USER'S GUIDE FOR
METAL & METAL PRODUCTS

METAL AIDS INDIA

4/1, ALANKAR CINEMA BLDG., S.V.P. ROAD,
NEAR PETROL PUMP, MUMBAI - 400 004 (INDIA)
TEL.: (00-91-22) 2382 0233 / 2389 8829
Email : metalaidexport@gmail.com / metalaidind@gmail.com
Website : www.metalaid.co

AN ISO 9001:2015 CERTIFIED COMPANY (BY TUV)

A MEMBER OF ASM INTERNATIONAL, OHIO, U.S.A.

(AMERICAN SOCIETY OF METALS)

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METAL AIDS INDIA

METAL AIDS INDIA

REF. NO. MAI/C/ DATE

INTRODUCTION

IT GIVES IMMENSE PLEASURE TO INTRODUCE THAT METAL AIDS INDIA IS ONE OF THE LEADING EXPORTERS - IMPORTERS, MANUFACTURER & SUPPLIERS OF METAL & METAL PRODUCTS IN FERROUS & NON-FERROUS METALS (INDUSTRIAL RAW-MATERIALS) WHICH SPECIFIED FULL DETAILS IN RANGE OF PRODUCTS IN PAGE NO.3. THROUGH ITS DISTRIBUTION NETWORKS OF SUBSIDIARIES & AGENTS, IT IS CLOSELY IN TOUCH WITH THE CHANGING REQUIREMENTS, TRENDS & NEW TECHNOLOGIES OF THE WORLD MARKET.

PRIME QUALITY OF SUPPLY IS NOT AN EVENT OF CHANCE, IT IS A CONCIOUS EFFORT TO WORK EFFECTIVELY & EFFICIENTLY TO DELIVER MATERIALS THAT FULLY SATISFY OUR CUSTOMER'S NEEDS FOR PRIME QUALITY MATERIALS WISH IS METAL AIDS INDIA'S MOTTO, WITH TOTAL CONFORMANCE TO HIGH STANDARD OF QUALITY METAL & METAL PRODUCTS IN FULL RANGE OF PRODUCTS.

IT IS NEEDLESS TO MENTION THAT METAL AIDS INDIA HAVE GAINED SUFFICIENT EXPERIENCE TO THIS FIELD & ACHIEVED SUBSTANTIAL BUSINESS FROM REPUTED CONCERNS, GOVT. SECTORS AND EVEN FROM ISO ORGANIZATION ON REPEAT ORDER BASIS. METAL AIDS INDIA HAVE ALSO EXTENSIVE EXPERIENCE IN EXPORTING CARGOES TO NUMEROUS FIRM IN U. S. A., JAPAN, SINGAPORE, MALASIA, SOUTH KOREA, SOUTH AFRICA, AUSTRALIA, MARITIOUS, SRILANKA, ALL GULF AND ALL FAR EAST COUNTRIES ETC.

METAL AIDS INDIA HAVE THE INCLINATION TO HAVE SOUND BUSINESS TIES AND WILL VERY MUCH APPRECIATE TO RECEIVING YOUR VALUED TIMELY ENQUIRIES, FOR WHICH YOU WILL RECEIVE BETTER SERVICES, BEST FACILITIES & PROMPT ATTENTION AT ALL TIME.

PLEASE SEND YOUR ENQUIRIES OR CONTACT US ON BELOW ADDRESS :-

METAL AIDS INDIA

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WORKS : SHED # A-2/56, G.I.D.C., KILLA PARDI-369125 DIST - VALSAD (GUJRAT).

A MEMBER OF ASM INTERNATIONAL, OHIO, U.S.A.

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TÜV SÜD ◆ CERTIFICATE ◆ 認証証書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

South Asia

CERTIFICATE

The Certification Body
of TÜV SÜD South Asia Private Limited

certifies that

METAL AIDS INDIA

4/1, Alankar Cinema Building, S. V. P Road,
Mumbai - 400 004, Maharashtra, INDIA

has implemented a Quality Management System
in accordance with **ISO 9001:2015**
For Scope of

Export and Import of Flanges, Pipe & Fittings, Round Bar, Angles, Strips, Wires, Coils, Plates of Stainless Steel, High Nickel Alloys, Inconel, Monel, Hastalloy, Titanium, Duplex Steel, Alloy Steel, Carbon Steel and Other Ferrous and Non-Ferrous Metals.

Procurement of Metal Products as per Drawings and Samples.

Procurement & Supply of SS Strap Bands, Seals and Metal Accessories for Thermal Insulation Projects

The certificate is valid From 2023/02/22 until 2026/02/22
Subject to successful completion of annual periodic audits
The present status of this Certificate can be obtained on www.tuv-sud.in
Further clarifications regarding the scope of this certificate may be obtained by consulting the certification body

Certificate Registration No. **99 100 19579**

Date of Initial certification : 2023/02/22

Certification Body
of TÜV SÜD South Asia Private Limited, **Mumbai**
Member of TÜV SÜD Group

NABCB
QM011

SPECIFICATION & RANGE OF PRODUCTS

PRODUCTS	BRIEF SPECIFICATION
STAINLESS STEEL	AISI-304, 304L, 316, 316L, 321, 316 Ti, 309, 310, 410, 420,430,431,ETC. (ASTM)-A-176, A-182, A-213, A-240, A-249, A-276, A-312, A-269, A-479 ETC.
COPPER ALLOY	ISS-2501 (DHP-I&DHP-II), 2501 DPA, 2501 DPA, 2501 ETP, 1545, 4171, 288, 613 ETC. BSS-2871 -C-106 / C-107 / C-101, 2874-C-106 / C-108 / C-109, 2874 CA-104 ETC.
BRASS ALLOY	ISS-407 /1543 / 319 / 3488 / 320 / 291 / 4170 / 4413, MS 58-17760 ETC. BSS-2874 CZ 110 / 2874-CZ-111/2871 -CZ-126 / 249 / 218 / 2874 / 251 / 2873 ETC.
ALUMINIUM	IS-1254 / 1975, IS-737, N-6 GRADE ETC.
CARBON STEEL	ASTM A-106 GR. A,B,C, ASTM -A53, A & B, ASTM-210 GR. A-1, BS-3059 PART I, II, SA-179 ETC.
ALLOY STEEL	ASTM-A-335 GR. P1 / P11 / P12 / P22, ASTM-A-387 GR. 2 /11 / 12/22 ETC. ASTM -A-515 / 516 GRADE 60 / 70 (IS-2002 GRADE-2) ETC.
EN SERIES	EN-8, EN-9, EN-16, EN-24, EN-36, EN-42 ETC.
NICKEL ALLOY	NICKEL 200 / 201 / 205 / 212 / 222 / 270 ETC.
MONEL ALLOY	MONEL 400, MONEL K-500 ETC.
INCONEL ALLOY	INCONEL - 600 / 625 / 626 ETC.

ALSO AVAILABLE IN ANY INDIAN & INTERNATIONAL SPECIFICATION

OTHER RANGE

BESIDES ABOVE ALSO AVAILABLE TITANIUM, HASTALLOYS, HOT DIE STEEL, HIGH SPEED STEEEL, HCHCHR, GUN METALS, PHOSPHER BRONE, COPPER CADMIUM, COPPER CHROMIUM, LEAD, MILD STEEL, NAVEL BRASS, CUPRO-NICKEL, GALVANISED STEEL, IBR & NON-IBR, TUBE, SUGAR TUBES, ADMIRALTY BRASS, ALUMINIUM BRASS, HIGH TENSILE BRASS, ETC.

AVAILABLE SHAPES

ALL ABOVE MATERIALS ARE AVAILABLE IN THE SHAPES OF SHEETS, PLATES, STRIPS, COILS, FOILS, SHIMS, PIPES, TUBES, ROUND, SHAFT, SQUARE, HEXAGONAL, WIRES, RECTANGULAR, FLANGES, WIRE MECH, PERFORATED SHEETS, CIRCLES, RINGS, HOLLOW BAR, FLATS, ELBOWS, TEES, REDUCERS, UNIONS, STUB-END, DAIRY BEND, NUT - BOLTS, VALVES, COUPLING, NIPPLE, BLOCKS, ANGLES, FILLER WIRE, SUPER ENAMEL WIRES ETC. ALSO FABRICATING ANY ENGG. ITEMS IN METAL & METAL PRODUCTS AS PER SAMPLE & DRAWINGS.

ENQUIRY SOLICITED FOR ANY OTHER TYPES OF METAL & METAL PRODUCTS IN ANY SIZE / ANY GRADE / ANY SHAPE

METAL AIDS INDIA - TEL.: 2382 0233 / 2389 8829
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INSPECTION TESTINGS & CERTIFICATES

WE ARE HAVING A TEAM OF QUALIFIED TECHNICAL PEOPLE FOR INSPECTION & WE ARE ALSO ASSOCIATED, WITH TESTING LABORATORIES TO ENSURE THAT WHATEVER MATERIALS IS SUPPLIED BY US AS PER THE REQUIRED STANDARD. WE ARE ALSO PROVIDING FOLLOWINGS FACILITIES FOR OUR CUSTOMER WHICH ARE AS BELOW :-

A) INSPECTION WE ACCEPT ANY THIRD PARTY INSPECTION, WHICH CAN BE DONE EITHER AT OUR BOMBAY GODOWN OR AT OUR WORKS. THESE ARE THE FOLLOWINGS INSPECTION AGENCIES WHICH ARE AS BELOW :-

- ★ AMERICAN BUREAU OF SHIPPING (ABS)
- ★ BUREAU VERITAS (BV)
- ★ BAXCOUSILE
- ★ CHEMPRO INSPECTION
- ★ CHEMTEX
- ★ DET - NORSKE VERITAS (DNV)
- ★ DALAL CONSULTANCY
- ★ DAVY POWER GAS (I) P. LTD.
- ★ ENGINEERS INDIA LTD. (EIL)
- ★ ELECTROMECH ENGG. ENTERPRISES
- ★ GERMANISCHER LLOYD
- ★ HUMPHREYS & GLASSGOW (H&G)
- ★ HALLMARK INSPECTION SERVICES (HIS)
- ★ INDIAN REGISTRAR OF SHIPPIN0G (IRS)
- ★ INDIAN BOILER REGULATION (IBR)
- ★ INSPECTRORATE INDIA
- ★ IBI CHEMTUR (ENGG & CONSULTANCY)
- ★ INDUSTRIAL QUALITY CIRCLE
- ★ LLOYD'S REGISTRAR OF SHIPPING
- ★ MECON
- ★ M. N. DASTUR & CO. LTD.
- ★ MERCHANTILE MARINE DEPT. (MMD)
- ★ NATIONAL THERMAL POWER (NTCP)
- ★ NUCLEAR POWER CORPN. LTD. (NPCL)
- ★ PROFEN
- ★ P.D.I.L.
- ★ QUEST INSPECTION SERVICES P. LTD.
- ★ RITES.
- ★ R. J. ASSOCIATES (ENGRS.) P. LTD.
- ★ S. G. S. INDIA LIMITED (S.G.S.)
- ★ S. S. INSPECTION SERVICES
- ★ SHARPTECH ENGG. SERVICES
- ★ SACARDANDE ENGINEERS
- ★ TOYO ENGINEERING INDIA LTD.
- ★ TATA CONSULTING ENGINEERS.
- ★ UHDE INDIA LTD.

B) TESTING : WE CAN ACCEPT ALL TYPES OF TESTS WHICH WILL BE DONE AT ANY GOVT. APPROVED LABORATORIES FOLLOWINGS ARE THE MAJOR TESTS WHICH ARE USUALLY ACCEPTING BY US ARE AS BELOW :

- ★ CHEMICAL TEST
- ★ PHYSICAL TEST
- ★ MECHANICAL TEST
- ★ MICRO TEST
- ★ MACRO ETCH TEST
- ★ ULTRASONIC TEST
- ★ I. G. C. TEST
- ★ FLATTENING TEST
- ★ FLARRING TEST
- ★ REVERSE BEND TEST
- ★ HYDRAULICS TEST
- ★ HYDROSTATIC TEST
- ★ HARDNESS TEST
- ★ MICRO HARDNESS TEST
- ★ TENSION TEST
- ★ CORROSION TEST
- ★ IMPACT TEST
- ★ CRUSHING TEST
- ★ OPTIMAL CONC. TEST.
- ★ BALL TEST
- ★ RADIOGRAPHIC TEST
- ★ EDDY CURRENT TEST
- ★ INSIDE ENDOSCOPIC TEST
- ★ WELDEBILITY TEST
- ★ REBEND TEST
- ★ ERICHSEN CUPPING TEST
- ★ SHEAR TEST

C) MILL TEST CERTIFICATE : A COPY OF CORRELATED MILL (MANUFACTURER) TEST CERTIFICATE ALONG WITH LAB. TEST CERTIFICATE CAN BE PROVIDED AT THE TIME OF SUPPLY

D) HEAT NOS & MARKINGS : THERE WILL BE ORIGINAL CORRELATED HEAT NOS & ORIGINAL MARKINGS ON ALL TYPES OF MATERIALS.

E) GAURANTEE CERTIFICATE : ALSO WE CAN PROVIDE A GAURANTEE CERTIFICATE ALONG WITH THE SUPPLY WHENEVER IT IS REQUIRED BY CUSTOMER.

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WEIGHT & THICKNESS OF S.S. SCHEDULE PIPES (IN KG. PER METER)

SIZES			SCH-5S		SCH-10S		SCH-10		SCH-20		SCH-40S		SCH-40		SCH-60		SCH-80S		SCH-80		SCH-120		SCH-160		SCH-XXS	
INCH NB	MM NB	MM O.D.	MM THICK	WT.PER MTR.	MM THICK	WT.PER MTR.	MM THICK	WT.PER MTR.	MM THICK	WT.PER MTR.	MM THICK	WT.PER MTR.	MM THICK	WT.PER MTR.	MM THICK	WT.PER MTR.	MM THICK	WT.PER MTR.	MM THICK	WT.PER MTR.	MM THICK	WT.PER MTR.	MM THICK	WT.PER MTR.	MM THICK	WT.PER MTR.
1/8	3	10.3	1.24	0.28	1.24	0.28	1.24	0.28	-	-	1.73	0.37	1.73	0.37	-	-	2.41	0.47	2.41	0.47	-	-	-	-	-	-
1/4	6	13.7	1.24	0.30	1.65	0.49	1.65	0.49	-	-	2.24	0.64	2.24	0.64	-	-	3.02	0.80	3.02	0.80	-	-	-	-	-	-
3/8	10	17.2	1.65	0.54	1.65	0.64	1.65	0.64	-	-	2.31	0.85	2.31	0.85	-	-	3.20	1.10	3.20	1.10	-	-	-	-	-	-
1/2	15	21.3	1.65	0.80	2.11	1.00	2.11	1.00	-	-	2.77	1.27	2.77	1.27	-	-	3.73	1.62	3.73	1.62	-	-	4.75	1.95	7.47	2.56
3/4	20	26.7	1.65	1.02	2.11	1.29	2.11	1.29	-	-	2.87	1.70	2.87	1.70	-	-	3.91	2.20	3.91	2.20	-	-	5.54	2.91	7.82	3.66
1	25	33.4	1.65	1.30	2.77	2.10	2.77	2.10	-	-	3.38	2.52	3.38	2.52	-	-	4.55	3.26	4.55	3.26	-	-	6.35	4.26	9.09	5.48
11/4	32	42.2	1.65	1.66	2.77	2.71	2.77	2.71	-	-	3.56	33.41	3.56	3.41	-	-	4.85	4.49	4.85	4.49	-	-	6.35	5.65	9.70	7.82
11/2	40	48.3	1.65	1.90	2.77	3.13	2.77	3.13	-	-	3.68	4.10	3.68	4.10	-	-	5.08	5.44	5.08	5.44	-	-	7.14	7.29	10.16	9.61
2	5	60.3	2.11	2.40	2.77	3.95	2.77	3.95	-	-	3.91	5.47	3.91	5.47	-	-	5.54	7.52	5.54	7.52	-	-	8.71	11.14	11.07	13.52
21/2	65	73.0	2.11	3.71	3.05	5.29	3.05	5.29	-	-	5.16	8.68	5.16	8.68	-	-	7.01	11.47	7.01	11.47	-	-	9.53	15.00	14.02	20.51
3	80	88.9	2.11	4.54	3.05	6.49	3.05	6.49	-	-	5.49	11.36	5.49	11.36	-	-	7.62	15.36	7.62	15.36	-	-	11.13	21.47	15.24	27.84
31/2	90	101.6	2.11	5.20	3.05	7.45	3.05	7.45	-	-	5.74	13.65	5.74	13.65	-	-	8.08	18.76	8.08	18.74	-	-	-	-	16.19	34.56
4	100	114.3	2.77	5.93	3.05	8.42	3.05	8.42	-	-	6.02	16.17	6.02	16.17	-	-	8.56	22.45	8.56	22.45	11.13	28.79	13.49	33.73	17.12	41.27
5	125	141.3	2.77	9.51	3.40	11.63	3.40	11.63	-	-	6.55	21.89	6.55	21.89	-	-	9.53	31.15	9.53	31.15	12.70	40.80	15.88	49.40	19.05	57.76
6	150	168.3	2.77	11.37	3.40	13.91	3.40	13.91	-	-	7.11	28.43	7.11	28.43	-	-	11.00	42.81	11.00	42.81	14027	55.05	18.24	67.89	21.95	79.68
8	200	219.1	3.40	14.86	3.76	20.08	3.76	20.08	6.35	33.51	8.18	42.79	8.18	42.79	10.31	53.40	12.70	65.02	12.70	65.02	18.24	91.73	23.01	111.92	22.23	108.55
10	250	273.0	3.96	22.73	4.19	27.90	4.19	27.90	6.35	42.00	9.27	60.64	9.27	60.64	12.70	82.00	15.70	82.80	15.06	96.35	21.41	134.90	28.58	173.27	25.40	156.00
12	300	323.0	3.96	31.33	4.57	36.10	4.57	36.10	6.35	49.87	9.53	75.01	10.31	80.94	14.27	109.28	12.70	98.95	17.45	132.25	25.40	189.82	33.32	239.41	25.40	187.50
14	350	355.6	4.19	34.53	4.78	41.59	6.35	55.53	7.92	68.30	9.53	82.56	11.13	96.00	15.06	127.21	12.70	109.04	19.05	159.02	27.76	227.88	35.71	283.25	-	-
16	400	406.4	4.19	41.80	4.78	47.62	6.35	63.61	7.92	78.28	9.53	94.70	12.70	125.20	16.66	161.10	12.70	125.20	21.41	204.45	30.94	290.88	40.46	367.25	-	-
18	450	457.2	4.78	47.08	4.78	53.64	6.35	71.69	7.92	88.26	9.53	106.83	14.27	158.27	19.05	207.03	12.70	141.35	23.80	255.85	34.93	369.34	45.24	462.28	-	-
20	500	508.0	5.54	59.66	5.54	68.92	6.35	79.76	9.53	117.8	9.53	118.95	15.06	184.14	20.62	249.28	12.70	157.51	28.60	313.00	38.10	448.30	49.99	567.92	-	-
24	600	609.6		83.00	6.35	95.01	6.35	95.01	9.53	141.8	9.53	143.20	17.45	256.04	24.59	356.82	12.70	189.82	30.94	444.10	46.02	649..44	59.51	812.00	-	-

NB = NOMINAL BORE, O.D. = OUT SIDE DIAMETER, SCH = SCHEDULE, WT = WEIGHT, MTR = METER, MM = MILIMETER

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WEIGHT OF S.S. SHEET / PLATE

WEIGHT IN KG/PER SHEET

THICKNESS IN MM.	SIZES IN MM.			THICKNESS IN MM.	WEIGHT KG/M²
	1000 X 2000	1250 X 2500	1500 X 3000		
0.50	08.000	12.500	18.000	.50	4.000
0.63	10.080	15.750	22.680	.63	5.040.
0.75	12000	18.750	27.000	.75	6.000
0.88	14.080	22.000	31.680	.88	7.040
1.00	16.000	25.000	36.000	1.0	8.000
1.25	20.000	31.250	45.000	1.25	10.000
1.50	24.000	37.500	54.000	1.50	12.000
1.60	25.600	40.000	57.600	1.60	12.800
2.00	32.000	50.000	72.000	2.00	16.000
2.50	40.000	62.500	90.000	2.50	20.000
2.60	41.600	65.000	93.600	2.60	20.800
3.00	48.000	75.000	108.000	3.00	24.000
3.25	52.000	81.250	117.000	3.25	26.000
4.00	64.000	100.000	144.000	4.00	32.000
5.00	80.000	125.000	180.000	5.00	40.000
6.00	96.000	150.000	216.000	6.00	48.000
7.00	112.000	175.000	252.000	7.00	56.000
8.00	128.000	200.000	288.000	8.00	64.000
10.00	160.000	250.000	360.000	11.00	80.000
12.00	192.000	300.000	432.000	12.00	96.000
14.00	224.000	350.000	504.000	14.00	112.000
15.00	240.000	375.000	540.000	15.00	120.000
16.00	256.000	400.000	576.000	16.00	128.000
19.00	304.000	475.000	684.000	19.00	152.000
20.00	320.000	500.000	720.000	20.00	160.000

WEIGHT OF S. S. GAUGE PIPES

Size	O.D. mm	10G(3.25)	12G(2.64)	14G(2.03)	16G(1.62)	18G(1.21)	20G(0.91)	22G(0.71)
1/4"	6.35	0.075	0.070	0.065	0.058	0.046	0.037	0.030
5/16"	7.93	0.114	0.105	0.089	0.079	0.060	0.048	0.038
3/8"	9.52	0.152	0.135	0.113	0.097	0.080	0.058	0.046
1/2"	12.7	0.226	0.200	0.157	0.134	0.105	0.079	0.063
3/4"	19.05	0.386	0.326	0.256	0.215	0.161	0.124	0.097
1"	25.4	0.541	0.450	0.351	0.294	0.218	0.167	0.131
1.1/4"	31.82	0.696	0.580	0.448	0.375	0.275	0.200	-
1.1/2"	38.1	0.851	0.700	0.542	0.452	0.332	-	-
1.3/4"	44.45	1.020	0.832	0.646	0.530	0.390	-	-
2"	50.8	1.161	0.960	0.733	0.607	0.447	-	-
2.1/4"	57.15	1.315	1.085	0.828	0.687	0.504	-	-
2.1/2"	63.5	1.472	1.210	0.924	0.792	0.562	-	-
2.3/4"	69.85	1.630	1.338	1.022	0.847	0.619	-	-
3"	76.2	1.782	1.460	1.115	0.924	0.676	-	-
3.1/2"	88.9	2.092	1.718	1.306	1.082	0.791	-	-
4"	101.6	2.403	1.971	1.497	1.239	0.905	-	-
4.1/2"	114.3	2.713	2.224	1.608	1.397	1.020	-	-
5"	127.0	3.023	2.477	1.879	1.554	1.134	-	-
5.1/2"	139.7	3.336	2.730	2.070	1.713	1.250	-	-
6"	152.4	3.654	2.983	2.261	1.875	1.364	-	-
8"	203.2	4.912	4.002	-	-	-	-	-
10'	254.0	6.160	5.016	-	-	-	-	-
12"	304.8	7.409	-	-	-	-	-	-
16"	406.4	8.058	-	-	-	-	-	-
20"	508.0	12.401	-	-	-	-	-	-

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CHEMICAL COMPOSITION (IN%) OF STAINLESS STEEL

AISI	DIN	C MAX	Si MAX	MN MAX	P MAX	S MAX	CR	MO	Ni	OTHER MAX
201	-	0.15	1.00	7.50	0.060	0.030	16.0-18.0	-	3.50-5.50	NO.25
202	14371	0.15	1.00	10.00	0.060	0.030	17.0-19.0	-	4.00-6.60	NO.25
301	14310	0.15	1.00	2.00	0.045	0.030	16.0-18.0	-	6.00-8.00	-
302	16900	0.15	1.00	2.00	0.045	0.030	17.0-19.0	-	8.00-10.0	-
303	14305	0.15	1.00	2.00	0.200	0.15	17.0-19.0	-	8.00-10.0	ZR OF MO-0.60
304	14301	0.08	1.00	2.00	0.045	0.030	18.0-20.0	-	8.00-10.5	-
304L	14303	0.030	1.00	2.00	0.045	0.030	18.0-20.0	-	8.00-12.0	-
304LN	14311	0.03	1.00	2.00	0.045	0.030	18.0-20.0	-	8.0012.0	N0.10-0.16
305	14303	0.12	1.00	2.00	0.045	0.030	17.0-19.0	-	10.5-13.0	-
308	14303	0.08	1.00	2.00	0.045	0.030	19.0-21.0	-	10.0-12.0	-
309	14828	0.20	1.00	2.00	0.045	0.030	22.0-24.0	-	12.0-15.0	-
309S	14833	0.08	1.00	2.00	0.045	0.030	22.0-24.0	-	12.0-15.0	-
310	14841	0.25	1.50	2.00	0.045	0.030	24.0-26.0	-	19.0-22.0	-
310S	14845	0.08	1.50	2.00	0.045	0.030	24.0-26.0	-	19.0-22.0	-
314	14841	0.25	3.00	2.00	0.045	0.030	23.0-26.0	-	19.022.0	-
316	14401	0.08	1.00	2.00	0.045	0.030	16.0-18.0	2.00-3.00	10.0-14.0	-
316L	14404	0.03	1.00	2.00	0.045	0.030	16.0-18.0	2.00-3.00	10.0-14.0	-
316TI	14571	0.08	1.00	2.00	0.045	0.030	16.0-18.0	2.00-3.00	10.0-14.0	TI-5XC
317	14449	0.08	1.00	2.00	0.045	0.030	18.0-20.0	3.00-4.00	11.0-15.0	-
317L	14438	0.03	1.00	2.00	0.045	0.030	18.0-20.0	3.00-4.00	11.0-15.0	-
318	14583	0.08	1.00	2.00	0.045	0.030	17.0-19.0	1.75-2.75	13.0-15.0	CB+TA10XC(MAX)
321	14541	0.08	1.00	2.00	0.045	0.030	17.0-19.0	-	9.00-12.0	TI-5XC
329	14460	0.20	0.75	1.00	0.040	0.030	23.0-28.0	1.00-2.00	2.50-5.00	-
347	14550	0.08	1.00	2.00	0.045	0.030	17.0-19.0	-	9.00-13.0	CB/TA-10XC
403	14000	0.15	0.50	1.00	0.040	0.030	11.5-13.0	-	-	-
405	14002	0.08	1.00	1.00	0.040	0.030	11.0-14.5	-	-	AL0.10-0.30
409	14512	0.08	1.00	1.00	0.045	0.045	10.5-11.7	-	0.50	TI 6xC-0.75
410S	14001	0.08	1.00	1.00	0.040	0.030	11.5-13.5	-	0.60	-
410	14006	0.15	1.00	1.00	0.045	0.030	11.5-13.5	-	-	-
416	14005	0.15	1.00	1.25	0.060	0.150	12.0-14.0	-	-	ZR OF MO-0.60
420	14021	0.15	1.00	1.00	0.040	0.030	12.0-14.0	-	-	-
430	14016	0.12	1.00	1.00	0.040	0.030	16.0-18.0	-	-	-
430F	14104	0.12	1.00	1.25	0.060	0.150	16.0-18.0	0.60	-	-
431	14057	0.20	1.00	1.00	0.040	0.030	15.0-17.0	-	1.25-2.50	-
434	14113	0.12	1.00	1.00	0.040	0.030	16.0-18.0	0.75-1.25	-	-
440B	14112	0.95	1.00	1.00	0.040	0.030	16.0-18.0	0.75	-	-
440C	14125	1.20	1.00	1.00	0.040	0.030	16.0-18.0	0.75	-	-
446	14762	0.20	1.00	1.50	0.040	0.030	23.0-27.0	-	-	N-0.25

C = CARBON, Si = SILICON. Mn = MANGANESE, P = PHOSPHOROUS, S = SULPHUR, Cr = CHROMIUM, Mo = MOLYBDENUM, Ni = NICKEL, N = NITROGEN, Zr = ZIRCONIUM, Ti = TITANIUM, Co = COBALT, Ta = TANTALUM, AL = ALUMINIUM.

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HARDNESS CONVERSION - GUIDANCE

HB	HV	HRB	HRC	HB	HV	HRB	HRC
118	125	68.5	-	269	284	-	27.6
121	127	70.0	-	275	292	-	28.7
123	130	71.0	-	285	301	-	29.9
126	132	72.0	-	295	310	-	31.0
128	135	73.0	-	302	319	-	32.1
131	137	74.0	-	312	329	-	33.2
134	140	75.0	-	321	339	-	34.3
137	143	76.5	-	331	350	-	35.4
140	147	77.5	-	341	360	-	36.6
143	150	78.5	-	352	372	-	37.8
146	153	79.5	-	363	383	-	39.1
149	156	81.0	-	375	396	-	40.4
152	159	82.0	-	388	410	-	41.8
156	163	83.0	-	402	425	-	43.1
159	167	84.0	-	415	440	-	44.5
163	171	85.0	-	430	457	-	45.8
166	175	86.0	-	444	474	-	47.2
170	178	87.0	-	-	495	-	48.7
175	183	88.0	-	-	516	-	50.3
179	188	89.0	-	-	535	-	51.4
183	192	90.0	-	-	553	-	52.5
187	196	90.5	-	-	560	-	53.0
192	202	91.5	-	-	577	-	54.0
197	207	93.0	-	-	595	-	55.0
202	212	93.5	-	-	613	-	56.0
207	218	94.5	-	-	633	-	57.0
212	222	95.5	-	-	653	-	58.0
217	228	96.5	-	-	674	-	59.0
229	234	97.5	19.0	-	697	-	60.0
229	241	98.0	20.5	-	720	-	61.0
235	247	99.0	21.6	-	746	-	62.0
241	253	100	22.8	-	772	-	63.0
248	261	101.0	24.1	-	800	-	64.0
255	269	-	25.4	-	832	-	65.0
262	276	-	26.5	-	-	-	-

MECHANICAL PROPERTIES IN S.S.

Stainless Steel Grade Designation	Condition	UTS N / mm² Min	0.2% Proof Stress N / mm² Min	% Elongation on 50 mm GL Min	Hardness RB Max
SS301	Annealed	515	205	40	88
SS304	Annealed	515	205	40	92
SS304L	Annealed	485	170	40	88
SS310	Annealed	515	205	40	95
SS316	Annealed	515	205	40	95
SS316L	Annealed	485	170	40	95
SS321	Annealed	515	205	40	85
SS430	Annealed	450	205	22	88
SS410S	Annealed	415	205	22	88

PHYSICAL PROPERTIES IN S.S.

GRADE	301	304	316	310S	430	409
Density (gm / cm3)	7.9	7.9	8.0	7.9	7.7	7.7
Elasticity (Kg / mm²)	19700	19700	19700	20300	20300	20300
Specific Heat Capacity (Cal/gm/0C)	0.12	0.12	0.12	0.12	0.11	0.11
Thermal conductivity (Cal/cm2/sec/0C/cm at 1000C)	0.039	0.039	0.0373	0.033	0.0625	0.0595
Specific Electrical Resistance (un)/cm3)	72	72	74	80	60	57
Coefficient of thermal Expansion (0C X 10 - 60 - 5000C)	198	184	160	169	1134	1152
Melting Range (0C)	1400	1400	1370	1400	1430	1430
	1420	1455	1400	1455	1510	1510
Magnetic	Non magnetic	Non magnetic	Non magnetic	Non magnetic	Ferro magnetic	Ferro magnetic

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EQUIVALENT SPECIFICATION OF STAINLESS STEEL

AISI U.S.A.	IS INDIA	DIN GERMANY	BS-BRITAIN B.S.	BS-BRITAIN EN	PN POLAND	STAS ROMANIA	SIS SWEDEN	AFNOR FRANCH	UNI ITALY	JIS JAPAN
201	-	-	-	-	-	3583	-	-	-	SUS 201
202	-	1.4371	202 S 16	-	86020	-	-	-	-	SUS 202
301	10cr17Ni7	1.4310	301 S 21	-	-	-	-	Z12CN17-08	X12 CR NI 1707	SUS 301
302	-	1.4300	302 S 25	58 A	86020	3583	2330/2331	Z10CN18-09	X10 CR NI 1809	SUS 302
303	-	1.4305	303 S 21	58 M	-	-	2346	Z12CNF18-09	X10 CR NI S 1809	SUS 303
303Se	-	1.4305	303 S 41	58 M	-	-	2346	-	X10 CR NI 1809	SUS 303 se
304	04CrI8Ni10	1.4301	304 S 15	58 E	86020	3583	2332/2333	Z6CN18-09	X5 CR NI 1810	SUS 304
304L	02CrI8Ni11	1.4306	304 S 12	-	86020	-	2352	Z2CN18-10	X2 CR NI 1811	SUS 304L
309	-	1.4828	309 S 24	-	86022	3583	-	-	X16 CR NI 2314	SUS 309
310	-	1.4841	310 S 24	-	86022	-	-	-	X22 CR NI 2520	SUS 310
310S	-	1.4845	-	-	86022	-	2361	-	-	SUS 310S
316	04Cr17 Ni12Mo2	1.4401	316 S 12	58 J	-	6855	2347/2343	Z6CND17-11	X5 Crnimo1712	SUS 316
316Ti	-	1.4571	-	-	-	-	-	-	-	-
316L	02Cr17Ni12Mo2	1.4404	316 S 12	-	86022	-	2353	Z2CN17-12	-	SUS 316L
317	-	1.4438	317 S 16	-	-	-	-	Z2CN17-13	X2Crnimo1712	SUS 317
317L	-	1.4435	317 S 12	-	-	-	-	-	-	SUS 317L
321	04Cr18Ni10Ti20	1.4541	321 S 12	-	-	3583	2337	Z10CNT 18-11	-	SUS 321
347	-	1.4550	347 S 17	58F&G	86022	3583	2338	Z6CNNB18-11	X8Crnimo1811	SUS 347
403	-	1.4006	403 S 17	-	-	3583	2302	Z6 C13	X12 Cr13	SUS 403
405	-	1.4002	-	-	86022	-	-	Z6CA13	X6CrA113	SUS 405
410	-	1.4006	410 S 21	56-A	-	3583	2302	Z6C13	X12Cr13	SUS 410
416	-	1.4005	416 S 41	56AM	-	-	-	Z12CF13	X12CrS13	SUS 416
416Se	-	-	-	56AM	-	-	-	-	-	-
420	-	1.4021	420 S 37	56C	86020	3583	2302	Z20C13	X20Cr13	SUS 420
430	05Cr17	1.4016	430 S 15	60	86020	3583	2320	Z8C17	X8Cr17	SUS 430
431	-	1.4057	431 S 29	57	86020	-	2321	-	X16CrNi16	SUS 431

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HIGH SPEED, HOT / COLD DIE, CARBON STEEL, SILVER STEEL & EN SERIES

Steel Type	Brand Bohler Name	C	SL	Mn	Cr	Ni	W	Co.	V	Mo	Hardening Temp 0C	Ouenching Medium	Tempering Temp 0C	Brinell Rock Well Hardness	Uses	Work Stuff No.
HIGH SPEED STEEL	CC[18%W-10%Co]	.75/.85	.3/.5	.3/.5	4/4.5	--	17.5/18.5	9/10	1/1.5	.5/1	1260/1320	Oil/Air	560/590	64-66	Machining Tools for Citting-materials	1.3265
	SUPER RAPID Extra 500 [18%W-5%Co]	.7/.85	.3/.4	.3/.4	4/4.5	--	17.5/18.5	4.5/5	1/1.5	.5/8	1250/1310	Oil/Air	550/580	64-66	Machining Blades Same Tools	1.3255
	SUPER RAPID Extra Mo [6/5/2]	.7/.85	.3/.5	.3/.5	4/4.5	--	6/6.5	--	1/2	5/5.5	1190/1250	Oil/Air	540/570	64-66	Broches-Segments milling Cutter	1.3343
	SUPER RAPID Extra [18%W]	.7/.8	.3/.4	.3/.4	4/4.5	--	17/18	--	1/1.2	--	1240/1290	Oil/Air	550/580	64-66	Twist-Drill-Screw cutting Tools	1.3355
	[22%W]	.75/.85	.3/.5	.3/.5	4/4.5	--	22/22.5	--	1/1.5	--	1250/1350	Oil/Air	580/600	65-66	Machining High Tensile Materials Milling Cutters / Hubs Reamers	--
HOT DIE STEEL	Us ULTRA	.35/.45	.7/1	.3/.4	5/5.3	--	--	--	.3/.4	1/1.2	1000/1050	Oil/Air	600/700	38-52	Pressure Cutting Mould	1.2343
	WKZ-50	.35/.4	.2/.4	.3/.4	2/2.4	--	4.4.4	--	.5/.6	--	1050/1100	Oil/Air	600/700	40-50	Hot Extrusion Dies	1.2567
	WKZ	.3/.35	.2/.3	.3/.4	2/3	--	8/9	--	.4/.5	--	1100/1150	Oil/Air	600/650	44/52	Component Pressing Dies	1.2581
	US ULTRA-4	.35/.4	.7/1	.4/.5	5/5.5	--	1/1.3	--	.1/.2	1.5/2	1000/1050	Oil/Air	600/700	40/53	Track Pressing Dies	1.2606
COLD DIE STEEL	Special 'K'	1.8/2.1	.3/.4	.3/.4	1.8/12.2	--	--	--	--	--	920/980	Oil	100/350	58-65	Heavy Duty Cutting Dies Broches Shear Blades	2080 2436
	Amutit	1/1.05	.3/.5	.8/.9	.8/1.2	--	--	--	--	--	790/830	Oil	100/300	63-66	Cutting Dies Punches	2419
	Amutit 'S'	.9/1	.3/.5	.8/.7	.5/.6	--	1/1.5	--	.1	--	780/820	Oil	100/300	63-66	Press Tools Dies Punches	2510
	MST	.9/1	.3/.5	1.8/2	.4/.5	--	.5/.6	--	.1	--	780/830	Oil	100/300	63-65	Difficulting Cutting Dies Punches/Forming	2842 2060
	R3 JESS/AISI 304	0.08	.5/1.00	1.5/2.00	18/19	8/10	--	--	--	--	1000/1120	Oil	200/760	NON HRD RB-163	Hospital & Domastic Exuip. Chemical	--
STAINLESS STEEL	R55 Saville/AISI316	0.06	.5/1	1.5/2.00	17/18	10/12	--	--	--	2.5	1000/1120	Oil	200/760	NON HRD RB-163	Chemical & Corrosion Resistance	-- --
	KW-10/AISI410	0.15	.5/1.00	1.00	12.5	--	--	--	--	--	930/1000	Oil	200/760	RB 183	Pump Parts Non. Corrosion	--
	Antint / AISI 420 KW-15	.3/.4	.5/1.00	1.00	13.00	--	--	--	--	--	920/1000	Oil	150/750	RB 183	Pump Valve Parts Air Craft	--

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Steel Type	Brand Bohler Name	C	SL	Mn	Cr	Ni	W	Co.	V	Mo	Hardening Temp 0C	Ouenching Medium	Tempering Temp 0C	Brinell Rock Well Hardness	Uses	Work Stuff No.
CARBON STEEL	MS 85	.85	.25	.87	--	--	--	--	--	--	800/820	Water	150/200	62	Std. Cutting Tools Plain Hard Tools	
	Extra Tought	.85	.3	.5	--	--	--	--	--	--	750/820	Water	150/200	63	Short Peroved Tools	
SILVER STEEL	WV.	1.2	--	--	--	--	1	--	--	--	780/810	Water	100/300	--	Plain Dowel Pins Guidepin	
	CV.	1.15	--	--	.8	--	--	--	--	--	790/820	Water	100/320	--	Maudrals & Small Tools	
EN SERIES STEEL	En-1A	0.07/.15	.1	.8/1	SUL 0.3	--	--	--	--	--	--	--	--	--	Auto Parts Tools & Production m/c	
	EN-2	0.2	.3	.8	--	--	--	--	--	--	750/900	Case Hrd	100-200	56-60	Ordinary Case Hardening jobs	
	EN-3B EN-8/1040	.25 .35/.45	.35 .05/.3	.1 .6/.1	-- --	-- --	-- --	-- --	-- --	-- --	750/9010 750/900	-- Oil	100-200 150/200	56-60 --	Small Tools Bolts, M/c Parts Axials, Shaft	
	EN-8D	.4/.5	.05/.3	.6/1	--	--	--	--	--	--	800/950	Oil	150/200	45-50	High Tensile Bolts & M/C Parts	
	EN-9/1060	.5/.6	.05/.3	.5/.8	--	--	--	--	--	--	850/950	Oil	200/250	55-60		
	EN-16	.3/.4	.1/.3	1.3/1.8	--	--	--	--	--	.2/.3	800/900	Oil	200/225	40-50		
	EN-19/4140	.35/.45	.1/.3	.5/.8	9/1.5	--	--	--	--	2/.4	850/900	Oil	200/225	45-55		
	EN-24/4340	.35/.45	.1/.3	.5/.7	.9/1.4	1.3/1.8	--	--	--	.2/.35	900/950	Oil	200/225	45-55		
	EN-30	.25/.34	.1/.3	4/.6	1.1/1.4	3.9/4.3	--	--	--	--	900/950	Oil	200/225	50-55		
	EN-31/52100	.9/1.2	.1/.3	.3/.7	1/1.6	--	--	--	--	--	820/860	Oil	180/225	59-65		
	EN-32B	0.15	.01/.3	.4/.7	--	--	--	--	--	--	850/900	Water	180	61-63		
	EN-36/3310	.12/.15	1/.3	.3/.6	.6/1.1	3/3.75	--	--	--	--	760/780	Case Hrd	150	61-63		
	EN-36C	.12/.15	.1/.35	.3/.6	.6/1.1	3/3.75	--	--	--	1/.2	800/850	Case Hrd	150	61-63		
	EN-42/1080	.7/.8	.1/.4	.5/.7	--	--	--	--	--	--	600/700	Direct Hrd	--	40-45		
	EN-44	.9/1.2	.3	.4/.7	--	--	--	--	--	--	650/750	Oil	150	45-50		
	EN-45/9260	.5/2 .5/.6	7/1 .15/2	-- 7/1	--	--	--	--	--	--	750/800	Oil	150	50-55		
	EN-351/3120	.1/.2	.35	.6/.1	.4/.8	--	--	--	--	--	850/860	Oil	175/200	62-64		
	EN-353/3120	.1/.2	.35	.5/.1	.7/1.5	1/1.5	--	--	--	.08/.15	840/970	Oil	150/200	62-64		
	EN-354/8620	.1/.2	.35	.5/.1	1.5/2	1.5/2	--	--	--	1/2	850/900	Oil	150/200	60-62		

ASTM SPECIFICATION FOR STAINLESS STEEL TUBES & PIPES TOLERANCE

SPECIFICATION	ALLOWABLE OUTSIDE DIAMETER VARIATIONS IN MM			ALLOWABLE WALL THICKNESS VARIATIONS		TESTING
ASTM-312 SEAMLESS & WELDED PIPE	3.175-38.1 INCL. 38.1-101.6 INCL. 101.6-203 INCL.	.4 .79 1.59	.79 .79 .79	MINIMUM WALL 12.5% UNDER NOMINAL WALL SPECIFIED		TENSION TEST FLATTERING TEST 100% HYDROSTATIC TEST
ASTM-213 SEAMLESS BOLLER SUPERHEATER AND HEAT EXCHANGER TUBES	NOMINAL DIAMETER UNDER 25.4 25.4-38.1 INCL. 38.1-5.8 EXCL. 50.8-63.5 EXCL. 63.5-76.2 EXCL. 76.2-101.6 INCL.	OVER .1016 .1524 .2032 .254 .3048 .381	UNDER .1016 .1524 .2032 .254 .3048 .381	%OVER +20 +20 +20 +22 +22 +22	%UNDER -0 -0 -0 -0 -0 -0	TENSION TEST FLATTERING TEST FLARE TEST HARDNESS TEST 100% HYDROSTATIC TEST
ASTM-249 WELDER BOLLER SUPERHEATER AND EXCHANGER AND CONDENSER TUBES	UNDER 25.4 25.4-38.1 INCL. 38.1-50.8 EXCL. 50.8-63.5 EXCL. 63.5-76.2 EXCL. 76.2-101.6 INCL.	.1016 .1524 .2032 .254 .3048 .381	.1016 .1524 .2032 .254 .3048 .381	%OVER +10 +10 +10 +10 +10 +10	%UNDER -10 -10 -10 -10 -10 -10	TENSION TEST FLATTERING TEST FLARE TEST REVERSE BEND TEST HARDNESS TEST 100% HYDROSTATIC TEST
ASTM-269 SEAMLESS & WELDED TUBING FOR GENERAL SERVICE	UPTO 12.7 12.7-38.1 EXCL. 38.1-99.9 EXCL. 88.9-139.7 EXCL. 139.7-203.2 EXCL.	.13 .13 .25 .38 .76	.13 .13 .25 .38 .76	%OVER +15 +10 +10 +10 +10	%UNDER -15 -10 -10 -10 -10	FLARE TEST FLANGE TEST (WELDED ONLY) HARDNESS TEST REVERSE FLATTERING TEST (WELDED ONLY) 100% HYDROSTATIC TEST

ASTM SPECIFICATION

ASTM - A - 240 & A - 167 FOR PLATES, SHEETS, STRIPS, FLATS
ASTM - A - 269, A-312 FOR SEAMLESS & WELDER TUBES
ASTM - A - 249 FOR WELDED TUBES ONLY
ASTM - A - 213 & A - 376 FOR SEAMLESS TUBES
ASTM - A - 276 & A - 475 FOR ROUND BARS
ASTM - A - 182 & A - 314 FOR FORGING OF ALL TYPES
ASTM - A - 473 & A - 493 FOR WIRE
ASTM - A - 106 FOR CARBON STEEL SEAMLESS PIPES
ASTM - A - 335 FOR ALLY STEEL SEAMLESS TUBES
ASTM - A - 210 FOR ERW BOILER TUBES
ASTM - A - 430 FOR FORGED & BORED TUBE
ASTM - A - 473 - FOR WIRE (A-493)
ASTM - A - 478 - FOR WIRE ROPE / A - 492

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SPECIAL FORMULA'S

1) **FORMULA FOR CALCULATION PIPE WEIGHT :**
O.D.(MM) - W.T. (IN MM) X W.T. (IN MM) X O.OO756 = WEIGHT (K.G.) PER FOOT

2) **FORMULA FOR CALCULATING S.S. SHEET/ PLATE WEIGHT :**
THICKNESS (IN MM) X WIDTH (IN MM) X LENGTH (IN MM) X 0,008 = WEIGHT (K.G. PER SHEET)

3) **FORMULA FOR CALCULATING S.S. ROUND BAR WEIGHT :**
DIA (IN MM) X DIA (IN MM) X 0.0019 = WEIGHT (KG. PER FOOT)

4) **FORMULA FOR CALCULATING HEX BAR WEIGHT :**
A/F (IN MM) X AF (IN MM) X 0.00207 = WEIGHT (KG. PER FOOT)

5) **FORMULA FOR CALCULATING S.S. SQUARE BAR WEIGHT :**
DIA (O) X DIA (O) X 0.00204 = WEIGHT (KG. PER FOOT)

6) **FORMULA FOR CALCULATING S.S. CIRCLE WEIGHT :**
DIA (IN MM) X DIA (IN MM) X THICKNESS 4-16000 WEIGHT (KG. PER PIECE)

7) **FORMULA FOR FABRICATION OF PIPES FROM SHEET / PLATE**
O.D. (IN MM) - W.T. (IN MM) X 22 = 7 = WIDTH OF SHEET

8)
- ★ WEIGHT FOR COPPER WILL BE APPROXIMATELY 12% MORE THAN STAINLESS STEEL WEIGHT
- ★ WEIGHT FOR BRASS WILL BE APPROXIMATELY 10% MORE THAN STAINLESS STEEL WEIGHT
- ★ WEIGHT FOR ALUMINIUM WILL BE APPROXIMATELY 1/3 OF STAINLESS STEEL WEIGHT

9)
- ★ 1 KILOMETER = 1000 MTR.
- ★ 1 METER = 1000 MM
- ★ 1MM = 1000 MICRONS
- ★ 1000 MM = 100 CM
- ★ 1 INCH = 25.4 MM
- ★ 1 FOOT = 304.8 MM
- ★ 1 POUND = 0454 KGS

10) **FORMULA FOR GETTING U.T.S.IN KG - MM^2 FROM N - MM^2**
N - MM^2 X 0.102 = U.T.S. IN KG - MM^2

11) **FORMULA FOR GETTING U.T.S. FROM HARDNESS**
HARDNESS (IN HBN) + 3 = U.T.S. IN KG - MM^2

12) **USEFUL INFORMATION**
- ★ **AISI** = AMERICAN INSTITUTION OF STEEL & IRON
- ★ **ASTM** = AMERIALN STANDARD OF TRADE MARK
- ★ **E.R.W.** = ELECTRIC RESISTANCE WELDED
- ★ **S.W.G.** = STANDARD WIRE GAUGE
- ★ **I.G.C.** = INTER GRANNULAR CORROSION
- ★ **U.T.** = ULTRASONIC TEST
- ★ **U.T.S.** = ULTIMATE TENSILE STRENGTH
- ★ **Y.S.** = YEILD STRENGTH
- ★ **BHN** = BRINNEL HARDNESS
- ★ **VPN** = VICKER HARDNESS
- ★ **R.C.** = ROCKWEL HARDNESS
- ★ **O.D.** = OUTSIDE DIAMETER
- ★ **W.T.** = WALL THICKNESS
- ★ **M.M.** = MILIMETER
- ★ **A.F.** = ACROSS FLAT
- ★ **C.M.** = CENTIMETER

13) **FORMULA FOR GOOD BUSINESS**
QUICK SERVICE + HONESTY + QUALITY OF GOODS

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SPECIAL FORMULA'S

NAME	SYMBOL	NAME	SYMBOL	NAME	SYMBOL
ACTINIUM	Ac	GOLD	Au	PRASEODYMIUM	Pr
ALUMINIUM	Al	HAFNIUM	Hf	PROMETHIUM	Pm
AMIRICIUM	Am	HELIUM	He	PROTACTINUM	Pa
ANTIMONY	Sb	HOLMIUM	Ho	RADIUM	Ra
ARGON	Ar	HYDROGEN	H	RADON	Rn
ARSENTIC	As	INDIUM	In	RHENIUM	Re
ASTATINE	At	IODINE	I	RHODIUM	Rh
BARIUM	Ba	IRIDIUM	Ir	RUBIDIUM	Rb
BERKELIUM	Bk	IRON	Fe	RUTHENIUM	Ru
BERYLLIUM	Be	KRYPTON	Kr	SAMARIUM	Sm
BISMUTH	Bi	LANTHANUM	La	SCANDOUM	Sc
BORON	B	LEAD	Pb	SELENIUM	Se
BROMINE	Br	LITHIUM	Li	SILICON	Si
CADMIUM	Cd	LUTETIUM	Lu	SILVER	Ag
CAESIUM	Cs	MAGNESIUM	Mg	SODIUM	Na
CALCIUM	Ca	MANGANESE	Mn	STRONTIUM	Sr
CALIFORNIUM	Cf	MENDELEVIUM	Md	SULPHUR	S
CARBON	C	MERCURY	Hg	TANTALUM	Ta
CERIUM	Ce	MOLYBEDINUM	Mo	TECHNETIUM	Tc
CHLORINE	C1	NEODYMIUM	Nd	TELLURIUM	Te
CHROMIUM	Cr	NEON	Ne	TERBIUM	Tb
COBALT	Co/Cb	NEPTUNIUM	Np	THALLIUM	Tl
COPPER	Cu	NICKEL	Ni	THORIUM	Th
CURIM	Cm	NIOBIUM	Nb	THULIUM	Tm
DYGOROSIUM	Dy	NITROGEN	N	TIN	Sn
EINSAEINUM	Es	NOBELIUM	No	TITANIUM	Ti
ERIBIUM	Er	OSRNIUM	Os	TUNGSTEN	W
EUROPIUM	Eu	OXYGEN	O	URANIUM	U
FERMIUM	Fm	PALLADIUM	Pd	VANADIUM	V
FLUORINE	F	PHOSPHORUS	P	XENON	Xe
FRANCIUM	Fr	PLATINUM	PT	YTTERBIUM	Yb
GADOLINIUM	Gd	PLUTONIUM	Pu	YTTRIUM	Y
GALHREN	Ga	POLONIUM	Po	ZINK	Zn
GARMANIUM	Ge	POTASSIUM	K	ZIRCONIUM	Zr

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WEIGHT OF COPPER TUBINGS

S. W. G. NO.		10	12	14	16	18	19	20	21	22	24
Millimeters		3.251	2.642	2.032	1.626	1.219	1.016	0.914	0.813	0.711	0.559
Outer Diameter		KGS	KGS	KGS	KGS	KGS	KGS	KGS	KGS	KGS	KGS
Inch	mm.	P. Feet	P.Feet	P.Feet	P.Feet	P.Feet	P.Feet	P.Feet	P.Feet	P.Feet	P.Feet
1/8	3.175	-	-	-	-	0.022	0.018	0.016	0.014	0.014	0.013
3/16	4.762	-	-	-	0.043	0.035	0.032	0.030	0.025	0.024	0.021
1/4	6.350	-	-	-	0.066	0.051	0.045	0.040	0.037	0.035	0.028
5/16	7.938	-			0.088	0.067	0.059	0.055	0.046	0.043	0.036
3/8	9.525	-	0.154	0.132	0.110	0.086	0.073	0.067	0.058	0.054	0.043
7/16	11.112	-	0.190	0.159	0.131	0.099	0.086	0.079	0.069	0.063	0.051
1/2	12.700	0.263	0.227	0.186	0.154	0.118	0.099	0.092	0.079	0.073	0.058
9/16	14.288	0.308	0.263	0.213	0.177	0.131	0.133	0.104	0.091	0.082	0.066
5/8	15.875	0.254	0.299	0.240	0.199	0.148	0.127	0.118	0.099	0.097	0.073
11/16	17.462	0.399	0.335	0.268	0.222	0.168	0.140	0.131	0.113	0.101	0.081
3/4	19.050	0.440	0.367	0.294	0.240	0.181	0.154	0.140	0.122	0.108	0.088
13/16	20.638	0.485	0.403	0.322	0.263	0.199	0.167	0.154	0.136	0.118	0.096
7/8	22.225	0.531	0.440	0.348	0.286	0.218	0.181	0.168	0.145	0.132	0.104
15/16	23.812	0.572	0.476	0.376	0.308	0.231	0.195	0.177	0.158	0.141	0.113
1	25.400	0.617	0.512	0.403	0.331	0.249	0.208	0.190	0.168	0.150	0.118
1.1/8	28.575	0.703	0.585	0.462	0.372	0.281	0.236	0.217	0.190	0.168	0.136
11/4	31.750	0.794	0.653	0.518	0.417	0.313	0.263	0.240	0.213	0.286	0.150
1.3/8	34.925	0.879	0.725	0.571	0.462	0.349	0.290	0.263	0.231	0.208	0.163
1.1/2	38.100	0.966	0.798	0.626	0.503	0.381	0.317	0.290	0.254	0.227	0.181
1.5/8	41.275	1.057	0.866	0.680	0.549	0.413	0.349	0.313	0.277	0.245	0.195
1.3/4	44.450	1.143	0.939	0.734	0.594	0.444	0.376	0.340	0.299	0.263	0.208
1.7/8	47.625	1.229	1.011	0.789	0.635	0.481	0.403	0.363	0.322	0.381	0.222
2	50.800	1.320	1.084	0.843	0.680	0.512	0.431	0.390	0.345	0.304	0.240
2.1/8	53.975	1.406	1.152	0.898	0.725	0.544	0.458	0.412	0.367	0.322	0.258
2.1/4	57.150	1.492	1.224	0.952	0.766	0.576	0.485	0.439	0.385	0.340	0.275
2.3/8	60.325	1.583	1.298	1.011	0.811	0.612	0.512	0.462	0.431	-	-
2.1/2	63.500	1.644	1.369	1.066	0.857	0.644	0.540	0.485	0.431	-	-
2.5/8	66.675	1.759	1.438	1.120	0.888	0.676	0.567	-	-	-	-
2.3/4	69.850	1.846	1.510	1.175	0.943	0.707	0.594	-	-	-	-
2.7/8	73.025	1.927	1.583	1.228	0.989	-	-	-	-	-	-
3	76.200	2.023	1.650	1.283	1.029	-	-	-	-	-	-

FORMULA FOR COPPER PIPE WEIGHT = O.D. (MM) - THICK (MM) x THICK (MM) x 0.0086 = WEIGHT PER FEET

WEIGHT FOR BRASS TUBES WILL BE APPROXIMATE 2% LESS THAN COPPER TUBE WEIGHT

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SPECIFICATION FOR COPPER TUBES (CHEMICALS)

MATERIAL DESCTIPTION	SPECIFICATION ISS	SPECIFICATION BSS %	COPPER %	ARSENIC PHOROUS	PHOSPH-OROUS%	LEAD %	IRON %	NICKEL ELEMENT	OTHER ELEMENT
PHOSPHOROUS DEOXIDISED NON ARSENICAL COPPER	2501 DHPI DHPII	2671 C 106	99.85 MIN	--	0.13 TO 0.05	0.01	0.03	--	0.06
PHOSPHOROUS OXIDISED NON ARSENICAL COPPER	2501 DHP I DHP II	2871 C 106	99.85 MIN	0.3 TO --	0.013 TO 0.05	0.01	0.03	--	0.06
HIGH CONDUCTIVITY COPPER TUBES	2501 ETP	1977 (2871-C-101)	99.9 MIN	--	--	0.005	--	--	0.03
CUPRO NICKEL TUBES	1545 CUNI10PA	BS2871 PART2 CN-102	REMAIND	MANGANESE 0.5-1.1	--	0.01	0.2	0.11	0.3
CUPRO NICKEL TUBES	CUNI30	CN-107	REMAIND	0.5-1..5	--	0.01	0.4/1	30/32	0.3

SPECIFICATION FOR COPPER TUBES (PHYSICAL)

MATERIAL DESCTIPTION	SPECIFICATION ISS	SPECIFICATION BSS	TENSILE STRENGTH ST KG/MM²		ELONGATION 4 $\sqrt{A}$	ELECTRICAL CONDUCTIVITY AT 20° C	HARDNESS
PHOSPHOROUS DEOXIDISED NON ARSENICAL COPPER	2501 DHPI DHPII	2871 C106	ANNEALED DRAWN	22 28	ANNEALED 40% DRAWN - H. H.		60 MAX. 105 MIN.
PHOSPHOROUS DEOXIDISED ARSENICAL COPPER	2501 DPA	2871 C 107	ANNEALED DRAWN	22 28	ANNEALED 40% DRAWN		
HIGH CONDUCTIVITY COPPER TUBES	2501 ETP	1977 (2811; C 101)	ANNEALED DRAWN	20.5 TO 25.2 TO 26.8 MIN.	ANNEALED 40% DRAWN	99.25IACS	
CUPRO NICKEL TUBES	1545 CUNI10FE	BS 2871 PART 2 CN - 102	ANNEALED DRAWN	30.5-38.5 44 MIN.	30 --		80-110 HV 150 MIN.
CUPRO NICKEL TUBES	CUNI 30	CN - 107	ANNEALED DRAWN	37-46 51 MIN.	30 --		90-120 HV 150 MIN.

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SPECIFICATION FOR BRASS TUBES (CHEMICALS)

MATERIAL DESCRIPTION	SPECIFICATION ISS	SPECIFICATION BSS %	COPPER %	LEAD %	ARSENIC % %	TIN %	ALUM-NIUM %	NICKEL %	ZINC %	OTHER ELE-MENTS
Tubes For General Purpose - Alloy	407		68.5-71.5	0.07	0.02 to 0.06			0.05	Remdr	0.30
Tubes For General Purpose - Alloy II	407		59 to 63	0.80	0.06			0.07	Remdr	0.30
Aluminium Brass	1545 CuZn21 AL2As	2874 CZ110	76 to 78	0.07	0.02 to 0.06		(1.8-2.3)	0.06	Remdr	0.30
Admirallty Brass	1545 CuZn29 Sn 1As	2874 CZ111	70 to 73	0.07	0.02 to 0.06	1.0 to 1.5		0.06	Remdr	0.03
Arsenical Brass Special 70 / 30	1545 Cu Zn 30 As	2871 CZ126	70 to 73	0.07 Max	0.02 to 0.06			0.06 Max	Remdr	0.30

SPECIFICATION FOR BRASS TUBES (PHISICAL)

MATERIAL DESCRIPTION	SPECIFICATION ISS	SPECIFICATION BSS	Tensile Strength KGS/mm²	Elongation	Hardness
Tubes For General Purpose - Alloy I	407		Anne. 29 to 38 1/2 Hard; 38 Min Hard; 46 Min		75 HV Max 80-110 HV 135 HV Min
Tubes For General Purpose - Alloy II	407		Anne. 29 to 38 1/2 Hard; 38 Min Hard; 46 Min		80 HV Max 80-110 HV 130 HV Min
Aluminium Brass	1545 CuZn21	2874 CZ110	Anne 31.5 to 40.9 Drawn; 58.3 to 70.9	H.H. Anne 60 to 70% Drawn; 8 to 14%	85-110 HV 75 Max 150 Min
Admirallty Brass	1545 CuZn29 Sn 1 As	2874 CZ111	Anne 28.3 to 37.8 Drawn; 50.4 to 61.4	H.H. Anne 55 to 65% Drawn; 8 to 15%	80-150 HV 75 HV Max 150 Min
Arsenical Brass Special 70 / 30	1545 CuZu 30As	2871 CuZu 126		Anne H.H. Drawn	75 Max 80-105 150 Min

ANNE = ANNEALED, H.H. = HALF HARD, H.V. = VICKERS HARDNESS, MIN = MINIMUM

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SPECIFICATION FOR COPPER RODS & SECTIONS

MATERIAL DESCRIPTION	SPECIFICATIONS		COPPER%	COMPOSITION LIMITS		OTHER IMPURITIES
	ISS	BSS		PHOSPHOROUS%	ARSENIC %	
PHOSPHOROUS DE-OXIDISED NON ARSENICAL COPPER	4171	2874 C 106	99.B5 MIN INCLUDING .015 TO .05	.015 TO .05		0.06 MAX
ARSENICAL COPPER	288		99.20		.3 TO .5	
HIGH CONDUCTIVITY ELECTROLYTIC TOUCH PITCH	613	2874 C 101	99.9 MIN INCLUDING SILVER			0.03 MAX
CADMIUM COPPER HIGH CONDUCTIVITY WEAR RESISTANCE		2874 C 108	REMAINDER		CADMIUM 0.5 TO 12%	0.1 MIN
HIGH CONDUCTIVITY TELLURIUM COPPER		2874 C 109	REMAINDER		0.3 1%	TILLURIUM 0.2 MAX
LEAD LEADED COPPER			REMAINDER		06-1%	0.2 MAX
ALUMINIUM		2874 CA 104	REMAINDER	NIEKEILION 4.6 4.6	MANGNESE 0.5 MAX	ALUMINIUM 8.5 11
BRONZE RODS		CA 103	REMAINDER	4% MAX	0.5 MAX	8.8-10
COPPER NICKEL SILICON		ASTM B411-66	REMAINDER	SILICON 16.220.1 MAX	LEAD ZINC 0.4-0.8	0.1 MAX 0.5 MAX
ALLOY RODS ALUMINIUM SILICON		ASTM B 2837	89MIN		1.5-3%	A165-8%

SPECIFICATION FOR BRASS RODS & SECTIONS

MATERIAL DESCRIPTION	INDIAN STANDARD SPECIFIC-ATION %	BRITISH STANDARD SPECIFIC-ATION %	COPPER %	LEAD %	TIN %	IRON %	MANGANESE	ALUMINIUM	OTHER ELEMENTS	ZINC %
FREE CUTTING BRASS TYPE - I	319	249	56 TO 59	2 TO 3.5	--	0.35 MAX	--	--	0.7 MAX	REMAINDER
TYPE - II	319		60 TO 63	2.5 TO 3.7	--	0.35 MAX	--	--	0.5 MAX	REMAINDER
FONTING BRASS	343B	218	56.5 TO 60	1.0 TO 2.5	--	--	--	--	0.25 MAX	REMAINDER
HIGH TENSILE BRAS RODS ALLOY - I	320		56 TO 59	0.5 MAX	0.75 TO 1.75	1.25 MAX	2.0 MAX	0.2 MAX	0.5 MAX	REMAINDER
ALLOY - II	320		56 TO 59	1.0 MAX	0.5 MAX	0.7 TO 1.2	0.5 TO 1.2	0.2 TO 1.2	0.5 MAX	REMAINDER
ALLOY - II	320		57 TO 61	0.75 TO 1.0	1.0 MAX	0.25 TO 1.0	0.25 TO 1.0	0.5 TO 2.0	0.5 MAX	REMAINDER
HIGH TENSILE BRASS TOS	---	BS:2874 CZ 114 (BS:250)	56 TO 60	0.5 TO 1.5	0.2 TO 1.0	0.25 TO 1.0	0.3 TO 2.0	1.50 MAX	--	REMAINDER
HIGH TENSILE BRASS RODS	---	BS:2874 CZ 115 (BS:250)	56 TO 60	0.5 TO 1.5	0.6 TO 1.1	0.25 TO 1.2	0.3 TO 2.0	0.2 MAX	--	REMAINDER
NAVAL BRASS GR 1	291	251	61 TO 64	0.20 MAX	1.0 TO 1.5	0.10 MAX	--	--	0.20 MAX	REMAINDER
NAVAL BRASS GR 2	291	251	59 TO 62	0.5 TO 1.0	0.5 TO 1.0	0.10 MAX	--	--	0.20 MAX	REMAINDER
RIVETING BRASS RODS (LEAD FREE)	4170	BS:2874 CZ 109	59 TO 62	0.10 MAX	--	0.10 MAX	--	--	0.3 MAX	REMAINDER

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NOMINAL CHEMICAL COMPOSITION, FOR NICKEL / MONEL, INCONEL & INCOLOY

MATERIAL DESCRIPTION	Ni	C	Mn	Fe	S	Sl	Cu	Cr	Co	Mo	Al	Ti	Others
Nickel 200	99.5+	0.08	0.18	0.2	0.005	0.18	0.13	--	--	--	--	--	--
Nickel 201	99.5+	0.01	0.18	0.2	0.005	0.18	0.13	--	--	--	--	--	--
Nickel 205	99.5+	0.08	0.18	0.10	0.004	0.08	0.08	--	--	--	--	0.03	Mg 0.05
Nickel 212	97.7	0.10	2.0	0.05	0.005	0.05	0.03	--	--	--	--	-	-
Nickel 222	99.5+	0.01	0.02	0.04	0.0025	0.01	0.01	0.06	0.06	--	0.01	0.01	Mg 0.08
Nickel 270	99.98	0.01	0.003	<0.001	<0	<0.001	<0.001	<0.001	<0.001	--	--	<0.001	Mg <0.001
MONEL alloy 400	63.0mint	0.15	1.0	2.5max	001	0.5max	31.0	--	--	--	--	-	-
MONEL alloy k-500	63.0mint	0.15	1.5max	2.0max	0.024max	0.5	30.0	--	--	--	2.9	0.6	--
INCONEL alloy 625	63.0mint	0.15max	1.0	8.0max	0.010max	0.5max	0.5max	15.5	--	--	--	-	-
INCONEL alloy 626	60.5+	0.10max	0.25	5.0max	0.015max	0.5max	--	21.5	--	9.0	0.25	0.25	Nb+Ta3.65
INCOLOY alloy 800	32.5+	0.10max	1.5max	Bal.	0.015max	1.0max	0.75max	21.0	--	--	0.38	0.38	--
INCOLOY alloy 825	42.0+	0.05max	1.0max	Bal	0.03max	0.5max	2.2max	21.5	--	3.0	0.20max	0.9	--
INCOLOY alloy 904	32.5	0.025	0.25	Bal.	0.015	0.25	0.25	--	14.5	--	0.1	1.6	--
INCOLOY alloy DS	37.0	0.1max	1.2	Bal.	--	2.3	0.5max	18.0	--	--	--	0.20	--

PHYSICAL AND MECHANICAL PROPERTIES

MATERIAL DESCRIPTION	Density Kg/dm²	Melting rangre °C	Specific heat at 20°C J/Kg°C	Thermal Conductivity at 20°C W/m°C	Thermal expansion 10-6/°C 20-95°C	Electrical resistivity at 20°C microhm cm	Tensile Strength N/mm³	Hardness HV
Nickel 200	8.89	1435-1445	456	74.9	13.3	9.5	380-550	90-120
Nickel 201	8.89	1435-1445	456	79.2	13.3	7.6	340-410	75-100
Nickel 205	8.89	1435-1445	456	74.9	13.3	9.5	340	77
Nickel 212	8.86	1435-1445	430	44.1	-	10.9	476	144
Nickel 222	8.89	1435-1445	456	74.9	13.3	8.8	340	77
Nickel 270	8.89	1455	460	85.7	13.3	7.5	340	80
MONEL alloy 400	8.83	1300-1350	419	21.7	14.1	51.0	480-620	111-151
MONEL alloy k-500	8.46	1315-1350	419	17.4	13.7	61.4	620-760	141-189
INCONEL alloy 600	8.42	1370-1425	461	14.8	13.3	103	550-690	121-173
INCONEL alloy 625	8.44	1290-1350	410	9.8	12.8	129	830-1040	146-247
INCOLOY alloy 800	7.95	1355-1385	502	11.7	14.2	99	520-700	121-188
INCOLOY alloy 825	8.14	1370-1400	441	10.9	14.0	113	590-730	121-183
INCOLOY alloy 904	8.12	--	442	14.9	4.6	72	923	--
INCOLOY alloy DS	7.92	1330-1400	452	12.0	14.1	108	680	208

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CHEMICAL & MECHANICAL PROPERTIES OF STEEL & ALLOY STEEL PIPES

	SPECIFICATION	C%	Min%	P% Max	S% Max	Si%	Cr%	Cu% MAX	Mo%	Ni% MAX	U.T.S. VA% MAX	Y.S. MPa	MPa	ELONGATION 50mm MIN TRANSVERSE
1	ASTM A53A	0.25MAX	0.95MAX	0.050	0.060	-	-	-	-	-	-	331MIN	207MIN	36
2	ASTM A53B	0.30MAX	1.20MAX	0.050	0.060	-	-	-	-	-	-	413MIN	240MIN	29.5
3	ASTM A106A	0.25MAX	0.27-0.93	0.025	0.025	0.10MIN	0.40MAX	0.40	0.15MAX	0.40	0.80	330MIN	205MIN	25/20
4	ASTM A106B	0.30MAX	0.29-1.06	0.025	0.025	0.10MIN	0.40MAX	0.40	0.15MAX	0.40	0.80	415MIN	240MIN	16.5/12.0
5	ASTM A106C	0.35MAX	0.29-1.06	0.025	0.025	0.10MIN	0.40MAX	0.40	0.15MAX	0.40	0.80	485MIN	275MIN	16.5/12.0
6	ASTM A179	0.06-0.18	0.27-0.93	0.048	0.048	-	-	-	-	-	-	325MIN	180MIN	35.0
7	ASTM A192	0.06-0.18	0.27-0.63	0.048	0.058	0.25MAX	-	-	-	-	-	325MIN	180MIN	35.0
13	ASTM A213/T2	0.10-0.20	0.30-0.61	0.045	0.045	0.10-0.30	050-081	-	0.44-0.65	-	-	415MIN	205MIN	30/22
14	ASTM A213/T-5	0.15MAX	0.30-0.60	0.030	0.030	0.50MAX	4.00-6.00	-	0.45-0.65	-	-	415MIN	205MIN	30/22
15	ASTM A213/T11	0.15MAX	0.30-0.60	0.030	0.030	0.50-1.00	1.00-1.50	-	0.44-0.65	-	-	415MIN	205MIN	30/22
16	ASTM A213/T12	0.15MAX	0.30-0.16	0.045	0.045	0.50MAX	0.80-1.25	-	0.44-0.65	-	-	415MIN	205MIN	30/22
17	ASTM A213/T-22	0.15MAX	0.30-0.60	0.030	0.030	0.50MAX	1.90-2.60	-	0.87-1.13	-	-	415MIN	205MIN	30/22
18	ASTM A333/1	0.30MAX	0.40-1.60	0.025	0.025	-	-	-	-	-	-	380MIN	205MIN	25/20
19	ASTM A333/T6	0.30MAX	0.29-1.06	0.025	0.025	0.10MIN	-	-	-	-	-	415MIN	205MIN	16.5/12.0
20	ASTM A333/T1	0.30MAX	0.40-1.60	0.025	0.025	-	-	-	-	-	-	480MIN	205MIN	35/28
21	ASTM A333/T6	0.30MAX	0.29-1.06	0.025	0.025	0.10MIN	-	-	-	-	-	415MIN	205MIN	30/22
22	ASTM A335/P-1	0.10-0.20	0.30-0.80	0.025	0.025	0.10-0.50	-	-	0.44-0.65	-	-	380MIN	205MIN	20
23	ASTM A335/P-2	0.10-0.20	0.30-0.61	0.025	0.025	0.10-0.30	0.50-0.81	-	0.44-0.65	-	-	380MIN	205MIN	20
24	ASTM A335/P5	0.15MAX	0.30-0.60	0.025	0.025	0.50MAX	4.00-6.00	-	0.45-0.65	-	-	415MIN	205MIN	20
25	ASTM A335/P11	0.15MAX	0.30-0.60	0.025	0.025	0.50-1.00	1.00-1.50	-	0.44-0.65	-	-	415MIN	205MIN	20
26	ASTM A335/P-12	0.15MAX	0.30-0.61	0.025	0.025	0.50MAX	0.80-1.25	-	0.44-0.65	-	-	415MIN	205MIN	20
27	ASTM A335/P22	0.15MAX	0.30-0.61	0.025	0.025	0.50MAX	1.90-2.60	-	0.87-1.13	-	-	415MIN	205MIN	20

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