSI)			18% (5000psi)	
TENSILE ASTM 152:	1500 psi	700 PSI			5000 psi	
VACUUM TO FULL PRESSURE:	3000 psi					
CHEMICAL RESISTANCE:	0 - 14 ph	0 - 14 ph			0 - 14 ph	
DENSITY:	.85 g/cm3	62.4 lbs/ft3			62.4 lb/ft	
TEMPERATURE MAX:	500 F	900 F (in air)			900 F (in air)	
		1200 F (in steam)			1800 F (inert media)	
PRESSURE MAX:	3000 psi	2000 psi		2000 psi		
TESTED BY ECOLE POLYTECHNIC (1/16")	:					
Gb psi	1260	98% minimum	CA	RBON	98% minimum	
a	0.2	1200 ppm max	LEACHABI	E CHLORIDES	1200 ppm max	
GS psi	3.5	50 ppm max			50 ppm max	

SPECIALTY SHEET PRODUCTS:

CHARACTERISTICS& APPLICATIONS:

CAIN BOLT & GASKET, INC.

GASKET INSTALLATION PROCEDURES AND LEAKS

I. Installation Procedure:

To obtain a satisfactory seal, it is necessary that basic procedures are followed during installation. These procedures are of fundamental importance for a successful operation no matter what style of gasket or material used.

a) Inspect the flange sealing surface. Check for tool marks, dents, scratches or corrosion. Radial tool marks on the sealing surface are difficult to seal regardless of the style of gasket. Be sure that the finish is adequate for the style of gasket being used.

b) Inspect the gasket. Verify to be sure the gasket material is compatible with the intended service. Check for defects and shipping or storage damage and tool marks on solid gaskets.

c) Inspect and clean bolts, nuts, and washers.

d) Lubricate bolt threads and the nut contact surfaces. Do not install bolts and nuts without lubrication. The lubricant should be compatible with the service temperature.

e) For raised or flat faced flanges installed vertically, installation is started by the bolts on the lower part. Install the gasket then the other bolts.

f) For male and female or tongue and groove flanges, the gasket should be installed in the center of the groove.

g) Tighten the bolts approximately 30% of the final torque following the sequence shown in the below diagrams for the different types of flanges. Number the screws to facilitate following the tightening order. If the correct tightening sequence is not followed, the flanges may be misaligned, making it impossible to have a uniform seating of the gasket.

h) Repeat step g, elevating the torque from 50% to 65% of the final value.

i) Continue tightening in the recommended sequence until the final value is reached. The same bolt normally has to be tightened more than once.

j) All gaskets relax after seating. Retightening is recommended 24 hours after installation to compensate for the relaxation.

II. Tightening Sequence:



GASKETS.DOC



III. Torque Values:

The most correct method for obtaining the correct seating stress is to apply the bolt load by direct measuring its tension. However, in practice, this procedure is cumbersome and of difficult execution. If direct tension measuring is not possible, it is recommended to use a torque wrench or hydraulic tools. The use of manual tools without torque control is acceptable only in non-critical applications.

IV. Allowable Bolt Stress:

The ASME Pressure Vessel and Boiler Code, Section VIII, Appendix S specifically deals with the bolt stress. For example, the designer of the flange should determine the necessary tightening for the temperature and pressure in specific operational conditions according to the allowable bolt stress at the operating temperature.

Hydrostatic testing, which in the majority of cases is necessary to verify the system, is done at one and a half times the operational pressure. Consequently, a flanged joint designed in accordance with the ASME Code, which should be hydrostatic tested with a pressure higher than the design pressure, has to be tightened for the test.

The ASME Pressure Vessel and Boiler Code, Section VIII, Appendix S established that in order to pass the hydrostatic test, the bolts must be tightened up to the torque necessary for that purpose. If, in this case, the tension is greater than what is admissible, bolts made with a higher allowable tension material should be used observing the following procedure:

- Use bolts with allowable tension compatible with the one necessary to pass the hydostatic test, following the normal installation procedure for the gasket.

- After the hydrostatic test is completed, loosen the bolts approximately 50% of the initial tension.

- Replace the bolts used for the test with the originally designed bolts, one at a time, tightening until reaching the torque of the other bolts.

- After replacing all bolts, tighten them up to the design torque following the recommended sequence.

V. Thermal Growth:

When the bolts are tightened to resist the existing forces of the system, care should be taken with tensions caused by different thermal growth coefficients of the materials and by the temperature gradient in the flanges and bolts.

Whenever thermal growth is a serious problem it is recommended that the gasket be seated up to a point to allow an additional seating when the operational temperature is reached.

The use of longer bolts or spring washers as shown below is also recommended.





VI. Leakage:

One of the most efficient ways to analyze the causes of leakage is to carefully analyze the gasket used when such a leakage has taken place as shown below.

- A very corroded gasket: select a material with better corrosion resistance.

- A very extruded gasket: select a material with a better cold flow resistance or with a higher seating stress, use a compression limiter ring or redesign the flanges.

- Gasket with a damaged sealing surface: verify the gasket and flange dimensions. It could be that the gasket has the inside diameter smaller that the inside diameter of the flange or the outside diameter of the gasket is larger than the outside diameter of the flange.

- Gasket not seated: select a softer gasket or reduce that contact area between gasket and flange.

- Gasket thinner at the outside diameter: indication of a "rotation" or flange deflection. Change the gasket dimensions in a way that it fits closer to the bolts to reduce the rotational torque. Select a softer gasket that requires a lower seating stress. Reduce the area of the gasket. Reinforce the flange to increase its rigidity.

- Gasket irregularly seated: incorrect procedure in tightening the bolts. Make sure the tightening sequence of the bolts is followed properly.

- Gasket with regularly varying thickness: indication of flanges with excessive distance between bolts or without sufficient rigidity. Reinforce the flanges, reduce the distance between bolts or select a softer gasket.

VII. Misaligned Flanges:

When the flanges are not aligned, as shown below, it is not recommended to align them by tightening the bolts. Misalignments must be corrected.



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OLD STANDARD/ NEW STANDARD PIPING GASKET SPECS/ RINGS, FULL FACE

OLD S	TANDARD/	NEW STANDARD PIPIN	G GASKET SF	PECS/ RINGS, FULL F	ACE		
-		125-150# RING		125-	150# FULL I	ACE	
	PIPE SIZE		PIPE SIZE	NEW STD. ASA			
	& OLD STD. I.D.	NEW STD. ASA I.D. X O.D.	& OLD STD. I.D.	I.D. X O.D.	NO.	DIA.	BOLT
					HOLES	HOLES	CIRCLE
	1/2 3/4	27/32 X 1-7/8 1-1/16 X 2-1/4	1/2 3/4	27/32 X 3-1/2 1-1/16 X 3-7/8	4	5/8 5/8	2-3/8 2-3/4
	1	1-5/16 X 2-5/8	1	1-5/16 X 4-1/4	4	5/8	3-1/8
	1-1/4	1-21/32 X 3	1-1/4	1-21/32 X 4-5/8	4	5/8	3-1/2
	2	2-3/8 X 4-1/8	2	2-3/8 X 6	4	5/8 3/4	3-7/8 4-3/4
	2-1/2	2-7/8 X 4-7/8	2-1/2	2-7/8 X 7	4	3/4	5-1/2
	3	3-1/2 X 5-3/8	3	3-1/2 X 7-1/2	4	3/4	6 7-1/2
	5	5-9/16 X 7-3/4	5	5-9/16 X 10	8	7/8	8-1/2
	6	6-5/8 X 8-3/4	6	6-5/8 X 11	8	7/8	9-1/2
Ъ	8 10	8-5/8 X 11 10-3/4 X 13-3/8	8 10	8-5/8 X 13-1/2 10-3/4 X 16	8 12	7/8 1	11-3/4 14-1/4
A H	12	12-3/4 X 16-1/8	12	12-3/4 X 19	12	1	17
2 2	14	14 X 17-3/4	14	14 X 21	12	1-1/8	18-3/4
SA	18	16 X 20-1/4 18 X 21-5/8	18	18 X 25	16	1-1/6	21-1/4 22-3/4
	20	20 X 23-7/8	20	20 X 27-1/2	20	1-1/4	25
00	22	22 X 26	22	22 X 29-1/2	20	1-1/4	27-1/4
STI	26	26 X 30-1/2	24	26 X 34-1/4	24	1-3/8	31-3/4
N (S	28	28 X 32-3/4	28	28 X 36-1/2	28	1-3/8	34
NEN	30	30 X 34-3/4 32 X 37	30	30 X 38-3/4 32 X 41-3/4	28	1-3/8	36 38-1/2
	34	34 X 39	34	34 X 43-3/4	32	1-5/8	40-1/2
	36 38	36 X 41-1/4 38 X 43-5/8	36 38	36 X 46	32 36	1-5/8 1-5/8	42-3/4 45-1/4
	40	40 X 45-5/8	40	40 X 50-3/4	36	1-5/8	47-1/4
	42	42 X 48	42	42 X 53	36	1-5/8	49-1/2
	44 46	44 X 50-1/8 46 X 52-1/8	44 46	44 X 55-1/4 46 X 57-1/4	40 40	1-5/8 1-5/8	51-3/4 53-3/4
	48	48 X 54-1/2	48	48 X 59-1/2	44	1-5/8	56
		250-300 # RING		250-3	300 # FULL	FACE	
		200-000 # 11110	PIPE SIZE	200-0		AOL	
	OLD STD. I.D.	NEW STD. ASA	OLD STD. I.D.	NEW STD. ASA I.D.			
		I.D. X O.D.		X O.D.	NO. HOLES	DIA. HOLES	CIRCLE
	1/2	27/32 X 2-1/8	1/2	27/32 X 3-3/4	4	5/8	2-5/8
	3/4	1-1/16 X 2-5/8 1 5/16 X 2 7/8	3/4	1-1/16 X 4-5/8	4	3/4	3-1/4
อ ง	1-1/4	1-21/32 X 3-1/4	1-1/4	1-21/32 X 5-1/4	4	3/4	3-7/8
SO	1-1/2	1-29/32 X 3-3/4	1-1/2	1-29/32 X 6-1/8	4	7/8	4 1/2
36	2 2-1/2	2-3/8 X 4-3/8 2-7/8 X 5-1/8	2 2-1/2	2-3/8 X 6-1/2 2-7/8 X 7-1/2	8	3/4 7/8	5 5-7/8
O.S	3	3-1/2 X 5-7/8	3	3-1/2 X 8-1/4	8	7/8	6-5/8
ЦЦ	4	4-1/2 X 7-1/8	4	4-1/2 X 10	8	7/8 7/8	7-7/8 9-1/4
LO V	6	6-5/8 X 9-7/8	6	6-5/8 X 12-1/2	12	7/8	10-5/8
	8	8-5/8 X 12-1/8	8	8-5/8 X 15	12	1	13
	10	10-3/4 X 14-1/4 12-3/4 X 16-5/8	10	10-3/4 X 17-1/2 12-3/4 X 20-1/2	16	1-1/8	15-1/4 17-3/4
	14	14 X 19-1/8	14	14 X 23	20	1-1/4	20-1/4
	16	16 X 21-1/4	16	16 X 25-1/2	20	1-3/8	22-1/2
	20	20 X 25-3/4	20	20 X 30-1/2	24	1-3/8	24-5/4
	22	22 X 27-3/4	22	22 X 33	24	1-3/8	29-1/4
	24	24 X 30-1/2 26 X 32-7/8	24	24 X 36 26 X 38-1/4	24	1-5/8	32 34-1/2
	28	28 X 35-3/8	28	28 X 40-3/4	28	1-5/8	37
	30 32	30 X 37-1/2 32 X 39-5/8	30 32	30 X 43 32 X 45-1/4	28 28	1-7/8 1-7/8	39-1/4 41-1/2
	34	34 X 41-5/8	34	34 X 47-1/2	28	1-7/8	43-1/2
	36	36 X 44	36	36 X 50	32	2-1/8	46
	38 40	38 x 46-1/8 40 X 48-3/4	38	38 X 52-1/4 40 X 54-1/4	32 36	∠-1/8 2-1/8	48 50-1/4
	42	42 X 50-3/4	42	42 X 57	36	2-1/8	52-3/4
	44	44 X 53 46 X 55-1/4	44	44 X 59-1/4 46 X 61-1/2	36 40	2-1/8 2-1/8	55 57-1/4
	40	40 X 50 0/4	40		40	2 1/0	60.2/4

CAIN BOLT & GASKET, INC SPIRAL WOUND GASKETS

AVAILABLE GAS				TEDIAL
METAL WINDING	STRIP	FILLER MATERIAL	GUIDE RING MA	TERIAL
AS STANDARD		AS STANDARD	AS STANDARD	
Stainless Steel		Non Asbestos	Carbon Steel	
	type 3161			
	304			
OTHERS		OTHERS	OTHERS	
Stainless Steel		Graphoil	Stainless Steel	
type	304L	Asbestos Paper	Туре	304
	309	PTFE		304L
	310	Ceramic		316
	316Ti			316L
	321	Graphoil has been carefully researched and		316Ti
	347	developed to meet industry's demand for a superior		310
	430	alternative to asbestos filler in spiral wound gas-		321
	17-7PH	kets. Graphoil provides performance that is		347
ALLOY 20		superior to asbestos, and has been field proven		410
MONEL		through years of actual service in critical applica-	INCONEL	600
TITANIUM		tions throughout the world. Graphoil is pure		625
NICKEL	200	graphite and is manufactured without the use or		MONEL
INCONEL	600	fillers, resins or binders that could deteriorate at		TITANIUM
	625	elevated temperatures.		NICKEL
	X-750		INCOLOY	825
HASTELLOY	B2	Graphoil is also available in the following products	HASTELLOY	B-2
	C276	to meet all your sealing needs: Bulk rolls, sheets,		C276
INCOLOY	800	reinforced sheets, gasket tape and tape packing,		
	825	and cut gaskets.		
DUPLEX		NOTE: Materials should be selected with regard to operating		
ZIRCONIUM		temperature and chemical compatibility.		
TANTALUM				
COPPER		decomposition starts to occur slowly increasing rapidly above	400C	
PHOS-BRONZE		(750F). Care should be taken to avoid inhaling the resultant fu	mes,	
CARBON STEEL		which may produce unpleasant effects.		

API STAMPING REQUIREMENTS





ENGINEERING DATA: BOLTS, STUDS, AND NUTS

Materials sold by Cain Bolt & Gasket are manufactured from quality materials meeting the physical and chemical requirements of both The American Society for Testing and Materials (ASTM) and The American Society of Mechanical Engineers (ASME). These quality controlled materials are normally used by the petroleum, petrochemical and process industries in valves, flanges, piping systems, pressure vessels, etc.

The design codes used by the various industries specify the bolting requirements by ASTM or ASME designations and give the limitations of each. Selection of a bolting material will normally be governed by design requirements, service conditions, desired mechanical properties and temperature characteristics. The following is a partial listing, by specification, of the most commonly used bolting materials:

STEEL BOLTING MATERIALS FOR H	IGH TEMPERATURE	SERVICE"
Identification Symbol	AISI TYPE	Outstanding Chemical
B-5	501	5% Chromium
B-6	410	12% Chromium
B-6X	410	12% Chromium
B-7	4140-4142-4145	Chromium-Molybdenum
B-7M	4140-4142.4145	Chromium-Molybdenum
B-16		Chromlum-Molybdenum-Vanadium
B-8, B8A	304	18 Chromium-S Nickel
B-8C, B8CA	347	18 Chromium-8 Nickel, Stabilized
B-8M, B8MA	316	18 Chromium-8 Nickel-2 Molybdenum
B-8T, B8TA	321	18 Chromium-8 Nickel, Stabilized

ASTM A-193/ASME SA-193 - "STANDARD SPECIFICATION FOR ALLOY~STEEL AND STAINLESS STEEL BOLTING MATERIALS FOR HIGH TEMPERATURE SERVICE"

The most commonly used Ferritic steel stud grades are Grade B7 and Grade B7M, which are normally used from - 50 F. to 1000 F., and Grade B16, which are normally used from - -50 F to 1100 F. These types are stock items, with the other listed grades available on a special order basis. The most commonly used Austenitic steel studs are Grade B8 and Grade B8M, in both the Class 1 (Carbide Solution Treated) and Class 2 (Carbide Solution Treated and Strain-Hardened) conditions. These Austenitic steel grades are stocked, with the others available on a special order basis. The Austenitic group of steels are normally used in service temperatures from -325 F. to 1500 F.

MATERIAI	LS FOR LOW-TEMPERAT	URE SERVICE."	
	Identification Symbol	AISI TYPE	Outstanding Chemical
Ferritic	L-7	4140-4142-4145	Chromium-Molybdenum
	L-7M	4140-4142-4145	Chromium-Molybdenum
	L-7A	4037	Molybdenum
	L-7B	4137	Chromium-Molybdenum
	L-7C	8740	Nickel-Chromium-Molybdenum
	L-43	4340	Nickel-Chromium-Molybdenum
Austenitic	B-8, B-8A	304	Unstabilized 18 Chromium -8 Nickel
	B-8C, B-8CA	847	Stabilized 18 Chromium-8 Nickel
	B-8M, B-8MA	316	18 Chromium-8 Nickel-2 Molybdenum
	B-8F B-8FA	321	Stabilized 18 Chromium-8 Nickel

ASTM A-320/ASME A-320 - "STANDARD SPECIFICATION FOR ALLOY STEEL BOLTING MATERIALS FOR LOW-TEMPERATURE SERVICE."



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B-8F, B-8FA

Free Machining 18 Chromium-8 Nickel

The Ferritic steel Grades L7 and L7M together with the Austenitic Grades B8 and B8M are normally stocked for immediate shipment, with the other Grades available on special order. Grade L7 is normally used to 500F without a Charpy Test and to -150 F with a Charpy Test. Grade L7M is normally used In H_2S service with a required Charpy Test at -100°F. All of the Austenitic steels listed above may be used to -325 °F without a Charpy Irnpact Test and at lower temperatures with the requisite Impact Tests.

ASTM A-194/ ASME SA-194	"STANDARD	SPECIFICATION	FOR	CARBON	AND	ALLOY	STEEL
NUTS FOR BOLTS FOR HIGH-PR	ESSURE AND	HIGH-TEMPERA	TURE	SERVICE.	**		

Identification Symbol	AISI Type	Outstanding Chemical	Brinell Hardness
Ferritic 2-M		Carbon	159 to 287
2-H		Carbon	248 to 352
4		Carbon-Molybdenum	248 to 352
3	501	8% Chromium	248 to 352
6	410	12% Chromium	228 to 271
6-F	416	12% ChromIum	228 to 271
7	4140-4145	Chromium-Molybdenum	248 to 352
Austenitic 8	304	18 Chromium-8 Nickel	126 to 300
8-C	347	18 Chromium-B Nickel	126 to 300
8-M	316	18 ChromIum-8 Nickel-2 Molybdenum	126 to 300
8-T		321	18
Chromium-8 Nickel	126 to 300		
8-F		303	18
Chromium-8 Nickel	126 to 300		
8-P		308	18
Chromium-10 Nickel	126 to 800		

Ferritic steel nuts are manufactured In Grades 2H, 2M and 7, which are normally used in conjunction with Grade B7, B7M, B16, L7 and L7M studs. The Austenitic steel nuts, Grade 8 and 8M are also available from stock for use on stainless steel studs and bolts. Heavy pattern hex nuts are available in the grades listed above to the dimensional requirements of ANSI B18.2.2. Unless otherwise specified, these nuts are tapped 8UNC-2B in sizes 1" and under, and 8UN-2B over 1" diameter. All other grades of nuts listed may require special order.

CAIN BOLT & GASKET, INC

CHEMICAL AND MECHANICAL PROPERTIES OF NUTS AND BOLTS

ASTM AISI AISI AISI													0.2% Yield	Mechanical P Tensile	roperties Elonda-	Reduc-	Hard-
Grade Mat'l C Si Mn P S Ni Cr Mo	Matil C Si Mn P S Ni Cr Mo	Mat'l C Si Mn P S Ni Cr Mo	C Si Mn P S Ni Cr Mo	Si Mn P S Ni Cr Mo	Mn P S Ni Cr Mo	P S Ni Cr Mo	S Ni Cr Mo	Ni Cr Mo	Cr Mo	Mo		Others	Strength	Strength	tion	tion	ness
													psi	psi	%	%	H8
A193 B5 501 min 0.10 max 1.00 max 1.00 max 0.040 max 0.030 0 4.00-6.00 0.40-0.65	B 5 5 501 min 0.10 max 1.00 max 1.00 max 0.040 max 0.030 4.00-6.00 0.40-0.65	501 min 0.10 max 1.00 max 1.00 max 0.040 max 0.030 4.00-6.00 0.40-0.65	min 0.10 max 1.00 max 1.00 max 0.040 max 0.030 4.00-6.00 0.40-0.65	max 1.00 max 1.00 max 0.040 max 0.030 4.00-6.00 0.40-0.65	max 1.00 max 0.040 max 0.030 4.00-6.00 0.40-0.65	max 0.040 max 0.030 4.00-6.00 0.40-0.65	max 0.030 4.00-6.00 0.40-0.65	4.00-6.00 0.40-0.65	4.00-6.00 0.40-0.65	0.40-0.6	10		min 80000	min 100000	min 16	min 50	
B 6 410 max 0.15 max 1.00 max 1.00 max 0.040 max 0.030 11.50-13.50	B 6 410 max 0.15 max 1.00 max 1.00 max 0.040 max 0.030 11:50-13:50	410 max 0.15 max 1.00 max 1.00 max 0.040 max 0.030 11.50-13.50	max 0.15 max 1.00 max 1.00 max 0.040 max 0.030 11.50-13.50	max 1.00 max 1.00 max 0.040 max 0.030 11.50-13.50	max 1.00 max 0.040 max 0.030 11.50-13.50	max 0.040 max 0.030 11.50-13.50	max 0.030 11.50-13.50	11.50-13.50	11.50-13.50				min 85000	min 110000	min 15	min 50	
B 7 4140 0.38-0.48 0.20-0.35 0.75-1.00 max 0.040 max 0.040 0 0.080 0 0.80-1.10 0.15-0.2	B 7 4140 0.38-0.48 0.20-0.35 0.75-1.00 max 0.040 max 0.040 max 0.040	4140 0.38-0.48 0.20-0.35 0.75-1.00 max 0.040 max 0.040 0 max 0.040	0.38-0.48 0.20-0.35 0.75-1.00 max 0.040 max 0.040 0.15-0.2	0.20-0.35 0.75-1.00 max 0.040 max 0.040 2.2	0.75-1.00 max 0.040 max 0.040 0.15-0.2	max 0.040 max 0.040 0.15-0.2	max 0.040 0.15-0.2	0.80-1.10 0.15-0.2	0.80-1.10 0.15-0.2	0.15-0.2	2		min 105000*	min 125000*	min 16*	min 50*	
2 B 16 0.36-0.44 0.20-0.35 0.45-0.70 max 0.040 max	B 16 0.36-0.44 0.20-0.35 0.45-0.70 max 0.040 max 0.040 max 0.040 max 0.040	0.36-0.44 0.20-0.35 0.45-0.70 max 0.040 max 0.040 2.05 0.6	0.36-0.44 0.20-0.35 0.45-0.70 max 0.040 max 0.040 0.80-0.6	0.20-0.35 0.45-0.70 max 0.040 max 0.040 0.50 0.60	0.45-0.70 max 0.040 max 0.040 0.50-0.6	max 0.040 max 0.040 0.80-11.15 0.50-0.6	max 0.040 0.80-11.15 0.50-0.6	0.80-11.15 0.50-0.6	0.80-11.15 0.50-0.6	0.50-0.6	2	V:0.25-0.35	min 105000*	min 125000*	min 18*	min 50*	
2 A320 L 7 4140 0.38-0.48 0.20-0.35 0.75-1.00 max 0.040 max 0.040 0 max 0.040 0 0.80-1.10 0.15-0.2	L 7 4140 0.38-0.48 0.20-0.35 0.75-1.00 max 0.040 max 0.040 m 20.040 m 20.040 m 20.050 0.15-0.2	4140 0.38-0.48 0.20-0.35 0.75-1.00 max 0.040 max 0.040 0 0.040	0.38-0.48 0.20-0.35 0.75-1.00 max 0.040 max 0.040 0 ax 0.040	0.20-0.35 0.75-1.00 max 0.040 max 0.040 0.040	0.75-1.00 max 0.040 max 0.040 0.15-0.2	max 0.040 max 0.040 0.15-0.2	max 0.040 0.15-0.2	0.80-1.10 0.15-0.2	0.80-1.10 0.15-0.2	0.15-0.2	25		min 105000*	min 125000*	min 16*	min 50*	
Z L7A 4037 0.35-0.40 0.20-0.35 0.70-0.90 max 0.035 max 0.040	L7A 4037 0.35-0.40 0.20-0.35 0.70-0.90 max 0.035 max 0.040	4037 0.35-0.40 0.20-0.35 0.70-0.90 max 0.035 max 0.040	0.35-0.40 0.20-0.35 0.70-0.90 max 0.035 max 0.040	0.20-0.35 0.70-0.90 max 0.035 max 0.040 0.20-0.3	0.70-0.90 max 0.035 max 0.040 0.20-0.3	max 0.035 max 0.040 0.20-0.3	max 0.040 0.20-0.3	0.20-0.3	0.20-0.3	0.20-0.3	õ		min 105000	min 125000	min 16	min 50	
L LTB 4137 0.35-0.40 0.20-0.35 0.70-0.90 max 0.035 max 0.040 0.00-1.10 0.15-0.	L7B 4137 0.35-0.40 0.20-0.35 0.70-0.90 max 0.035 max 0.040 0.80-1.10 0.15-0.2	4137 0.35-0.40 0.20-0.35 0.70-0.90 max 0.035 max 0.040 0.15-0.	0.35-0.40 0.20-0.35 0.70-0.90 max 0.035 max 0.040 0.80-1.10 0.15-0.	0.20-0.35 0.70-0.90 max 0.035 max 0.040 0.15-0.	0.70-0.90 max 0.035 max 0.040 0.15-0.	max 0.035 max 0.040 0.15-0.	max 0.040 0.15-0.	0.80-1.10 0.15-0.	0.80-1.10 0.15-0.	0.15-0.	25		min 105000	min 125000	min 16	min 50	
L7C 8740 0.38-0.43 0.20-0.35 0.75-1.00 max 0.035 max 0.040 0.40-0.70 0.40-0.60 0.20-0.	L7C 8740 0.38-0.43 0.20-0.35 0.75-1.00 max 0.035 max 0.040 0.40-0.70 0.40-0.60 0.20-0.	8740 0.38-0.43 0.20-0.35 0.75-1.00 max 0.035 max 0.040 0.40-0.70 0.40-0.60 0.20-0	0.38-0.43 0.20-0.35 0.75-1.00 max 0.035 max 0.040 0.40-0.70 0.40-0.60 0.20-0	0.20-0.35 0.75-1.00 max 0.035 max 0.040 0.40-0.70 0.40-0.60 0.20-0	0.75-1.00 max 0.035 max 0.040 0.40-0.70 0.40-0.60 0.20-0	max 0.035 max 0.040 0.40-0.70 0.40-0.60 0.20-0.	max 0.040 0.40-0.70 0.40-0.60 0.20-0.	0.40-0.70 0.40-0.60 0.20-0.	0.40-0.60 0.20-0.	0.20-0.	35		min 105000	min 125000	min 16	min 50	
L43 4340 0.38-0.43 0.20-0.35 0.60-0.85 max 0.040 max 0.040 1.65-2.00 0.70-0.90 0.20-0.	L43 4340 0.38-0.43 0.20-0.35 0.60-0.85 max 0.040 max 0.040 1.65-2.00 0.70-0.90 0.20-0.	4340 0.38-0.43 0.20-0.35 0.60-0.85 max 0.040 max 0.040 1.65-2.00 0.70-0.90 0.20-0.	0.38-0.43 0.20-0.35 0.60-0.85 max 0.040 max 0.040 1.65-2.00 0.70-0.90 0.20-0.	0.20-0.35 0.60-0.85 max 0.040 max 0.040 1.65-2.00 0.70-0.90 0.20-0.	0.60-0.85 max 0.040 max 0.040 1.65-2.00 0.70-0.90 0.20-0.	max 0.040 max 0.040 1.65-2.00 0.70-0.90 0.20-0.	max 0.040 1.65-2.00 0.70-0.90 0.20-0.	1.65-2.00 0.70-0.90 0.20-0.	0.70-0.90 0.20-0.	0.20-0.	30		min 105000	min 125000	min 16	min 50	
A193/A320 B8 304 max 0.08 max 1.00 max 2.00 max 0.045 max 0.030 8.00-12.00 18.00-20.00	0 B8 304 max 0.08 max 1.00 max 2.00 max 0.045 max 0.030 8.00-12.00 18.00-20.00	304 max 0.08 max 1.00 max 2.00 max 0.045 max 0.030 8.00-12.00 18.00-20.00	max 0.08 max 1.00 max 2.00 max 0.045 max 0.030 8.00-12.00 18.00-20.00	max 1.00 max 2.00 max 0.045 max 0.030 8.00-12.00 18.00-20.00	max 2.00 max 0.045 max 0.030 8.00-12.00 18.00-20.00	max 0.045 max 0.030 8.00-12.00 18.00-20.00	max 0.030 8.00-12.00 18.00-20.00	8.00-12.00 18.00-20.00	18.00-20.00				min 30000	min 75000	min 30	min 50	max 192
BSC 347 max 0.08 max 1.00 max 2.00 max 0.045 max 0.030 9.00-13.00 17.00-19.00 BSC BS	B8C 347 max 0.08 max 1.00 max 2.00 max 0.045 max 0.030 9.00-13.00 17.00-19.00	347 max 0.08 max 1.00 max 2.00 max 0.045 max 0.030 9.00-13.00 17.00-19.00	max 0.08 max 1.00 max 2.00 max 0.045 max 0.030 9.00-13.00 17.00-19.00	max 1.00 max 2.00 max 0.045 max 0.030 9.00-13.00 17.00-19.00	max 2.00 max 0.045 max 0.030 9.00-13.00 17.00-19.00	max 0.045 max 0.030 9.00-13.00 17.00-19.00	max 0.030 9.00-13.00 17.00-19.00	9.00-13.00 17.00-19.00	17.00-19.00			Cb +Ta: 10 x C%	min 30000	min 75000	min 30	min 50	max 192
2 BBM 316 max 0.08 max 1.00 max 2.00 max 2.00 max 0.045 max 0.030 10.00-14.00 16.00-12.00 2.00-3	B8M 316 max 0.08 max 1.00 max 2.00 max 0.045 max 0.030 10.00-14.00 16.00-12.00 2.00-3	316 max 0.08 max 1.00 max 2.00 max 0.045 max 0.030 10.00-14.00 16.00-12.00 2.00-3	max 0.08 max 1.00 max 2.00 max 0.045 max 0.030 10.00-14.00 16.00-12.00 2.00-3	max 1.00 max 2.00 max 0.045 max 0.030 10.00-14.00 16.00-12.00 2.00-3	max 2.00 max 0.045 max 0.030 10.00-14.00 16.00-12.00 2.00-3	max 0.045 max 0.030 10.00-14.00 16.00-12.00 2.00-3	max 0.030 10.00-14.00 16.00-12.00 2.00-3	10.00-14.00 16.00-12.00 2.00-3	16.00-12.00 2.00-3	2.00-3	<u>8</u>		min 30000	min 75000	min 30	min 50	max 192
≅ B8T 321 max 0.08 max 1.00 max 2.00 max 0.045 max 0.030 9.00-12.00	B8T 321 max 0.08 max 1.00 max 2.00 max 0.045 max 0.030 9.00-12.00	321 max 0.08 max 1.00 max 2.00 max 0.045 max 0.030 9.00-12.00	max 0.08 max 1.00 max 2.00 max 0.045 max 0.030 9.00-12.00	max 1.00 max 2.00 max 0.045 max 0.030 9.00-12.00	max 2.00 max 0.045 max 0.030 9.00-12.00	max 0.045 max 0.030 9.00-12.00	max 0.030 9.00-12.00	9.00-12.00				TI: 5 X C%	min 30000	min 75000	min 30	min 50	max 192
A453 660 660 max 0.08 max 1.00 max 2.00 max 0.040 max 0.030 24.00-27.00 13.00-16.00 1.00-	660 660 max 0.08 max 1.00 max 2.00 max 0.040 max 0.030 24.00-27.00 13.00-16.00 1.00-	660 max 0.08 max 1.00 max 2.00 max 0.040 max 0.030 24.00-27.00 13.00-16.00 1.00-	max 0.08 max 1.00 max 2.00 max 0.040 max 0.030 24.00-27.00 13.00-16.00 1.00-	max 1.00 max 2.00 max 0.040 max 0.030 24.00-27.00 13.00-16.00 1.00-	max 2.00 max 0.040 max 0.030 24.00-27.00 13.00-16.00 1.00-	max 0.040 max 0.030 24.00-27.00 13.00-16.00 1.00-	max 0.030 24.00-27.00 13.00-16.00 1.00-	24.00-27.00 13.00-16.00 1.00-	13.00-16.00 1.00-	1.00-	1.50	v: 0.10-0.50 AI: max 0.35 Ti: 0.1-0.35 B: 0.00101	min 85000	min130000	min 15	min 18	248-341
												W:1.0-1.75 Cb: 0.25-0.60					
651 651 0.28-0.35 0.30-0.80 0.75-1.50 max 0.040 max 0.030 8.00-11.00 18.00-21.00 1.00-	651 651 0.28-0.35 0.30-0.80 0.75-1.50 max 0.040 max 0.030 8.00-11.00 18.00-21.00 1.00-	651 0.28-0.35 0.30-0.80 0.75-1.50 max 0.040 max 0.030 8.00-11.00 18.00-21.00 1.00-	0.28-0.35 0.30-0.80 0.75-1.50 max 0.040 max 0.030 8.00-11.00 18.00-21.00 1.00-	0.30-0.80 0.75-1.50 max 0.040 max 0.030 8.00-11.00 18.00-21.00 1.00-	0.75-1.50 max 0.040 max 0.030 8.00-11.00 18.00-21.00 1.00-	max 0.040 max 0.030 8.00-11.00 18.00-21.00 1.00-	max 0.030 8.00-11.00 18.00-21.00 1.00-	8.00-11.00 18.00-21.00 1.00-	18.00-21.00 1.00-	1.00-1	1.75	11:0. 1-0.35 Cu:max 0.50	min 50000**	min 95000	min 18**	min 35**	210-270
A194 3 501 min. 0.10 max 1.00 max 1.00 max 0.040 max 0.030 0.40-	3 501 min. 0.10 max 1.00 max 1.00 max 0.040 max 0.030 0.40-	501 min. 0.10 max 1.00 max 1.00 max 0.040 max 0.030 0.40-	min. 0.10 max 1.00 max 0.040 max 0.030 0.40-6.00 0.40-	max 1.00 max 1.00 max 0.040 max 0.030 0.40-	max 1.00 max 0.040 max 0.030 2.40-	max 0.040 max 0.030 0.40-1 4.00-6.00 0.40-1	max 0.030 4.00-6.00 0.40-0	4.00-6.00 0.40-0	4.00-6.00 0.40-0	0.40-(0.65						248-352
2 6 416 max 0.15 max 1.00 max 1.50 max 0.060 max 0.150 max 0.150	6 416 max 0.15 max 1.00 max 1.50 max 0.060 max 0.150 max 0.400 max 0	416 max 0.15 max 1.00 max 1.50 max 0.060 max 0.150 max 0.150 max 0.150	max 0.15 max 1.00 max 1.50 max 0.060 max 0.150 12.00-14.00 max 0	max 1.00 max 1.50 max 0.060 max 0.150 12.00-14.00 max 0	max 1.50 max 0.060 max 0.150 12.00-14.00 max 0	max 0.060 max 0.150 12.00-14.00 max 0	max 0.150 12.00-14.00 max 0	12.00-14.00 max 0	12.00-14.00 max 0	max C	.60	Zr: max 0.60					248-352
2 2H 1045 min 0.40 max 0.040 max 0.050	2H 1045 min 0.40 max 0.040 max 0.050	1045 min 0.40 max 0.040 max 0.050	min 0.40 max 0.040 max 0.050	max 0.040 max 0.050	max 0.040 max 0.050	max 0.040 max 0.050	max 0.050										248-352
5 4 0.40-0.50 0.20-0.35 0.70-0.90 max 0.035 max 0.040 0.20-0	4 0.40-0.50 0.20-0.35 0.70-0.90 max 0.035 max 0.040	0.40-0.50 0.20-0.35 0.70-0.90 max 0.035 max 0.040 0.20-0	0.40-0.50 0.20-0.35 0.70-0.90 max 0.035 max 0.040	0.20-0.35 0.70-0.90 max 0.035 max 0.040 0.20-0	0.70-0.90 max 0.035 max 0.040 0.20-0	max 0.035 max 0.040 0.20-0	max 0.040 0.20-0	0.20-0	0.20-0	0.20-0	.35						248-352
2 7 4140 0.38-0.48 0.20-0.35 0.70-1.00 max 0.040 max 0.040 0 0.80-1.10 0.15-0	7 4140 0.38-0.48 0.20-0.35 0.70-1.00 max 0.040 max 0.040 max 0.040 0.80-1.10 0.15-0	4140 0.38-0.48 0.20-0.35 0.70-1.00 max 0.040 max 0.040 0 0.35-0 0.35-0 0.80-1.10 0.15-0	0.38-0.48 0.20-0.35 0.70-1.00 max 0.040 max 0.040 m3 0.040	0.20-0.35 0.70-1.00 max 0.040 max 0.040 0.15-(0.70-1.00 max 0.040 max 0.040 0.15-(max 0.040 max 0.040 0.15-(0.15-(max 0.040 0.80-1.10 0.15-0	0.80-1.10 0.15-(0.80-1.10 0.15-0	0.15-0	0.25						248-352
c ⁰ A194 8 304 max 0.08 max 1.00 max 2.00 max 0.045 max 0.030 8.00-12.00 8.00-20.00	8 304 max 0.08 max 1.00 max 2.00 max 0.045 max 0.030 8.00-12.00 8.00-20.00	304 max 0.08 max 1.00 max 2.00 max 0.045 max 0.030 8.00-12.00 8.00-20.00	max 0.08 max 1.00 max 2.00 max 0.045 max 0.030 8.00-12.00 8.00-20.00	max 1.00 max 2.00 max 0.045 max 0.030 8.00-12.00 8.00-20.00	max 2.00 max 0.045 max 0.030 8.00-12.00 8.00-20.00	max 0.045 max 0.030 8.00-12.00 8.00-20.00	max 0.030 8.00-12.00 8.00-20.00	8.00-12.00 8.00-20.00	8.00-20.00								126-192
1 8C 347 max 0.08 max 1.00 max 2.00 max 0.045 max 0.030 9.00-13.00 7.00-19.00	8C 347 max 0.08 max 1.00 max 2.00 max 0.045 max 0.030 9.00-13.00 7.00-19.00	347 max 0.08 max 1.00 max 2.00 max 0.045 max 0.030 9.00-13.00 7.00-19.00	max 0.08 max 1.00 max 2.00 max 0.045 max 0.030 9.00-13.00 7.00-19.00	max 1.00 max 2.00 max 0.045 max 0.030 9.00-13.00 7.00-19.00	max 2.00 max 0.045 max 0.030 9.00-13.00 7.00-19.00	max 0.045 max 0.030 9.00-13.00 7.00-19.00	max 0.030 9.00-13.00 7.00-19.00	9.00-13.00 7.00-19.00	7.00-19.00			Cb = Ta: 10 x C%					126-192
7 8M 316 max 0.08 max 1.00 max 2.00 max 0.045 max 0.030 10.00-14.00 6.00-18.00 2.00	8M 316 max 0.08 max 1.00 max 2.00 max 0.045 max 0.030 10.00-14.00 6.00-18.00 2.00	316 max 0.08 max 1.00 max 2.00 max 0.045 max 0.030 10.00-14.00 6.00-18.00 2.00	max 0.08 max 1.00 max 2.00 max 0.045 max 0.030 10.00-14.00 6.00-18.00 2.00	max 1.00 max 2.00 max 0.045 max 0.030 10.00-14.00 6.00-18.00 2.00	max 2.00 max 0.045 max 0.030 10.00-14.00 6.00-18.00 2.00	max 0.045 max 0.030 10.00-14.00 6.00-18.00 2.00	max 0.030 10.00-14.00 6.00-18.00 2.00	10.00-14.00 6.00-18.00 2.00	6.00-18.00 2.00	2.00	-3.00						126-192
T 321 max 0.08 max 1.00 max 2.00 max 0.045 max 0.030 9.00-12.00 7.00-19.00	8T 321 max 0.08 max 1.00 max 2.00 max 0.045 max 0.030 9.00-12.00 7.00-19.00	321 max 0.08 max 1.00 max 2.00 max 0.045 max 0.030 9.00-12.00 7.00-19.00	max 0.08 max 1.00 max 2.00 max 0.045 max 0.030 9.00-12.00 7.00-19.00	max 1.00 max 2.00 max 0.045 max 0.030 9.00-12.00 7.00-19.00	max 2.00 max 0.045 max 0.030 9.00-12.00 7.00-19.00	max 0.045 max 0.030 9.00-12.00 7.00-19.00	max 0.030 9.00-12.00 7.00-19.00	9.00-12.00 7.00-19.00	7.00-19.00			TI: 5 × C%					126-192



CAIN BOLT & GASKET, INC

MECHANICAL REOUIREMENTS FOR STEEL BOLTS

Grade & Head Marking Coarse Thread Fine Thread Hardness Bit Size Diam. In Proof Tensile Proof Tensile Brinnell Rockwell Material and Strength Material and Strength in P.S.I SAE GRADE 2 1/4 1.750 2.200 2.000 241 max 100 B max. I/0 Strength in P.S.I SAE GRADE 2 1/4 1.750 2.200 2.000 241 max 100 B max. I/0 I/0 Brank 1/2 7.800 9.800 8.800 11.050 241 max 100 B max. I/0 Proof load Minimum 50.000 psi. 9/16 9.450 11.650 10.550 13.000 241 max 100 B max. I/0 Proof load Minimum 28.00 1/1 16.950 33.350 18.550 36.450 207 max 95 B max. I/0 Proof load Minimum 52.000 psi. 1/1/8 11/4 27.100 53.300 29.950 59.000 207 max 95 B max. I/0 Prosi I coad Minimum 55.000 psi. Tensile Strength Minimum 5				2011		10101		20210	
Grade & Head Marking Nom. Bolt Size Diam. In. Proof Load Tensile Strength Proof Load Tensile Strength Brinnell Rockwell Material and Strength Material and Strength SAE GRADE 2 5/16 2.900 3.600 3.200 4.000 241 max 100 B max. 100 B max. I/// 100 B max. I// 100 B max. </td <td></td> <td></td> <td>Coarse Th</td> <td>hread</td> <td>Fine Th</td> <td>read</td> <td>Hardness</td> <td>3</td> <td></td>			Coarse Th	hread	Fine Th	read	Hardness	3	
Head Marking Boit Size Dim., In. Load Lb. Strength Mm. Lb. Load Lb. Strength Mm. Lb. Low Carbon Steel. Up to 1/2 inch, Prof Lead Mminum 99,000 psi, Tensile Strength Minimum 28,000 psi, Tensile Strength Minimum 99,000 psi, Psi. Strength Minimum 90,000 psi, Psi. Stre	Grade &	Nom.	Proof	Tensile	Proof	Tensile	Brinnell	Rockwell	Material and
SAE Dot Not Low Min. Lb. Min. Lb. Min. Lb. Min. Lb. Min. Lb. Min. Lb. SAE 5/16 2.900 3.600 3.200 4.000 241 max 100 B max. Proof Load Minimum 95.000 psi. 1/2 7.16 5.850 7.350 6.550 8.200 241 max 100 B max. Tensile Strength Minimum 95.000 psi. Tensile Strength Minimum 95.000 psi. Tensile Strength Minimum 52.000 psi. Tensile Strength Minimum 52.000 psi. Over 1/2 inch 103/4 inch 70 of Load Minimum 52.000 psi. Tensile Strength Minim	Head Marking	Bolt Size	Load	Strength	Load	Strength			Strength in P.S.I
SAE GRADE 2 1/4 1.750 2.200 2.000 2.500 2.41 max 100 B max. 3/8 4.250 5.350 4.850 6.050 241 max 100 B max. 100 B max. 7/16 5.850 7.350 6.550 8.200 241 max 100 B max. 100 B max. 9/16 9.450 11.650 10.550 8.200 241 max 100 B max. 100 B max. 9/16 9.450 11.650 10.550 13.000 241 max 100 B max. 100 B max. 9/16 9.450 11.650 13.000 241 max 100 B max. 100 B max. 100 B max. 3/4 17.750 14.450 13.300 241 max 100 B max. 100 B max. 12 inch Proof Load Minimum 55.000 psi. 1 14 16.950 33.350 18.550 36.450 207 max 95 B max. 1 1/4 27.100 53.300 29.950 59.000 207 max 95 B max. 1 1/4 2.700 3.	The starking	Diam In	Lbuu	Min I h	Loud	Min I h			ou ongai in the ion
SAE GRADE 2 1/4 5/16 1.750 2.200 2.000 2.000 2.41 max 4.000 100 B max. 100 B max. Low Carbon Steel. Up to 1/2 inch, Proof Load Minimum 55,000 psi, Ore 1/2 inch to 3/ inch mum 55,000 psi, Ver 1/2 inch to 3/ inch mum 55,000 GRADE 2 3/8 4.250 5.350 4.850 6.050 241 max 100 B max. 100 B max. 1/2 7.800 9.800 11.050 241 max 100 B max. 100 B max. Proof Load Minimum 50,000 psi, Over 1/2 inch to 3/a inch Proof Load Minimum 52,000 psi, Tensile Strength Minimum 52,000 psi, Tensile Strength Minimum 52,000 psi, Tensile Strength Minimum 52,000 psi, Tensile Strength Minimum 52,000 psi, Traile Strength Minimum 52,000 psi, Traile Strength Minimum 55,000 psi, Tal 1/8 11.4 16.950 23.950 47.100 207 max 95 B max. 95 B max. 1 11/8 21.350 41.950 23.950 47.100 207 max 95 B max. 95 B max. 1 11/8 21.350 41.950 23.950 47.100 23.320 C 1 11/8 21.350 41.950 23.950 47.100 23.32 C 1 11/2 39.300 77.300 44.000 86.950			LU.	0.000	LU.	0.500	0.11	100 D	
SAE 5/16 2.900 3.600 3.200 4.000 241 max 100 B max. 112 inch Proof Load Minimum 52.000 psi. Tensile Strength Minimum 52.000 psi. Tensile Strength Minimum 28.000 psi. 112 inch Proof Load Minimum 28.000 psi. psi. 112 inch Proof Load Minimum 28.000 psi. 112 inch Proof Load Minimum	SAF	1/4	1.750	2.200	2.000	2.500	241 max	100 B max.	
GRADE 2 338 4.250 5.350 4.850 6.050 241 max 100 B max. Low Carbon Steel. Up to 1/2 inch, Prof Load Minimum 55,000 psi, Tensile Strength 9/16 9.450 11.650 10.550 13.000 241 max 100 B max. 100 B max. Prof Load Minimum 55,000 psi, Tensile Strength 3/4 17.350 21.400 19.400 23.850 241 max 100 B max. 100 B max. Over 1/2 inch to 3/4 inch Prof Load Minimum 69,000 psi, Tensile Strength 7/8 12.900 25.400 14.250 28.000 207 max 95 B max. 95 B max. 1 16.950 33.350 18.550 36.450 207 max 95 B max. 95 B max. 1 1/2 39.300 77.300 44.000 86.950 207 max 95 B max. 95 B max. 1/2 39.300 77.300 44.000 86.950 207 max 95 B max. 95 B max. 1/2 39.300 77.300 44.000 86.950 241-302 23-32 C GRADE 5 5/16	SAE	5/16	2.900	3.600	3.200	4.000	241 max	100 B max.	
SAE GRADE 5 OR ASTM A-325 1/4 7/16 5.850 9.450 7.350 9.800 6.550 8.800 8.200 11.050 241 max 241 max 100 B max. 100 B max. 100 B max. Tensile Strength Minimum 56,000 psi. Over 1/2 inch 03/4 inch Proof Load Minimum 52,000 psi. Over 1/2 inch 03/4 inch Proof Load Minimum 22,000 psi. 7/8 11.750 14.450 13.300 16.400 241 max 100 B max. 100 B max. Tensile Strength Minimum 52,000 psi. Tensile Strength Minimum 22,000 psi. Tensile Strength Minimum 22,000 psi. Tensile Strength Minimum 28,000 psi. 7/8 12.900 25.400 14.250 28.000 207 max 95 B max. 95 B max. 1 16.950 33.350 18.550 36.450 207 max 95 B max. 95 B max. 1 1/2 39.300 77.300 44.000 86.950 207 max 95 B max. 95 B max. 1 1/2 10.550 13.600 1.250 241- 302 23-32 C Minimum 82,000 psi. Tensile Strength Minimum 78,000 psi. Tensile Strength Minimum 15,000 psi. Tensil	GRADE 2	3/8	4.250	5.350	4.850	6.050	241 max	100 B max.	Low Carbon Steel Up to 1/2 inch
1/2 7.800 9.800 8.800 11.050 241 max 100 B max. Tensile Strength Minimum 69.00 psi. 9/16 9.450 11.650 10.550 13.000 241 max 100 B max. Over 1/2 inch 0.34 linch Prod Lad 3/4 17.350 21.400 19.400 23.850 241 max 100 B max. Over 1/2 inch 0.34 linch Prod Lad 7/8 12.900 25.400 14.250 28.000 207 max 95 B max. 17.8 12.800 18.550 23.950 47.100 58 max. 19.5 11.5 11.8 11		7/16	5.850	7.350	6.550	8.200	241 max	100 B max.	Proof Load Minimum 55,000 psi,
9/16 9.450 11.650 10.550 13.000 241 max 100 B max. Over 1/2 inch to 3/4 inch Proof Load 3/4 17.750 14.450 13.300 241 max 100 B max. 114 100 B max. 100 B max. 100 B max. 100 B max. 114 1500 23.500 210 max 95 B max. 114 1200 23.850 241 max 100 B max. 114 2.000 23.32 C Medium Carbon Steel. Quenched and Tempered . Up to 3/4 inch Proof Load Minimum 35.000 psi. 11/2 12.050 17.050 13.600 14.250 241 - 302 <td< td=""><td></td><td>1/2</td><td>7.800</td><td>9.800</td><td>8.800</td><td>11.050</td><td>241 max</td><td>100 B max.</td><td>Tensile Strength Minimum 69,000 psi.</td></td<>		1/2	7.800	9.800	8.800	11.050	241 max	100 B max.	Tensile Strength Minimum 69,000 psi.
5/8 11.750 14.450 13.300 16.400 241 max 100 B max. Minimum 52.000 psi, 1ense 3 rinch 01- 100.00. Over 3/4 rinch 01- 1/2 inch Proof Load Minimum 28,000 7/8 12.900 25.400 14.250 28.000 207 max 95 B max.	\sim	9/16	9.450	11.650	10.550	13.000	241 max	100 B max.	Over 1/2 inch to 3/4 inch Proof Load
3/4 17.350 21.400 19.400 23.850 241 max 100 B max. 11/2 inch Proof Load Minimum 28,000 psi. 7/8 12.900 25.400 14.250 28.000 207 max 95 B max. 95 B max. 95. </td <td></td> <td>5/8</td> <td>11.750</td> <td>14.450</td> <td>13.300</td> <td>16.400</td> <td>241 max</td> <td>100 B max.</td> <td>Minimum 52,000 psi, Tensile Strength Minimum 64,000 Over 3/4 inch to 1-</td>		5/8	11.750	14.450	13.300	16.400	241 max	100 B max.	Minimum 52,000 psi, Tensile Strength Minimum 64,000 Over 3/4 inch to 1-
7/8 12.900 25.400 14.250 28.000 207 max 95 B max. psi. Tensile Strength Minimum 55,000 psi. 1 16.950 33.350 18.550 36.450 207 max 95 B max. psi. tensile Strength Minimum 55,000 psi. 1 1/4 27.100 53.300 29.950 59.000 207 max 95 B max. psi. tensile Strength Minimum 55,000 psi. 1 1/4 27.100 53.300 29.950 59.000 207 max 95 B max. psi. tensile Strength Minimum 55,000 psi. 1 1/2 39.300 77.300 44.000 86.950 207 max 95 B max. psi. tensile Strength Minimum 55,000 psi. GRADE 5 5/16 4.450 6.300 4.950 6.950 241- 302 23-32 C Minimum 85,000 psi. 12.750 10.100 14.250 241- 302 23-32 C Minimum 12,000 psi. 17.250 17.50 13.600 19.200 241- 302 23-32 C 1/2 12.		3/4	17.350	21.400	19.400	23.850	241 max	100 B max.	1/2 inch Proof Load Minimum 28,000
1 16.950 33.350 18.550 36.450 207 max 95 B max. psi. 1 1/8 21.350 41.950 23.950 47.100 207 max 95 B max. 95 B max. 1 1/4 27.100 53.300 29.950 59.000 207 max 95 B max. 95 B max. 1 3/8 32.300 63.550 36.800 72.350 207 max 95 B max. 1 1/2 39.300 77.300 44.000 86.950 207 max 95 B max. GRADE 5 0R ASTM 5/16 4.450 6.300 4.950 6.950 241- 302 23-32 C 1/2 12.050 17.050 13.600 14.250 241- 302 23-32 C Medium Carbon Steel. Quenched and Tempered . Up to 3/4 inch Proof Load Minimum 78,000 psi. 1/2 12.050 17.050 13.600 19.200 241- 302 23-32 C 9/16 15.450 21.850 17.250 24.350 241- 302 23-32 C 1/2 12.050 17.00 21.750 30.700 241- 302 23-32 C		7/8	12.900	25.400	14.250	28.000	207 max	95 B max.	psi. Tensile Strength Minimum 55,000
1 1/8 21.350 41.950 23.950 47.100 207 max 95 B max. 1 1/4 27.100 53.300 29.950 59.000 207 max 95 B max. 1 3/8 32.300 63.550 36.800 72.350 207 max 95 B max. 1 1/2 39.300 77.300 44.000 86.950 207 max 95 B max. SAE 1 1/2 39.300 77.300 44.000 86.950 207 max 95 B max. SAE 5/16 4.450 6.300 4.950 6.950 241-302 23-32 C Medium Carbon Steel. Quenched and Minimum 78,000 psi. 5/16 4.450 6.300 4.950 6.950 241-302 23-32 C N/16 9.050 12.750 10.100 14.250 241-302 23-32 C 9/16 15.450 21.850 17.250 24.350 241-302 23-32 C 9/16 15.450 21.850 17.250 24.350 241-302 23-32 C 1 1/2 </td <td></td> <td>1</td> <td>16 950</td> <td>33 350</td> <td>18 550</td> <td>36 450</td> <td>207 max</td> <td>95 B max</td> <td>psi.</td>		1	16 950	33 350	18 550	36 450	207 max	95 B max	psi.
1 1/4 27.100 53.300 29.950 59.000 207 max 95 B max. 1 3/8 32.300 63.550 36.800 72.350 207 max 95 B max. 1 1/2 39.300 77.300 44.000 86.950 207 max 95 B max. SAE 1 1/2 39.300 77.300 44.000 86.950 207 max 95 B max. SAE 5/16 4.450 6.300 4.950 6.950 241- 302 23-32 C Medium Carbon Steel. 0.00 psi, Tensile Strength 3/8 6.600 9.300 7.450 10.550 241- 302 23-32 C 1/2 12.050 17.050 13.600 19.200 241- 302 23-32 C 9/16 15.450 21.850 17.250 24.350 241- 302 23-32 C 9/16 15.450 21.850 17.250 24.350 241- 302 23-32 C 1 3/4 28.400 40.100 31.700 44.750 241- 302 23-32 C		1 1/8	21 350	41 950	23 950	47 100	207 max	95 B max	
1 3/8 32.300 63.550 36.800 72.350 207 max 95 B max. 1 1/2 39.300 77.300 44.000 86.950 207 max 95 B max. SAE 1/4 2.700 3.800 3.100 4.350 241- 302 23-32 C GRADE 5 5/16 4.450 6.300 4.950 6.950 241- 302 23-32 C 3/8 6.600 9.300 7.450 10.550 241- 302 23-32 C 7/16 9.050 12.750 10.100 14.250 241- 302 23-32 C 9/16 15.450 21.850 17.250 241- 302 23-32 C Minimum 85.000 psi. Ver 3/4 inch to 9/16 15.450 21.850 17.250 24.350 241- 302 23-32 C 9/16 15.450 21.850 17.250 24.350 241- 302 23-32 C 1/2 12.050 17.000 21.750 30.700 241- 302 23-32 C 9/16 15.450 21.850 1	\sim	1 1/4	27 100	53 300	29,950	59 000	207 max	95 B max	
SAE GRADE 5 OR ASTM A-325 1/4 5/16 2.000 39.300 77.300 77.300 44.000 44.000 86.950 86.950 207 max 207 max 95 B max. Medium Carbon Steel. Quenched and Tempered. Up to 3/4 inch Proof Load Minimum 82,000 psi. Tensile Strength 1/2 1/4 1.2.050 2.700 1.2.750 3.800 4.950 3.100 6.950 4.350 241- 302 23-32 2.32 C Medium Carbon Steel. Quenched and Tempered. Up to 3/4 inch Proof Load Minimum 82,000 psi. Tensile Strength Minimum 120,000 psi. Over 3/4 inch to 1 inch, Proof Load Minimum 78,000 psi. 9/16 15.450 21.850 17.250 241- 302 23-32 2.32 C 1 inch, Proof Load Minimum 120,000 psi. Tensile Strength Minimum 115,000 psi. 9/16 15.450 21.850 17.250 24.350 241- 302 23-32 2.32 C 1 inch, Proof Load Minimum 115,000 psi. 9/16 15.450 21.850 17.250 24.350 241- 302 23-32 2.32 C Minimum 105,000 psi. 3/4 28.400 40.100 31.700 44.750 241- 302 23-32 2.32 C Minimum 105,000 psi. 1 1/4 25.0 53.150 39.700 58.550 235- 302 22-32 C Minimum 90,000 psi. 1		1 3/8	32 300	63 550	36,800	72 350	207 max	95 B max	
SAE GRADE 5 OR ASTM A-325 1/4 2.700 3.800 3.100 4.350 241-302 23-32 C Maintain 5/16 4.450 6.300 4.950 6.950 241-302 23-32 C Maintain 3/8 6.600 9.300 7.450 10.550 241-302 23-32 C Minimum 85,000 psi, Tensile 1/2 12.050 17.050 13.600 19.200 241-302 23-32 C 1/2 12.050 17.050 13.600 19.200 241-302 23-32 C 9/16 15.450 21.850 17.250 24.350 241-302 23-32 C 9/16 15.450 21.850 17.250 24.350 241-302 23-32 C 3/4 28.400 40.100 31.700 44.750 241-302 23-32 C 1 1/2 12.050 53.150 39.700 58.550 235-302 22-32 C 7/8 36.050		1 1/2	39,300	77 300	44 000	86.950	207 max	95 B max.	
SAE GRADE 5 OR ASTM A-325 1/4 2.700 3.800 3.100 4.350 241-302 23-32 C Medium Carbon Steel. Quenched and Tempered. Up to 3/4 inch Proof Load Marcel Action A-325 J/4 2.700 3.800 3.100 4.350 241-302 23-32 C J/4 4.450 6.300 4.950 6.950 241-302 23-32 C J/16 9.050 12.750 10.100 14.250 241-302 23-32 C J/2 12.050 17.050 13.600 19.200 241-302 23-32 C 9/16 15.450 21.850 17.250 24.350 241-302 23-32 C 5/8 19.200 27.100 21.750 30.700 241-302 23-32 C J/4 28.400 40.100 31.700 44.750 241-302 23-32 C J/4 28.400 40.100 31.700 44.750 235-302 22-32 C <td></td> <td>1 1/2</td> <td>39.300</td> <td>11.500</td> <td>44.000</td> <td>00.950</td> <td>207 1110</td> <td>35 D max.</td> <td></td>		1 1/2	39.300	11.500	44.000	00.950	207 1110	35 D max.	
GRADE 5 OR ASTM A-325 1/4 5/16 2.700 3.000 4.350 241-302 23-32 C Medium Carbon Steel. Quenched and Tempered . Up to 3/4 inch Proof Load A-325 3/8 6.600 9.300 7.450 10.550 241- 302 23-32 C 7/16 9.050 12.750 10.100 14.250 241- 302 23-32 C 9/16 15.450 21.850 17.250 24.350 241- 302 23-32 C 9/16 15.450 21.850 17.250 24.350 241- 302 23-32 C 9/16 15.450 21.850 17.250 24.350 241- 302 23-32 C 3/4 28.400 40.100 31.700 44.750 241- 302 23-32 C 7/8 36.050 53.150 39.700 58.50 235- 302 23-32 C 1 47.250 69.700 51.700 76.550 235- 302 22-32 C 1 1/4 71.700 101.750 79.400 12.650 235- 302 22-32 C <	SAE	1/4	2 700	2 800	2 100	4 250	241 202		
OR ASTM A-325 5/16 4.450 6.300 4.950 6.950 241-302 23-32 C Impered Impered Up 63/4 inch Proof Load A-325 3/8 6.600 9.300 7.450 10.550 241-302 23-32 C Impered Up 63/4 inch Proof Load 7/16 9.050 12.750 10.100 14.250 241-302 23-32 C Impered Minimum 85.000 psi, Tensile Strength 9/16 15.450 21.850 17.250 24.350 241-302 23-32 C Impered Ver 3/4 inch to 9/16 15.450 21.850 17.250 24.350 241-302 23-32 C Ver 1 inch to 1-1/2, Proof Load Minimum 78,000 psi. 3/4 28.400 40.100 31.700 241-302 23-32 C Minimum 105,000 psi. 3/4 28.400 40.100 31.700 44.750 241-302 23-32 C 1 47.250 69.700 51.700 76.250 235-302 22-32	GRADE 5	1/4	2.700	3.800	3.100	4.350	241-302	23-32 C	Medium Carbon Steel. Quenched and
A-325 3/8 6.600 9.300 7.450 10.550 241-302 23-32 C Minimum 120,000 psi. Over 34 inch to 1 inch, Proof Dad Minimum 120,000 psi. Over 34 inch to 1 inch, Proof Dad Minimum 120,000 psi. Over 34 inch to 1 inch, Proof Dad Minimum 120,000 psi. Over 34 inch to 1 inch, Proof Dad Minimum 120,000 psi. 9/16 15.450 21.850 17.250 24.350 241- 302 23-32 C 9/16 15.450 21.850 17.250 24.350 241- 302 23-32 C 5/8 19.200 27.100 21.750 30.700 241- 302 23-32 C 3/4 28.400 40.100 31.700 44.750 241- 302 23-32 C 7/8 36.050 53.150 39.700 58.550 235- 302 22-32 C 1 1/8 56.450 80.100 63.350 89.900 223-285 19-30 C 1 1/4 71.700 101.750 79.400 112.650 223- 285 19-30 C	OR ASTM	5/16	4.450	6.300	4.950	6.950	241-302	23-32 0	Tempered . Up to 3/4 inch Proof Load
7/16 9.050 12.750 10.100 14.250 241-302 23-32 C 1 inch, Proof Load Minimum 78,000 psi, Tensile Strength Minimum 15,000 psi, 9/16 15.450 21.850 17.250 24.350 241-302 23-32 C 9/16 15.450 21.850 17.250 24.350 241-302 23-32 C 5/8 19.200 27.100 21.750 30.700 241-302 23-32 C 3/4 28.400 40.100 31.700 44.750 241-302 23-32 C 1 1/8 36.050 53.150 39.700 58.550 235-302 22-32 C 1 47.250 69.700 51.700 76.250 235-302 22-32 C 1 1/8 56.450 80.100 63.350 89.900 223-285 19-30 C 1 1/4 71.700 101.750 79.400 126.50 235-302 22-32 C	A-325	3/8	6.600	9.300	7.450	10.550	241-302	23-32 C	Minimum 120,000 psi, Over 3/4 inch to
1/2 12.050 17.050 13.600 19.200 241-302 23-32 C Tensile Strength Minimum 115,000 psi. 9/16 15.450 21.850 17.250 24.350 241-302 23-32 C 5/8 19.200 27.100 21.750 30.700 241-302 23-32 C 3/4 28.400 40.100 31.700 44.750 241-302 23-32 C 7/8 36.050 53.150 39.700 58.550 235-302 22-32 C 1 47.250 69.700 51.700 76.250 235-302 22-32 C 1 1/8 56.450 80.100 63.350 89.900 223-285 19-30 C 1 1/4 71.700 101.750 79.400 122.650 223-285 19-30 C		//16	9.050	12.750	10.100	14.250	241- 302	23-32 C	1 inch, Proof Load Minimum 78,000 psi,
9/16 15.450 21.850 17.250 24.350 241- 302 23-32 C 5/8 19.200 27.100 21.750 30.700 241- 302 23-32 C 3/4 28.400 40.100 31.700 44.750 241- 302 23-32 C 7/8 36.050 53.150 39.700 58.550 235- 302 22-32 C 1 47.250 69.700 51.700 76.250 235- 302 22-32 C 1 1/8 56.450 80.100 63.350 89.900 223- 285 19-30 C	~	1/2	12.050	17.050	13.600	19.200	241- 302	23-32 C	Tensile Strength Minimum 115,000 psi.
5/8 19.200 27.100 21.750 30.700 241- 302 23-32 C 3/4 28.400 40.100 31.700 44.750 241- 302 23-32 C 7/8 36.050 53.150 39.700 58.550 235- 302 22-32 C 1 47.250 69.700 51.700 76.250 235- 302 22-32 C 1 1/8 56.450 80.100 63.350 89.900 223- 285 19-30 C 1 1/4 71.700 101.750 79.400 112.650 232- 285 19-30 C		9/16	15.450	21.850	17.250	24.350	241- 302	23-32 C	Over 1 inch to 1-1/2, Proof Load
3/4 28.400 40.100 31.700 44.750 241- 302 23-32 C 7/8 36.050 53.150 39.700 58.550 235- 302 22-32 C 1 47.250 69.700 51.700 76.250 235- 302 22-32 C 1 1/8 56.450 80.100 63.350 89.900 223- 285 19-30 C 1 1/4 71.700 101.750 79.400 112.650 223- 285 19-30 C		5/8	19.200	27.100	21.750	30.700	241- 302	23-32 C	Minimum 74,000 psi, Tensile Strength Minimum 105.000 psi.
7/8 36.050 53.150 39.700 58.550 235-302 22-32 C 1 47.250 69.700 51.700 76.250 235-302 22-32 C 1 1/8 56.450 80.100 63.350 89.900 223-285 19-30 C 1 1/4 71.700 101.750 79.400 112.650 223-285 19-30 C		3/4	28.400	40.100	31.700	44.750	241- 302	23-32 C	ASTM-A325 Over 1-1/2 inch to 3 inch
1 47.250 69.700 51.700 76.250 235-302 22-32 C 1 1/8 56.450 80.100 63.350 89.900 223-285 19-30 C 1 1/4 71.700 101.750 79.400 112.650 223-285 19-30 C		7/8	36.050	53.150	39.700	58.550	235- 302	22-32 C	Proof Load Minimum 55,000 psi,
1 1/8 56.450 80.100 63.350 89.900 223-285 19-30 C 1 1/4 71.700 101.750 79.400 112.650 223-285 19-30 C		1	47.250	69.700	51.700	76.250	235- 302	22-32 C	Tensile Strength Minimum 90,000 psi.
1 1/4 71.700 101.750 79.400 112.650 223- 285 19-30 C		1 1/8	56.450	80.100	63.350	89.900	223-285	19-30 C	
		1 1/4	71.700	101.750	79.400	112.650	223- 285	19-30 C	
1 3/8 85.450 121.300 97.300 138.100 223-285 19-30 C		1 3/8	85.450	121.300	97.300	138,100	223-285	19-30 C	
1 1/2 103 950 147 550 117 000 166 000 223- 285 19-30 C		1 1/2	103 950	147 550	117 000	166 000	223-285	19-30 C	
		· ··-					200		
SAE 1/4 3 800 4 750 4 350 5 450 302- 352 32-38 C	SAE	1/4	3 800	4 750	4 350	5 450	302- 352	32-38 C	
GRADE 8 5/16 6 300 7.850 6 550 8 700 302 352 32 38 C	GRADE 8	5/16	6 300	7 850	6 950	8 700	302-352	32-38	
OR ASTM 3/8 9 300 11 650 10 550 0.13 150 302- 32 32-38 C	ORASTM	3/8	9 300	11 650	10 550	13 150	302-352	32-38	
A-354 7/46 12 250 16 050 14 250 17 200 202 32 32 30 C	A-354	7/16	12 750	15.050	14 250	17 900	202 252	22.20 0	
GRADE BD 1/10 12.750 13.550 14.250 17.000 302-352 32-35 C	GRADE BD	1/10	12.750	10.900	14.200	17.000	302-352	32-30 C	Modium Carbon Allow ² Stool Ouenched
ASTM-A490 1/2 17.000 21.000 19.200 24.000 302-352 32-35 C weddin camered lafter Guerrede Guerrede Control and Steel Guerrede August and the fully incher Proof	ASTM-A490	1/2	17.050	21.300	19.200	24.000	302-352	32-38 C	and Tempered. Up to 1-1/2 inch Proof
9/10 21.500 21.500 24.500 30.450 302-352 32-35 C Los company market in the intermediate intermediate in the intermediate intermedinate intermediate intermedia		9/10	21.850	21.300	24.350	30.450	302- 352	32-38 C	Load Minimum 120,000 psi, Tensile
5/8 27.100 33.900 30.700 38.400 302-352 32-38 C Strength Minimum 150,000 psi.		5/8	27.100	33.900	30.700	38.400	302-352	32-38 C	Strength Minimum 150,000 psi.
3/4 40.100 50.100 44.750 55.950 302-352 32-38 C		3/4	40.100	50.100	44.750	55.950	302-352	32-38 C	
7/8 55.450 69.300 61.100 76.350 302- 352 32-38 C		7/8	55.450	69.300	61.100	76.350	302- 352	32-38 C	
1 72.700 90.900 79.550 99.450 302-352 32-38 C		1	72.700	90.900	79.550	99.450	302-352	32-38 C	
V V 1 1/8 91.550 114.450 102.700 128.400 302- 352 32-38 C		1 1/8	91.550	114.450	102.700	128.400	302- 352	32-38 C	
1 1/4 116.300 145.350 128.750 160.950 302-352 32-38 C		1 1/4	116.300	145.350	128.750	160.950	302-352	32-38 C	
1 3/8 138.600 173.250 157.800 197.250 302- 352 32-38 C		1 3/8	138.600	173.250	157.800	197.250	302-352	32-38 C	
1 1/2 168.600 210.750 189.700 237.150 302- 352 32-38 C	<u> </u>	1 1/2	168.600	210.750	189.700	237.150	302-352	32-38 C	

Grade 5 material heat treated before assembly with a hardened washer is an acceptable substitute.
 Carbon steel may be used by agreement between producer and consumer in size 1/4 thru 3/4 inch. NOTE: Carbon range is for check analysis of product.



American Water Works Association (AWWA)

150#	Qty		250#	Qty	
Flange	Per	Bolt	Flange	Per	Bolt
Size	Set	Size	Size	Set	Size
1/2, 3/4, 1	4	1/2-13 x 1 3/4	1	4	5/8-11 x 2 1/2
1 1/4	4	1/2-13 x 2	1 1/4	4	5/8-11 x 2 1/2
1 1/2	4	1/2-13 x 2	1 1/2	4	5/8-11 x 2 3/4
2	4	5/8-11 x 2 1/4	2	8	5/8-11 x 2 3/4
2 1/2	4	5/8-11 x 2 1/2	2 1/2	8	3/4-10 x 3 1/4
3	4	5/8-11 x 2 1/2	3	8	3/4-10 x 3 1/2
3 1/2	8	5/8-11 x 2 3/4	3 1/2	8	3/4-10 x 3 1/2
4	8	5/8-11 x 3	4	8	3/4-10 x 3 3/4
5	8	3/4-11 x 3	5	8	3/4-10 x 4
6	8	3/4-11 x 3 1/4	6	12	3/4-10 x 4
8	8	3/4-11 x 3 1/2	8	12	7/8-9 x 4 1/2
10	12	7/8-9 x 3 3/4	10	16	1-8 x 5 1/2
12	12	7/8-9 x 3 3/4	12	16	1 1/8-7 x 5 1/2
14	12	1-8 x 4 1/4	14	20	1 1/8-7 x 6
16	16	1-8 x 4 1/2	16	20	1 1/4-7 x 6
18	16	1 1/8-7 x 5	18	24	1 1/4-7 x 6 1/2
20	20	1 1/8-7 x 5	20	24	1 1/4-7 x 7
24	20	1 1/4-7 x 5 1/2	24	24	1 1/2-6 x 8
30	28	1 1/4-7 x 6 1/2	30	28	1 3/4-5 x 8 1/2
34, 36	32	1 1/2-6 x 7	36	32	2-4 1/2 x 9 1/2
42	36	1 1/2-6 x 7 1/2	42	36	2 - 4 1/2 x 10 1/2
48	44	1 1/2-6 x 8	48	40	2-4 1/2 x 11
54	44	1 3/4-5 x 8 1/2			
60	52	1 3/4-5 x 8 3/4			
72	60	1 3/4-5 x 9 1/2			
84	64	2-4 1/2 x 10 1/2			
96	68	2 1/4-4 1/2 x 11 1/2			



BOLTING DATA FOR ASME/ANSI B16.5 FLANGES WITH HVY 2H NUTS

		150	LB FLANC	GES (3)			300 LB FL	ANGES (3	3)			400 LB FL	ANGES (4	4)
Nominal	2H Nuts	No. of	Dia. of	Length	Length	2H Nuts	No. of	Dia. of	Length	Length	2H Nut	No.	Dia	Length
Pipe	Wrench	Bolts or	Bolts or	of	of	Wrench	Bolts or	Bolts or	of	of	Wrench	of	of	of
Size	Size	Studs	Studs	Bolts	Studs	Size	Studs	Studs	Bolts	Studs	Size	Studs	Studs	Studs
1/2	7/8	4	1/2	1-3/4	2-1/4	7/8	4	1/2	2	2-1/2	7/8	4	1/2	3
3/4	7/8	4	1/2	2	2-1/4	1-1/16	4	5/8	2-1/4	3	1-1/16	4	5/8	3-1/2
1	7/8	4	1/2	2	2-1/2	1-1/16	4	5/8	2-1/2	3	1-1/16	4	5/8	3-1/2
1-1/4	7/8	4	1/2	2-1/4	2-1/2	1-1/16	4	5/8	2-1/2	3-1/4	1-1/16	4	5/8	3-3/4
1-1/2	7/8	4	1/2	2-1/4	2-3/4	1-1/4	4	3/4	2-3/4	3-1/2	1-1/4	4	3/4	4-1/4
2	1-1/16	4	5/8	2-1/2	3-1/4	1-1/16	8	5/8	2-3/4	3-1/2	1-1/16	8	5/8	4-1/4
2-1/2	1-1/16	4	5/8	2-3/4	3-1/2	1-1/4	8	3/4	3-1/4	4	1-1/4	8	3/4	4-3/4
3	1-1/16	4	5/8	3	3-1/2	1-1/4	8	3/4	3-1/2	4-1/4	1-1/4	8	3/4	5
3-1/2	1-1/16	8	5/8	3	3-1/2	1-1/4	8	3/4	3-1/2	4-1/4	1-7/16	8	7/8	5-1/2
4	1-1/16	8	5/8	3	3-1/2	1-1/4	8	3/4	3-3/4	4-1/2	1-7/16	8	7/8	5-1/2
5	1-1/4	8	3/4	3	3-3/4	1-1/4	8	3/4	4	4-3/4	1-7/16	8	7/8	5-3/4
6	1-1/4	8	3/4	3-1/4	4	1-1/4	12	3/4	4	4-3/4	1-7/16	12	7/8	6
8	1-1/4	8	3/4	3-1/2	4-1/4	1-7/16	12	7/8	4-1/2	5-1/2	1-5/8	12	1	6-3/4
10	1-7/16	12	7/8	3-3/4	4-3/4	1-5/8	16	1	5-1/4	6-1/4	1-13/16	16	1-1/8	7-1/2
12	1-7/16	12	7/8	4	4-3/4	1-13/16	16	1-1/8	5-3/4	6-3/4	2	16	1-1/4	8
14	1-5/8	12	1	4-1/4	5-1/4	1-13/16	20	1-1/8	6	7	2	20	1-1/4	8-1/4
16	1-5/8	16	1	4-1/2	5-1/2	2	20	1-1/4	6-1/4	7-1/2	2-3/16	20	1-3/8	8-3/4
18	1-13/16	16	1-1/8	4-3/4	6	2	24	1-1/4	6-1/2	7-3/4	2-3/16	24	1-3/8	9
20	1-13/16	20	1-1/8	5	6-1/4	2	24	1-1/4	6-3/4	8-1/4	2-3/8	24	1-1/2	9-3/4
24	2	20	1-1/4	5-1/2	7	2-3/8	24	1 - 1/2	7-3/4	9-1/4	2-3/4	24	1-3/4	10-3/4

	600 L	B FLANGE	ES (4)		900	LB FLANC	GES (4)		1500	LB FLAN	GES (4)		2500	LB FLANC	GES (4)	
					-											
Nominal	2H Nut	No.	Dia	Length	2H Nut	No.	Dia	Length	2H Nut	No.	Dia	Length	2H Nut	No.	Dia	Length
Pipe	Wrench	of	of	of	Wrench	of	of	of	Wrench	of	of	of	Wrench	of	of	of
Size	Size	Studs	Studs	Studs	Size	Studs	Studs	Studs	Size	Studs	Studs	Studs	Size	Studs	Studs	Studs
1/2	7/8	4	1/2	3	1-1/4	4	3/4	4-1/4	1-1/4	4	3/4	4-1/4	1-1/4	4	3/4	4-3/4
3/4	1-1/16	4	5/8	3-1/2	1-1/4	4	3/4	4-1/2	1-1/4	4	3/4	4-1/2	1-1/4	4	3/4	5
1	1-1/16	4	5/8	3-1/2	1-7/16	4	7/8	5	1-7/16	4	7/8	5	1-7/16	4	7/8	5-1/2
1-1/4	1-1/16	4	5/8	3-3/4	1-7/16	4	7/8	5	1-7/16	4	7/8	5	1-5/8	4	1	6
1-1/2	1-1/4	4	3/4	4-1/4	1-5/8	4	1	5-1/2	1-5/8	4	1	5-1/2	1-13/16	4	1-1/8	6-3/4
2	1-1/16	8	5/8	4-1/4	1-7/16	8	7/8	5-3/4	1-7/16	8	7/8	5-3/4	1-5/8	8	1	7
2-1/2	1-1/4	8	3/4	4-3/4	1-5/8	8	1	6-1/4	1-5/8	8	1	6-1/4	1-13/16	8	1-1/8	7-3/4
3	1-1/4	8	3/4	5	1-7/16	8	7/8	5-3/4	1-13/16	8	1-1/8	7	2	8	1-1/4	8-3/4
3-1/2	1-7/16	8	7/8	5-1/2												
4	1-7/16	8	7/8	5-3/4	1-13/16	8	1-1/8	6-3/4	2	8	1-1/4	7-3/4	2-3/8	8	1-1/2	10
5	1-5/8	8	1	6-1/2	2	8	1-1/4	7-1/2	2-3/8	8	1-1/2	9-3/4	2-3/4	8	1-3/4	12
6	1-5/8	12	1	6-3/4	1-13/16	12	1-1/8	7-3/4	2-3/16	12	1-3/8	10-1/4	3-1/8	8	2	13-3/4
8	1-13/16	12	1-1/8	7-3/4	2-3/16	12	1-3/8	8-3/4	2-9/16	12	1-5/8	11-1/2	3-1/8	12	2	15-1/4
10	2	16	1-1/4	8-1/2	2-3/16	16	1-3/8	9-1/4	2-15/16	12	1-7/8	13-1/2	3-7/8	12	2-1/2	19-1/4
12	2	20	1-1/4	8-3/4	2-3/16	20	1-3/8	10	3-1/8	16	2	15	4-1/4	12	2-3/4	21-1/4
14	2-3/16	20	1-3/8	9-1/4	2-3/8	20	1-1/2	10-3/4	3-1/2	16	2-1/4	16-1/4				
16	2-3/8	20	1-1/2	10	2-9/16	20	1-5/8	11-1/4	3-7/8	16	2-1/2	17-3/4				
18	2-9/16	20	1-5/8	10-3/4	2-15/16	20	1-7/8	13	4-1/4	16	2-3/4	19-1/2				
20	2-9/16	24	1-5/8	11-1/2	3-1/8	20	2	13-3/4	4-5/8	16	3	21-1/2				
24	2-15/16	24	1-7/8	13	3-7/8	20	2-1/2	17-1/4	5-3/8	16	3-1/2	24-1/4				

NOTES:

All dimensions in inches.
 Lengths include allowance for pull-up.
 Length based on 1/16" raised face Welding Neck, Slip-On, Screwed or Blind Flanges. For lap joint, add the thickness of both laps.

4) Length based on 1/4" raised face Welding Neck, Slip-On, Screwed or Blind Flanges. For lap joint, add the thickness of both laps and subtract 1/2". For male and female or tongue and groove flange faces, subtract 1/4".

NON ASBESTOS SHEET AND GASKETS

CAIN BOLT & GASKET SUPPLIES MANY DIFFERENT STYLE NON-ASBESTOS GASKETS.HERE IS SUBMITTAL DATA AND SPECIFICATIONS ON OUR MOST COMMONLY USED MATERIALS.

MANUFACTURER :	GARL	OCK	TEADI	1	THERMOS	EAL (KLINGER
STYLE #	2550	3000	NAIOOI	NAI 100		C-4401
BINDER	NITRILE	NITRILE	NITRILE	NITRILE		NITRILE
COLOR :	GREEN	BLUE	GREEN	BLACK/GREY		GREEN
IEMPERATURE :						
: WAXIMUM :	+ 700 DEG F	+700 DEG F	+ 750 DEG F	+840 DEG F	т	+ 750 DEG F
: WINIMUM	-40 DEG F	-40 DEG F	-40 DEG F	-40 DEG F		
CONTINUOUS MAX :	+ 400 DEG F	+ 400 DEG F				
PRESSURE(MAX) :	1000 PSIG	1000 PSIG	1370 PSI	IS4 006 I		I 450 PSI
P X T (MAX) : 1/16"	350,000	350,000				400,000
∽ <mark>ا/8</mark> "	250,000	250,000				
TENSILE STRENGTH ACROSS GRAIN	1500 PSI	2250 PSI	I 740 PSI	2460 PSI		2000 PSI
ASTM F104 LINE CALL OUT	F712100A9B4E22K5M5	F712100A9B4E22K5M6	F712111B5E11M5	F713131B4E22M6		F712121B3E22M5
	GOOD FOR: •	GOOD FOR: WATER	GOOD FOR:	GOOD FOR: -MILD ORGANIC ACI	ž	GOOD FOR: -GOOD GENERAL
We also stock a wide variety of	HYDROCARBONS	ALIPHATIC	-MILD INORGANIC ACIDS	-MILD INORGANIC A	CIDS	PURPOSE SHEET
OTHER SPECIALTY NON-ASBESTOS	OILS	HYDROCARBONS 2015	-COCENTRATED ALKALIES	-CONCENTRATED AL	KALIES	-EXCELLENT CHEMICAL DESIGTANICE
PRODUCTS THAT ARE NOT LISTED HER	.EGASOLINE	-UILS -GASOLINE	-DILUTED ALKALIES .water	-DILUTEU ALMALIES -WATER		
IF YOU NEED HELP IN LOCATING SPEC	S		BRINE	-BŔINE		
OR OTHER INFORMATION, PLEASE FEEL			-AIR	-SATURATED STEAM		
FREE TO GIVE US A CALL AND WE WILL			-INDUSTRIAL GASES	-AIR INICHETPHAL GAGES		
BE HAPPY TO HELP.			-OILS GENIEPAL CHEANICALE	-OILS		
- AIN ROLT & GASKET INC	2 3/14 HTT ACT	CEATTLE WAR ARE AR	-DEMEMAL CHEMICALS -ALIPHATIC SOLVENTS	-PETROLEUM		
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			-	-CHLORINATED SOLV	FNTS	
PROPERTIES AND APPLICATION PARAMETERS SHORIN ARE TVI	KAL AND ANE PNESENTED IN GOOD FAITH BU	t no knamanty is expressed on inplied.		OXYGENATED SOLV	ENTS	
FALLINE TO PROPERLY USE CASHETING CORED RESULT IN SEM	MIS INURIAN ON DEATH.			REFRIGERANTS		

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