



# SAMJEON

BOLT & NUT / ALL FASTENERS



**SAMJEON METAL Co.,Ltd.**

# SAMJEON METAL Co.,Ltd.



(미음공단 신축공장)

## GREETINGS

당사는 볼트, 너트류 전문제작 취급업체로서 1991년 창립이후 한 분야에서만 지속적으로 연구, 개발 노력하는 회사입니다.

어느 분야든 최고가 있듯이 저희 삼전금속(주)는 전 임직원이 볼트, 너트 분야에서 만큼은 최고라는 자부심으로

User의 요구에 만족하고자 노력하고 있으며, 또한 한번 만난 인연을 소중하게 생각하며 최선을 다하여,

다시 찾아 올 수 있도록 감동을 주는 회사로 만들고자 최선을 다하겠습니다.

자칫 소홀하기 쉬우며 잘 보이지도, 드러 나지도 않는 부품이지만 해양, 선박, 석유화학 Plant 등

모든 산업분야에 없어서는 안 될 귀중한 한 부분 요소입니다.

따라서 우리의 제품은 중요한 역할을 한다는 자부심으로 결코 느슨해 지는 일은 없을 것입니다.

감사합니다

삼전금속(주) 임직원 일동



**Best Quality  
&  
Service in the World**

## COMPANY HISTORY

- 1991. 05 부산시 사상구 패법동에서 창립
- 1991. 09 포항종합제철 등록 및 공급
- 1992. 02 포항가속기연구소 등록 및 공급 (진공그룹실)
- 1993. 01 부산 지하철 2호선 1단계 공사 철골용 조립볼트 공급 승인
- 1996. 12 삼락동으로 공장이전
- 1998. 09 LG-OTIS 엘리베이터 화스너 관련제품 생산 공급(금산산기외)
- 2004. 04 조선기자재 관련 업체 화스너류 공급 확대 및 매출처 확대
- 2008. 08 덕포동 공장(자가)이전
- 2010. 03 오리엔탈정공 그룹의 조선 기자재업체 개발 확대
- 2011. 05 부산 조선해양기자재협동조합 출자 및 가입
- 2014. 02 미음공단 신축공장 이전



**Best**

**Marine Plants**

# SAMJEON FASTENERS IN USE

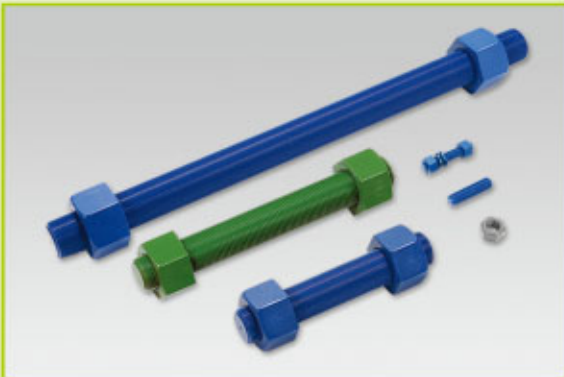
- Offshore Facilities
- Nuclear Power Plants
- Shipbuildings
- Oil & Gas Plants
- Thermal Power Plants
- Bridge
- Iron&Steel Mills
- Containers
- Auto-Motor



# Shipbuildings



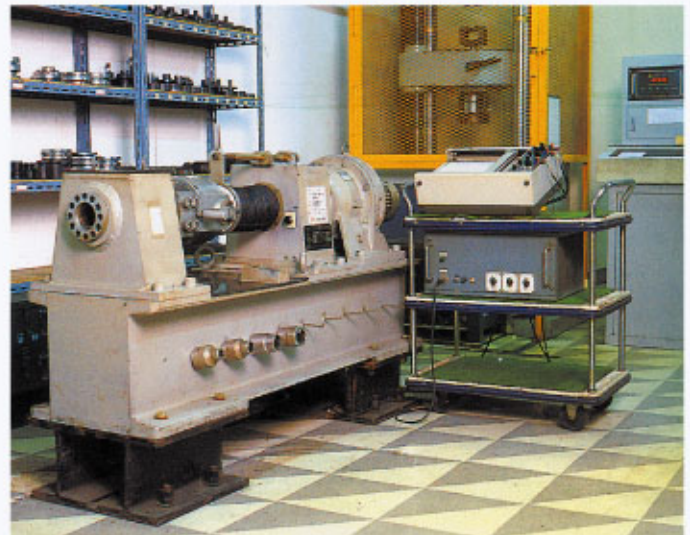
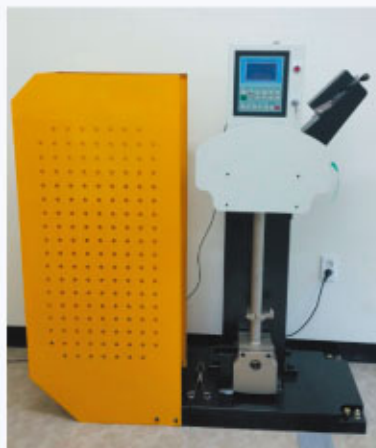
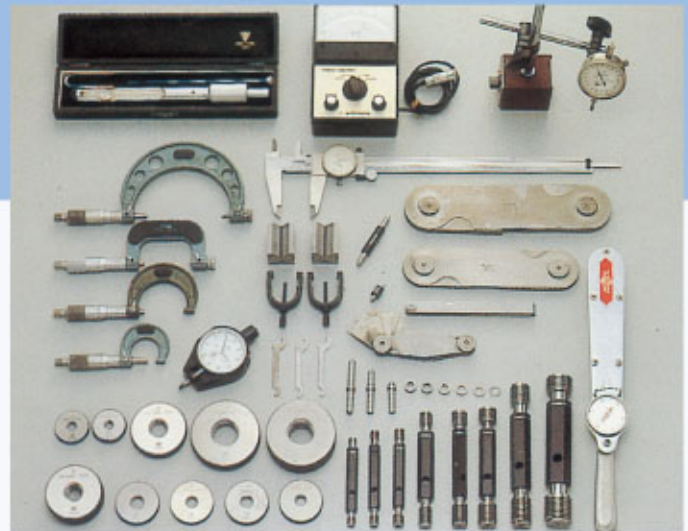
# PRODUCTION PROCESS







# QUALITY CONTROL



# LIMITS OF SIZE FOR STANDARD SERIES THREADS

## UNIFIED COARSE THREADS & UN THREADS

ANSI B 1.1 / JIS B0210(CLASS 2A.2B)

unit:mm

Nominal Size and Threads/in	External							Internal					
	Major Diameter(d)			Pitch Diameter(d <sub>2</sub> )			Minor Dia	Pitch Diameter(D <sub>2</sub> )			Major Diameter(D <sub>1</sub> )		
	Max	Min	Tol	Max	Min	Tol		Max	Min	Tol	Max	Min	Tol
# 8-32 UNC	4.142	3.991	0.151	3.627	3.554	0.073	3.198	3.746	3.650	0.096	3.530	3.302	0.228
# 10-24 UNC	4.800	4.618	0.182	4.112	4.029	0.083	3.514	4.246	4.138	0.108	3.962	3.683	0.279
# 12-24 UNC	5.461	5.279	0.182	4.772	4.687	0.085	4.201	4.909	4.799	0.110	4.597	4.344	0.253
1/4 -20 UNC	6.322	6.117	0.205	5.496	5.403	0.093	4.811	5.648	5.525	0.123	5.257	4.979	0.278
5/16 -18 UNC	7.907	7.687	0.220	6.990	6.889	0.101	6.228	7.155	7.021	0.134	6.731	6.401	0.330
3/8 -16 UNC	9.491	9.254	0.237	8.460	8.349	0.111	7.600	8.638	8.494	0.144	8.153	7.798	0.355
7/16 -14 UNC	11.076	10.816	0.260	9.898	9.779	0.119	8.198	10.088	9.934	0.154	9.550	9.144	0.406
1/2 -13 UNC	12.661	12.386	0.275	11.392	11.265	0.127	10.264	11.595	11.430	0.165	11.023	10.592	0.431
9/16 -12 UNC	14.246	13.958	0.288	12.873	12.741	0.132	11.727	13.086	12.914	0.172	12.446	11.989	0.457
5/8 -11 UNC	15.834	15.528	0.306	14.335	14.197	0.138	13.086	14.559	14.377	0.182	13.868	13.386	0.482
3/4 -10 UNC	19.004	18.677	0.327	17.353	17.204	0.149	15.979	17.594	17.399	0.195	16.840	16.307	0.533
7/8 -9 UNC	22.176	21.824	0.352	20.342	20.183	0.159	18.816	20.599	20.392	0.207	19.761	19.177	0.584
1 -8 UNC	25.349	24.969	0.380	23.286	23.114	0.172	21.570	23.561	23.338	0.223	22.606	21.971	0.635
1 1/8 -7 UNC	28.519	28.103	0.416	26.162	25.980	0.182	24.199	26.456	26.218	0.238	25.349	24.638	0.711
1 1/4 -7 UNC	31.694	31.278	0.416	29.337	29.150	0.187	27.374	29.636	29.393	0.243	28.524	27.813	0.711
1 3/8 -6 UNC	34.864	34.402	0.462	32.113	31.911	0.202	29.805	32.438	32.175	0.263	31.115	30.353	0.762
1 1/2 -6 UNC	38.039	37.577	0.462	35.288	35.083	0.205	33.000	35.615	35.350	0.265	34.290	33.528	0.762
1 3/4 -5 UNC	44.381	43.861	0.520	41.082	40.856	0.225	38.334	41.445	41.151	0.294	39.827	38.964	0.863
2 -4 1/2 UNC	50.726	50.168	0.558	47.061	46.820	0.241	44.003	47.449	47.135	0.314	45.593	44.679	0.914
2 1/4 -4 1/2 UNC	57.076	56.518	0.558	53.411	53.165	0.246	50.353	53.804	53.485	0.319	51.943	51.029	0.914
2 1/2 -4 UNC	63.421	62.817	0.604	59.296	59.033	0.263	55.860	59.717	59.376	0.341	57.581	56.617	0.964
2 3/4 -4 UNC	69.768	69.165	0.603	65.643	65.378	0.265	65.207	66.073	65.726	0.347	63.931	62.967	0.964
3 -4 UNC	76.118	75.515	0.603	71.993	71.722	0.271	68.557	72.428	72.076	0.352	70.281	69.317	0.964
3 1/4 -4 UNC	82.466	81.862	0.604	78.341	78.065	0.276	74.905	78.783	78.426	0.357	76.631	75.667	0.964
3 1/2 -4 UNC	88.816	88.212	0.604	84.691	84.412	0.279	81.225	85.138	84.776	0.362	82.981	82.017	0.964
3 3/4 -4 UNC	95.163	94.560	0.603	91.038	90.755	0.283	87.602	91.493	91.126	0.367	89.331	88.367	0.964
4 -4 UNC	101.513	100.910	0.603	97.388	97.102	0.286	93.952	97.848	97.476	0.372	95.681	94.717	0.964
4 1/4 -4 UN	107.863	107.260	0.603	103.738	103.447	0.291	100.302	104.203	103.826	0.377	102.031	101.067	0.965
4 1/2 -4 UN	114.211	113.607	0.604	110.086	109.792	0.294	106.650	110.558	110.176	0.382	108.381	107.417	0.965
4 3/4 -4 UN	120.561	119.957	0.604	116.436	116.139	0.297	113.000	116.913	116.526	0.387	114.731	113.767	0.965
5 -4 UN	126.908	126.305	0.604	122.783	122.482	0.301	119.347	123.266	123.876	0.390	121.081	120.117	0.965
1 1/8 -8 UN	28.521	28.141	0.38	26.459	26.284	0.175	24.742	26.741	26.513	0.228	25.781	25.146	0.635
1 1/4 -8 UN	31.696	31.316	0.38	29.634	29.457	0.177	27.917	29.921	29.688	0.233	28.956	28.321	0.635
1 5/16 -8 UN	33.284	32.904	0.38	31.221	31.042	0.179	29.505	31.509	31.276	0.233	30.531	29.896	0.635
1 3/8 -8 UN	34.869	34.489	0.38	32.806	32.624	0.182	31.090	33.099	32.863	0.236	32.131	31.496	0.635
1 1/2 -8 UN	38.044	37.664	0.38	35.981	35.797	0.185	34.265	36.279	36.038	0.241	35.306	34.671	0.635
1 5/8 -8 UN	41.219	40.839	0.38	39.156	38.969	0.187	37.551	39.459	39.213	0.246	38.481	37.846	0.635
1 3/4 -8 UN	44.391	44.011	0.38	42.329	42.139	0.190	40.612	42.636	42.388	0.248	41.656	41.021	0.635
1 7/8 -8 UN	47.566	47.186	0.38	45.504	45.309	0.195	43.787	45.817	45.563	0.254	44.831	44.196	0.635
2 -8 UN	50.741	50.361	0.38	48.679	48.481	0.198	46.962	48.994	48.738	0.256	48.006	47.371	0.635
2 1/4 -8 UN	57.089	56.709	0.38	55.027	54.824	0.203	53.310	55.352	55.088	0.264	54.356	53.721	0.635
2 1/2 -8 UN	63.439	63.059	0.38	61.377	61.169	0.208	59.660	61.707	61.438	0.269	60.706	60.071	0.635
2 3/4 -8 UN	69.786	69.406	0.38	67.724	67.514	0.210	66.007	68.061	67.788	0.273	67.056	66.421	0.635
3 -8 UN	76.133	75.753	0.38	74.071	73.856	0.215	72.354	74.419	74.138	0.281	73.406	72.771	0.635
3 1/4 -8 UN	82.483	82.103	0.38	80.421	80.201	0.220	78.704	80.775	80.488	0.287	79.756	79.121	0.635
3 1/2 -8 UN	88.833	88.453	0.38	86.771	86.548	0.223	85.054	87.130	86.838	0.292	86.106	85.471	0.665
3 3/4 -8 UN	95.181	94.801	0.38	93.118	92.891	0.227	91.402	93.485	93.188	0.297	92.456	91.821	0.635
4 -8 UN	101.531	101.151	0.38	99.468	99.238	0.230	97.752	99.840	99.538	0.302	98.806	98.171	0.635

# LIMITS OF SIZE FOR STANDARD SERIES THREADS

## METRIC

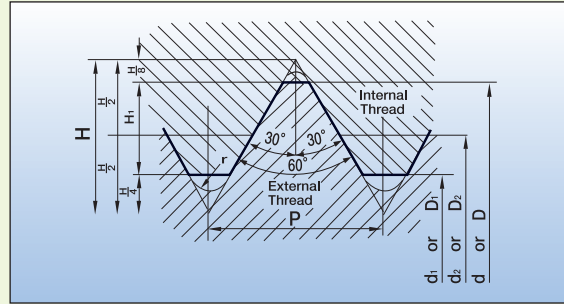
$$H = 0.866025P$$

$$H_1 = 0.541266P$$

$$d_2 = d - 0.649519P$$

$$d_1 = d - 1.082532P$$

$$D = d \quad D_2 = d_2 \quad D_1 = d_1$$



## UNIFIED

$$P = \frac{25.4}{n}$$

$$H = \frac{0.866025}{n} \times 25.4, \quad d = (d) \times 25.4$$

$$H = \frac{0.541266}{n} \times 25.4$$

$$d_2 = (d - \frac{0.649519}{n}) \times 25.4$$

$$D = d \quad D_2 = d_2 \quad D_1 = d_1$$

$$d_1 = (d - \frac{1.082532}{n}) \times 25.4$$

## METRIC COARSE THREADS JIS B0209(CLASS 2A.2B)

unit:mm

Nominal Size	Pitch	Internal Thread						External Thread					
		Pitch Diameter			Minor Diameter			Major Diameter			Pitch Diameter		
		Max	Min	Tol	Max	Min	Tol	Max	Min	Tol	Max	Min	Tol
M 3	0.5	2.775	2.675	0.100	2.599	2.459	0.140	2.980	2.847	0.106	2.655	2.580	0.075
M 4	0.7	3.663	3.545	0.118	3.422	3.242	0.180	3.978	3.838	0.140	3.523	3.433	0.090
M 5	0.8	4.605	4.480	0.125	4.334	4.134	0.200	4.976	4.826	0.150	4.456	4.361	0.095
M 6	1.0	5.470	5.350	0.120	5.153	4.917	0.236	5.970	5.820	0.150	5.320	5.220	0.100
M 8	1.25	7.318	7.188	0.130	6.912	6.647	0.265	7.960	7.790	0.170	7.148	7.038	0.110
M 10	1.5	9.166	9.026	0.140	8.676	8.376	0.300	9.960	9.770	0.190	8.986	8.866	0.120
M 12	1.75	11.023	10.863	0.160	10.441	10.106	0.335	11.950	11.760	0.190	10.813	10.683	0.130
M 14	2.0	12.871	12.701	0.170	12.210	11.835	0.375	13.950	13.740	0.210	12.651	12.511	0.140
M 16	2.0	14.871	14.701	0.170	14.210	13.835	0.375	15.950	15.740	0.210	14.651	14.511	0.140
M 18	2.5	16.566	16.376	0.190	15.744	15.294	0.450	17.950	17.710	0.240	16.326	16.166	0.160
M 20	2.5	18.566	18.376	0.190	17.744	17.294	0.450	19.950	19.710	0.240	18.326	18.166	0.160
M 22	2.5	20.566	20.373	0.190	19.744	19.294	0.450	21.950	21.710	0.240	20.326	20.166	0.160
M 24	3.0	22.251	22.051	0.200	21.252	20.752	0.500	23.940	23.680	0.260	21.991	21.821	0.170
M 27	3.0	25.251	25.051	0.200	24.252	23.752	0.500	26.940	26.680	0.260	24.991	24.821	0.170
M 30	3.5	27.947	27.727	0.200	26.771	26.211	0.560	29.940	29.660	0.280	27.667	27.477	0.190
M 33	3.5	30.947	30.727	0.220	29.771	29.211	0.560	32.940	32.660	0.280	30.667	30.477	0.190
M 36	4.0	33.632	33.402	0.230	32.270	31.670	0.600	35.930	35.630	0.300	33.332	33.132	0.200
M 39	4.0	36.632	36.402	0.230	35.270	34.670	0.600	38.930	38.630	0.300	36.332	36.132	0.200
M 42	4.5	39.327	39.077	0.250	37.799	37.129	0.670	41.930	41.610	0.320	39.007	38.797	0.210
M 45	4.5	42.327	42.077	0.250	40.799	40.129	0.670	44.930	44.610	0.320	42.007	41.797	0.210
M 48	5.0	45.012	44.752	0.260	43.297	42.587	0.710	47.930	47.590	0.340	44.682	44.452	0.230
M 52	5.0	49.087	48.752	0.335	47.297	46.587	0.710	51.929	51.399	0.530	48.681	48.431	0.250
M 56	5.5	52.783	52.428	0.355	50.796	50.046	0.750	55.925	55.365	0.560	52.353	52.088	0.265
M 60	5.5	56.783	56.428	0.355	54.796	54.046	0.750	59.925	59.365	0.560	56.353	56.088	0.265
M 64	6.0	60.478	60.103	0.375	58.305	57.505	0.800	63.920	63.320	0.600	60.023	59.743	0.280
M 68	6.0	64.478	64.103	0.375	62.305	61.505	0.800	67.920	67.320	0.600	64.023	63.743	0.280

## UNIFIED FINE THREADS ANSI B1.1/JIS B0212(CLASS 2A.2B)

unit:mm

Nominal Size and Threads/in	External Thread						Internal Thread					
	Major Diameter			Pitch Diameter			Pitch Diameter			Minor Diameter		
	Max	Min	Tol	Max	Min	Tol	Max	Min	Tol	Max	Min	Tol
#12 -28 UNF	5.461	5.296	0.165	4.871	4.791	0.080	5.003	4.898	0.105	4.724	4.496	0.228
1/4 -28 UNF	6.324	6.160	0.164	5.735	5.652	0.083	5.869	5.761	0.108	5.588	5.360	0.228
5/16 -24 UNF	7.909	7.727	0.182	7.221	7.128	0.093	7.371	7.250	0.121	7.035	6.782	0.253
3/8 -24 UNF	9.497	9.315	0.182	8.808	8.713	0.095	8.961	8.837	0.124	8.636	8.382	0.254
7/16 -20 UNF	11.079	10.847	0.205	10.254	10.147	0.107	10.424	10.287	0.137	10.033	9.729	0.304
1/2 -20 UNF	12.666	12.462	0.204	11.841	11.732	0.109	12.016	11.875	0.141	11.607	11.329	0.278
9/16 -18 UNF	14.251	14.031	0.220	13.335	13.221	0.114	13.520	13.371	0.149	13.081	12.751	0.330
5/8 -16 UNF	15.839	15.619	0.220	14.922	14.804	0.118	15.110	14.959	0.151	14.681	14.351	0.330
3/4 -16 UNF	19.011	18.774	0.237	17.980	17.854	0.126	18.183	18.019	0.164	17.678	17.323	0.355
7/8 -14 UNF	22.184	21.923	0.261	21.005	20.869	0.136	21.224	21.047	0.117	20.675	20.270	0.405
1 -12 UNF	25.354	25.065	0.289	23.980	23.831	0.149	24.218	24.026	0.192	23.571	23.114	0.457
1 1/8 -12 UNF	28.529	28.240	0.289	27.155	27.003	0.152	27.398	27.201	0.197	26.746	26.289	0.457
1 1/4 -12 UNF	31.704	31.415	0.289	30.330	30.173	0.157	30.579	30.376	0.203	29.921	29.464	0.457
1 3/8 -12 UNF	34.876	34.588	0.288	33.502	33.343	0.159	33.759	33.551	0.208	33.096	32.639	0.457
1 1/2 -12 UNF	38.051	37.763	0.288	36.677	36.516	0.161	36.936	36.726	0.210	36.271	35.814	0.457

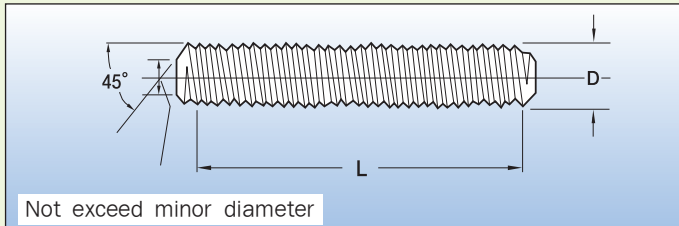
# STUD BOLTS AND NUTS

## FOR PRESSURE-TEMPERATURE PIPING (ANSI B16.5)



### STUD-BOLT SIZE & DIMENSION TOLERANCE

unit: inch



Diameter	Length	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

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

### THREADS

Nominal Size or Diameter of Stud-bolt(D)		D = 1"(25mm) & smaller	D = 1 1/8"(25mm) & larger
Thread	INCH Series	Unified Coarse Thread Series Class 2A and 2B ANSI B1.1	Unified 8-thread (3-pitch) Series Class 2A and 2B ANSI B1.1
	METRIC Series	METRIC Coarse Thread Series Class 6g and 6H JIS B0209/ISO R68	METRIC 3-pitch Series Class 6g and 6H JIS B0209/ISO R68

### NUTS

INCH Series	Conform to Heavy Hex Nuts of ANSI B 18. 2. 2 Double chamfered or Washer faced.
METRIC Series	Conform to Heavy Hex Nuts of ANSI B 18. 2. 4.6M Double chamfered or Washer faced.

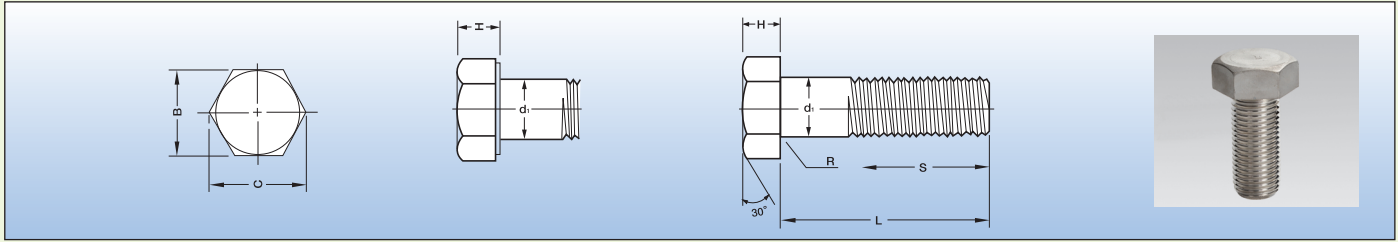
### MATERIAL

Conform to ASTM. ASME. JIS specification.  
(See details on Page 22~23 of this Catalog)

### MARKING

Identification Grade Markings shall conform to ASTM designation  
for steel fasteners

# HEX BOLTS & HEX CAP SCREWS



## METRIC KS B1002 JIS B1180

unit:mm

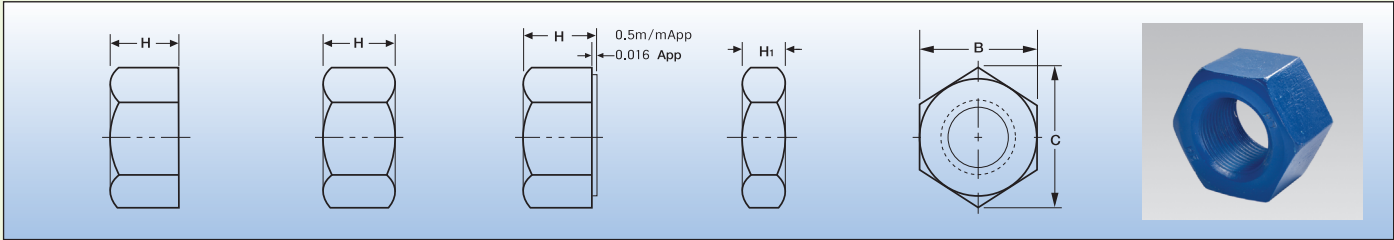
Bolt Diameter and Pitch		d <sub>1</sub>				H			B				C		R			S		
Coarse	Fine	Basic	Tolerance			Basic	Tolerance			Basic	Tolerance			App	Min	L ≤ 125	125 < L ≤ 200	L > 200		
			Fin	Semi Fin	Regu		Fin	Semi Fin	Regu		Fin	Semi Fin	Regu							
M6×1	-	6	0 -0.1	0	+0.35 -0.15	4	±0.15	±0.25	±0.6	10	0 -0.2	0 -0.6	0 -0.6	11.5	0.25	18	-	-		
M8×1.25	M8×1	8	0	-0.2	+0.7	5.5	±0.15	±0.25	±0.6	13	0	0	0	15	0.4	22	-	-		
M10×1.5	M10×1.25	10	-0.15	-0.2	-0.2	7				17	-0.25	-0.7	-0.7	19.6	0.4	26	-	-		
M12×1.75	M12×1.25	12	0	-0.25	+0.9 -0.2	8				±0.2	±0.3	±0.8	19	0	0	0	21.9	0.6	30	36
(M14×2)	(M14×1.5)	14				9	22	25.4	0.6				34				40	-		
M16×2	M16×1.5	16				10	24	27.7	0.6				38				44	-		
(M18×2.5)	(M18×1.5)	18	-0.2	0	+0.95 -0.35	12	±0.2	±0.35	±0.9	27	-0.35	-0.8	-0.8	31.2	0.6	42	48	-		
M20×2.5	M20×1.5	20				13				30				34.6	0.8	46	52	-		
(M22×2.5)	(M22×1.5)	22				14				32				37	0.8	50	56	-		
M24×3	M24×2	24	-0.35	-0.35	-0.35	15	±0.25	±0.4	±1.0	36	0	0	0	41.6	0.8	54	60	-		
(M27×3)	(M27×2)	27				17				41				47.3	1	60	66	79		
M30×3.5	M30×2	30				19				46				53.1	1	66	72	85		
(M33×3.5)	(M33×2)	33	0	0	+1.2 -0.4	21	±0.25	±0.4	±1.0	50	-0.45	-1.0	-1.0	57.7	1	72	78	91		
M36×4	M36×3	36				23				55				63.5	1	78	84	97		
(M39×4)	(M39×3)	39				25				60				69.3	1	84	90	103		
M42×4.5	-	42	-0.25	-0.4	-0.4	26	±0.25	±0.4	±1.0	65	0	0	0	75	1.2	90	96	109		
(M45×4.5)	-	45	28	70	80.8	1.2				96	102	115								
M48×5	-	48	30	75	86.5	1.6				102	108	121								
(M52×5)	-	52	0	0	-	+1.2 -0.7	±0.3	±0.5	±1.5	80	-0.45	-1.2	-1.2	92.4	1.6	-	116	129		
M56×5.5	-	56				35				85				98.1	2	-	124	137		
(M60×5.5)	-	60				38				90				104	2	-	132	145		
M64×6	-	64	-0.3	-0.45	-	40	±0.3	±0.5	±1.5	95	0	0	-	110	2	-	140	153		
(M68×6)	-	68				43				100				115	2	-	148	161		
-	M72×6	75				45				105				121	2	-	146	169		
-	(M76×6)	76	48	110	127	2	-	164	177											
-	M80×6	80	50	115	133	2	-	172	185											

## UNIFIED ANSI B18.2.1

unit:inch

Nominal Size of Basic Bolt Dia		d <sub>1</sub>	B				C		H			R		S	
		Body Dia	Width Across Flats		Width Across Corners		Head Height			Radius of Fillet		Thread Length for Bolt Lengths			
		Max	Basic	Max	Min	Max	Min	Basic	Max	Min	Max	Min	Basic	Basic	
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 5/16	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	2.250	
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	2 1/16	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	0.559	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	

# HEX NUTS & HEX JAM NUTS



**METRIC**

**KS B1012 JIS B1181**

unit: mm

Nominal Size and Pitch		H				H <sub>1</sub>				B				C
Coarse	Fine	Basic	Tolerance			Basic	Tolerance			Basic	Tolerance			App
			Finish	Semi Finish	Regu		Finish	Semi Finish	Regu		Finish	Semi Finish	Regu	
M6 × 1	-	5	0 <sup>-0.30</sup>	0 <sup>-0.48</sup>	±0.6	3.6				10	0 <sup>-0.2</sup>	0 <sup>-0.6</sup>	0 <sup>-0.6</sup>	11.5
M8 × 1.25	M8 × 1	6.5				5	0	0	±0.6	13	0	0	0	15
M10 × 1.5	M10 × 1.25	8	0	0	±0.8	6	-0.3	-0.48		17	-0.25	-0.7	-0.7	19.6
M12 × 1.75	M12 × 1.25	10	-0.36	-0.58		7				19				21.9
(M14 × 2)	(M14 × 1.5)	11				8	0	0	±0.8	22				25.4
M16 × 2	M16 × 1.5	13				10	-0.36	-0.58		24	0	0	0	27.7
(M18 × 2.5)	(M18 × 1.5)	15	0	0	±0.9	11				27	-0.35	-0.8	-0.8	31.2
M20 × 2.5	M20 × 1.5	16	-0.43	-0.70		12				30				34.6
(M22 × 2.5)	(M22 × 1.5)	18				13	0	0	±0.9	32				37
M24 × 3	M24 × 2	19				14	-0.43	-0.70		36				41.6
(M27 × 3)	(M27 × 2)	22	0	0	±1.0	16				41	0	0	0	47.3
M30 × 3.5	M30 × 2	24	-0.52	-0.84		18				46	-0.4	-1.0	-1.0	53.1
(M33 × 3.5)	(M33 × 2)	26				20				50				57.7
M36 × 4	M36 × 3	29				21	0	0	±1.0	55				63.5
(M39 × 4)	(M39 × 3)	31				23	-0.52	-0.84		60				69.3
M42 × 4.5	-	34				25				65				75
(M45 × 4.5)	-	36				27				70	0	0	0	80.8
M48 × 5	-	38	0	0	±1.2	29				75	-0.45	-1.2	-1.2	86.5
(M52 × 5)	-	42	-0.62	-1.0		31				80				92.4
M56 × 5.5	-	45				34				85				98.1
(M60 × 5.5)	-	48				36				90				104
M64 × 6	-	51				38				95				110
(M68 × 6)	-	54				40	0	0	±1.2	100	0	0	0	115
-	M72 × 6	58				42	-0.62	-1.0		105	-0.55	-1.4	-1.4	121
-	(M76 × 6)	61				46				110				127
-	M80 × 6	64	0	0	±1.5	48				115				133
-	(M85 × 6)	68	-0.74	-1.2		50				120				139
-	M90 × 6	72				54				130				150
-	(M95 × 6)	76				57				135				156
-	M100 × 6	80				60	0	0	±1.5	145	0	0	0	167
-	M110 × 6	88	-0.74	-1.2		65	-0.74	-1.2		155	-0.65	-1.6	-1.6	179
-	(M120 × 6)	96	0	0	±1.8	72				170				196

**UNIFIED**

unit: inch

Nominal Size or Basic Major Dia of Thread		B			C		H			H <sub>1</sub>		
		Width 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	0.764	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	1 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	1 1/4	2.250	2.175	2.598	2.480	1 9/32	1.317	1.245	27/32	0.880	0.808

# PLAIN WASHERS

## METRIC

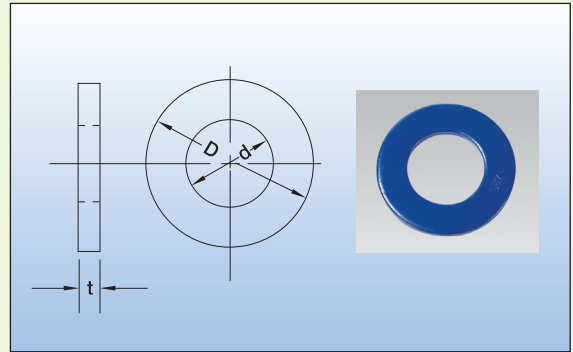
KS B1326 JIS B1256 DIN126

unit:mm

ASTM F436M

unit:mm

Nominal Size	Narrow Type		Regular Type						Hardened Circular Washers					
	D		d		D		t		(d) Inside Diameter		(D) Outside Diameter		Thickness (t)	
	Basic	Basic	Basic	Tolerance	Basic	Tolerance	Basic	Tolerance	Max	Min	Max	Min	Max	Min
6	11.5	1.6	6.6	+0.6	12.5	0	1.6	±0.2	12	14.4	14.0	27.0	25.7	3.1
8	15.5	1.6	9	0	17	-0.7	1.6		14	16.4	16.0	30.0	28.7	
10	18	2	11	+0.7	21	0	2	±0.25	16	18.4	18.0	34.0	32.4	4.6
12	21	2.5	14		24	0	2.3	±0.3	20	22.5	22.0	42.0	40.4	
(14)	24	2.5	16	0	28	-0.8	3.2	±0.4	22	24.5	24.0	44.0	42.4	3.4
16	28	3	18	30	3.2				24	26.5	26.0	50.0	48.4	
(18)	30	3	20	+0.8	34	0	3.2	±0.5	27	30.5	30.0	56.0	54.1	7.2
20	34	3	22		37	0	3.2			30	33.6	33.0	60.0	
(22)	37	3	24	0	44	-1	4.5	±0.7	36	39.6	39.0	72.0	70.1	4.6
24	39	4	26	50	4.5				42	45.6	45.0	84.0	81.8	
(27)	44	4	30	+1	56	0	4.5	±0.7	48	52.7	52.0	95.0	92.8	8.7
30	50	4	33		60	0	6			56	62.7	62.0	107.0	
(33)	56	5	36	0	66	-1.2	6	±0.1	64	70.7	70.0	118.0	115.8	6.1
(36)	60	5	39	72	6				72	78.7	78.0	130.0	127.5	
(39)	66	6	42	0	78		7	±0.1	80	86.9	86.0	142.0	139.5	4.6
42			45	85	7				90	96.9	96.0	159.0	156.5	
(45)			48	+1.2	92	0	8	±0.1	100	107.9	107.0	176.0	173.5	6.1
48			52		98	0	8							
(52)			56	0	105	-1.4	9	±0.1						6.1
56			62	110	9									
(60)			66	+1.4	115	0	9	±0.14						6.1
64			70		120	10								
(68)			74	0	125	-1.6	10	±0.14						6.1
72			78	135	10									
(76)			82	+1.4	140	0	12	±0.14						6.1
80			86		145	12								
(85)			91	0	160	-1.6	12	±0.14						6.1
90			96	165	12									
(95)			101	+1.4	175	0	14	±0.14						6.1
100			107		175	14								



## TYPE B

ANSI B18.22.1

unit:inch

ASTM F436

unit:inch

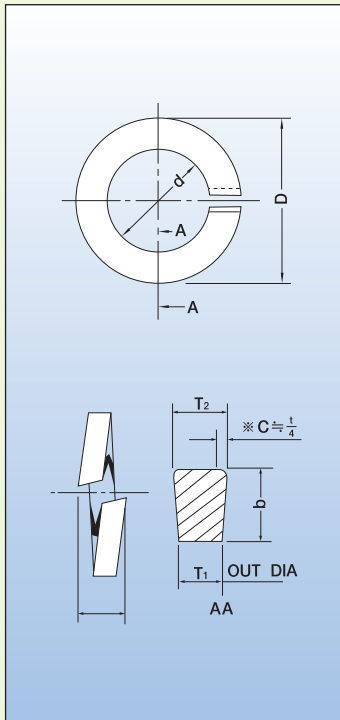
Nominal Size	Narrow Type						Hardened Circular Washers							
	(d) Inside Diameter	(D) Outside Dia		(t) Thickness		Bolt Size	Outside (D) Diameter		Inside (d) Diameter		Thickness (t)			
		Basic	Tolerance	Basic	Tolerance		Basic	Tol	Basic	Tol	Max	Min		
# 10	0.023	0.406	0.008	0.005	0.040	0.045	0.036	1/4	5/8	±1/32	9/32	±1/32	0.051	0.080
# 12	0.234	0.438	0.015		0.063	0.071	0.056	5/16	11/16		11/32			
1/4	0.281	0.500		0.030				0.100	0.112	0.090	3/8	13/16	13/32	-0
5/16	0.344	0.625	0.007		0.160	0.174	0.146				7/16	59/64	15/32	
3/8	0.406	0.734		0.010				0.250	0.266	0.234	1/2	1 - 1/16	17/32	±1/16
7/16	0.469	0.875	0.010		0.250	0.266	0.234				5/8	1 - 5/16	11/16	
1/2	0.531	1.000		0.010				0.250	0.266	0.234	3/4	1 - 15/32	13/16	0
5/8	0.656	1.250	0.010		0.250	0.266	0.234				7/8	1 - 3/4	15/16	
3/4	0.812	1.375		0.010				0.250	0.266	0.234	1	2	1 - 1/8	±1/16
7/8	0.938	1.469	0.010		0.250	0.266	0.234				1 - 1/8	2 - 1/4	1 - 1/4	
1	1.062	1.750		0.010				0.250	0.266	0.234	1 - 1/4	2 - 1/2	1 - 3/8	0
1 - 1/8	1.188	2.000	0.010		0.250	0.266	0.234				1 - 3/8	2 - 3/4	1 - 1/2	
1 - 1/4	1.312	2.250		0.010				0.250	0.266	0.234	1 - 1/2	3	1 - 5/8	0
1 - 3/8	1.438	2.500	0.010		0.250	0.266	0.234				1 - 3/4	3 - 3/8	1 - 7/8	
1 - 1/2	1.562	2.750		0.010				0.250	0.266	0.234	2	3 - 3/4	2 - 1/8	0
1 - 5/8	1.750	3.000	0.010		0.250	0.266	0.234				2 - 1/4	4	2 - 3/8	
1 - 3/4	1.875	3.250		0.010				0.250	0.266	0.234	2 - 1/2	4 - 1/2	2 - 5/8	0
1 - 7/8	2.000	3.500	0.010		0.250	0.266	0.234				2 - 3/4	5	2 - 7/8	
2	2.125	3.750		0.010				0.250	0.266	0.234	3	5 - 1/2	3 - 1/8	0

# SPRING LOCK WASHER

METRIC

KS B1324 JIS B1251

unit:mm



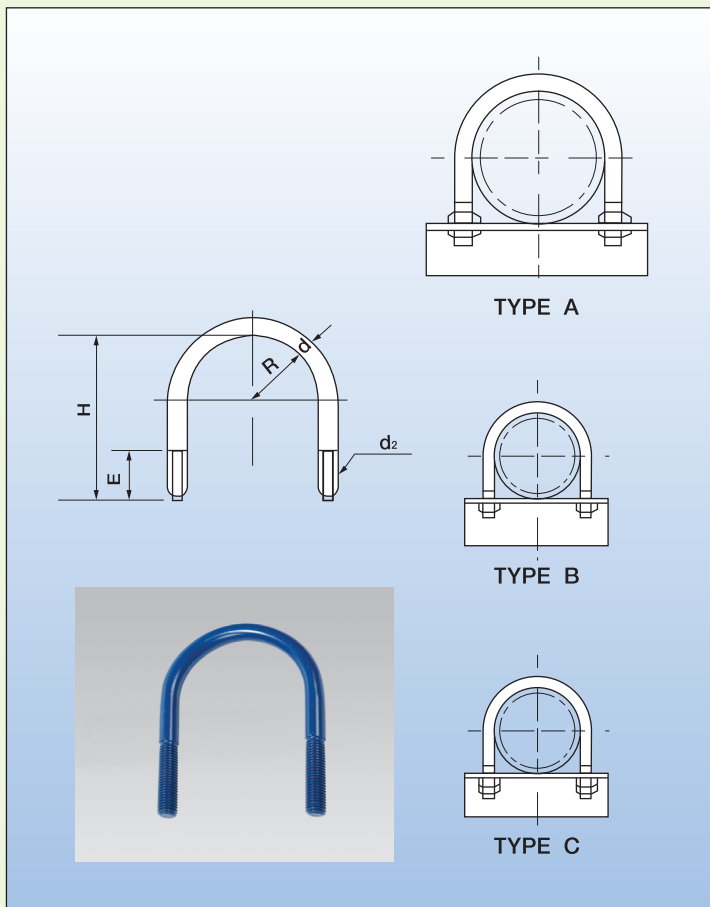
Nominal Size	Inside Diameter		Section Size		Outside Diameter		Free height after compression test		Test Load (kgf/kN)
	Basic	Tolerance	No.2 b × t	No.3 b × t	No.2	No.3	No.2 (Min)	No.3 (Min)	
4	4.1	+0.4 0	1.4 × 1	-	7.6	-	1.7	-	180 (1.77)
(4.5)	4.6		1.5 × 1.2	-	8.3	-	2	-	230 (2.26)
5	5.1		1.7 × 1.3	-	9.2	-	2.2	-	300 (2.94)
6	6.1		2.7 × 1.5	2.7 × 1.9	12.2	12.2	2.5	3.2	420 (4.12)
(7)	7.1	+0.5 0	2.8 × 1.6	2.8 × 2	13.4	13.4	2.7	3.35	600 (5.88)
8	8.2		3.2 × 2	3.3 × 2.5	15.4	15.6	3.35	4.2	760 (7.45)
10	10.2	+0.6 0	3.7 × 2.5	3.9 × 3	18.4	18.8	4.2	5	1,200 (11.8)
12	12.2		4.2 × 3	4.4 × 3.6	21.5	21.9	5	6	1,800 (17.7)
(14)	14.2	+0.8 0	4.7 × 3.5	4.8 × 4.2	24.5	24.7	5.85	7	2,400 (23.5)
16	16.2		5.2 × 4	5.3 × 4.8	28	28.2	6.7	8	3,300 (32.4)
(18)	18.2		5.7 × 4.6	5.9 × 5.4	31	31.4	7.7	9	4,000 (39.2)
20	20.2	+1.0 0	6.1 × 5.1	6.4 × 6.0	33.8	34.4	8.5	10	5,000 (49.0)
(22)	22.5		6.8 × 5.6	7.1 × 6.8	37.7	38.3	9.35	11.3	6,300 (61.8)
24	24.5	+1.2 0	7.1 × 5.9	7.6 × 7.2	40.3	41.3	9.85	12	7,300 (71.6)
(27)	27.5		7.9 × 6.8	8.6 × 8.3	45.3	46.7	11.3	13.8	9,500 (93.2)
30	30.5	+1.4 0	8.7 × 7.5	-	49.9	-	12.5	-	12,000 (118)
(33)	33.5		9.5 × 8.2	-	54.7	-	13.7	-	15,000 (147)
36	36.5		10.2 × 9	-	59.1	-	15	-	17,000 (167)
(39)	39.5		10.7 × 9.5	-	63.1	-	15.8	-	20,000 (197)

# U-BOLT

METRIC

JIS F3022

unit:mm

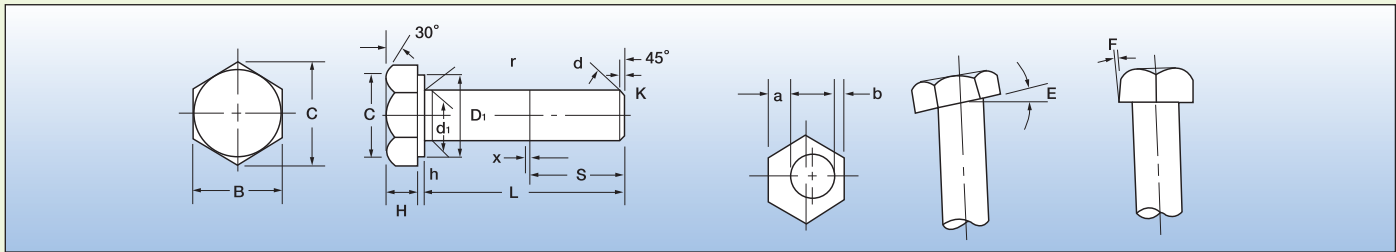


Nominal Size	Outdia of Pipe	R	d <sub>1</sub>	Thread dia (d <sub>2</sub> )	A Type		B Type		C Type	
					H	E	H	E	H	E
15	21.7	12	10	M10	-	-	39	20	47	30
20	27.2	15	10	M10	-	-	45	20	53	30
25	34.0	18	10	M10	-	-	52	20	60	30
32	42.7	23	10	M10	-	-	60	20	68	30
40	48.6	26	10	M10	-	-	66	20	74	30
50	60.5	32	10	M10	-	-	78	20	86	30
65	76.3	40	12	M12	-	-	98	25	108	35
80	89.1	46	12	M12	-	-	110	25	120	35
90	101.6	52	12	M12	-	-	123	25	133	35
100	114.3	59	16	M16	141	50	-	-	-	-
125	139.8	72	16	M16	167	50	-	-	-	-
150	165.2	85	16	M16	192	50	-	-	-	-
175	190.7	98	16	M16	218	50	-	-	-	-
200	216.3	111	20	M20	249	60	-	-	-	-
225	241.8	124	20	M20	274	60	-	-	-	-
250	267.4	137	20	M20	300	60	-	-	-	-
300	318.5	163	24	M24	357	70	-	-	-	-
350	355.6	181	24	M24	394	70	-	-	-	-
400	406.4	207	24	M24	444	70	-	-	-	-
450	457.2	233	30	M30	505	85	-	-	-	-
500	508.0	259	30	M30	556	85	-	-	-	-
550	558.8	284	30	M30	606	85	-	-	-	-
600	609.6	310	36	M36	663	100	-	-	-	-
650	660.4	335	36	M36	713	100	-	-	-	-
700	711.2	361	36	M36	764	100	-	-	-	-
750	762.0	387	36	M36	818	100	-	-	-	-
800	812.8	413	42	M42	875	115	-	-	-	-



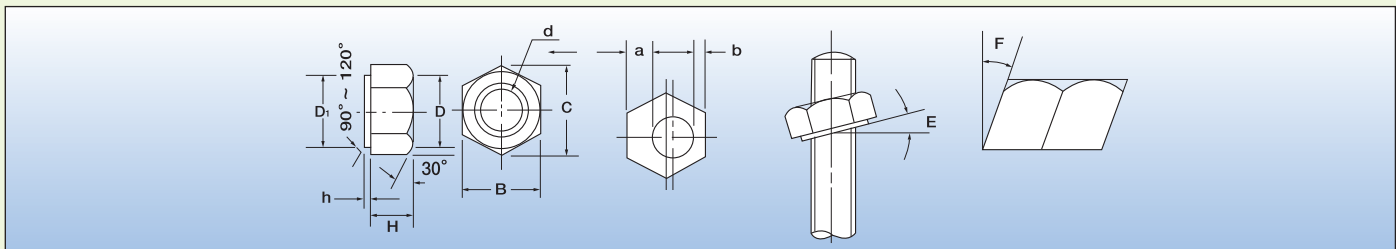
# HIGH STRENGTH BOLT, NUT & WASHER

## BOLTS



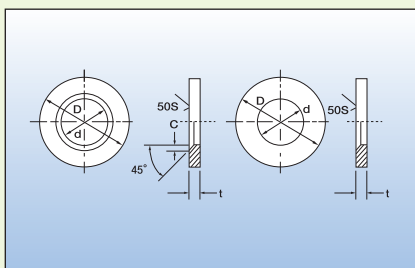
Nominal Diameter	d <sub>i</sub>		H		B		C	D	D <sub>1</sub>	r	k	a-b	E	F	h	S	
	Basic	Tolerance	Basic	Tolerance	Basic	Tolerance	App	App	Min		App	Max	Max	Max		Basic	Tolerance
M12	12	+0.7	8	±0.8	22	0	25.4	20	20	0.8~1.6	2	0.7	1°	2°	0.4~0.8	25	+5
M16	16	-0.2	10		27	-0.8	31.2	25	25			30				0	
M20	20	+0.8	13	±0.9	32	0	37	30	29	1.2~2.0	2.5	0.9	1°	2°	0.4~0.8	35	+6
M22	22		14		36		41.6	34	33			40				0	
M24	24	-0.4	15	±1.0	41	-1	47.3	39	38	1.6~2.4	3	1.2	1°	2°	0.4~0.8	45	0
M27	27	17	46		53.1		44	43	50								
M30	30		19		50		57.9	48	47	2.0~2.8	3.5	1.5			55		

## NUTS



Nominal Diameter	d <sub>i</sub>	H		B		C	D	D <sub>1</sub>	a-b	E	F	h
		Basic	Tolerance	Basic	Tolerance	App	App	Min	Max	Max	Max	App.
M12	12	12	±0.35	22	0	25.4	2.0	20	0.5	1°	2°	0.4~0.8
M16	16	16		27	-0.8	31.2	2.5	25	0.8			
M20	20	20	±0.4	32	0	37	3.0	29	0.9	1°	2°	0.4~0.8
M22	22	22		36		41.6	3.4	33	1.1			
M24	24	24	±1.0	41	-1	47.3	3.9	38	1.2	1°	2°	0.4~0.8
M27	27	27		46		53.1	4.4	43	1.3			
M30	30	30		50	57.7	4.8	47	1.5				

## WASHER

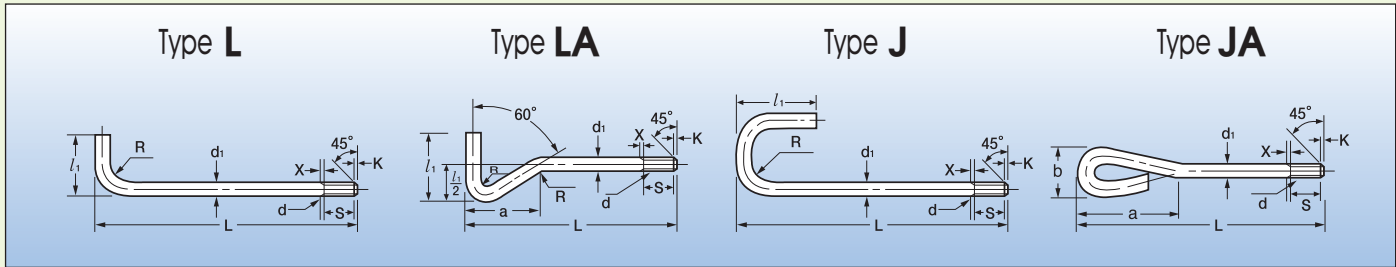


Nominal Size	d		D		t	
	Basic	Tolerance	Basic	Tolerance	Basic	Tolerance
12	13	+0.7	26	0 -0.8	3.2	±0.4
16	17	0	32	0 -1	4.5	±0.5
20	21	+0.8 0	40			
22	23		44	6	±0.7	
24	25	48				
27	28	56	0 -1.2	8		
30	31	+1.0 0	60			

# MECHANICAL PROPERTIES

Description	Bolt					Nut		Waser	
	Mechanical Properties					Grade	Hardness	Grade	Hardness
Grade	Yield strength kg/mm <sup>2</sup>	Tensile strength kg/mm <sup>2</sup>	Elongation In2x (%)	Reduction of Area (%)	Hardness				
F 8T	65Min	80-100	16Min	45Min	HRC 18-31	F 8	HRB85-100	F35	HRC 35-45
F10T	90Min	100-120	14Min	40Min	HRC 27-38	F10	HRB 95 HRC 35	F35	HRC 35-45
F11T	95Min	110-130	14Min	40Min	HRC 30-40	F10	HRB 95 HRC 35	F35	HRC 35-45

# FOUNDATION BOLTS(Anchor Bolts)



## METRIC

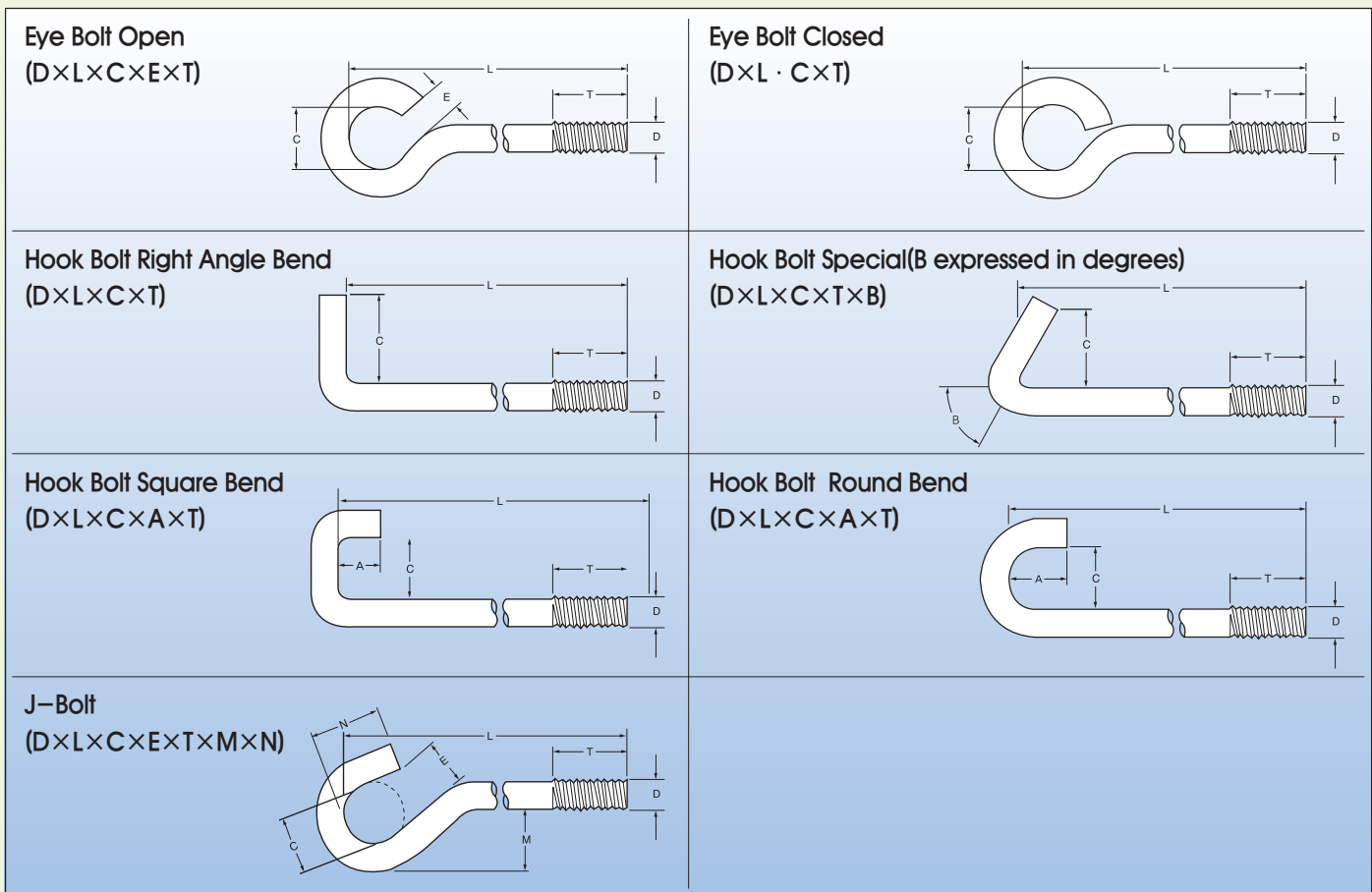
KS B1016, JIS B1178

unit:mm

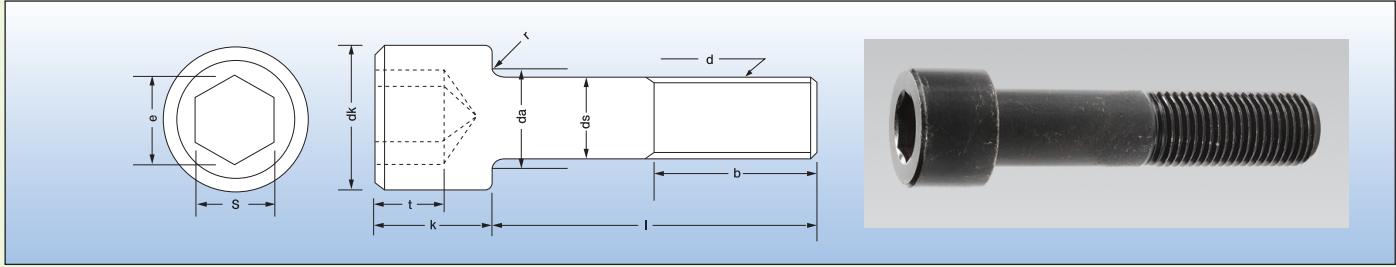
d	d <sub>1</sub>		S			l <sub>1</sub> App		R App		a App		b App	K App
	Basic	Tolerance	L. J	LA. JA	Tolerance	L. LA	J	L. J	LA	LA	JA	JA	
M 8	8	±0.4		20	+6.3	32			8	41			1.2
M 10	10		25	30	0	40	45	20	10	51	50	35	1.5
M 12	12		32	35	+8 0	50	56	25	12	64	65	40	2
M 16	16	40	40	80		90	40	20	102	105	70	2.5	
M 20	20	±0.5	50	50	+10 0	100	112	50	24	127	125	80	3
M 24	24		63	80		125	140	63	30	158	155	100	3.5
M 30	30	±0.6	80	90	0	140	160	71	36	181	190	120	4
M 36	36	±0.7	90	110		180	200	90	42	226	220	140	4.5
M 42	42	±0.8	112	125	+12.5 0	200	244	100	48	252	225	160	5
M 48	48	±0.9	125	150									

Diameter of type "L" is M10~M20

# BENT BOLTS



# HEXAGON SOCKET HEAD CAP SCREWS

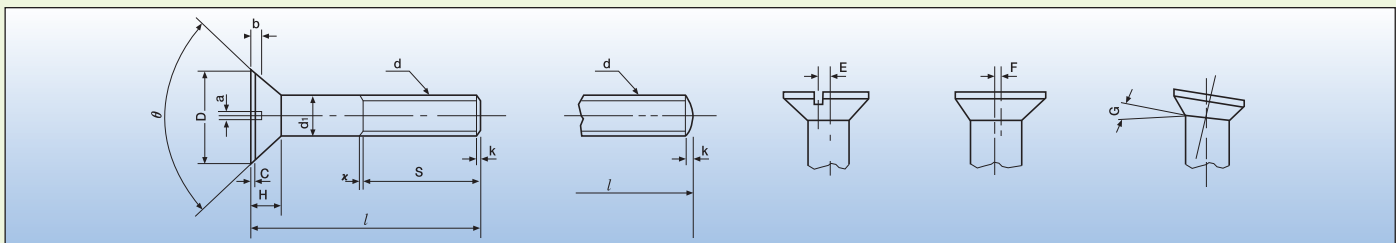


KS B1003 JIS B1176

unit:mm

(d) Nominal Size and Pitch		dk			da	ds		e	k		r	s			t	b
		Basic	Max	Min	Max	Basic	Min	Min	Basic	Min	Min	Basic	Min	Max	Max	Reference
M 3	0.5	5.5	5.68	5.32	3.6	3	2.86	2.87	3	2.86	0.1	2.5	2.52	2.56	1.3	18
M 4	0.7	7	7.22	6.78	4.7	4	3.82	3.44	4	3.82	0.2	3	3.02	3.080	2	20
M 5	0.8	8.5	8.72	8.28	5.7	5	4.82	4.58	5	4.82	0.2	4	4.02	4.095	2.5	22
M 6	1	10	10.22	9.78	6.8	6	5.82	5.72	6	5.70	0.25	5	5.02	5.095	3	24
M 8	1.25	13	13.27	12.73	9.2	8	7.78	6.86	8	7.64	0.4	6	6.02	6.095	4	28
M 10	1.5	16	16.27	15.73	11.2	10	9.78	9.15	10	9.64	0.4	8	8.025	8.115	5	32
M 12	1.75	18	18.27	17.73	13.7	12	11.73	11.43	12	11.57	0.6	10	10.025	10.115	6	36
(M 14)	2	21	21.33	20.67	15.7	14	13.73	13.72	14	13.57	0.6	12	12.032	12.142	7	40
M 16	2	24	24.33	23.67	17.7	16	15.73	16.00	16	15.57	0.6	14	14.032	14.142	8	44
(M 18)	2.5	27	27.33	26.67	20.2	18	17.73	16.00	18	17.57	0.6	14	14.032	14.142	9	48
M 20	2.5	30	30.33	29.67	22.4	20	19.67	19.44	20	19.48	0.8	17	17.050	17.230	10	52
(M 22)	2.5	33	33.39	32.61	24.4	22	21.67	19.44	22	21.48	0.8	17	17.050	17.230	11	56
M 24	3	36	36.39	35.61	26.4	24	23.67	21.73	24	23.48	0.8	19	19.065	19.275	12	60
(M 27)	3	40	40.39	39.61	30.4	27	26.67	21.73	27	26.48	1	19	19.065	19.275	13.5	66
M 30	3.5	45	45.39	44.61	33.4	30	29.67	25.15	30	29.48	1	22	22.065	22.275	15.5	72
(M 33)	3.5	50	50.39	49.61	36.4	33	32.61	27.43	33	32.38	1	24	24.065	24.275	16.5	78
M 36	4	54	54.46	53.54	39.4	36	35.61	30.85	36	35.38	1	27	27.065	27.275	19	84
(M 39)	4	58	58.46	57.54	42.4	39	38.61	30.85	39	38.38	1	27	27.065	27.275	20	90
M 42	4.5	63	63.46	62.54	45.6	42	41.61	36.57	42	41.38	1.2	32	32.080	32.330	21	96
(M 45)	4.5	68	68.46	67.54	48.6	45	44.61	36.57	45	44.38	1.2	32	32.080	32.330	23	102
M 48	5	72	72.46	71.54	52.6	48	47.61	41.13	48	48.38	1.6	36	36.080	36.330	24	108
(M 52)	5	78	78.46	77.54	56.6	52	51.54	41.13	52	51.26	1.6	36	36.080	36.330	26	116

# FLAT HEAD BOLTS



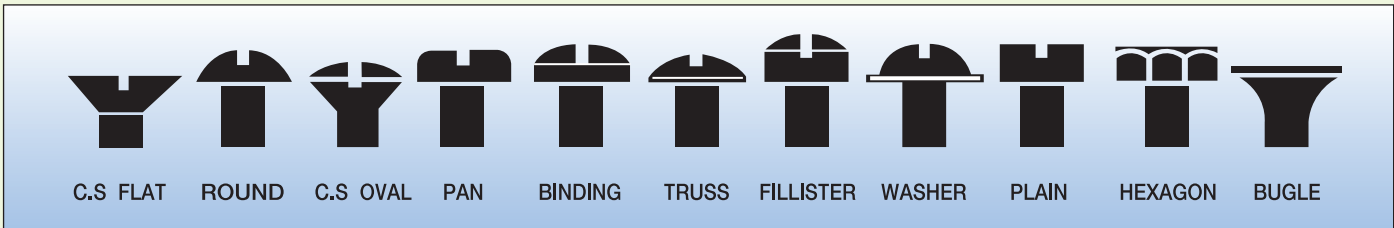
KS B1017 JIS B1179

unit:mm

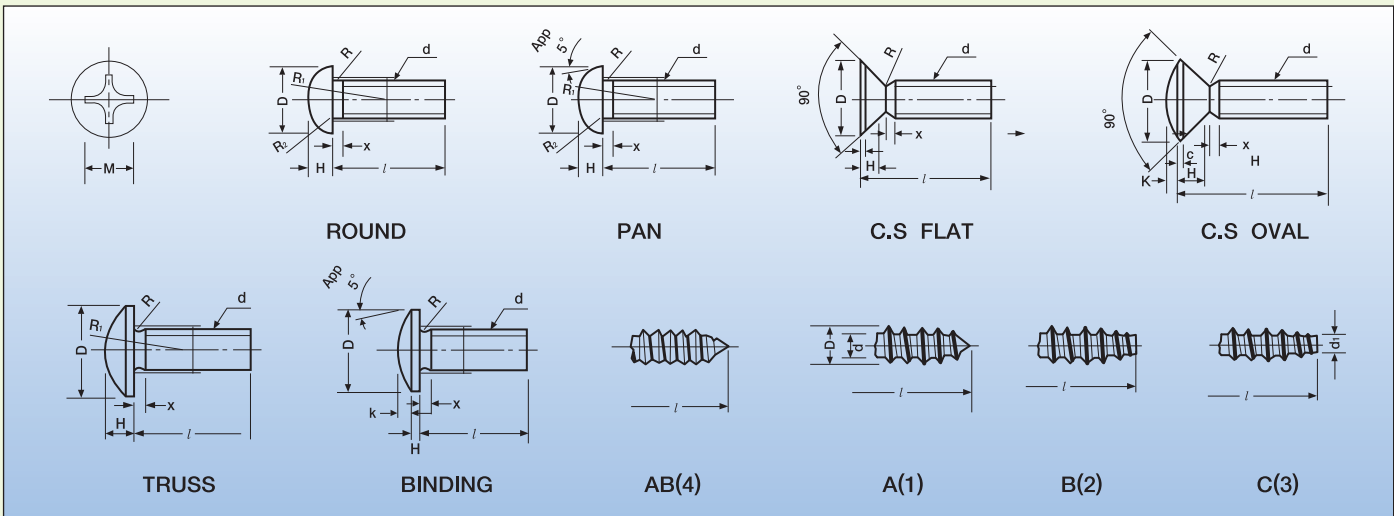
(d) Size	Basic	d <sub>1</sub>		D		H(Max)		C	θ			a		b			E & F	
		Tolerance		Basic	Tolerance		Finish		Regu	App	Basic	Tolerance		Basic	Tolerance		Finish	Regu
		Finish	Regu		Finish	Regu						Finish	Regu		Basic	Tolerance		
M 10	10	0	-0.2	+0.7	-0.2	20						2		2.5				
M 12	12					24	0	0				2		2.5	±0.3	±0.4	±0.35	±0.5
M 14	14	0		+0.9		27	-0.35	-1.3		90°	+2°	+5°	3	+0.25	3.5			
M 16	16	-0.25		-0.2		30					0		3	0	3.5			
M 18	18					33							3		3.5			
M 20	20					36							4		4.5	±0.4	±0.5	±0.6
M 22	22	0		+0.95		36	0	0					4		5			
M 24	24	-0.35		-0.35		39	-0.4	-1.6		60°	+2°	+5°	4	+0.3	5			±0.4
M 30	30					48							5		6			
M 36	36	0	-0.4	+1.2	-0.4	57	0	-0.45	0	-1.9	19.2	19.7	1		7	±0.45	±0.6	±0.45

# MACHINE & TAPPING SCREWS

## TYPE OF HEAD (TAPPING & MACHINE SCREWS) / Cross-Recessed & Slotted Head



## DIMENSIONS OF SCREWS' HEAD TYPE (METRIC)

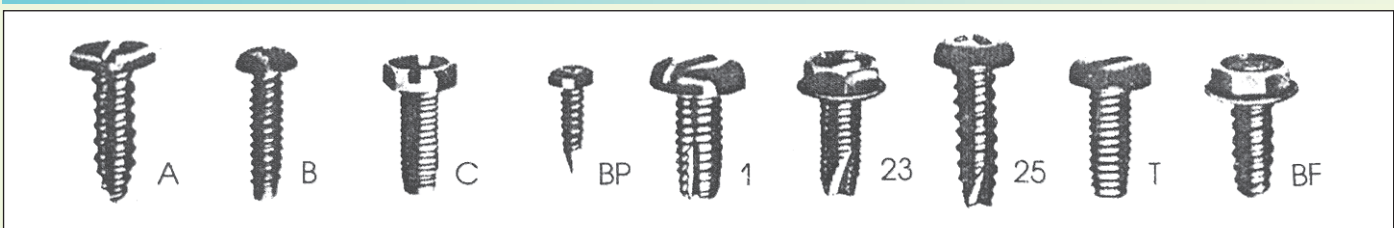


unit: mm

Nominal Size (d)	No. of Bite	Round Pan						Flat Oval								
		D		H		M		D		H		H+K		M		
		Basic	Tolerance	Basic		Tolerance	Max		Basic	Tolerance	Basic	Tolerance	Basic	Tolerance	Max	
				R.H	P.H		R.H	P.H							F.H	O.H
M 3	2	5.5	0	2	2	±0.15	3.4	3.5	6	0	1.75	0	2.45	-0.3	3.5	3.7
(M 3.5)		6	-0.5	2.3	2.3		3.7	3.8	7	-0.5	2		2.8		4.0	4.2
M 4		7	0	2.6	2.6		4.0	4.1	8	0	2.3		3.2		4.4	4.6
(M4.5)		8	-0.6	3	2.9		4.4	4.5	9	0	2.55		3.55		4.8	5.0
M 5	3	9	-0.6	3.4	3.3	±0.2	4.7	4.8	10	-0.6	2.8	0	4	-0.6	5.0	5.2
M 6		10.5	-0.7	4	3.9		6.1	6.2	12	-0.7	3.4		4.8		6.6	6.8
M 7		12	-0.7	4.5	4.4		7.1	7.2	13	-0.7	3.8		5.3		7.1	7.3
M 8		14	-0.8	5.4	5.2		7.6	7.7	16	-0.8	4.4		6.2		8.3	8.5

Nominal Size (d)	No. of Bite	Truss					Binding				
		D		H		M	D		H+K		M
		Basic	Tolerance	Basic	Tolerance	Max	Basic	Tolerance	Basic	Tolerance	Max
M 3	1	6.9	0	1.9	±0.15	2.9	6.3	0	1.9	±0.15	3.6
(M 3.5)	2	8.1	-0.5	2.2		3.9	7.3	-0.5	2.2		3.9
M 4		9.4	0	2.5		4.2	8.3	0	2.5		4.2
(M4.5)	10.6	-0.6	2.8	4.6		9.3	-0.6	2.8	4.6		
M 5	3	11.8	-0.7	3.1	±0.2	4.9	10.3	-0.7	3.1	±0.2	4.9
M 6		14	-0.8	3.7		6.2	12.4	-0.8	3.7		6.2
M 7		16	-0.8	4.2		7.1	13.5	-0.8	4.2		7.1
M 8		17.8	-0.9	4.8		7.7	16.4	-0.9	4.8		7.7

## SHAPE OF TAPPING SCREWS



# GRADE MARKINGS AND MECHANICAL PROPERTIES FOR STEEL FASTENERS

## BOLTS

Grade Mark	Specification	Fastener Description	Material	Nominal Size Range	Mechanical Properties			
					Proof Load (Min)	Yield Strength (Min)	Tensile Strength (Min)	Elongation (Min)%
	SAE J429 Gr 2	Bolts	Low or Medium Carbon Steel	1/4-3/4 7/8-11/2	(Psi) 55.000 33.000	(Psi) 57.000 36.000	(Psi) 74.000 60.000	18 18
	SAE J429 Gr 5		Medium Carbon Steel Quenched & Tempered	1/4-1 1/8-11/2	85.000 74.000	92.000 81.000	120.000 105.000	14 14
	SAE J429 Gr 8		Medium Carbon Alloy Steel Quenched & Tempered	1/4-11/2	120.000	130.000	150.000	12
	ASTM A307 Gr A ASTM A307 Gr B		Low or Medium Carbon Steel	1/4-4	- -	- -	60.000 60.000	18 -
	ASTM A325 TYPE 1	High Strength Bolts	Medium Carbon Steel Quenched & Tempered	1/2-1 11/8-11/2	85.000 74.000	92.000 81.000	120.000 105.000	14 14
	ASTM A325 TYPE 2		Low Carbon Martensitic Steel Quenched & Tempered	1/2-1	85.000	92.000	120.000	14
	ASTM A490 TYPE 1		Alloy Steel Quenched & Tempered	1/2-11/2	120.000	130.000	150.000 170.000	14
	ASTM A193 Gr B7	Bolts Screws	AISI 4140	1/2-21/2 21/2-4	- -	105.000 95.000	125.000 115.000	16 16
	ASTM A193 Gr B7M		AISI 4142 or AISI 4145	1/2-21/2	-	80.000	100.000	18
	ASTM A193 Gr B16	Studs for High Temperature	Cr-Mo-Va Alloy Steel	1/2-21/2	-	105.000	125.000	18
	ASTM A193 Class 1-BB	Service	AISI 304	1/4 and Larger	-	30.000	57.000	30
	ASTM A320 Gr L7	Bolts Screws Studs for Low Temperature Service	AISI 4140 AISI 4141 AISI 4145	1/2-21/2	-	105.000	125.000	16
	ASTM A320 Grade 1-BB		AISI 304	1/4 and Larger	-	30.000	75.000	30
	ASTM A354 Gr BC	Bolts Studs	Alloy Steel Quenched & Tempered	1/4-21/2 21/2-4	- -	109.000 99.000	125.000 115.000	16 16
	KS B1002 JIS B1180 DIN267-3 Calss 48	Bolts Screws Studs	KS D3752 JIS G-4051 S20C	M12-M48	(kg/mil) 22.6	(kg/mil) 24	(kg/mil) 40.55	25
	KS B1002 JIS B1180 DIN 267-3 Calss 88		KS D3753 JIS G4051 S45C		58.2	64	80-100	12
	KS B1002 JIS B1180 DIN 267-3 Calss 109		KS D3711 JIS G4105 SCM 435 SCM 440		79.2	90	100-120	9

Grade Mark	Specification	Fastener Description	Material	Nominal Size Range	Mechanical Properties			
					Proof Load (Min)	Yield Strength (Min)	Tensile Strength (Min)	Elongation (Min)%
	DS B1002 JIS B1180 DIN 267.3 Class 12.9	High Strength Structural Bolts	KS D3711 JIS G4104 SCM 435 SCM 440	M12-M30	(kg/mil) 95.0	(kg/mil) 108	(kg/mil) 120-140	8
	DS B1010 JIS B1186 Class F8T		KS D3752 JIS G4051 SCM 435 S45C	-	64	80-100	16	
	High KS B1010 JIS B1186 Class F10T		KS D3711 JIS G4105 51B20 SCM 435 SCM 440	-	90	100-120	14	
	KS B1010 JIS B1186		-	-	95	100-130	14	

## NUTS

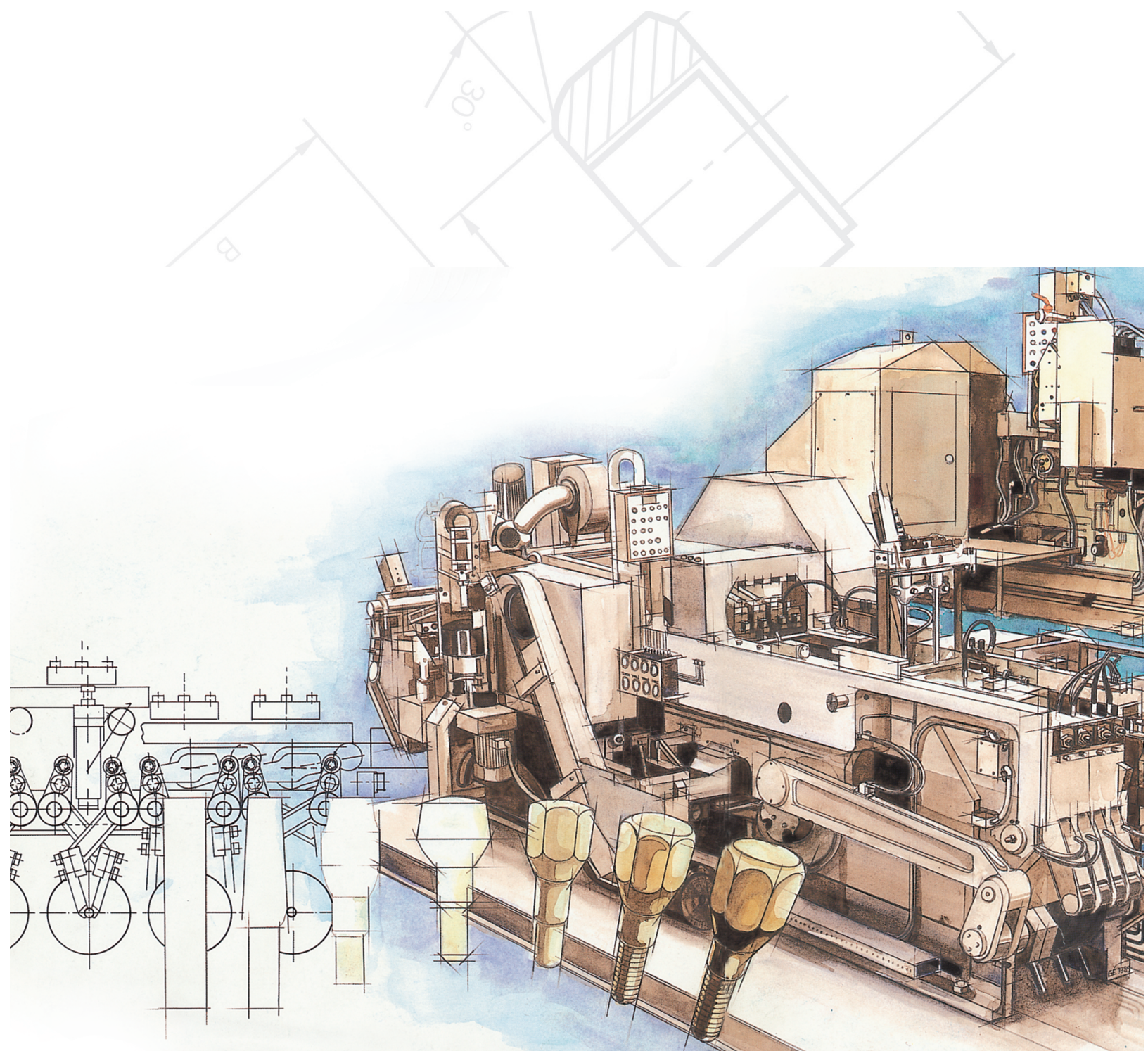
Grade Mark	Specification	Fastener Description	Material	Nominal Size Range	Proof Load (Min)	Hardness		
						HrB	HrC	
	KS B1012 JIS B1181 DIN 267-4 Class 4	Nuts for General Structural and Mechanical Uses on Bolts	KS D3752 JIS G4051 S20C	M20-M48	(kg/mil) 40	49Min	30Max	
	KS B1012 JIS B1181 DIN 267-4 Class 8					80	88Min	30Max
	KS B1012 JIS B1181 DIN 267-4 Class 10					100	-	18-36
	KS B1012 JIS B1181 DIN 267-4 Class 12					120	-	25-36
	KS B1010 JIS B1186 F8	Nuts for High Strength Structural Bolts	KS D3752 JIS G4051 S450C	M12-M30	80	85-100	-	
	KS B1010 JIS B1186 F10					100	95Min	35Max
	JIS G4051 S45C					M16-M48	-	94Min
	ASTM A307 Gr A & B SAE J995 Gr 2	Nuts for General Structural and Mechanical Uses on Inch Bolts	AISI 1020 JIS G4051 S20C JIS G3101 SS41	1/4-11/2	(psi) 90.000	68Min	32Max	
	SAE J995 Gr 5		AISI 1045 JIS G 4051 S45C	1/4-11/2 11/8-11/2	120.000 105.000	-	-	
	SAE J995 Gr 8			1/4-5/8 3/4-1 11/8-11/2	15.000	-	24-32 26-34 26-36	
	ASTM A194 Gr 2H		1/2-2	175.000	-	24-38		
	ASTM A563 Gr c (for A325 Bolts)			144.000	78Min	38Max		

# MECHANICAL REQUIREMENTS

Specification Grade	Diameter inch (mm)	Tensile strength Min	Yield strength Min	E.L % Min	R.A % Min	Hardness			Tempering Temp °F (°C) Min
						HB	HrB	HrC	
A193 Gr B7	2½ and under	125.000 psi	105.000 psi	16	50				1.100 (593)
	Over 2½ to 4	115.000 psi	95.000 psi	16	50				1.100 (593)
A193 Gr B7M	2½ and under	100.000 psi	80.000 psi	18	50	200-235	93-99		1.150 (620)
A193 Gr B16	2½ and under	125.000 psi	105.000 psi	18	50	253-319		25-34	1.200 (650)
	Over 2½ to 4	110.000 psi	95.000 psi	17	45	253-319		25-34	1.200 (650)
A193 GrB8, B8M	All diameters	75.000 psi	30.000 psi	30	50	Max 223	Max 96		
A193 Gr B6	Up to 4	110.000 psi	85.000 psi	15	50				1.100 (593)
A320 Gr L7	2½ and under	125.000 psi	105.000 psi	16	50				
A320 Gr L7M	2½ and under	100.000 psi	80.000 psi	18	50	Max 235	Max 99		1.150 (620)
A320 GrB8, B8M	All diameters	75.000 psi	30.000 psi	35	50	Max 223	Max 96		
A325	½ to 1	120.000 psi	92.000 psi			248-331		24-35	800 (427)
	1 ⅛ to 1 ½	105.000 psi	81.000 psi	14	35	223-293		19-31	800 (427)
A354 Gr BC	¼ to 2½	125.000 psi	109.000 psi	16	50	255-331		26-36	800 (427)
	Over 2½	115.000 psi	99.000 psi	16	45	235-311		22-33	800 (427)
A354 Gr BD	¼ to 2½	150.000 psi	130.000 psi	14	40	311-363		33-39	800 (427)
	Over 2½	140.000 psi	115.000 psi	14	40	293-363		31-39	800 (427)
A449	¼ to 1	120.000 psi	92.000 psi	14	35	255-321		25-34	800 (427)
	Over 1 to 1 ½	105.000 psi	81.000 psi	14	35	223-285		19-30	800 (427)
	Over 1 ½ to 3	90.000 psi	58.000 psi	14	35	183-235			800 (427)
A490	½ to 1 ½	150-170 psi	130.000 psi	14	40	311-352		33-38	800 (427)
JIS SUS 310S		53 kgf/mm <sup>2</sup>	21 kgf/mm <sup>2</sup>	40	50	Max 187	Max 90		
JIS SCM 435		95 kgf/mm <sup>2</sup>	80 kgf/mm <sup>2</sup>	15	50	269-331		29-35	(530-630)
JIS SCM 440		100 kgf/mm <sup>2</sup>	85 kgf/mm <sup>2</sup>	12	45	285-352		29-39	(530-630)
JIS SNB 5		70 kgf/mm <sup>2</sup>	56 kgf/mm <sup>2</sup>	16	50				(595)
JIS SNB 7	Up to 63(mm)	88 kgf/mm <sup>2</sup>	74 kgf/mm <sup>2</sup>	16	50				(595)
	Over(63)to(100)	82 kgf/mm <sup>2</sup>	67 kgf/mm <sup>2</sup>	16	50				(595)
JIS SNB 16	Up to 63(mm)	88 kgf/mm <sup>2</sup>	74 kgf/mm <sup>2</sup>	18	50				(650)
	Over(63)to(100)	77 kgf/mm <sup>2</sup>	67 kgf/mm <sup>2</sup>	17	50				(650)
JIS S45C		70 kgf/mm <sup>2</sup>	50 kgf/mm <sup>2</sup>	17	45	201-269		14.5-27	(530-650)
A194 Gr 2						159-352	Min 84		1.000 (538)
A194 Gr 2H	To 1 ½					248-352		24.38	850 (435)
	Over 1 ½					212-352	Min 95	Max 38	850 (455)
A194 Gr 2HM						159-237		Max 22	1.150 (620)
A194 Gr 6						228-271		20-28	1.100 (595)
A194 Gr 7M						159-237		Max 22	1.100 (595)
A194 Gr 4, 7						248-352		24-38	1.100 (595)
A194 Gr 8, 8M						126-300	60-105		
A563 Gr A	¼ to 4					116-302	Min 68	Max 32	
A563 Gr B	¼ to 1 ½					121-302	Min 69	Max 32	
A563 Gr C	¼ to 4					143-352	Min 78	Max 38	800 (427)
A563 Gr D	¼ to 4					159-352	Min 84	Max 38	800 (427)
A563 Gr DH	¼ to 4					248-352		24-38	800 (427)

# CHEMICAL REQUIREMENTS

Specification Grade	C	Si	Mn	P Max	S Max	Ni	Cr	Mo	Vanadium
ASTM A193 Gr B7	0.37-0.49	0.15-0.35	0.65-1.10	0.035	0.04		0.75-1.20	0.15-0.25	
ASTM A193 Gr B7M	0.37-0.49	0.15-0.35	0.65-1.10	0.035	0.04		0.75-1.20	0.15-0.25	
ASTM A193 Gr B16	0.36-0.47	0.15-0.35	0.45-0.70	0.035	0.04		0.80-1.15	0.50-0.65	0.25-0.35
ASTM A193 Gr B8	Max 0.08	Max 1.00	Max 2.00	0.045	0.03	8.00-10.5	18.0-20.0		
ASTM A193 Gr B8M	Max 0.08	Max 1.00	Max 2.00	0.045	0.03	10.0-14.0	16.0-18.0	2.0-3.0	
ASTM A193 Gr B6	Max 0.15	Max 1.00	Max 1.00	0.045	0.03			11.5-13.5	
ASTM A320 Gr L7	0.38-0.48	0.15-0.35	0.75-1.00	0.035	0.04		0.80-1.10	0.15-0.25	
ASTM A320 Gr L7M	0.38-0.48	0.15-0.35	0.75-1.00	0.035	0.04		0.80-1.10	0.15-0.25	
ASTM A320 Gr B8	Max 0.08	Max 1.00	Max 2.00	0.045	0.03	8.00-10.5	18.0-20.0		
ASTM A320 Gr B8M	Max 0.08	Max 1.00	Max 2.00	0.045	0.03	10.0-14.0	16.0-18.0	2.0-3.0	
ASTM A325 TYPE 1	0.28-0.55		Min 0.60	0.040	0.05				
ASTM A325 TYPE 2	0.15-0.34		Min 0.70	0.040	0.05			Boron Min 0.0005	
ASTM A354 Gr BC	0.30-0.53			0.035	0.04				
ASTM A354 Gr BD	0.30-0.53			0.035	0.04				
ASTM A449 TYPE 1	0.28-0.55		Min 0.60	0.040	0.05				
ASTM A449 TYPE 2	0.15-0.38		Min 0.70	0.040	0.05			Boron Min 0.0005	
ASTM A490 TYPE 1	0.30-0.48			0.040	0.04				
JIS G4303 SUS310S	Max 0.08	Max 1.50	Max 2.00	0.045	0.03	19.0-22.0	24.0-26.0		
JIS G4105 SCM 435	0.33-0.38	0.15-0.35	0.60-0.85	0.030	0.03		0.90-1.20	0.15-0.30	
JIS G4105 SCM 440	0.38-0.43	0.15-0.35	0.60-0.85	0.030	0.03		0.90-1.20	0.15-0.30	
JIS G4107 SNB 5	Min 0.10	Min 1.00	Min 1.00	0.040	0.03		4.00-6.00	0.40-0.65	
JIS G4107 SNB 7	0.38-0.48	0.20-0.35	0.75-1.00	0.040	0.04		0.80-1.10	0.15-0.25	
JIS G4107 SNB 16	0.36-0.44	0.20-0.35	0.45-0.70	0.040	0.04		0.80-1.15	0.50-0.65	0.25-0.35
JIS G4051 S45C	0.42-0.48	0.15-0.35	0.60-0.90	0.040	0.035				
ASTM A194 Gr 2H	Min 0.40	Max 0.40	Max 1.00	0.040	0.05				
ASTM A194 Gr 2HM	Min 0.40	Max 0.40	Max 1.00	0.040	0.05				
ASTM A194 Gr 7M	0.37-0.49	0.15-0.35	0.65-1.10	0.040	0.04		0.75-1.20	0.15-0.25	
ASTM A194 Gr 4	0.40-0.50	0.15-0.35	0.70-0.90	0.035	0.04			0.20-0.30	
ASTM A194 Gr 7	0.37-0.49	0.15-0.35	0.65-1.10	0.040	0.04		0.75-1.20	0.15-0.25	
ASTM A194 Gr 8	Max 0.08	Max 1.00	Max 2.00	0.045	0.03	8.00-10.5	18.0-20.0		
ASTM A194 Gr 8M	Max 0.08	Max 1.00	Max 2.00	0.045	0.03	10.0-14.0	16.0-18.0	2.00-3.00	
ASTM A563 Gr A,B,C	Max 0.55			0.012	0.15				
ASTM A563 Gr D	Max 0.55		Max 0.30	0.040	0.05				
ASTM A563 Gr DH	0.20-0.55		Min 0.60	0.040	0.05				



**삼전금속(주)**  
SAMJEON METAL Co., Ltd.



ISO 9001:2008



KSA 9001:2001

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