

Since 1988



HWASUNG FASTENERS

Special Bolt and Nuts



 **HWASUNG
FASTENERS**

www.hsbolt.co.kr

CONTENTS

Company Information	CEO Message	03
	About HWASUNG	04
	Business Area	04
	History	06
	Partners	07
Quality Management	Certificate	08
Business Part	Performance	09
Main Products	Stud Bolt & Nut for Pressure-Temperature piping (ANSI B16.5)	12
	Heavy Hex Nuts & Heavy Hex Jan Nuts	13
	Hex Nuts & Hex Jam Nuts	14
	U-Bolt / Hex Nut / Insolation Pad (I-Rod)	15
	Heavy Hex Bolt / Heavy Hex Cap Screws	16
	Hex Bolts & Hex Cap Screws	17
	Anchor Bolt Set (Foundation Bolt)	18
	Double End Stud Bolt, Tap Stud Bolt / Slotted Nut	19
	High Tension Bolt, Nuts & Washers / Torque Shear Bolt, Nuts & Washers	20
	Bolt Cap, Stick Cover	21
	Welding Studs	22
	Insolation Pin & Washer	23
	Insulation kit, Plug	24
	Plane Washers	25
	Technology Requirements	Technology requirements
Laboratory		30



Company Information

CEO Message

HWASUNG FASTENERS is a professional fastener manufacturer that has been leading the special fastener market based on exclusive proprietary technologies since its foundation in 1988. Through continuous technology development and accumulated professional experiences and know-how, Hwasung has provided numerous projects at home and abroad with rigid qualification standards with quality products satisfying customer needs even at extreme high and low temperature or pressure.

HWASUNG manufactures products that comply with diverse industrial codes such as ASME, ASTM, KEPIC, IFI, DIN, KS and JIS, while precisely understanding HWASUNG FASTENERS Co.,Ltd. IL - BONG WON what a customer wants and expects from us. With flexible application of its proprietary technologies, HWASUNG has differentiated its offerings with competitors and acquired enviable market competitiveness. We believe we could not have achieved the growth we have undergone in a relatively short time overcoming a short history without the supports and interests from our customers as well as our collective efforts for quality improvement and customer satisfaction. We promise to provide customers with quality products with the highest value through consistent quality management and technological development. We will do our best and be truthful so that we can develop a relationship with any customer.

Thank you.

HWASUNG FASTENERS Co.,Ltd.

IL - BONG, WON

Company Information

About HWASUNG

Through challenge to the world

We will become the world's best fasteners maker!

Through technological advancements and professional experiences,
We will lead the fasteners industry!



Company Information

Business Area



On/Off Shore Facilities

HWASUNG FASTENERS mainly produces and offers special bolt and nut solutions with excellent corrosion and thermal resistance, proactively coping with changing market requirements. HWASUNG FASTENERS has offered products and solutions as a top-tier vendor to Hyundai Heavy Industries, Samsung Heavy Industries, and other companies in Korea, and has accumulated wide and deep experiences in global projects in various global locations with a proactive approach for product quality through acquiring NORSOK, a Norwegian standard for off-shore installations.



Nuclear Power Plant

HWASUNG FASTENERS has also offered products to various nuclear power plants such as Hanul, Hanbit, Gori, and Wolsong in Korea, and in UAE (BNPP) as well.



Customer Satisfaction

Providing values for customers through products and services in better quality, we offer customers with an impressive beyond satisfaction.

Respect for Humans

HWASUNG's respect for humans, which nurtures the growth of business, creates a value not only for the company but also for the entire society.

Endless Challenge

We create a bigger value through challenges to new possibilities through passion and creative thinking, while not being complacent in anyway.



Power Plant & Construction

HWASUNG FASTNERS has offered products to various hydro-electric and thermal power plants in Korea such as Dongdocheon, Boryong, Samcheok, Taean, Dangjin, Pocheon, etc. HWASUNG FASTNERS has also participated in construction projects at overseas locations such as UAE, Qatar, Nigeria, Oman and Turkmenistan.



Refinery & Petrochemical

As a certified vendor of KNPC, Kuwait's state-run oil firm and SamRef, a Saudi Arabian oil firm, HWASUNG FASTNERS has been actively handling demands from refinery and petrochemical industries in the Middle East.

Company Information

History

New Challenge & Leap

- 2021.03 Eamed a certificate of approval for API (American Petroleum Institute)
- 2020.04 BAPCO MODERNIZATION PROGRAM(BMP) pjt. by TTSJV
- 2019.05 BECHTEL- Sabine Pass Liquefaction Project Stage 4
- 2019.01 Business agreement with Hydro group (United Kingdom)
- 2018.07 ITER (International Thermonuclear Experimental Reactor, FRANCE) pjt.
- 2017.01 Accredited a "Q" class by Sin-gori 5,6 nuclear power plant
- 2017.02 Approved of a vendor of saline water conversion corporation (SWCC) in Saudi arabia
- 2016.01 Earned a certificate of approval for OHSAS 18000: 2007 by GERMAN cert.
- 2016.02 Earned a certificate of approval for NORSOK M-650 by DNV & HHI
- 2016.07 Earned a certificate of approval for NORSOK M-650 by MRC Energy-Piping, Equinor (TR-2000)
- 2015.09 Exclusive vendor registration of Samsung Eng. clean fuel project (KNPC)
- 2014.05 Registration of approved vendor of KNPC (Kuait national petroleum Co. (K.S.C))
- 2012.07 Earned a certificate of approval for PED (CE) by LOQA Korea
- 2011.04 Approved of a vendor by Achilles JQS (for the oil industry in norway and denmark)
- 2011.05 Accredited a "Q" class by Shinuljin nuclear power plant
Accredited a "Q" class by UAE BNPP nuclear power plant

Expansion & Growth

- 2010.07 Establishment of R&D center
- 2010.08 "One-KEPCO expor business group" organized by KEPCO
- 2010.10 Earned a certificate of approval for ISO 9001 and ISO/TS 29001 by LRQA Korea
Earned a certificate of approval for ISO 14001 by LRQA Korea
- 2009.01 Approved of a vendor by SAMREF in Saudi aravia (SAUDI Aramco EXXON MOBIL)
- 2009.04 Accredited certificate of global brand 2002 choice company by KOTRA
- 2006.08 Heat treatment line set up (at Kimhae-si)
- 2005.05 Had quality system approved by KEPIC-MN/SN by KEA
- 2000.04 Approved of vendor by Korea national gas corporation
- 2000.10 Approved of a vendor for nuclear power plant (ASME SECIII)
- 1999.04 Approved of "Q" class (ASME section III) vendor by KEPCO
Accredited a "Q" class (ASME section & KEPIC-MN/SN)
- 1998.10 Approved as a QAP III (ASME section III) vendor for KEPIC
(Korea Electric Power Industry Code)by Korea heavy industry
- 1997.01 Approved of vendor bt "Q" class (ASME section III) for Youngkwang nuclear power plant
- 1997.04 Earned a certificate of approval for "ISO 9001" by KPC-QA

Founding & Base Firming

- 1995.07 Earned QPCIII (ASMEIII) quality approval for Wolseong nuclear power plant by HYUNDAI Eng. & Construction Co., Ltd.
- 1994.06 Got quality approved for the Nuclear power plant use by KEPCO [Korea Electric Power Corporation]
- 1989.03 Registered as fastener supplier to Hyundai heavy industry
- 1988.09 Established HWASUNG FASTENERS Co., Ltd.

Company Information

Partners

Domestic



Overseas



equinor



eni



bp



Chevron



ADMA OPCO

ExxonMobil



GECOL



Hitachi Zosen



JG SUMMIT



JGC



KOC



LUK OIL



MODEC



ONGC



aramco



PETRONAS



PETROVIETNAM



PTT PLC



PTTEP



QATARGAS



RasGas



Saudi Electricity



Shell



BECHTEL



TAKREER



TOTAL



woodside



KNPC



SWCC



TechnipFMC

Quality Management

Certificate

Certificate



- 1 ISO 9001
- 2 ISO TS 29001
- 3 ISO 14001
- 4 OH SAS 18001
- 5 JQS Achilles
- 6 PED
- 7 KEPIC-MN (DN247)
- 8 Norsok M-650
- 9 Norsok Accredited DNV, GL & HHI
- 10 API Certificate 20E-0094
- 11 API Certificate 20F-0046

Certificates by Customers



- 1 SAMREF
- 2 KEPCO
- 3 BNPP Q Class Certification
- 4 HDEC (Shinhanul) NPP Certification
- 5 DAEWOO (Shinwolsung) RDP Certification
- 6 Nuclear Power Plant Certification By HHI
- 7 KNPC Vendor Registration
- 8 KORI Nuclear Producer
- 9 Korea Hydro & Nuclear Power
- 10 Certification Of A Qualified Supplier

Business Part

Performance

On / Off Shore Facilities

Project Name	Customer	Country
King's Quay FPS PJT.	LLOG Exploration	USA
CORAL FLNG PJT.	ENI	MOZAMBIQUE
Mad Dog 2FPU PJT.	BP	USA
MARTIN LINGE PJT.	TOTAL	NORWAY
JOHAN SVERDRUP PJT.	STATOIL	NORWAY
Bergading CPP PJT.	Hess Exploration & Production Malaysia B.V.	MALAYSIA
Jangkrik Complex PJT.	Eni Muara Barkau B.V.	INDONESIA
Aasta Hansteen PJT.(Platform)	STATOIL	NORWAY
MOHO NORD (TLP/FPU) PJT.	TOTAL	CONGO
CARIGALI PJT.	B.C.P	MALAYSIA
HEBRON PJT.	EXXON MOBIL	CANADA
DELTA HOUSEPJT.	LLOG	AMERICA
POINT THOMSON PJT.	EXXON MOBIL	CANADA
Ichthys Gas Field Development PJT.	TOTAL	AUSTRALIA
WHEATSTONE PJT.	CHEVRON	AUSTRALIA
SEADRILL Drill Ship #4	CHEVRON	NIGERIA
STENA Drill Ship #4	STENA	SWEDEN
DSO PJT.	SHELL	NIGERIA
CLAIR RIDGE PJT.	BP	UK
Q204 PJT.	BP	NORTH SEA
BARZAN PJT.	EXXON MOBIL	QATAR
OFON PJT.	TOTAL	NIGERIA
PTT SPURLINE PJT.	PTT PLC	THAILAND
GOLIAT PJT.	ENI	NORWAY
GOLGON PJT.(Barrow Island LNG Plan)	CHEVRON	AUSTRALIA
IGD-DAS PJT.	ADMA-OPCO	UAE
DAEWOO SHWE PJT.	DAEWOO INTERNATIONAL PTT	MYANMAR
BONGKOT FIELD DEVELOPMENTPJT.	PTT Exploration & Production	THAILAND
ENFIELD FPSO PJT.	WOODSIDE	AUSTRALIA
UMM SHAIK GAS INJECTION FACILITIES PJT.	ADMA-OPCO	UAE
EXMAR LNG HULL PJT.	EXMAR	BELGIUM
VASAI PLATFORM PJT.	ONGC	INDIA

Nuclear Power Plant

Project Name	Customer	Country
ShinGori Nuclear Power Plant 5&6 PJT.	KEPCO	KOREA
ShinWolsong Nuclear Power Plant 1&2 PJT.	KEPCO	KOREA
ShinGori Nuclear Power Plant 1&2 PJT.	KEPCO	KOREA
ShinGori Nuclear Power Plant 3&4 PJT.	KEPCO	KOREA
Ulchin NPP 3&4 SGR PJT.	KEPCO	KOREA
Shinulchin Nuclear Power Plant 1&2 PJT.	KEPCO	KOREA
Braka Nuclear Power Plant 1&2 PJT.	KNHP	UAE
Braka Nuclear Power Plant 3&4 PJT.	KNHP	UAE

Refinery & Petrochemical

Project Name	Customer	Country
BACO MODERNIZATION PROGRAM(BMP) PJT.	TTSJV	BAHRAIN
HMC PP4 PJT.	HMC Polymers	THAILAND
Sabine Pass Liquefaction PJT. Stage 4	BECHTEL	USA
Nigeria Indorama Fertilizer II PJT.	IEFCL (Indorama Eleme Fertilizer & Chemicals imited)	NIGERIA
AL-ZOUR LNG IMPORT PJT.	KNPC	KUWAIT
GAS SEPARATE PLANT	GAZPROM	IRAQ
RABICH-2 CP-3,4 Package PJT.	ARAMCO DVERSEAS COMPANY B.V& SUMITOMO CHEMICAL CO., LTD	SAUDI ARABIA
Ichthys Gas Field Development PJT.	TOTAL	AUSTRALIA
Indorama Fertilizer Plant PJT.	SAUDI ARAMCO	NIGERIA
Dow DMC Polyol PJT.	Rayong Terminal Co., Ltd	THAILAND
Yep-V PJT.	KUMHO POLYCHEM	KOREA
E-KANDYM PJT.	LUOC (LukOil)	UZBEKISTAN
Clean Fuel PJT.	KNPC	KUWAIT
CATHER FPSO PJT.	Cairn Energy	UK
Evergreen	Shoei Kisen Kaisha	TAIWAN
THERMA VISAYAS ENERGY PJT. 150MW X 2 UNITS	THERMA VISAYAS INC.	PHILIPPINES
Sadara Project SAUDI ARAMCO & Dow Chemical SAUDI ARABIA	SAUDI ARAMCO & Dow Chemical	SAUDI ARABIA
Boryeon LNG Terminal	Boryeon LNG Terminal	KOREA
RPLC Deep Conversion PJT.	Petroleo de Venezuela, S.A (PDVSA)	VENEZUELA

Power Plant & Construction

Project Name	Customer	Country
Ørsted Greater Changhua OWF PJT. (Wind-power generation)	Ta San Shang Marine Co. Ltd.	TAIWAN
ALGERIA RAS DJINET CCPP PJT.	S.P.E	ALGERIA
KLAM PROJECT	KNPC	KUWAIT
CIREBON 2 1,000MW CFPP PJT.	CIREBON ENERGI PARASARANA	INDONESIA
UMM Al Houli RO EXPANSION PJT.	UMM Al Houli POWER	QATAR
RIAU GFPP 275MW IPP PJT.	PT MEDCO RATCH POWER RIAU	INDONESIA
410,000 MTY Mpe PLANT	DAELIM INDUSTRIAL	KOREA
Jawa Satu Power 1 PJT.	SAMSUNG C & T	INDONESIA
MUSAI PJT.	QATAR ENGINEERING MATERAIL SOLUTION WLL	QATAR
BORYENG LNG TERMIAL PJT. 2-2	KOGAS	KOREA
RIYARD NEW CITY FREEDERS (RNCP) PJT.	SWCC	SAUDI ARABIA
THAI BINH TERMAL POWER PLANT UNIT-1	FUJI ELECTRIC Co., Ltd.	VIETNAM
BISKRA GAS TURBINE POWER PLANT PJT.	S.P.E	ALGERIA
KIRIKKALE INDEPENDENT POWER PLANT PJT.	ACWA GUC	TURKEY
THAI BINH TERMAL POWER PLANT UNIT-1	FUJI ELECTRIC Co., Ltd.	VIETNAM
SM#1 MODERNIZATION PJT.	SAMSUNG TOTAL PETROCHEMICALS	KOREA
IRAQ AL FAW BREAKWATER PJT.	THE GENERAL COMPANY FOR PORTS OF IRAQ	IRAQ
RAS-DJINET 1,131.1MW COMBINED CYCLE POWER PLANT PJT.	S.P.E	ALGERIA
KUMHO YEP IV PJT.	KUMHO POLYCHEM	KOREA
AZITO PHASE 3	AZITO ENERGY	COTE D'IVOIRE
ZWITINA COMBINED CYCLE ADD-ON PJT.	GENERAL ELECTRIC COMPANY OF LIBYA	LIBYA

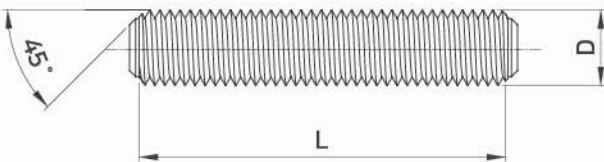


Stud Bolt & Nut for Pressure -Temperature Piping (Ansi B16.5)



Alloy Steel B7, B7M, B16, B5, L7, L7M, L43, 20CrMoVTIB4-10	Carbon Steel A36, A307, 4.6, SS400, S45C, A325, A490
Stainless Steel B8 CL1&2, B8M CL1&2, B8T, B8C, B6, SS317(L)	Nickel Alloys A453-660, Inconel 625 / 718, Incoloy 925, C276
Super Duplex UNS S32760 / S32750	Copper Alloy C65100, C63000, C61400
Titanium Grade 2 / 5 / 7	

Stud Bolts Size & Dimension Tolerance



Note

- 1) L is length of first thread to first thread not including point of both ends.
- 2) Points shall be flat and chamfered.

Unit : inch

Diameter	Lengths	Tolerance On Stud Lengths	
		L≤6	L>6
Over 5/16 to 3/4		± 1/16	± 1/8
Over 3/4 to 1-1/4		± 1/8	± 3/16
Over 1-1/4		± 1/4	± 1/4

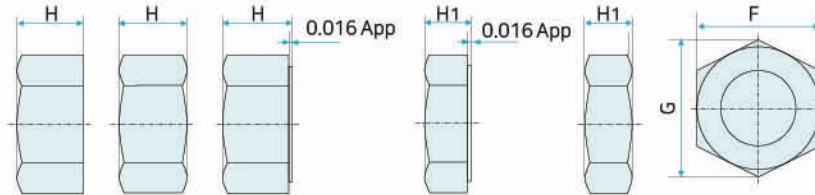
Threads

Nominal Size or Diameter of Stud-Bolt (D)	D=1" (25mm) & Smaller	D=1- 1/8"(28mm) & Larger
Unified Inch Series	Unified Coarse Thread Series Class 2A and 2B ANSI 81.1	Unified 8-Thread Series Class 2A and 2B ANSI 81.1
METRIC Series	METRIC Coarse Thread Series Class 6G and 6H JIS B0209 / ISO 261	METRIC 3-Pitch & Coarse Thread Series Class 6G and 6H JIS B0209 / ISO 261

Dimension of Nuts

Unified Inch Series	Conform to Heavy hex nuts of ANSI 8 18. 2. 2. Double chamfered or washer faced
METRIC Series	Conform to Heavy hex nuts of ANSI B 18. 2. 4. 6 M Double chamfered of washer faced

Heavy Hex Nuts & Heavy Hex Jam Nuts



Unified ANSI B 18.2.2 - Heavy Hex Nuts & Heavy Hex Jam Nuts

Unit : inch

Nominal Size or Basic Major Dia. of Thread	F Width Across Flats			G Width Across Corners		H Thickness Hex Nuts			H1 Thickness Hex Jam Nuts			
	Basic	Max.	Min.	Max.	Min.	Basic	Max.	Min.	Basic	Max.	Min.	
	1/2	0.500	7/8	0.875	0.850	1.010	0.969	31/64	0.504	0.464	19/64	0.317
5/8	0.625	1 1/16	1.062	1.031	1.227	1.175	39/64	0.631	0.587	23/64	0.381	0.337
3/4	0.750	1 1/4	1.250	1.212	1.443	1.382	47/64	0.758	0.710	27/64	0.446	0.398
7/8	0.875	1 7/16	1.438	1.394	1.660	1.589	55/64	0.885	0.833	31/64	0.510	0.458
1	1.000	1 5/8	1.625	1.575	1.876	1.796	63/64	1.012	0.956	35/64	0.575	0.519
1 1/8	1.125	1 13/16	1.812	1.756	2.093	2.002	1 7/64	1.139	1.079	39/64	0.639	0.579
1 1/4	1.250	2	2	1.938	2.309	2.209	1 7/32	1.251	1.187	23/32	0.751	0.687
1 3/8	1.375	2 3/16	2.188	2.119	2.526	2.416	1 11/32	1.378	1.310	25/32	0.815	0.747
1 1/2	1.500	2 3/8	2.375	2.300	2.742	2.622	1 15/32	1.505	1.433	27/32	0.880	0.808
1 5/8	1.625	2 9/16	2.562	2.481	2.959	2.828	1 19/32	1.632	1.556	29/32	0.944	0.868
1 3/4	1.750	2 3/4	2.750	2.662	3.175	3.035	1 23/32	1.759	1.679	31/32	1.009	0.929
1 7/8	1.875	2 15/16	2.938	2.844	3.392	3.242	1 27/32	1.886	1.802	1 1/32	1.073	0.989
2	2.000	3 1/8	3.125	3.025	3.608	3.449	1 31/32	2.013	1.925	1 3/32	1.138	1.050
2 1/4	2.250	3 1/2	3.5	3.388	4.041	3.862	2 13/64	2.251	2.155	1 13/64	1.251	1.155
2 1/2	2.500	3 7/8	3.875	3.750	4.474	4.275	2 29/64	2.505	2.401	1 29/64	1.505	1.401
2 3/4	2.750	4 1/4	4.250	4.112	4.907	4.688	2 45/64	2.759	2.647	1 37/64	1.634	1.522
3	3.000	4 5/8	4.625	4.475	5.340	5.102	2 61/64	3.013	2.893	1 45/64	1.763	1.643
3 1/4	3.250	5	5.000	4.838	5.774	5.515	3 3/16	3.252	3.124	1 13/16	1.876	1.748
3 1/2	3.500	5 3/8	5.375	5.200	6.207	5.928	3 7/16	3.506	3.370	1 15/16	2.006	1.870
3 3/4	3.750	5 3/4	5.750	5.562	6.640	6.341	3 11/16	3.760	3.616	2 1/16	2.134	1.990
4	4.000	6 1/8	6.125	5.925	7.073	6.755	3 15/16	4.014	3.862	2 3/16	2.264	2.112

ANSI B18.2.4.6M - Metric Heavy Hex Nut

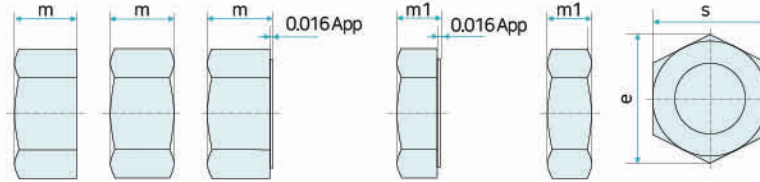
Unit : mm

Nominal Size and Pitch		F Width Across Flats		G Width Across Corners		H Thickness		C Washer Face Thickness	
		Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
		M12 x 1.75	M12 x 1.75	21.00	20.16	24.25	22.78	12.30	11.90
M14 x 2	M14 x 2	24.00	23.16	27.71	26.17	14.30	13.60	0.80	0.40
M16 x 2	M16 x 2	27.00	26.16	31.18	29.56	17.10	16.40	0.80	0.40
*M18 x 2.5	M18 x 2.5	30.00	29.16	34.18	32.56	18.90	18.10	0.80	0.40
M20 x 2.5	M20 x 2.5	34.00	33.00	39.26	37.29	20.70	19.40	0.80	0.40
M22 x 2.5	M22 x 2.5	36.00	35.00	41.57	39.55	23.60	22.30	0.80	0.40
M24 x 3	M24 x 3	41.00	40.00	47.34	45.20	24.20	22.90	0.80	0.40
M27 x 3	M27 x 3	46.00	45.00	53.12	50.85	27.50	26.30	0.80	0.40
M30 x 3.5	M30 x 3	50.00	49.00	57.74	55.37	30.70	29.10	0.80	0.40
*M33 x 3.5	M33 x 3	55.00	53.80	64.28	61.44	33.60	32.00	0.80	0.40
M36 x 4	M36 x 3	60.00	58.80	69.28	66.44	36.60	35.00	0.80	0.40
*M39 x 4	M39 x 3	65.00	63.80	75.83	72.41	39.00	37.50	1.00	0.50
M42 x 4.5	M42 x 3	70.00	67.90	80.83	77.41	42.00	40.40	1.00	0.50
*M45 x 4.5	M45 x 3	75.00	72.80	85.83	82.41	45.00	43.40	1.00	0.50
M48 x 5	M48 x 3	80.00	77.60	92.38	88.46	48.00	46.40	1.00	0.50
*M52 x 5	M52 x 3	85.00	82.40	97.38	93.46	52.00	50.30	1.00	0.50
M56 x 5.5	M56 x 3	90.00	87.20	103.92	99.41	56.00	54.10	1.00	0.50
M64 x 6	M64 x 3	100.00	96.80	115.47	110.35	64.00	62.10	1.00	0.50
M72 x 6	M72 x 3	110.00	106.40	127.02	121.30	72.00	70.10	1.20	0.60
M80 x 6	M80 x 3	120.00	116.00	138.56	132.24	80.00	78.10	1.20	0.60
M90 x 6	M90 x 3	135.00	130.50	155.88	148.77	90.00	87.80	1.20	0.60
M100 x 6	M100 x 3	150.00	145.00	173.21	165.30	100.00	97.80	1.20	0.60

* M18, M33, M39, M45 & M52 : Hwasung standard dimension

Hex Nuts & Hex Jam Nuts

Unit : mm



ISO 4032, ISO4035

Unit : mm

Thread d.	Nut Diameter		s		e		m		m1	
	Coarse p	Fine p	Nom =Max	Min.	Min	Min.	Max	Min.	Max	
M1.6	0.35		3.2	3.02	3.41	1.05	1.3	0.75	1	
M2	0.4		4	3.82	4.32	1.35	1.6	0.95	1.2	
M2.5	0.45		5	4.82	5.45	1.75	2	1.35	1.6	
M3	0.5		5.5	5.32	6.01	2.15	2.4	1.55	1.8	
M3.5	0.6		6	5.82	6.58	2.55	2.8	1.75	2	
M4	0.7		7	6.78	7.66	2.9	3.2	1.95	2.2	
M5	0.8		8	7.78	8.79	4.4	4.7	2.45	2.7	
M6	1		10	9.78	11.05	4.9	5.2	2.9	3.2	
M8	1.25		13	12.73	14.38	6.44	6.8	3.7	4	
M10	1.5	1.25	16	15.73	17.77	8.04	8.4	4.7	5	
M12	1.75	1.25	18	17.73	20.03	10.37	10.8	5.7	6	
M14	2	1.5	21	20.67	23.35	12.1	12.8	6.42	7	
M16	2	1.5	24	23.67	26.75	14.1	14.8	7.42	8	
M18	2.5	1.5	27	26.16	29.56	15.1	15.8	8.42	9	
M20	2.5	1.5	30	29.16	32.95	16.9	18	9.1	10	
M22	2.5	1.5	34	33	37.29	18.1	19.4	9.9	11	
M24	3	2	36	35	39.55	20.2	21.5	10.9	12	
M27	3	2	41	40	45.2	22.5	23.8	12.4	13.5	
M30	3.5	2	46	45	50.85	24.3	25.6	13.9	15	
M33	3.5	2	50	49	55.37	27.4	28.7	15.4	16.5	
M36	4	3	55	53.8	60.79	29.4	31	16.9	18	
M39	4	3	60	58.8	66.44	31.8	33.4	18.2	19.5	
M42	4.5	3	65	63.1	71.3	32.4	34	19.7	21	
M45	4.5	3	70	68.1	76.95	34.4	36	21.2	22.5	
M48	5	3	75	73.1	82.6	36.4	38	22.7	24	
M52	5	4	80	78.1	88.25	40.4	42	24.7	26	
M56	5.5	4	85	82.8	93.56	43.4	45	26.7	28	
M60	5.5	4	90	87.8	99.21	46.4	48	28.7	30	
M64	6	4	95	92.8	104.86	49.1	51	30.4	32	

Unified ANSI B 18.2.2

Unit : inch

Nominal Size or Basic Major Dia. of Thread		s		e		m			m1			
		Witht Across Flats		Width Across Corners		Thickness Hex Nuts			Thickness Hex Jam Nuts			
		Basic	Max.	Min.	Max.	Min.	Basic	Max.	Min.	Basic	Max.	Min.
1/4	0.2500	7/16	0.438	0.428	0.505	0.488	7/32	0.226	0.212	5/32	0.163	0.150
5/16	0.3125	1/2	0.500	0.489	0.577	0.557	17/64	0.273	0.258	3/16	0.195	0.180
3/8	0.3750	9/16	0.562	0.551	0.650	0.628	21/64	0.337	0.320	7/32	0.227	0.210
7/16	0.4375	11/16	0.688	0.675	0.794	0.768	3/8	0.385	0.365	1/4	0.260	0.240
1/2	0.5000	3/4	0.750	0.736	0.866	0.840	7/16	0.448	0.427	5/16	0.323	0.302
9/16	0.5625	7/8	0.875	0.861	1.010	0.982	31/64	0.496	0.473	5/16	0.324	0.301
5/8	0.6250	15/16	0.938	0.922	1.083	1.051	35/64	0.559	0.535	3/8	0.387	0.363
3/4	0.7500	1 1/8	1.125	1.088	1.299	1.240	41/64	0.665	0.617	27/64	0.446	0.398
7/8	0.8750	1 5/16	1.312	1.269	1.516	1.447	3/4	0.776	0.724	31/64	0.510	0.458
1	1.0000	1 1/2	1.500	1.450	1.732	1.653	55/64	0.887	0.831	35/64	0.575	0.519
1 1/8	1.1250	1 11/16	1.688	1.631	1.949	1.859	31/32	0.999	0.939	39/64	0.639	0.579
1 1/4	1.2500	1 7/8	1.875	1.812	2.165	2.066	1 1/16	1.094	1.030	23/32	0.751	0.687
1 3/8	1.3750	2 1/16	2.062	1.994	2.382	2.273	1 11/64	1.206	1.138	25/32	0.815	0.747
1 1/2	1.5000	2 1/4	2.250	2.175	2.598	2.480	1 9/32	1.317	1.245	27/32	0.880	0.808

U-Bolt / Hex Nut / Insolation Pad (I-Rod)

Alloy Steel

B7, B7M, B16,
B5, L7, L7M, L43,
20CrMoVTIB4-10

Carbon Steel

A36, A307, 4.6, SS400,
S45C, A325, A490

Stainless Steel

B8 CL1&2, B8M CL1&2,
B8T, B8C, B6, SS317(L)

Nickel Alloys

A453-660,
Inconel 625 / 718,
Incoloy 925, C276

Super Duplex

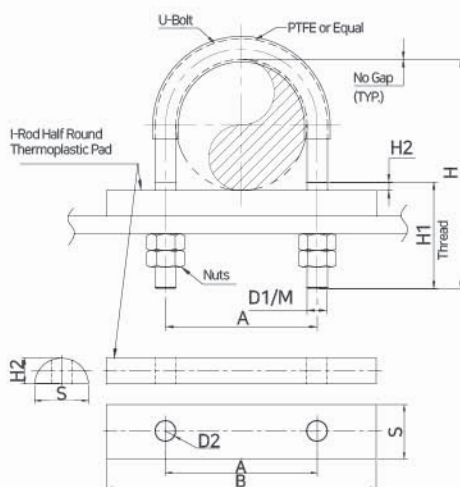
UNS S32760 / S32750

Titanium

Grade 2 / 5 / 7

Copper Alloy

C65100, C63000,
C61400

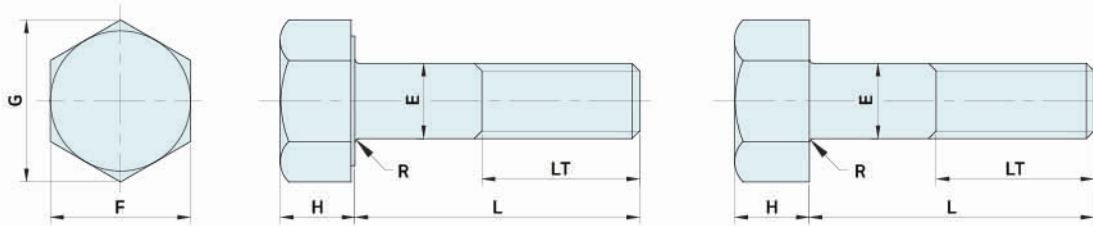


» Metric / JIS F 3022

Diameter of Pipe		U-Bolt (mm)					I-Rod (mm)			
inch	mm	D1	A	H	L	H1	B	S	H2	D2(Hole)
0.5	21.3	M6	28	80	190	60	64	20	8	8
0.75	26.7	M6	34	84	200	60	76	20	8	8
1	33.4	M10	44	87	220	60	76	25	11	12
1.5	48.3	M10	59	102	260	64	102	25	11	12
2	60.3	M10	71	114	285	64	114	25	11	12
2.5	73	M14	88	133	340	76	128	25	11	16
3	88.9	M14	104	148	380	76	152	25	11	16
4	114.3	M14	129	173	445	76	178	25	11	16
6	168.3	M16	185	241	625	95	230	25	11	18
8	219.1	M16	236	292	750	95	280	25	11	18
10	273.1	M20	294	351	910	102	344	38	18	22
12	323.9	M22	347	408	1060	108	406	38	18	25
14	355.6	M22	379	440	1140	108	432	38	18	25
16	406.4	M22	429	491	1270	108	484	38	18	25
18	457	M24	482	551	1430	121	550	38	18	27
20	508	M24	533	602	1560	121	600	38	18	27
24	610	M24	635	703	1820	121	700	38	18	27
26	660	M24	685	754	1950	121	750	38	18	27
28	711	M24	736	805	2080	121	800	38	18	27

Heavy Hex Bolt / Heavy Hex Cap Screws

Heavy Hex Bolts



Unified ANSI B 18.2.1

Unit : inch

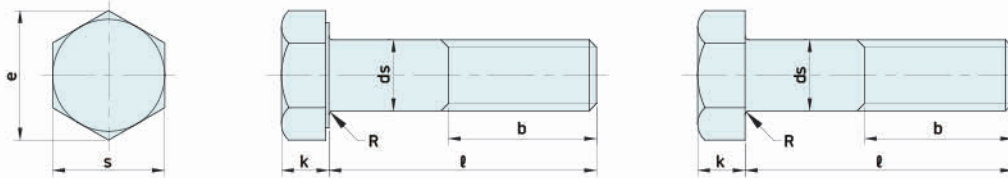
Nominal Size of Basic Product Diameter	E	F		G		H		E		LT			
		Body Dia		Width Across Flats		Width Across Corners		Head Height		Radius of Fillet		Thread Length for Bolt Length	
		Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	6 In Shorter	6 In Over
3/8	0.3750	0.388	0.36	0.688	0.669	0.794	0.763	0.268	0.226	0.03	0.01	1.000	1.250
1/2	0.5000	0.515	0.482	0.875	0.850	1.01	0.969	0.364	0.302	0.03	0.01	1.250	1.500
5/8	0.6250	0.642	0.605	1.062	1.031	1.227	1.175	0.444	0.378	0.06	0.02	1.500	1.750
3/4	0.7500	0.768	0.729	1.250	1.212	1.443	1.383	0.524	0.455	0.06	0.02	1.750	2.000
7/8	0.8750	0.895	0.852	1.438	1.394	1.66	1.589	0.604	0.531	0.06	0.02	2.000	2.250
1	1.0000	1.022	0.976	1.625	1.575	1.876	1.796	0.7	0.591	0.09	0.03	2.250	2.500
1 1/8	1.1250	1.149	1.098	1.812	1.756	2.093	2.002	0.78	0.658	0.09	0.03	2.500	2.750
1 1/4	1.2500	1.277	1.223	2.000	1.938	2.309	2.209	0.876	0.749	0.09	0.03	2.750	3.000
1 3/8	1.3750	1.404	1.345	2.188	2.119	2.526	2.416	0.94	0.81	0.09	0.03	3.000	3.250
1 1/2	1.5000	1.531	1.47	2.375	2.300	2.742	2.622	1.036	0.902	0.09	0.03	3.250	3.500
1 5/8	1.6250	1.658	1.591	2.562	2.481	2.959	2.829	1.116	0.978	0.09	0.03	3.500	3.750
1 3/4	1.7500	1.785	1.716	2.750	2.662	3.175	3.035	1.196	1.054	0.12	0.04	3.750	4.000
1 7/8	1.8750	1.912	1.839	2.938	2.844	3.392	3.242	1.276	1.13	0.12	0.04	4.000	4.250
2	2.0000	2.039	1.964	3.125	3.025	3.608	3.449	1.388	1.175	0.12	0.04	4.250	4.500
2 1/4	2.2500	2.305	2.214	3.500	3.388	4.041	3.862	1.548	1.327	0.19	0.06	4.750	5.000
2 1/2	2.5000	2.559	2.461	3.875	3.750	4.474	4.275	1.708	1.479	0.19	0.06	5.250	5.500
2 3/4	2.7500	2.827	2.711	4.250	4.112	4.907	4.688	1.869	1.632	0.19	0.06	5.750	6.000
3	3.0000	3.081	2.961	4.625	4.475	5.34	5.102	2.06	1.815	0.19	0.06	6.250	6.500

Metric ANSI B 18.2.3.6M

Unit : mm

Nominal Size of Basic Bolt Dia.	E		F		G		H		R	LT		
	Body Dia.		Width Across Flats		Width Across Corners		Head Height		Radius of Fillet	Thread Length for Bolt Length		
	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Min.	≤125	>125 and ≤200	L > 200
M12 X 1.75	12.70	11.30	21.00	20.16	24.25	22.78	7.95	7.24	0.6	30	35	49
M14 X 2	14.70	13.30	24.00	23.16	27.71	26.17	9.25	8.51	0.6	34	40	53
M16 X 2	16.70	15.30	27.00	26.16	31.18	29.56	10.75	9.68	0.6	38	44	57
M20 X 2.5	20.84	19.16	34.00	33.00	39.26	37.29	13.40	12.12	0.8	46	52	65
M24 X 3	24.84	23.16	41.00	40.00	47.34	45.20	15.90	14.56	0.8	54	60	73
M30 X 3.5	30.84	29.16	50.00	49.00	57.74	55.37	19.75	17.92	1.0	66	72	85
M36 X 4	37.00	35.00	60.00	58.80	69.28	66.44	23.55	21.72	1.0	78	84	97

Hex Bolts & Hex Cap Screws



ISO 4014, ISO4017

Unit : mm

Bolt Diameter			S		e		k				ds		R	b			ISO 4017 All Size	
Thread d	Coarse p	Fine p	Norm = Max	Gr.A Min	Gr.B Min	Norm	Gr.A Min	Gr.B Max	Gr.A Min	Gr.B Max	Norm = Max	Gr.A Min	Gr.B Min	0.1	ISO 4014 L≤125	ISO 4014 L<125 L≥200		ISO 4017 L>200
M1.6	0.35		3.2	3.02		3.41		1.1	0.975	1.225		1.6	1.46		0.1	9		
M2	0.4		4	3.82		4.32		1.4	1.275	1.525		2	1.86		0.1	10		
M2.5	0.45		5	4.82		5.45		1.7	1.575	1.825		2.5	2.36		0.1	11		
M3	0.5		5.5	5.32		6.01		2	1.875	2.125		3	2.86		0.2	12		
M3.5	0.6		6	5.82		6.58		2.4	2.275	2.525		3.5	3.32		0.1	13		
M4	0.7		7	6.78		7.66		2.8	2.675	2.925		4	3.82		0.2	14		
M5	0.8		8	7.78		8.79		3.5	3.35	3.65		5	4.82		0.25	16		
M6	1		10	9.78		11.05		4	3.85	4.15		6	5.82		0.4	18		
M8	1.25		13	12.73		14.38		5.3	5.15	5.45		8	7.78		0.4	22		
M10	1.5	1.25	16	15.73		17.77		6.4	6.22	6.58		10	9.78		0.4	26		
M12	1.75	1.25	18	17.73		20.03		7.5	7.32	7.68		12	11.73		0.6	30		
M14	2	1.5	21	20.67		23.36		8.8	8.62	8.98		14	13.73		0.6	34	40	
M16	2	1.5	24	23.67	13.16	26.75	26.17	10	9.82	10.18	9.71	10.29	16	15.73	15.57	0.6	38	44
M18	2.5	1.5	27	26.67	26.16	30.14	29.56	11.5	11.285	11.715	11.15	11.85	18	17.73	17.57	0.6	42	48
M20	2.5	1.5	30	29.67	29.16	33.53	32.95	12.5	12.285	12.715	12.15	12.85	20	19.67	19.48	0.8	46	52
M22	2.5	1.5	34	33.38	33	37.72	37.29	14	13.785	14.215	13.65	14.35	22	21.67	21.48	0.8	50	56
M24	3	2	36	36.38	35	39.98	39.55	15	14.785	15.215	14.65	15.35	24	23.67	23.48	0.8	54	60
M27	3	2	41		40		45.2	17			16.65	17.35	27		26.48	1	60	66
M30	3.5	2	46		45		50.85	18.7			18.28	19.12	30		29.48	1	66	72
M33	3.5	2	50		49		55.37	21			20.58	21.42	33		32.38	1	78	84
M36	4	3	55		53.8		60.79	22.5			22.08	22.92	36		35.38	1	84	90
M39	4	3	60		58.8		66.44	25			24.58	25.42	39		38.38	1	90	96
M42	4.5	3	65		63.1		71.3	26			25.58	26.42	42		41.38	1.2	96	102
M45	4.5	3	70		68.1		76.95	28			27.58	28.42	46		44.38	1.2	102	108
M48	5	3	75		73.1		82.6	30			29.58	30.42	48		47.38	1.6	108	114
M52	5	4	80		78.1		88.25	33			32.5	33.5	52		51.26	1.6	114	120
M56	5.5	4	85		82.8		93.56	35			34.5	35.5	56		55.26	2		126
M60	5.5	4	90		87.8		99.21	38			37.5	38.5	60		59.26	2		132
M64	6	4	95		92.8		104.86	40			39.5	40.5	64		63.26	2		138

※ Gr.A = For d ≤ 24 mm and L ≤ 10 d or 150 mm

※ Gr.B = For d > 24 mm and L > 10 d or 150 mm

Unified ANSI B 18.2.1

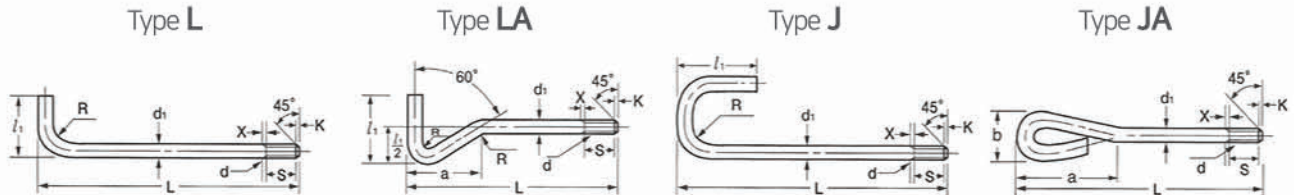
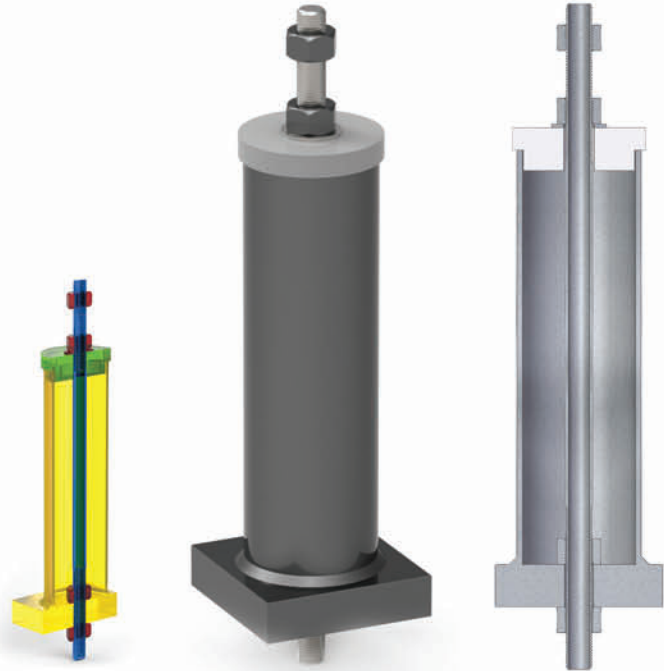
Unit : inch

Nominal Size of Basic Bolt Dia.	ds	s		e		k			R		b			
		Width Across Flats		Width Across Corners		Head Height			Radius of Fillet		Thread Length for Bolt Length			
		Max.	Basic	Max.	Min.	Basic	Max.	Min.	Max.	Min.	L≤6	L>6		
1/4	0.2500	0.260	7/16	0.438	0.425	0.505	0.484	11/64	0.188	0.150	0.03	0.01	0.750	1.000
5/16	0.3125	0.324	1/2	0.500	0.484	0.577	0.552	7/32	0.235	0.195	0.03	0.01	0.875	1.125
3/8	0.3750	0.388	9/16	0.562	0.544	0.650	0.620	1/4	0.268	0.226	0.03	0.01	1.000	1.250
7/16	0.4375	0.452	5/8	0.625	0.603	0.722	0.687	19/64	0.316	0.272	0.03	0.01	1.125	1.375
1/2	0.5000	0.515	3/4	0.750	0.725	0.866	0.826	11/32	0.364	0.302	0.03	0.01	1.250	1.500
5/8	0.6250	0.642	15/16	0.938	0.906	1.083	1.033	27/64	0.444	0.378	0.06	0.02	1.500	1.750
3/4	0.7500	0.768	1 1/8	1.125	1.088	1.299	1.240	1/2	0.524	0.455	0.06	0.02	1.750	2.000
7/8	0.8750	0.895	1 1/2	1.312	1.269	1.516	1.447	37/64	0.604	0.531	0.06	0.02	2.000	2.250
1	1.0000	1.022	1 1/2	1.500	1.450	1.732	1.653	43/64	0.700	0.591	0.09	0.03	2.250	2.500
1 1/8	1.1250	1.149	1 11/16	1.688	1.631	1.949	1.859	3/4	0.780	0.658	0.09	0.03	2.500	2.750
1 1/4	1.2500	1.277	1 7/8	1.875	1.812	2.165	2.066	27/32	0.876	0.749	0.09	0.03	2.750	3.000
1 3/8	1.3750	1.404	1 1/2	2.062	1.994	2.382	2.273	29/32	0.940	0.810	0.09	0.03	3.000	3.250
1 1/2	1.5000	1.531	2 1/4	2.250	2.175	2.598	2.480	1	1.036	0.902	0.09	0.03	3.250	3.500
1 3/4	1.7500	1.785	2 5/8	2.625	2.538	3.031	2.893	1 5/32	1.196	1.054	0.12	0.04	3.750	4.000
2	2.0000	2.039	3	3.000	2.900	3.464	3.306	1 11/32	1.388	1.175	0.12	0.04	4.250	4.500
2 1/4	2.2500	2.305	3 3/8	3.375	3.262	3.897	3.719	1 1/2	1.548	1.327	0.19	0.06	4.750	5.000
2 1/2	2.5000	2.559	3 3/4	3.750	3.625	4.330	4.133	1 21/32	1.708	1.479	0.19	0.06	5.250	5.500
2 3/4	2.7500	2.827	4 1/8	4.125	3.988	4.763	4.546	1 13/16	1.869	1.632	0.19	0.06	5.750	6.000
3	3.0000	3.081	4 1/2	4.500	4.330	5.196	4.959	2	2.060	1.815	0.19	0.06	6.250	6.500
3 1/4	3.2500	3.335	4 7/8	4.875	4.712	5.629	5.372	2 3/16	2.251	1.936	0.19	0.06	6.750	7.000
3 1/2	3.5000	3.589	5 1/4	5.250	5.075	6.062	5.786	2 5/16	2.380	2.057	0.19	0.06	7.250	7.500
3 3/4	3.7500	3.858	5 5/8	5.625	5.437	6.495	6.198	2 1/2	2.572	2.241	0.19	0.06	7.750	8.000
4	4.0000	4.111	6	6.000	5.800	6.928	6.612	2 11/16	2.764	2.424	0.19	0.06	8.250	8.500

Anchor Bolt Set (Foundation Bolt)

- Sleeve Type
- Sleeveless Type
- KS B 1016 (Type L / LA / J / JA)

Alloy Steel B7, B7M, B16, B5, L7, L7M, L43, 20CrMoVTIB4-10	Carbon Steel A36, A307, 4.6, SS400, S45C, A325, A490
Stainless Steel B8 CL1&2, B8M CL1&2, B8T, B8C, B6, SS317(L)	Nickel Alloys A453-660, Inconel 625 / 718, Incoloy 925, C276



» Metric / KS B1016, JIS B1178

Unit : mm

d	d ₁		S			l ₁ App		R App		a App		b App	K App
	Basic	Tolerance	LJ	LA, JA	Tolerance	L LA	J	L J	LA	LA	JA	JA	
M8	8			20	+6.3 0	32			8	41			1.2
M10	10	±0.4	25	30		40	45	20	10	51	50	35	1.5
M12	12		32	35		50	56	25	12	64	65	40	2
M16	16		40	40	+8 0	63	71	32	16	81	85	55	2
M20	20	±0.5	50	50		80	90	40	20	102	105	70	2.5
M24	24		63	80		100	112	50	24	127	125	80	3
M30	30	±0.6	80	90	+10 0	125	140	63	30	158	155	100	3.5
M36	36	±0.7	90	110		140	160	71	36	181	190	120	4
M42	42	±0.8	112	125		180	200	90	42	226	220	140	4.5
M48	48	±0.9	125	150	+12.5 0	200	244	100	48	252	250	160	5

Diameter of type "L" is M10-20

Double End Stud Bolt



Alloy Steel

B7, B7M, B16,
B5, L7, L7M, L43,
20CrMoVTIB4-10

Carbon Steel

A36, A307, 4.6, SS400,
S45C, A325, A490

Stainless Steel

B8 CL1&2, B8M CL1&2,
B8T, B8C, B6, SS317(L)

Nickel Alloys

A453-660,
Inconel 625 / 718,
Incoloy 925, C276

Super Duplex

UNS S32760 / S32750

Titanium

Grade 2 / 5 / 7

Copper Alloy

C65100, C63000,
C61400

Tap Stud Bolt / Slotted Nut

Alloy Steel

B7, B7M, B16,
B5, L7, L7M, L43,
20CrMoVTIB4-10

Carbon Steel

A36, A307, 4.6, SS400,
S45C, A325, A490

Stainless Steel

B8 CL1&2, B8M CL1&2,
B8T, B8C, B6, SS317(L)

Nickel Alloys

A453-660,
Inconel 625 / 718,
Incoloy 925, C276

Super Duplex

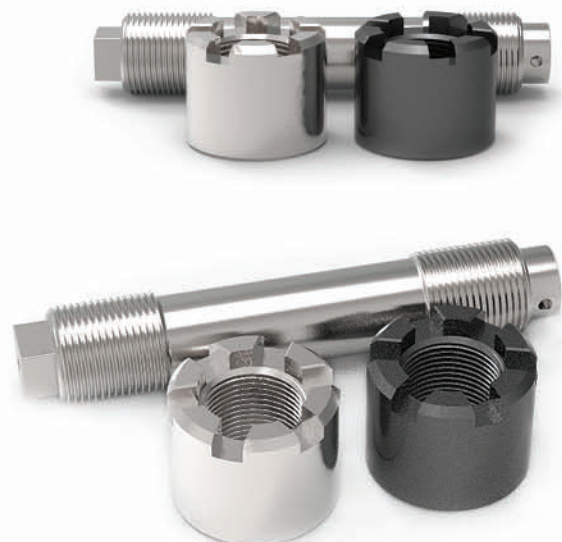
UNS S32760 / S32750

Titanium

Grade 2 / 5 / 7

Copper Alloy

C65100, C63000,
C61400



High Tension Bolt, Nuts & Washers / Torque Shear Bolt, Nuts & Washers

High Strength Bolts, Nuts & Washers

KSB1010, JIS B1186, BS4395 ASTM F1852, F2280	Normal Dia
KSB2819, EN14399-10 EN14399-4, JSS II	M12-M30



Torque Shear Type Weights & Range of Products

Unit : gr.

Size	M 16	M 20	M 22	M 24
Weights	57	97	137	201
Washer	20	32	52	62
Set Weights of T.S. Bolt / Nut / Washer				
35	185			
40	191	318		
45	199	328	449	
50	207	341	463	
55	215	354	478	631
60	223	367	493	649
65	231	380	508	667
70	239	393	523	685
75	247	406	538	703
80	255	419	553	721
85	263	432	568	739
90	271	445	583	757
95	279	458	598	775
100	287	471	613	793
105	295	484	628	811
110		497	643	829
115		510	658	847
120		523	673	865
125		536	688	883
130		549	703	901
135			718	919
140			733	937
145			748	955
150				973

BOLT LENGTH

(mm)

Hex Head Type Weights & Range of Products

KS B1010 JIS B 1186

Unit : gr.

Diameter	Length	40	45	50	55	60	65	70	75	80	85	90	95	100	110	120	130	140	150	Nut	Washer
		M12	Set Bolt	107	112	116	121	125	130	134	138	143	147	152	156	-	-	-	-	-	-
M16	Set Bolt	202	210	217	225	233	241	249	275	265	273	281	289	296	312	328	-	-	-	57	20
	Bolt	105	113	120	128	136	144	152	160	168	176	184	192	199	215	231	-	-	-		
M20	Set Bolt	336	348	361	373	385	398	410	422	435	447	459	472	484	509	533	558	583		97	32
	Bolt	175	187	200	212	224	237	249	261	274	286	298	311	323	348	374	397	422			
M22	Set Bolt	-	481	496	510	525	540	555	570	585	600	615	630	645	674	704	734	764	794	137	52
	Bolt	-	240	255	269	284	299	314	329	344	359	374	389	404	433	464	493	523	553		
M24	Set Bolt	-	-	648	666	683	701	719	737	754	772	790	808	825	861	896	932	967	1003	201	62
	Bolt	-	-	323	341	358	376	394	412	429	447	465	483	500	536	571	607	642	678		
M27	Set Bolt	-	-	-	-	-	976	999	1022	1045	1068	1091	1114	1137	1183	1229	1275	1321	1367	263	93
	Bolt	-	-	-	-	-	527	550	573	596	619	642	665	688	734	780	826	872	918		
M30	Set Bolt	-	-	-	-	-	-	1319	1347	1375	1403	1431	1459	1487	1543	1599	1655	1711	1767	340	134
	Bolt	-	-	-	-	-	-	711	739	767	795	823	851	879	935	991	1047	1103	1159		

Bolt Cap



- Thermoplastic Rubber Bolt Cap
- For Anti-Corrosion
- Bolt Size : 1" ~ 3.5"

Stick Cover

Stainless Steel
B8 CL1&2, B8M CL1&2,
B8T, B8C, B6, SS317(L)

Super Duplex
UNS S32760 / S32750

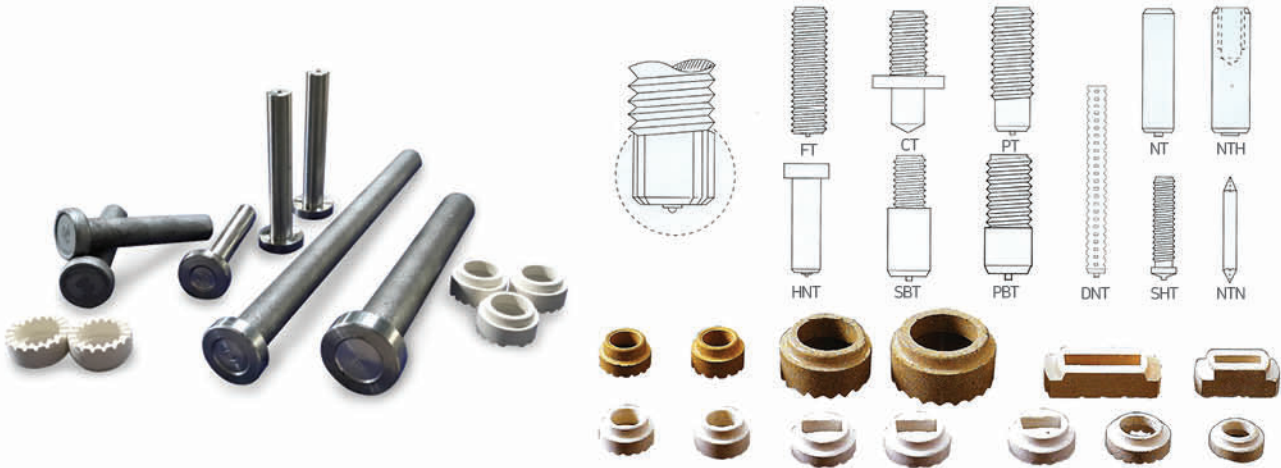
Nickel Alloys
A453-660,
Inconel 625 / 718,
Incoloy 925, C276



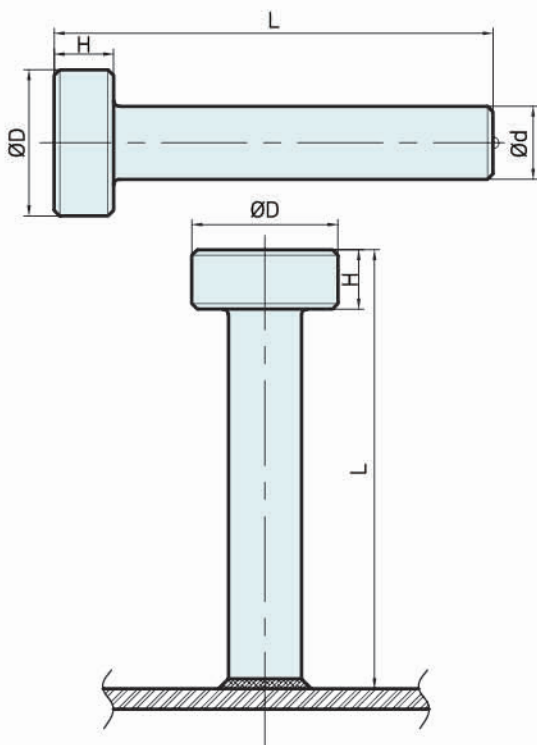
Above drawing is figure of our own but can supply changes material and / or figure under customer's requirements

Welding Studs

An Example Shape of Welding Stud & Ferrules
ISO 13918, KS B1062, AWS D1.1-D1.1M



Specification of Headed Welding Studs



L : Manufactured Length Before Welding

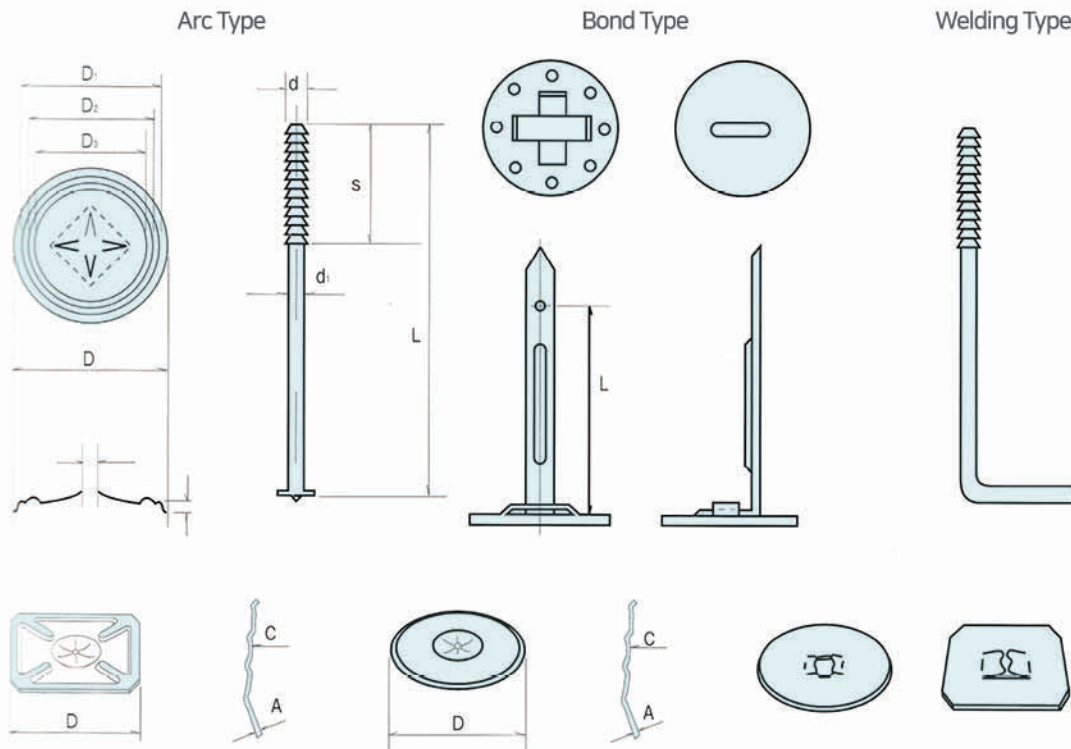
Standard Dimensions, in [AWS D1.1]

Shank Diameter (C)	Length Tolerances (L)	Head Diameter (H)	Minimum Head Height (T)	
3/8	+0.010 -0.010	±1/16	3/4 ± 1/64	9/32
1/2	+0.010 -0.010	±1/16	1 ± 1/64	9/32
5/8	+0.010 -0.010	±1/16	1-1/4 ± 1/64	9/32
3/4	+0.015 -0.015	±1/16	1-1/4 ± 1/64	3/8
7/8	+0.015 -0.015	±1/16	1-3/8 ± 1/64	3/8
1	+0.020 -0.020	±1/16	1-5/8 ± 1/64	1/2

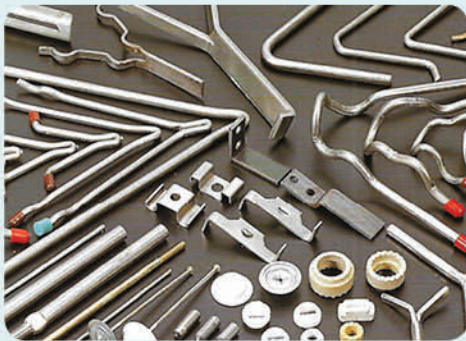
Standard Dimensions, mm

Shank Diameter (C)	Length Tolerances (L)	Head Diameter (H)	Minimum Head Height (T)	
10	+0.025 -0.025	±1.6	19 ± 0.40	7.1
13	+0.025 -0.025	±1.6	25 ± 0.40	7.1
16	+0.025 -0.025	±1.6	32 ± 0.40	7.1
19	+0.040 -0.040	±1.6	32 ± 0.40	9.5
22	+0.040 -0.040	±1.6	35 ± 0.40	9.5
25	+0.040 -0.040	±1.6	41 ± 0.40	12.7

Insolation Pin & Washer



Refractory Anchors



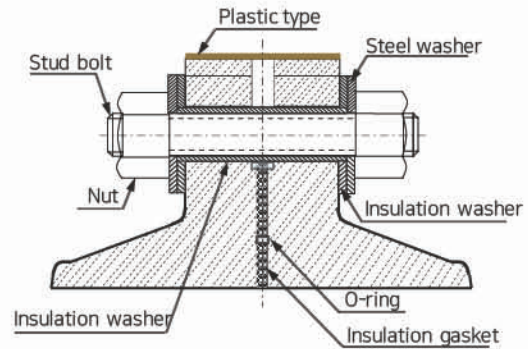
An extensive range of refractory anchors is available in various grades of heat resistant stainless steels and carbon steel. Whilst this wide selection of various profile anchors is available, we can readily manufacture specifically profiled anchors to customer requirements in small or large quantities.

Included in the range are ceramic fiber and ceramic module fixing systems, fabricated plate anchors and welded components.

Anchors are available for either manual or stud welded application.

Insulation Kit

<p>Stud Bolt</p> <ul style="list-style-type: none"> - Allow Steel - Stainless Steel 	<p>Insulating Washer</p> <ul style="list-style-type: none"> - Phenolic - PTFE - Epoxy Glass Type
<p>Nut</p> <ul style="list-style-type: none"> - Carbon Steel - Alloy Steel - Stainless Steel 	<p>Insulating Sleeve</p> <ul style="list-style-type: none"> - Phenolic - PTFE - Epoxy Glass Type
<p>Allow Steel</p> <ul style="list-style-type: none"> - F844 Type - F436 Type - A240 Type 316-304 	<p>Gasket</p> <ul style="list-style-type: none"> - Core Material - Physical Properties of Laminate Material - Seal Material



Plug



SB564 - N08825	SA182 - F304	SA182 - F316	SA350 - LF2
SA182 - F316L	SA182 - F321	SA182 - F304L	SA105 - N

Above drawing is figure of our own but can supply changes material and / or figure under customer's requirements

Plane Washers

» Metric KS B1326, JIS B1256, DIN 126

Unit: mm

Nominal Size	Narrow Type		Regular Type					
	t		d		D		t	
	Basic	Basic	Basic	Tolerance	Basic	Tolerance	Basic	Tolerance
6	11.5	1.6	6.6		12.5	0	1.6	
8	15.5	1.6	9	+0.6	17	-0.7	1.6	±0.2
10	18	2	11		21		2	±0.25
12	21	2.5	14	+0.7	24	0	2.3	±0.3
(14)	24	2.5	16	0	28	-0.8	3.2	
16	28	3	18		30		3.2	
(18)	30	3	20		34		3.2	±0.4
20	34	3	22		37	0	3.2	
(22)	37	3	24	+0.8	39	0	3.2	
24	39	4	26	0	44	-1	4.5	
(27)	44	4	30		50		4.5	±0.5
30	50	4	33		56		4.5	
(33)	56	5	36		60	0	6	
(36)	60	5	39	+1	66	-1.2	6	
(39)	66	6	42	0	72		6	
42			45		78		7	±0.7
(45)			48		85		7	
48			52		92		8	
(52)			56		98		8	
56			62		105	0	9	
(60)			66	+1.2	110	-1.4	9	
64			70	0	115		9	
(68)			74		120		10	
72			78		125		10	
(76)			82		135		10	±1
80			86		140		12	
(85)			91	+1.4	145	-1.6	12	
90			96	0	160		12	
(95)			101		165		12	
100			107		175		14	±1.4

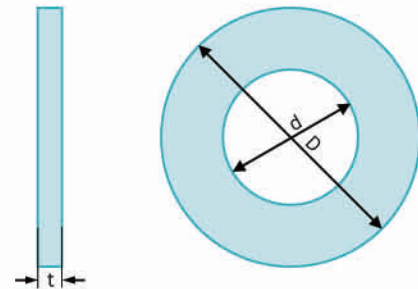
» ASME B18.22.1 - ASTM F844 Type A, Narrow

Nominal Size	Narrow Type					
	(d) Inside Diameter	(D) Outside Type		(t) Thickness		Tolerance
		Basic	Tolerance	Basic	Tolerance	
# 10	0.023	0.406				
#12	0.234	0.438	0.008		0.04	0.045 0.036
1/4	0.281	0.500				
5/16	0.344	0.625		0.005		
3/8	0.406	0.734	0.015		0.063	0.071 0.056
7/16	0.469	0.875				
1/2	0.531	1.000				
5/8	0.656	1.250				
3/4	0.812	1.375				
7/8	0.938	1.469			0.100	0.112 0.090
1	1.062	1.750				
1-1/8	1.188	2.000				
1-1/4	1.312	2.250	0.030	0.007		
1-3/8	1.438	2.500				
1-1/2	1.562	2.750			0.160	0.174 0.146
1-5/8	1.750	3.000				
1-3/4	1.875	3.250				
1-7/8	2.000	3.500	0.045	0.010	0.250	0.266 0.234
2	2.125	3.750				

» ASTM F436M

Unit: mm

Nominal Size	Hardened Circular Washers					
	(d) Inside Diameter		(D) Outside Diameter		Thickness(t)	
	Max.	Min.	Max.	Min.	Max.	Min.
12	14.4	14.0	27.0	25.7		
14	16.4	16.0	30.0	28.7		
16	18.4	18.0	34.0	32.4		3.1
20	22.5	22.0	42.0	40.4		
22	24.5	24.0	44.0	42.4	4.6	
24	26.5	26.0	50.0	48.4		
27	30.5	30.0	56.0	54.1		3.4
30	33.6	33.0	60.0	58.1		
36	39.6	36.0	72.0	70.1		
42	45.6	45.0	84.0	81.8	7.2	4.6
48	52.7	52.0	95.0	92.8		
56	62.7	62.0	107.0	104.8		
64	70.7	70.0	118.0	115.8		
72	78.7	78.0	130.0	127.5	8.7	6.1
80	86.9	86.0	142.0	139.5		
90	96.9	96.0	159.0	156.5		
100	107.9	107.0	176.0	173.5		



» ASTM F436

Bolt Size	Hardened Circular Washers					
	(D) Outside Diameter		(d) Inside Diameter		Thickness(t)	
	Basic	Tol.	Basic	Tol.	Min.	Max.
1/4	5/8		9/32			
5/16	11/16		11/32		0.051	0.08
3/8	13/16		13/32			
7/16	59/84		15/32			
1/2	1-1/16		17/32		0.097	
5/8	1-5/16		11/16		0.122	
3/4	1-15/32		13/16			
7/8	1-3/4	±1/32	15/16	+1/32 -0		
1	2		1-1/8		0.177	
1-1/8	2-1/4		1-1/4		0.136	
1-1/4	2-1/2		1-3/8			
1-3/8	2-3/4		1-1/2			
1-1/2	3		1-5/8			
1-3/4	3-3/8		1-7/8		0.178	0.28
2	3-3/4		2-1/8			
2-1/4	4		2-3/8			
2-1/2	4-1/2	±1/16	2-5/8	+1/16 -0	0.24	0.34
2-3/4	5		2-7/8			
3	5-1/2		3-1/8			

Technology Requirements

Technology Requirements

Available Material & Specifications

Alloy Steel

ASTM A193	B7, B7M, B16, B5, L7, L7M,
ASTM A194	2H, 2HM, 3, 4, 7, 7M
ASTM A320	L7, L7M, L43
JIS B1051/BS3692	Grade 8.8, 10.9, 12.9
EN10269	20CrMoVTIB4-10

Nickel Alloys

ASTM A453	660 Class A / B / C / D
Incoloy	800, 800HT, A286, 925 [N09925]
Inconel	600, 625, 718
Monel	400, K500
Hastelloy	C276, C22

Duplex Steel

UNS	S32750, S32760 (Condition A & S) S32205 / S31803 / S32550
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Washer Materials

ASTM	F436 / F844
KS D 3559	SWRH 62B - 72B
AISI	SS 304(L), SS 316(L), SS316Ti, SS 317(L)
UNS	S32750, S32760, S31803

Plating & Galvanizing

Hot Dip Galvanized	ASTM A153 / A123 / IL-1 10684
Zinc	ATM B633 (SC1&SC2&SC3)
Cadmium	ASTM B766
Zinc Nickel	ASTM B841
Electroless Nickel	ASTM B733
Zinc Flake	ISO 10683
Phosphate	ASTM F1137 / ISO 11408
Mechanical Galvanized	ASTM A695

Coating

Xylan	Xylar 2, 1014, 1052, 1070, 1424
Sermagard	1105, 1175, 1280, 1628
Molykote	7409

Carbon Steel

ASTM A325 / ASTM A490 / ASTM A449	
ASTM A307	Grade A / B / C
BS3692	Grade 4.8, 8.8
ASTM	A36
ASTM F1554	Grade 36 / 55
KS	D 3752 / A 3503

Stainless Steel

ASTM A193	B6, B8 Class 1&2, B8M Class 1&2, B8C
ASTM A194	8M, 8MA, 8, 8A, 8T, 8C, 6
ASTM A320	B6, B8 Class 1&2, B8M Class 1&2, B8T Class 1&2, B8C
ISO 3506	A2-70, A2-80, A4-70, A4-80
AISI	SS 304(L), SS 316(L), SS316Ti, SS 317(L)

Other Materials

Titanium	Grade 2 / 5 / 7
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Requirements for Bolt Materials

Grade	Chemical Requirements [%]										
	C	Mn	Si	P max.	S max.	Cr	Mo	Ni	Fe	Cu	Others Elements
ASTM A193 Gr. B6	0.08-0.15	1.00 max.	1.00 max.	0.040	0.030	11.5-13.5	-	-	-	-	-
ASTM A193 Gr. B7, B7M	0.38-0.48	0.75-1.00	0.15-0.35	0.035	0.040	0.80-1.10	0.15-0.25	-	-	-	-
ASTM A193 Gr. B16	0.36-0.47	0.45-0.70	0.15-0.35	0.035	0.040	0.80-1.15	0.50-0.65	-	-	-	V: 0.25-0.35 Al: 0.015 max.
ASTM A193/A320 Gr. B8, B8 CL2	0.08 Max	2.00 max.	1.00 max.	0.045	0.030	18.0-20.0	-	8.0-11.0	-	-	-
ASTM A193/320 Gr. B8M, B8M CL2	0.08 Max	2.00 max.	1.00 max.	0.045	0.030	16.0-18.0	2.0-3.0	10.0-14.0	-	-	-
ASTM A320 Gr. L7, L7M	0.38-0.48	0.75-1.00	0.15-0.35	0.035	0.040	0.80-1.10	0.15-0.25	-	-	-	-
ASTM A320 Gr. L43	0.38-0.43	0.60-0.85	0.15-0.35	0.035	0.040	0.70-0.90	0.20-0.30	-	-	-	-
ASTM A325 Type 1	0.30-0.52	0.60 min.	0.15-0.30	0.040	0.050	Carbon Steel		-	-	-	-
ASTM A325 Type 1	0.30-0.52	0.60 min.	0.15-0.35	0.035	0.040	Alloy steel		-	-	-	-
ASTM A354 Gr. BC	4)0.3-0.53	-	-	0.035	0.040	-	-	-	-	-	-
ASTM A354 Gr. BD	4)0.3-0.53	-	-	0.035	0.040	-	-	-	-	-	-
ASTM A449 Type 1	0.30-0.52	0.60 min.	-	0.040	0.050	-	-	-	-	-	-
ASTM A453 Gr. 660 A-C	0.08 max.	2.00 max.	1.00 max.	0.040	0.030	13.5-16.0	1.0-1.5	24.0-27.0	-	-	6)Ti, Al, V, B
ASTM A453 Gr. 660D	0.08 max.	2.00 max.	1.00 max.	0.040	0.030	13.5-16.0	1.0-1.5	24.0-27.0	-	-	6)Ti, Al, V, B
ASTM A479 UNS S31803	0.030 max.	2.00 max.	1.00 max.	0.030	0.020	21.0-23.0	2.5-3.5	4.5-6.5	-	-	N 0.08-0.20
ASTM A479 UNS S32750	0.030 max.	1.20 max.	0.80 max.	0.035	0.020	24.0-26.0	3.0-5.0	6.0-8.0	-	0.50 max.	N 0.24-0.32
ASTM A479 UNS S32760	0.030 max.	1.00 max.	1.00 max.	0.030	0.010	24.0-26.0	3.0-4.0	6.0-8.0	-	0.50-1.00	N 0.20-0.30
ASTM A490 Type1 (≤1-3/8)	5)0.30-0.48	-	-	0.040	0.040	-	-	-	-	-	-
ASTM A540 Gr. B23	0.37-0.44	0.60-0.95	0.15-0.35	0.025	0.025	0.65-0.95	0.20-0.30	1.55-2.00	-	-	-
ASTM B98 UNS C65100	-	0.7 max.	0.8-2.0	-	-	-	-	-	0.8 max.	96.0 min.	11)Pb, Zn
ASTM B150 UNS C63000	-	1.5 max.	0.25 max.	-	-	-	-	4.0-5.5	2.0-4.0	Re	12)Al, Sn, Zn
ASTM B169 UNS C61400	-	1.00 max.	0.015 max.	-	-	-	-	-	1.5-3.5	Re	13)Pb, Al, Zn
ASTM B637 UNS N07718	0.08 max.	0.35 max.	0.35 max.	0.015	0.015	17.0-21.0	2.80-3.30	50.0-55	-	0.03 max.	10)Co, Cb, Ti, Al, B
MONEL K-500	0.25 max.	1.5 max.	0.50 max.	-	0.010	-	-	63 min.	2.00 max.	27.0-33	9)Al, Ti
ISO 898-1 (JIS B1051) Gr 8.8	0.25-0.55	-	-	0.035	0.035	Carbon Steel		-	-	-	-
ISO 898-1 (JIS B1051) Gr 10.9	0.25-0.55	-	-	0.035	0.035	Alloy steel		-	-	-	7)Cr, Ni, Mo
KS B1010 (JIS 81186) F10T	-	-	-	-	-	-	-	-	-	-	-
KS D3752 (JIS G4051) S45(N)	0.42-0.48	0.60-0.9	0.15-0.35	0.030	0.035	0.20 max.	-	0.20 max.	-	0.30 max.	-
KS D3711 (JIS G4105) SCM440	0.38-0.43	0.60-0.85	0.15-0.35	0.030	0.030	0.90-1.20	0.15-0.30	0.25 max.	-	0.30 max.	-
KS D3706 (JIS G4303) SUS304	0.08 max.	2.00 max.	1.00 Max	0.045	0.030	18.0-20.0	-	8.0-10.50	-	-	-
KS D3706 (JIS G4303) SUS316	0.08 max.	2.00 max.	1.00 Max	0.045	0.030	16.90-18.0	2.00-3.00	10.0-14.0	-	-	-

1) When copper is specified, 2) A320 Gr.B8.B8M 30min, 3) A320 Gr.B8.B8M 95min, 4) $\geq 1-1/2$ C 0.35-0.53, 5) 1-3/8 over C 0.35-0.53,

6) Ti 1.9-2.35 Al 0.35max V 0.1-0.5 B 0.001-0.010, 7) Alloy steel shall contain one or more of the alloying elements Cr Ni Mo or V

7) Alloy steel shall contain one or more alloying elements Cr Ni Mo or V

8) Proof Stress, 9) Al 2.3-3.15, Ti, 10) Co 1.0max, Cb 4.75-5.50, Ti 0.65-1, 15, Al 0.20-0.80, B 0.006max

11) Pb 0.05 Max, Zn 1.5 Max, 12) Al 9.0-11.0, Sn 0.20 Max, Zn 0.30 Max, 13) Pb 0.01, Al 6.0-8.0, Zn 0.20 Max

Requirements for Bolt Materials

Grade	Mechanical Requirements						
	Dia in[mm]	Tensile Strength [Unit] Min	Yield Strength 0.2% [Unit] Min	EL(%) Min	R/A(%) Min	Hardness	Impact Test
ASTM A193 Gr. B7	≤2-1/2 [65] over ≤4 [100]	125 [ks] 115 [ksi]	105 [ksi] 95 [ksi]	16	50%	HRC 35 max	-
ASTM A193 Gr. B7M	≤4 [100] over ≤7 [180]	100 [ksi] 100 [ksi]	80 [ksi] 75 [ksi]	18	50	HRB 99 max	-
ASTM A193 Gr. B16	≤2-1/ 2 [65] over ≤4 [100]	125 [ksi] 110 [ksi]	105 [ksi] 95 [ksi]	18 17	50 45	HRC 35 max	-
ASTM A193/A320 Gr. B8	All	75 [ksi]	30 [ksi]	2)30	50	HRB 96 max	-
ASTM A193/A320 Gr. B8 CL2	≤3/4 [20]	125 [ksi]	100 [ksi]	12	35	HRC 35 max	-
ASTM A193/A320 Gr. B8M	All	75 [ksi]	30 [ksi]	2)30	50	HRB 96 max	-
ASTM A193/A320 Gr. B8M CL2	≤3/4 [20]	110 [ksi]	3)95 [ksi]	15	45	HRC 35 max	-
ASTM A320 Gr. L7	≤2-1/2	125 [ksi]	105 [ksi]	16	50	HRC 35 max	-101°C/27J min
ASTM A320 Gr. L7M	≤2-1/2	100 [ksi]	80 [ksi]	18	50	HRB 99 max	-73°C/27J min
ASTM A320 Gr. L43	≤4 [100]	125 [ksi]	105 [ksi]	16	50	HRC 35 max	-
ASTM A325 Type 1	1/2 to 1 1-1/8 to 1-1/2	120 [ksi] 105 [ksi]	92 [ksi] 81 [ksi]	14	35	HRC 25 - 34 HRC 19 - 30	-
ASTM A354 Gr. BC	1/4 to 2-1/ 2	125 [ksi]	109 [ks]	16	50	HRC 26 - 36	-
ASTM A354 Gr. BD	1/4 to 2-1/ 2	150 [ksi]	130 [ksi]	14	40	HRC 33 - 39	-
ASTM A449 Type 1	1/4 to 1 1-1/8 to 1-1/2	120 [ksi] 105 [ksi]	92 [ksi] 81 [ksi]	14	35	HRC 25 - 34 HRC 19 - 30	-
ASTM A453 Gr. 660 A - C	All	130 [ksi]	85 [ksi]	15	18	HRC 24 - 37	Rupture Test
ASTM A453 Gr. 660 D	All	130 [ksi]	105 [ksi]	15	18	HRC 24 - 35	-
ASTM A479 UNS S31803	All	90 [ksi]	65 [ksi]	25	-	HB 290 max	-
ASTM A479 UNS S32750	≤2 ≥2	116 [ksi] 110 [ksi]	80 [ksi] 75 [ksi]	15	-	HB 310 max	-
ASTM A479 UNS S32760	All	109 [ksi]	80 [ks]	25	-	HB 300 max	-
ASTM A490 Type 1	1/2 to 1-1/2	150-170 [ksi]	130 [ksi]	14	40	HRC 33 - 39	-
ASTM A540 Gr. B23	≤6 CL5	120 [ksi]	105 [ksi]	15	50	HB 248 - 311	Late. 0.635 min
ASTM B98 UNS C65100	All	40 [ksi]	12 [ksi]	30	-	-	-
ASTM B150 UNS C63000	1/2 to 1 over 1 to 2 over 2 to 3	100 [ksi] 90 [ksi] 85 [ksi]	50 [ksi] 45 [ksi] 42.5 [ksi]	5 6 10	-	-	-
ASTM B169 UNS C61400	≤1/2 over 1/2 to 2 over 2 to 5	72 [ksi] 70 [ksi] 65 [ksi]	30 [ksi] 28 [ksi] 26 [ksi]	35	-	-	-
ASTM B637 UNS N07718	All	1275 [Mpa]	1034 [Mpa]	12	15	HB 331 min	-
MONEL K-500	All	480 [N/mil]	175 [N/mil]	46	72	HRB 90 max	-
ISO 898-1(JIS B1051) Gr. 8.8	≤[16] > [16]	800 [N/mil] 830 [N/mil]	8)640 [N/mil] 8)660 [N/mil]	12	52	HRC 22 - 32 HRC 23 - 44	30J min
ISO 898-1(JIS B1051) Gr. 10.9	All	1040 [N/mil]	8)940 [N/mil]	9	-	HRC 32 - 39	20J min
KS B1010(JIS B1186) F10T	All	100-120 [N/mil]	90 [N/mil]	14	40	HRC 27 - 28	-
KS D3752(JIS G4051) S45(N)	All	570 [N/mil]	345 [N/mil]	20	-	HB 167 - 229	-
KS D3711(JIS G4053) SCM440	All	980 [N/mil]	835 [N/mil]	12	45	HB 285 - 352	59J/oil min
KS D3706(JIS G4303) SUS304	All	520 [N/mil]	205 [N/mil]	40	60	HRB 90 max	-
KS D3706(JIS G4303) SUS316	All	520 [N/mil]	205 [N/mil]	40	60	HRB 90 max	-

8) Proof Stress, 9) Al 2.3-3.15, Ti, 10) Co 1.0max, Cb 4.75-5.50, Ti 0.65-1, 15, Al 0.20-0.80, B 0.006max

Requirements for Nut Materials

Grade	Chemical Requirements [%]									
	C	Mn	Si	P max.	S max.	Cr	Mo	Ni	Cu	Other Elements
ASTM A194 Gr. 2, 2H, 2HM	0.40 min.	1.00 max.	0.40 max.	0.040	0.050	-	-	-	-	-
ASTM A194 Gr. 4	0.40 - 0.50	0.70 - 0.90	0.15 - 0.35	0.035	0.040	-	0.20 - 0.30	-	-	-
ASTM A194 Gr. 6	0.08 - 0.15	1.00 max.	1.00 max.	0.040	0.030	11.5 - 13.5	-	-	-	-
ASTM A194 Gr. 7, 7M	0.37 - 0.49	0.65 - 1.10	0.15 - 0.35	0.035	0.040	0.75 - 1.20	0.15 - 0.25	-	-	-
ASTM A194 Gr. 8, 8A	0.08 max.	2.00 max.	1.00 max.	0.045	0.030	18.0 - 20.0	-	8.0 - 11.0	-	-
ASTM A194 Gr. 8M, 8MA	0.08 max.	2.00 max.	1.00 max.	0.045	0.030	16.0 - 18.0	2.0 - 3.0	10.0 - 14.0	-	-
ASTM A182 F51	0.030 max.	2.00 max.	1.00 max.	0.030	0.020	21.0 - 23.0	2.5 - 3.5	4.5 - 6.5	-	N 0.08 - 0.20
ASTM A182 F53	0.030 max.	1.20 max.	0.80 max.	0.035	0.020	24.0 - 26.0	3.0 - 5.0	6.0 - 8.0	0.50 max.	N 0.24 - 0.32
ASTM A182 F55	0.030 max.	1.00 max.	1.00 max.	0.030	0.010	24.0 - 26.0	3.0 - 4.0	6.0 - 8.0	0.50 - 1.00	N 0.20 - 0.30
ISO 898-2(JIS B1052) Gr. 8	0.58 max.	0.25 min.	-	0.060	0.150	-	-	-	-	-
ISO 898-2(JIS B1052) Gr. 10	0.58 max.	0.30 min.	-	0.048	0.058	-	-	-	-	-
KS B1010(JIS B1186) F10	-	-	-	-	-	-	-	-	-	-

Grade	Mechanical Requirements				
	Dia in[mm]	Nut Proof Load	Hardness		
			HB	HRB	HRC
ASTM A194 Gr. 2	all	Heavy 150,000 psi, Hex 135,000	159 - 352	84 min	-
ASTM A194 Gr. 2H	≤1-1/2 [38.1] >2-1/2 [38.1]	Heavy 175,000 psi, Hex 150,000 Heavy 175,000 psi, Hex 150,000	248 - 327 212 - 327	- 95 min	24 - 35 35 max
ASTM A194 Gr. 2HM, 7M	all	Heavy 150,000 psi, Hex 135,000	159 - 235	84 - 99	-
ASTM A194 Gr. 3, 4, 7	all	Heavy 175,000 psi, Hex 150,000	248 - 327	-	24 - 35
ASTM A194 Gr. 6	all	Heavy 150,000 psi, Hex 135,000	228 - 271	-	20 - 28
ASTM A194 Gr. 8, 8M	all	Heavy 80,000 psi, Hex 75,000	126 - 300	60 min	32 max
ASTM A194 Gr. 8A, 8MA	all	Heavy 80,000 psi, Hex 75,000	126 - 192	60 - 90	-
ASTM A182 F51	all	-	-	-	-
ASTM A182 F53	all	-	310 max	-	-
ASTM A182 F55	all	-	-	-	-
ISO 898-2(JIS B1052) Gr. 8	[16 - 39]	920 [N/mm]	-	-	38 max
ISO 898-2(JIS B1052) Gr. 10	[16 - 39]	1060 [N/mm]	-	-	28 - 38
KS B1010(JIS B1186) F10	all	100 [kgf/mm]	-	95 min	35 max

Requirements for Washer Materials

Grade	Dia in[mm]	Washer Type	Hardness		
			HB	HRB	HRC
F436	All	Plain washer / Square	-	-	38 - 45 HDG 26-45
F844	All	Plain Washer	-	-	-
F35	All	Plain Washer	-	-	35 - 45
14H	All	Plain Washer / Square	-	75 - 95	-
22H	All	Plain Washer / Square	-	95 min.	29 min.
SWRH	All	Spring (Lock) Washer	-	-	42 - 50

Laboratory



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HW-0011