SPECS

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010 065 387 2 / 3 / 4

Admin@AfricanHoseSolutions.co.za

INFORMATION
CORROSION RESISTANCE DATA

The following table gives the theoretical corrosin resistance of stainless steel types AISI 304, 304L, 316, 316L, 321 and 347; nickel, Monel and Inconel to the most frequently used chemical solutions. These data sheets are compiled from laboratory tests based on commercially pure chemicals under ideal conditions. The symbols A, B, C, D, and E represent approximate corrosion ranges as defined in the table shown. It must be noted that under actual operating conditions there are often present in the system other chemicals which may either inhibit or accelerate the rate of attack. This information is only intended to serve as a general guide; for more specicific details the advice of the basic metal producers should be sought.

A	Fully resistant	▶	Less than .00035" penetration per month
B	Satisfactorily resistant	▶	.00035-.0035" penetration per month
C	Fairly resistant	▶	.0035 -.010" penetration per month
D	Slightly resistant	▶	:010 -.035" penetration per month
E	Non resistant	▶	Over .035" penetration per month
-	Insufficient data to warrant rating		

Product and Condition	Temp. (°F.)	304 304 ELC 321 347	316 316L	Nickel	Monel	Inconel
Acetic Acid						
5% and 10%	70°	A	A	A	A	A
20%	70°	A	A	A	A	A
50%	70°	A	A	B	A	A
50%	Boiling	C	B	B	A	B
80%	70°	A	A	B	A	A
80%	Boiling	D	B	B	A	B
100%	70°	A	A	A	A	A
100%	Boiling	C	B	C	B	B
100%-50 lb. pressure	400°	E	C	-	-	-
Acetic Anhydride	Boiling	A	A	A	A	A
	70°	A	A	A	A	A
Acetic Vapours						
100%	Hot	E	C	C	B	B
30%	Hot	C	B	-	-	-
Acetone	Boiling	A	A	A	A	A
	70°	A	A	A	A	A
Alcohol Ethyl	70°	A	A	A	A	A
	Boiling	A	A	A	A	A
Alcohol methyl	70°	A	A	A	A	A
	150°	C	B	A	A	A
Aluminium Acetate - saturated		A	A	-	-	-
Aluminium Chloride	70°	D	C	B	B	C
Alum (Chrome) 5%	70°	A	A	C	C	A
Aluminium Fluoride	70°	D	C	A	A	B
Aluminium Hydroxide- saturated		A	A	A	A	A
Aluminium	Molten	E	E	E	E	E
Aluminium Potassium Sulphate						
2% (alum.)	70°	A	A	A	A	A
10%	70°	A	A	A	A	A
10%	Boiling	B	A	B	A	B
saturated	Boiling	C	B	C	B	B
Aluminium Sulphate						
10%	70°	A	A	A	A	A
10%	Boiling	B	A	B	A	B
saturated	70°	A	A	A	A	A
saturated	Boiling	B	A	B	A	B
Ammonia						
All concentrations	70°	A	A	-	-	A
Gas	Hot	D	-	-	-	-

Product and Condition	Temp. (°F.)	304 304 ELC 321 347	316 316L	Nickel	Monel	Inconel
Ammonia Liquor	70°	A	A	C	C	A
	Boiling	A	A	C	C	A
Ammonium Bicarbonate	70°	A	A	A	A	A
	Hot	A	A	A	A	A
Ammonium Carbonate						
1% and 5%	70°	A	A	A	A	A
Ammonium Chloride						
1%	70°	A	A	A	A	A
10% Solution	Boiling	A	A	A	A	B
28% Solution	Boiling	B	A	A	A	B
50% Solution	Boiling	B	A	A	A	B
Ammonium Nitrate						
All con. Agitated	70°	A	A	C	C	A
All con. Aerated	70°	A	A	C	C	A
Saturated	Boiling	A	A	E	E	B
Ammonium Oxalate - 5%	70°	A	A	A	A	A
Ammonium Persulphate						
-5%	70°	A	A	E	E	A
Ammonium Phosphate						
-5%	70°	A	A	A	A	A
Ammonium Solphate						
1% and 5% agitated	70°	A	A	A	A	A
1% and 5% aerated	70°	A	A	A	A	A
10%	Boiling	B	A	B	A	B
Saturated	Boiling	B	A	B	A	B
Ammonium Sulphite	Cold	A	A	C	B	B
	Boiling	A	A	E	C	C
Aniline - 3%	70°	A	A	A	A	A
Conc. Crude	70°	A	A	A	A	A
Aniline Hydrochloride	70°	E	D	B	B	C
Antimony Trichloride	70°	E	D	A	A	A
Barium Carbonate	70°	A	A	A	A	A
Barium Chloride						
5%	70°	A	A	A	A	A
Saturated	70°	A	A	A	A	A
Aqueous solution	Hot	B	A	A	A	B
Barium Nitrate - aqueous solution	Hot	A	A	C	C	B
Barium Sulphate Barytes						
- Blanc Fixe	70°	A	A	A	A	A
Benzene	70°	A	A	A	A	A

Product and Condition	Temp. (°F.)	304 304 ELC 321 347	316 316L	Nickel	Monel	Inconel
Benzoic Acid	70°	A	A	A	A	A
Benzol	Hot	A	A	A	A	A
Boracic Acid - 5%	Hot or Cold	A	A	A	A	A
Borax - 5%	Hot	A	A	A	A	A
Bromide - dry	70°	-	-	A	A	A
Bromine Water	70°	E	D	D	D	D
Butyric Acid						
5%	70°	A	A	A	A	A
5%	150°	A	A	A	A	A
Aqueous solution- sp. g. 0.964	Boiling	A	A	-	-	A
Calcium Carbonate	70°	A	A	A	A	A
Calcium Chlorate						
Dilute Solution	70°	A	A	A	A	A
Dilute Solution	Hot	A	A	A	A	B
Calcium Chloride						
Dilute Solution	70°	B	A	A	A	A
Conc. Solutions	70°	B	A	A	A	A
Calcium Hydroxide						
10%	Boiling	A	A	A	A	A
20%	Boiling	A	A	A	A	A
50%	Boiling	C	B	A	A	A
Caldium Hypochlorite - 2%	70°	B	A	C	C	B
Calcium Sulphate - saturated	70°	A	A	A	A	A
Carbolic Acid						
C.P.	Boiling	A	A	A	A	A
Crude	Boiling	A	A	A	A	A
C.P.	70°	A	A	A	A	A
Carbonated Water		A	A	A	A	A
Carbon Bisulphide	70°	A	A	A	A	A
Carbon Monoxide Gas	1600°	A	A	-	-	-
	1400°	A	A	-	-	-
Carbon Tetrachloride						
Pure	70°	A	A	A	A	A
Aqueous solution- 5-10%	70°	C	-	A	A	A
Chloracetic Acid	70°	D	C	A	A	A
Chlorbenzol Conc. - pure	70°	A	A	A	A	A
Chloric Acid	70°	E	D	D	D	D
Chlorinated Water - saturated	70°	C	B	C	C	B
Chlorine Gas - dry	70°	C	B	C	C	C
Gas- moist	70°	D	C	C	C	C
Gas	212°	E	D	A	A	A
Chloroform	70°	A	A	A	A	A
Chromic Acid						
5%	70°	A	A	A	A	A
10% C.P.	Boiling	C	B	C	B	C
50% Com. (cont. SO_3)	Boiling	D	C	-	-	-
Chromium Plating Bath	70°	A	A	C	C	A
Citric Acid						
5% still	70°	A	A	A	A	A
5% still	150°	A	A	A	A	A

Product and Condition	Temp. (°F.)	304 304 ELC 321 347	316 316L	Nickel	Monel	Inconel
Citric Acid						
15%	70°	A	A	A	A	A
15%	Boiling	B	A	B	A	A
Concentrated	Boiling	B	A	B	A	A
Copper Acetate -						
situated sol.	70°	A	A	C	C	A
Copper Carbonate sat.						
solution in 50% NH_3OH		A	A	C	C	A
Copper Chloride						
1% agitated	70°	B	A	B	B	A
1% aerated	70°	B	A	B	B	A
5% agitated	70°	C	B	C	C	C
5% aerated	70°	E	C	C	C	D
Copper Cyanide -						
saturated solution	Boiling	A	A	B	B	B
Copper Nitrate						
1% and 5%	70°	A	A	C	C	A
50% aqueous solution	Hot	A	A	E	E	C
Copper sulphate						
5%	70°	A	A	B	B	A
saturated solution	Boiling	A	A	C	C	C
Creosotate (Coal Tar)	Hot	A	A	A	A	A
Creosote Oil	Hot	A	A	A	A	A
Cyanogen Gas	70°	A	A	A	A	A
Dinitrochlorbenzol -						
melted and solidified	70°	A	A	-	-	-
Ether	70°	A	A	A	A	A
Ethyl Chloride	70°	A	A	A	A	A
Ethylene Chloride	70°	A	A	A	A	A
Ferric Chloride						
1% solution, still	70°	B	A	B	C	C
1% solution, still	Boiling	D	C	E	E	E
5% solution, still	70°	D	C	D	D	C
5% agitated	70°	C	C	D	D	C
5% aerated	70°	C	C	D	D	C
Ferric Hydroxide						
(Hydrated Iron Oxide)	70°	A	A	A	A	A
Ferric Nitrate -						
1% and 5%	70°	A	A	D	D	A
Ferric Sulphate -						
1% and 5%	70°	A	A	C	C	A
Ferrous Sulphate - dilute						
sol.	70°	A	A	A	A	A
Flourine	70°	E	E	A	A	A
Formalin - 40% sol.						
Formaldehyde		A	A	A	A	A
Formic Acid						
5%, still	70°	B	A	A	A	A
5%, still	150°	B	A	A	A	A
Fuel Oil	Hot	A	A	B	B	A
Containing sulphuric acid		C	B	B	B	B

Product and Condition	Temp. (°F.)	304 304 ELC 321 347	316 316L	Nickel	Monel	Inconel
Galic Acid						
5% Solution	70°	A	A	A	A	A
5% Solution	150°	A	A	A	A	A
Glue- dry	70°	A	A	A	A	A
Solution- Acid	70°	B	A	A	A	A
Solution- Acid	140°	B	A	A	A	A
Glycerine	70°	A	A	A	A	A
Hydrochloric Acid						
All concentrations	70°	E	E	B	B	C
Hydrocyanic Acid		A	A	A	A	A
Hydrofluosilicic Acid	70°	E	D	A	A	B
Hydrogen Peroxide	70°	A	A	A	A	A
	Boiling	B	A	-	-	-
Hydrogen Sulphide						
Dry		A	A	A	A	A
Wet		B	A	A	A	A
Hyphosulphite Soda						
(Hypo)		A	A	B	A	A
Iodine		E	D	D	D	D
Iodoform		A	A	-	-	-
Lactic Acid						
5%	70°	A	A	A	A	A
5%	150°	B	A	A	A	A
10%	Boiling	D	B	C	C	D
10%	150°	C	B	B	B	B
Lead	Molten	B	B	D	D	B
Linseed Oil	70°	A	A	A	A	A
Magnesium Chloride						
1% and 5%, still	70°	A	A	A	A	A
1% and 5ş, still	Hot	C	B	A	A	A
Magnesium Sulphate	Hot or Cold	A	A	A	A	A
Malic Acid	Hot or Cold	B	A	A	A	A
Mayonnaise	70°	A	A	B	B	A
Mercuric Chloride Dilute Solutions		E	D	D	D	D
Mercury		A	A	A	A	A
Methanol (Methyl Alcohol)	70°	A	A	A	A	A
Mixed Acids						
53%, H_2SO_4	Cold	A	A	D	D	A
45% HNO_3	Cold	A	A	D	D	A
Molasses		A	A	A	A	A
Muriatic Acid	70°	E	E	B	B	C
Mustard	70°	A	A	A	B	B
Naphtha	70°	A	A	A	A	A
Naphtha- crude	70°	A	A	A	A	A
Nickle Chloride- solution	70°	A	A	B	B	B
Nickel Sulphate	Hot or Cold	A	A	A	A	A

Product and Condition	Temp. (°F.)	304 304 ELC 321 347	316 316L	Nickel	Monel	Inconel
Niter Cake	Fused	B	A	-	-	-
Nitric Acid						
5% solution	70°	A	A	E	E	B
20% solution	70°	A	A	E	E	A
50% solution	70°	A	A	E	E	A
50% solution	Boiling	A	A	E	E	C
65% solution	Boiling	B	B	E	E	D
Concentrated	70°	A	A	E	E	A
Concentrated	Boiling	D	D	E	E	D
Nitrous Acid						
5% solution	70°	A	A	D	D	A
Oils- crude	Hot or Cold	A	A	A	A	A
Oils- vegetable, mineral	Hot or Cold	A	A	A	A	A
Oleic Acid						
Oxalic Acid						
5%	Hot or Cold	A	A	A	A	A
10%	70°	A	A	A	A	A
10%	Boiling	D	C	B	A	B
Paraffin	Hot or Cold	A	A	A	A	A
Petroleum Ether		A	A	A	A	A
Phenol		A	A	A	A	A
Phosphoric Acid						
1%	70°	A	A	A	A	A
5%	70°	A	A	A	A	A
10%, still	70°	C	A	B	A	A
10% agitated	70°	C	B	B	B	B
10% aerated	70°	C	B	C	C	B
Picric Acid	70°	A	A	-	-	-
Potassium Bichromate	70°	A	A	A	A	A
Potassium Bromide	70°	B	A	A	A	A
Potassium Carbonate						
1%	70°	A	A	A	A	A
1%	Hot	A	A	A	A	A
Potassium Chlorate		A	A	A	A	A
Potassium Chloride						
1% and 5%	70°	A	A	A	A	A
1% and 5%	Boiling	A	A	A	A	A
Potassium Ferricyanide -5%	70°	A	A	-	-	-
Potassium Ferrocyanide -5%	70°	A	A	-	-	-
Potassium Hydroxide						
5%	70°	A	A	A	A	A
27%	Boiling	A	A	A	A	A
50%	Boiling	B	A	A	A	A
Potassium Nitrate						
1% and 5%	70°	A	A	A	A	A
1% and 5%	Hot	A	A	A	A	A
Potassium Oxalate		A	A	A	A	A
Potassium Permanganate -5%	70°	A	A	A	A	A
Potassium Sulphate						
1% and 5%	70°	A	A	A	A	A
1% and 5%	Hot	A	A	A	A	A

Product and Condition	Temp. (°F.)	304 304 ELC 321 347	316 316L	Nickel	Monel	Inconel
Potassium Sulphide (salt)		A	A	A	A	A
Pyrogallic Acid		A	A	A	A	A
Quinine Bisulphate- dry		B	A	A	A	A
Quinine Sulphate- dry		A	A	A	A	A
Rosin	Molten	A	A	A	A	A
Sea Water		A	A	A	A	A
Sewage		A	A	A	A	A
Silver Bromide		B	A	-	-	-
Silver Chloride		E	E	-	-	-
Silver Nitrate		E	E	-	-	-
Soap	70°	A	A	A	A	A
Sodium Acetate- moist		A	A	A	A	A
Sodium Bicarbonate All concentrations **5%,still**	 70° 150°	 A A	 A A	 A A	 A A	 A A
Sodium Carbonate **5%** **5%**	 70° 150°	 A A	 A A	 A A	 A A	 A A
Sodium Chloride **5% still** **5% still** **20% aerated** Saturated Saturated	 70° 150° 70° 70° Boiling	 A A A A B	 A A A A A	 A A A A A	 A A A A A	 A A A A A
Sodium Flouride- 5% solution		B	A	A	A	A
Sodium Hydroxide		A	A	A	A	A
Sodium Hypochlorite- 5% still		B	A	C	C	C
Sodium Hyposulphite	70%	A	A	A	A	A
Sodium Nitrate	Fused	C	B	A	B	A
Sodium Sulphate- 5%, still	70°	A	A	A	A	A
Sodium Sulphate- All concentrations	70°	A	A	A	A	A
Sodium Sulphide- Saturated		B	A	A	A	A
Sodium Sulphite 5% 10%	 70° 150°	 A A	 A A	 A A	 A A	 A A
Stannic Chloride- SP. G. 1.21	Boiling	E	E	B	B	C
Stannic Chloride- solution	70°	D	C	A	B	B
Stannous Chloride- Saturated		C	A	A	B	B
Stearic Acid		A	A	A	A	A
Sulphur Chloride		E	D	A	A	A
Sulphur Dioxide Gas- Moist	70° 575°	B A	A A	D -	C -	C -

Product and Condition	Temp. (°F.)	304 304 ELC 321 347	316 316L	Nickel	Monel	Inconel
Sulphur Dry Wet	 Molten	 A B	 A A	 A B	 A B	 A A
Sulphuric Acid 5% 5% 10% 10% 50% 50% **Concentrated** Concentrated **Concentrated** Fuming	 70° Boiling 70° Boiling 70° Boiling 70° Boiling 300° 70°	 C E C E D E A D E C	 B C B D C D A D E B	 A D B C B E B E E C	 A A A A A E B E E B	 A C B C B E B E E B
Sulphurous Acid **Saturated** Saturated 60 lb. **pressure** Saturated 70-125 lb. **pressure** 150 lb. pressure **Sulphurous spray**	 70° 250° 310° 375° 70°	 C C C C D	 B B B B D	 E E E E E	 E E E E E	 E E E E E
Tannic Acid	70° 150°	A A	A A	A A	A A	A A
Tartaric Acid	70° 150°	A B	A A	A A	A A	A A
Tin	Molten	C	C	E	E	E
Trichloracetic Acid	70°	E	E	B	B	B
Varnish	70°	A	A	A	A	A
	Hot	A	A	A	A	A
Vinegar Fumes		B	A	B	A	A
Vinegar Still Agitated Aerated	 70° 70°	 A A A	 A A A	 A A B	 A A A	 A A A
Zinc	Molten	E	E	E	E	E
Zinc Chloride 5%, still 5%, still	 70° Boiling	 A B	 A B	 A B	 A B	 A B
Zinc Sulphate 5% Saturated 25%	 70° 70° Boiling	 A A A	 A A A	 A A A	 A A A	 A A A

African Hose Solutions

kPa	PSI	Metres Head
1,00	0,15	0,10
2,00	0,29	0,20
3,00	0,44	0,31
4,00	0,58	0,41
5,00	0,73	0,51
6,00	0,87	0,61
6,89	1,00	0,70
7,00	1,02	0,71
8,00	1,16	0,82
9,00	1,31	0,92
10,00	1,45	1,02
13,79	2,00	1,41
20,00	2,90	2,04
20,68	3,00	2,11
27,58	4,00	2,81
30,00	4,35	3,06
34,47	5,00	3,52
40,00	5,80	4,08
41,37	6,00	4,22
48,26	7,00	4,92
50,00	7,25	5,10
55,16	8,00	5,62
60,00	8,70	6,12
62,05	9,00	6,33
68,95	10,00	7,03
70,00	10,15	7,14
80,00	11,60	8,16
90,00	13,05	9,18
100,00	14,50	10,20
103,42	15,00	10,55
110,00	15,95	11,22
120,00	17,40	12,24
130,00	18,85	13,26
137,90	20,00	14,06
140,00	20,31	14,28
150,00	21,76	15,30
160,00	23,21	16,32
172,37	25,00	17,58
180,00	26,11	18,35
190,00	27,56	19,37
200,00	29,01	20,39
206,84	30,00	21,09
210,00	30,46	21,41
220,00	31,91	22,43
230,00	33,36	23,45
240,00	34,81	24,47
241,32	35,00	24,61
250,00	36,26	25,49
260,00	37,71	26,51
270,00	39,16	27,53
275,79	40,00	28,12
280,00	40,61	28,55
290,00	42,06	29,57
300,00	43,51	30,59
310,00	44,96	31,61
310,26	45,00	31,64
320,00	46,41	32,63
330,00	47,86	33,65
340,00	49,31	34,67
344,74	50,00	35,15
350,00	50,76	35,69
360,00	52,21	36,71
370,00	53,66	37,73
379,21	55,00	38,67

kPa	PSI	Metres Head
380,00	55,11	38,75
390,00	56,56	39,77
400,00	58,02	40,79
410,00	59,47	41,81
413,69	60,00	42,18
420,00	60,92	42,83
430,00	62,37	43,85
440,00	63,82	44,87
448,16	65,00	45,70
450,00	65,27	45,89
460,00	66,72	46,91
470,00	68,17	47,93
480,00	69,62	48,95
482,63	70,00	49,21
490,00	71,07	49,97
500,00	72,52	50,99
510,00	73,97	52,01
517,11	75,00	52,73
520,00	75,42	53,03
530,00	76,87	54,04
540,00	78,32	55,06
550,00	79,77	56,08
551,58	80,00	56,25
560,00	81,22	57,10
570,00	82,67	58,12
580,00	84,12	59,14
586,05	85,00	59,76
590,00	85,57	60,16
600,00	87,02	61,18
610,00	88,47	62,20
620,00	89,92	63,22
620,53	90,00	63,28
630,00	91,37	64,24
640,00	92,82	65,26
650,00	94,27	66,28
655,00	95,00	66,79
660,00	95,72	67,30
670,00	97,18	68,32
680,00	98,63	69,34
689,48	100,00	70,31
690,00	100,08	70,36
700,00	101,53	71,38
710,00	102,98	72,40
720,00	104,43	73,42
723,95	105,00	73,82
730,00	105,88	74,44
740,00	107,33	75,46
750,00	108,78	76,48
758,42	110,00	77,34
760,00	110,23	77,50
770,00	111,68	78,52
780,00	113,13	79,54
790,00	114,58	80,56
792,90	115,00	80,85
800,00	116,03	81,58
810,00	117,48	82,60
820,00	118,93	83,62
827,37	120,00	84,37
830,00	120,38	84,64
840,00	121,83	85,66
850,00	123,28	86,68
860,00	124,73	87,70
861,84	125,00	87,88
870,00	126,18	88,72

kPa	PSI	Metres Head
880,00	127,63	89,73
890,00	129,08	90,75
896,32	130,00	91,40
900,00	130,53	91,77
910,00	131,98	92,79
920,00	133,43	93,81
930,00	134,89	94,83
930,79	135,00	94,91
940,00	136,34	95,85
950,00	137,79	96,87
960,00	139,24	97,89
965,27	140,00	98,43
970,00	140,69	98,91
980,00	142,14	99,93
990,00	143,59	100,95
999,74	145,00	101,95
1 000,00	145,04	101,97
1 034,21	150,00	105,46
1 378,95	200,00	140,61
1 500,00	217,56	152,96
1 723,69	250,00	175,77
2 000,00	290,08	203,94
2 068,43	300,00	210,92
2 413,16	350,00	246,07
2 500,00	362,59	254,93
2 757,90	400,00	281,23
3 000,00	435,11	305,91
3 102,64	450,00	316,38
3 447,38	500,00	351,53
3 500,00	507,63	356,90
3 792,12	550,00	386,69
4 000,00	580,15	407,89
4 136,85	600,00	421,84
4 481,59	650,00	457,00
4 500,00	652,67	458,87
4 826,33	700,00	492,15
5 000,00	725,19	509,86
5 171,07	750,00	527,30
5 500,00	797,71	560,84
5 515,81	800,00	562,46
5 860,54	850,00	597,61
6 000,00	870,23	611,83
6 205,28	900,00	632,76
6 500,00	942,75	662,82
6 550,00	950,00	667,91
6 894,76	1000,00	703,07
7 000,00	1015,26	713,80
7 239,49	1050,00	738,22
7 500,00	1087,78	764,79
7 584,23	1100,00	773,38
7 928,97	1150,00	808,53
8 000,00	1160,30	815,77
8 273,71	1200,00	843,68
8 500,00	1232,82	866,76
8 618,45	1250,00	878,84
8 963,18	1300,00	913,99
9 000,00	1305,34	917,74
9 307,92	1350,00	949,14
9 500,00	1377,86	968,73
9 652,66	1400,00	984,30
9 997,40	1450,00	1 019,45
1 0000,00	1450,38	1 019,72

INFORMATION

TABULATION SHEET - USEFUL CONVERSION FACTORS AND FORMULAE

To convert from	to	multiply by
Atmospheres	pounds per sq. inch	14,70
Centimeters Cubic centimetres	inches cubic inches	0,3937 0,06103
Cubic feet Cubic feet	cubic metres gallons	0,02832 6,228
Cubic inches Cubic inches	cubic centimetres litres	16,3871 0,01639
Cubic metres Cubic metres	cubic feet cubic yards	35,32 1,308
Cubic yards	cubic metres	0,7645
Feet	metres	0,3048
Gallons Gallons	litres cubic feet	4,546 0,1605
Grams	pounds	0,00220
Inches Inches	centimetres millimetres	2,540 25,40
Kilograms Kilograms	pounds tons	2,205 0,00098
Kilometres	miles	0,6214
Kilograms per metre	pounds per foot	0,672
Kilograms per sq. mm Kilograms per sq. mm	tons per sq. in. pounds per sq. in.	0,635 1422,34
Kilograms per sq.cm.	pounds per sq. in.	14,223
Kilograms per sq. mm	newtons per sq. mm.	9,8115
Litres Litres	cubic inches gallons	61,03 0,2205
Litres of water at 62^{o}F	pounds	2,205
Metres Metres	feet yards	3,281 1,094
Miles Milimetres	kilometres inches	1,609 0,0394
Newtons per sq.mm. Newtons per sq.mm.	Kilograms per sq. mm. pounds per sq. inch	0,1019 145,0677
Pounds Pounds	grams kilograms	453,60 0,4536
Pounds per foot	kilograms per metre	1,488
Pounds per sq. in Pounds per sq. in	Kpa atmospheres	6,895 0,06803
Pounds per sq. in Pounds per sq. in Pounds per sq. in	kilograms per sq. cm. kilograms per sq. mm. newtons per sq. mm.	0,07031 0,0007031 0,0069
Square centimetres	square inches	0,1550
Square feet	square metres	0,09296
Square inches	square centimetres	6,452
Square kilometres	square miles	0,3861
Square metres Square metres	square feet square yards	10,76 1,196
Square miles Square yards	square kilometres square metres	2,590 0,8367
Temperature conversion:	F^{o} to C^{o} = 5/9 (F^{o}-32) C^{o} to F^{o} = X 9/5 + 32	
Tons per sq. in.	kilograms per sq. mm.	1,575
Tons Yards	kilograms metres	1016,0 0,9144

USEFUL DATA - IMPERIAL WIRE AND SHEET METAL GAUGE

No.	Imperial Standard (swg)		Birmingham Wire (bwg)		No.	Imperial Standard (swg)		Birmingham Wire (bwg)	
	ins.	mm	ins.	mm		ins.	mm	ins.	mm
7/0	0.500	12.70			18	0.048	1.220	0.049	1.240
6/0	0.464	11.78			19	0.040	1.020	0.042	1.070
5/0	0.432	10.97			20	0.036	0.914	0.035	0.888
4/0	0.400	10.16	0.454	11.53	21	0.032	0.813	0.032	0.813
3/0	0.372	9.45	0.425	10.79	22	0.028	0.711	0.028	0.711
2/0	0.348	8.84	0.380	9.65	23	0.024	0.610	0.025	0.635
0	0.324	8.23	0.340	8.63	24	0.0220	0.559	0.022	0.559
1	0.300	7.62	0.300	7.62	25	0.0200	0.508	0.020	0.508
2	0.276	7.01	0.284	7.21	26	0.0180	0.457	0.018	0.457
3	0.252	6.40	0.259	6.58	27	0.0164	0.417	0.016	0.417
4	0.232	5.89	0.238	6.05	28	0.0148	0.376	0.014	0.376
5	0.212	5.38	0.220	5.59	29	0.0136	0.345	0.013	0.345
6	0.192	4.88	0.203	5.16	30	0.0124	0.315	0.012	0.305
7	0.176	4.47	0.180	4.57	31	0.0116	0.295	0.010	0.254
8	0.160	4.06	0.165	4.19	32	0.0108	0.274	0.009	0.228
9	0.144	3.65	0.148	3.76	33	0.0100	0.254	0.008	0.203
10	0.128	3.25	0.134	3.40	34	0.0092	0.234	0.007	0.178
11	0.116	2.95	0.120	3.04	35	0.0084	0.213	0.005	0.127
12	0.104	2.64	0.109	2.77	36	0.0076	0.193	0.004	0.102
13	0.092	2.34	0.095	2.41	37	0.0068	0.173		
14	0.080	2.03	0.083	2.11	38	0.0060	0.152		
15	0.072	1.83	0.072	1.83	39	0.0052	0.132		
16	0.064	1.63	0.065	1.63	40	0.0048	0.122		
17	0.056	1.42	0.058	1.42					

STEEL PIPE COMPARISONS (ANSI, JIS, BS AND DIN)

Nominal Pipe Size	Outside Diameter (Inches)				Outside Diameter (Metric)			
	ANSI	JIS	BS	DIN	ANSI	JIS	BS	DIN
1/2	0.840	0.854	-	0.838	21.34	21.7	-	21.3
3/4	1.050	1.071	-	1.059	26.67	27.2	-	26.9
1	1.315	1.339	1.344	1.326	33.40	34.0	34.1	33.7
1 1/4	1.660	1.681	1.688	1.669	42.16	42.7	42.8	42.4
1 1/2	1.900	1.913	1.906	1.902	48.26	48.6	48.4	48.3
2	2.375	2.382	2.375	2.374	60.32	60.5	60.3	60.3
2 1/2	2.875	3.004	3.000	2.996	73.02	76.3	76.2	76.1
3	3.500	3.508	3.500	3.500	88.90	89.1	88.9	88.9
3 1/2	4.000	4.000	4.000	4.000	101.60	101.6	101.6	101.6
4	4.500	4.500	4.500	4.500	114.30	114.3	114.3	114.3
5	5.563	5.504	5.500	5.500	141.30	139.8	139.7	139.7
6	6.625	6.504	6.625	6.625	168.27	165.2	168.3	168.3
8	8.625	8.516	8.625	8.625	219.07	216.3	219.07	219.1
10	10.75	10.528	10.7500	10.750	273.05	267.4	273.05	273.0
12	12.75	12.539	12.7500	12.750	323.85	318.5	323.85	323.9
14	14.000	14.000	14.000	14.000	355.60	355.6	355.6	355.6
16	16.000	16.000	16.000	16.000	406.40	406.4	406.4	406.4
18	18.000	18.000	-	18.000	457.20	457.2	-	457.2
20	20.000	20.000	-	20.000	508.00	508.0	-	508.0
22	22.000	22.000	-	-	558.80	558.8	-	-
24	24.000	24.000	-	-	609.60	609.6	-	-

AREAS AND VOLUMES

Area	
Circle	$p r^2$
Rhomboid	base x height
Triangle	1/2 base x height
Parabola	2/5 base x height
Ellipse	0,7854 x short axis x long axis
Cube	Sum of areas of sides
Sphere	$4 p r^2$
Cylinder	$2 p r^2 \pm 2 p rh = 2 p r (r \pm h)$
Volume	
Sphere	$4/3 p r3$
Cylinder	$p r^2 h$
Cube	side3

VALUES OF SINGLE DEGREES

°C	°F	°F	°C
1 = 1.8		1 = 0.56	
2 = 3.6		2 = 1.11	
3 = 5.4		3 = 1.67	
4 = 7.2		4 = 2.22	
5 = 9.0		5 = 2.78	
6 = 10.8		6 = 3.33	
7 = 12.6		7 = 3.89	
8 = 14.4		8 = 4.44	
9 = 16.2		9 = 5.00	
°C = 5/9 (°F- 32°)		°F = (9/5°C) + 32°	

FRACTIONS TO DECIMALS AND MILLIMETRES

Fractions	1/32	1/16	3/32	1/8	5/32	3/16	7/32	1/4	9/32	5/16	11/32	3/8	13/32	7/16	15/32	1/2
Decimals	0.03125	0.0625	0.09375	0.125	0.15625	0.1875	0.21875	0.250	0.28125	0.3125	0.34375	0.375	0.40625	4375	46875	0.500
Millimetres	0.7937	1.5875	2.3812	3.1750	3.9687	4.7025	5.5562	6.3500	7.1437	7.9375	8.7312	9.5250	10.3187	11.1125	11.9062	12.7000
Fractions	17/32	9/16	19/32	5/8	21/32	11/16	23/32	3/4	25/32	13/16	27/32	7/8	29/32	15/16	31/32	1
Decimals	0.53125	0.5625	0.53975	0.625	0.65625	0.6875	0.71875	0.750	0.78125	0.8125	0.84375	0.875	0.90625	0.9375	96875	1.000
Millimetres	13.4937	14.2875	15.0812	15.8750	16.6687	17.4625	18.2562	19.0500	19.8437	20.6375	21.4312	22.2250	23.0187	23.8125	24.6062	25.4000

African Hose Solutions

INFORMATION

MATERIAL ANALYSIS AND COMPARISON

Standard	Tensile Strength		Yield Point		Elongation Min.%		C %		Si %		Mn %		P=max, %	S=max %	Mo %	Cr %	Ni %	Size and Tolerance Standard	Technical Spec.	Comparable Standards		
																				A.S.A.	D.I.N.	B.S
German																						
St. 00,29	ca,	35-45	ca,	24	ca,	25	-	-	-	-	-	-	-	-	-	-	-	DIN 2448	DIN 1692/2	-	-	-
St. 35,29	-	35-45	-	24	-	25	≤	0,18	-	-	-	-	0,05	0,05	-	-	-	DIN 2448	DIN 1629/ 3	A 53 A	-	3601 HFS 22
St. 45,29	-	45-55	-	26	-	21	≤	0,25	-	-	-	-	0,05	0,05	-	-	-	DIN 2448	DIN 1629/3	A 53 B	-	3601 HFS 27
St. 55,29	-	55-65	-	30	-	17	≤	0,36	-	-	-	-	0,05	0,05	-	-	-	DIN 2448	DIN 1629/3	-	-	3601 HFS 35
St. 52,00	-	52-62	-	34	-	22	≤	0,20	<	0,55	<	1,50	0,05	0,05	-	-	-	DIN 2448	DIN 1629/3	-	-	-
St. 35,80	-	35-45	-	24	-	25	≤	0,17	<	0,35	>	0,40	0,05	0,05	-	-	-	DIN 2448	DIN 17175	A 106 A	-	3059/01/02
St. 45,80	-	45-55	-	26	-	21	≤	0,22	-	0,10/0,35	>	0,45	0,05	0,05	-	-	-	DIN 2448	DIN 17175	A 106 B	-	3059/05-06
TT St. 35 N	-	35-45	-	23	-	25	≤	0,16	-	0,10/0,35	-	0,40/0,60	0,045	0,045	-	-	-	DIN 2448	S.E.Werk./Blt.680	A 333 Gr 1	-	3603 LT 27
15 Mo 3	-	45-55	-	29	-	22	-	0,12/0,20	-	0,15/0,35	-	0,50/0,80	0,04	0,04	0,25/0,35	-	-	DIN 2448	DIN 17175	A 335 P1	-	3059/07-08
16 Mo 5	≥	38,7	-	21,1	-	30	-	0,10/0,20	-	0,10/0,50	-	0,30/0,80	0,045	0,045	0,45/0,65	-	-	DIN 2448	DIN 17175	A 335 P1	-	3059/07-08
13 Cr Mo 44	-	45-58	-	30	-	22	-	0,10/0,18	-	0,15/0,35	-	0,40/0,70	0,04	0,04	0,40/0,50	0,70/1,00	-	DIN 2448	DIN 17175	A 335 P12/P11	-	3604 Gr 620
10 Cr Mo 910	-	42-60	-	27	-	20	≤	0,15	-	0,15/0,50	-	0,40/0,60	0,04	0,04	0,90/1,10	2,0/2,50	-	DIN 2448	DIN 17175	A 335 P22	-	3604 Gr 622
12 Cr Mo 195	≤	42	--	18	-	21	≤	0,15	<	0,50	-	0,30/0,60	0,03	0,03	0,45/0,65	4-6	-	DIN 2448	-	-	-	3604 Gr 625
American																						
ASTM A 53 A	≥	33,7		21,1		35	-		-	(0,10-0,30)	-	-	0,048	-	-	-	-	ASA B 36,10		API SL GR A	St. 35,29	3601 HFS 22
A 53 B	≥	42,2		24,6		30	-	0,25	-	(0,10-0,30)	-	-	0,048	-	-	-	-	ASA B 36,10		API SL GR 8	St. 45,29	3601 HFS 27
A 106 A	≥	33,7		21,1		35	≤	0,30	≥	0,10	-	0,27/0 ,93	0,048	0,058	-	-	-	ASA B 36,10		API 5L GR A	St. 35,8	3059/01/02
A 106 B	≥	42,2		24,6		30	≤	0,30	>	0,10	-	0,29/1,06	0,048	0,058	-	-	-	ASA B 36,10		API 5L GR B	St. 45,8	3059/5-6
ASTM A 333/1	≥	38,7		21,1		35	≤	0,19	-	-	-	0,40/1,06	0,05	0,06	-	-	-	ASA B 36,10		-	TT St. 35 N	3603 LT 27
A 333/3	≥	45,7		24,6		30	≤	0,10/0,20	-	0,18/0,37	-	0,31/0,64	0,05	0,05	-	-	3,18/3,82	ASA B 36,10		-	10 Ni 14	3603 503 LT 100
ASTM A 335 P1	≥	38,7		21,1		30	-	0,10/0,20	-	0,10/0,50	-	0,30/0,80	0,045	0,045	0,44/0,65	-	-	ASA B 36,10		-	16 Mo 5	3059/7-8
P2	≥	38,7		21,1		30	-	0,15	-	0,10/0,30	-	0,30/0,61	0,045	0,045	0,44/0,65	0,50/0,81	-	ASA B 36,10		-	13 Cr Mo 44	-
P11	≥	42,2		21,1		30	≤	0,15	-	0,50/1,00	-	0,30/0,60	0,03	0,03	0,44/0,65	1-1,5	-	ASA B 36,10		-	13 Cr Mo 44	3604 Gr 621
P12	≥	42,2		21,1		30	≤	0,15	<	0,50	-	0,30/0,61	0,045	0,045	0,44/0,65	0,8/1,25	-	ASA B 36,10		-	13 Cr Mo 44	3604 Gr 620
P22	≥	42,2		21,1		30	≤	0,15	<	0,50	-	0,30/0,60	0,03	0,03	0,87/1,13	1,9/2,6	-	ASA B 36,10		-	10 Cr Mo 910	3604 Gr 622
P5	≥	42,2		21,1		30	≤	0,22	<	0,50	-	0,30/0,60	0,03	0,03	0,45/0,65	4-6	-	ASA B 36,10		-	12 Cr Mo 195	3604 Gr 625
API 5 L GR A	≥	37,7		21,1		-	<	0,27	-	-	<	0,90	0,04	0,05	-	-	-	ASA B 36,10		ASTM A 53 A	-	-
L GR B	≥	42,2		24,6		-	<	0,29	-	-	<	1,15	0,04	0,05	-	-	-	ASA B 36,10		ASTM A 53 B	-	-
LX 42	≥	42,2		29,5		-	<	0,31	-	-	<	1,25	0,04	0,05	-	-	-	ASA B 36,10		-	-	-
LX 46	≥	44,3		32,3		-	<	0,26	-	-	<	1,35	0,04	0,05	-	-	-	ASA B 36,10		-	-	-
LX 56	≥	49,9		39,2		-	<	0,26	-	-	<	1,35	0,04	0,05	-	-	-	ASA B 36,10		-	-	-
LX 60	≥	52,7		42,2		-	<	0,26	-	-	<	1,35	0,04	0,05	-	-	-	ASA B 36,10		-	-	-
LX 65	≥	54,1		45,7		-	<		-	-	<	1,40	0,04	0,05	-	-	-	ASA B 36,10		-	-	-
British																						
BS 3601 HFS 22	≥	34,6		21,3			<	0,21		-	<	0,70	0,06	0,06						A 53 A	St. 35,29	
BS 3601 HFS 27	≥	42,5		25,2			<	0,25		-	<	0,70	0,05	0,05						A 53 B	St. 45-29	
BS 3601 HFS 35	≥	55,1		31,5			<	0,40		-	<	1,20	0,05	0,05						-	St. 55,29	
BS 3602 HFS 23	-	36,2-47,2		21,3			<	0,20		-	-	0,30/0,70	0,05	0,05						A 106 A	St. 35-8	
BS 3602 HFS 27	-	42,5-55,1		25,2			<	0,25		(0,10-0,35)	-	0,30/0,70	0,05	0,05						A 106 B	St. 45,8	
BS 3602 HFS 35	-	55,1-67,7		31,5			<	0,35		(0,10-0,35)	-	0,70/1,10	0,05	0,05						A 106 C	-	
BS 3059/3 ERW	-	31,5-44,1		-			-	-		-	-	-	0,05	0,05						-	St.35,8	

INFORMATION

COMPARISON TABLE CHEMICAL ANALYSIS

ASTM A 213, 249, 269, 270, 271, 312, 409, 632

Grade	Composition, per cent																
	Carbon max[7]	Manganese max[7]	Phosphorus max	Sulfur, max	Silicon max	Nickel	Chromium	Molyb-denum	Titanium	Columbium plus Tantalum	Tantalum max	Nitrogen6	Sweden S.I.S	Germany DIN / Werkstoff	Japan J.I.S.	Britain B.S.	America A.I.S.I.
TP304	0,08	2,0	0,040	0,030	0,75	8,00-11,00	18,0-20,0	-	-	-	-	-	2333	1,4301	SUS 304	304 S15	304
TP304H	0,04-0,10	2,00	0,040	0,030	0,75	8,00-11,0	18,0-20,0	-	-	-	-	-	-	-	-	-	-
TP 304L	0,0351	2,00	0,040	0,030	0,75	8,00-13,0	18,0-20,0	-	-	-	-	-	2352	1,4306	SUS 304L	304 S12	304L
TP 304N	0,08	2,00	0,040	0,030	0,75	8,00-11,00	18,0-20,0	-	-	-	-	0,10-0,16	-	-	-	-	-
TP 309	0,15	2,00	0,040	0,030	0,75	12,0-15,0	22,0-24,0	-	-	-	-	-	-	-	-	-	-
TP 310	0,15	2,00	0,040	0,030	0,75	19,0-22,0	24,0-26,0	-	-	-	-	-	2361	1,4845	SUS 310 S/309s	310 S24	310
TP 316	0,08	2,00	0,040	0,030	0,75	11,0-14,0	16,0-18,0	2,00-3,00	-	-	-	-	2343	1,14436	SUS 316 J1	316 S16	316
TP 316H	0,04-0,10	2,00	0,040	0,030	0,75	11,0-14,0	16,0-18,0	2,00-3,00	-	-	-	-	2353	1,4435	SUS 316 J1L	316 S12	316L
TP 316L	0,0351	2,00	0,040	0,030	0,75	10,0-15,0	16,0-18,0	2,00-3,00	-	-	-	-	2366	1,4449	SUS 317	317 S16	317
TP 316N	0,08	2,00	0,040	0,030	0,75	11,0-14,0	16,0-18,0	2,00-3,00	-	-	-	-	2337	1,4541	SUS 321	321 S12	321
TP 317	0,08	2,00	0,040	0,030	0,75	11,0-14,0	18,0-20,0	3,00-4,00	-	-	-	-	-	-	-	-	-
TP 321	0,08	2,00	0,040	0,030	0,75	9,00-13,0	17,0-20,0	-	2	-	-	-	2338	1,4550	SUS 347	347 S17	347
TP 321H	0,04-0,10	2,00	0,040	0,030	0,75	9,00-13,0	17,0-20,0	-	3	-	-	-	-	-	-	-	-
TP 347	0,08	2,00	0,040	0,030	0,75	9,00-13,0	17,0-20,0	-	-	4	-	-	2302	1,4006	SUS 410 J1	410 S21	410
TP 347H	0,04-0,10	2,00	0,040	0,030	0,75	9,00-13,0	17,0-20,0	-	-	5	-	-	-	-	-	-	-
TP 348	0,08	2,00	0,040	0,030	0,75	9,00-13,0	17,0-20,0	-	-	4	0,10	0,10	2380	1,4005	SUS 416	416 S21	416
TP 348H	0,04-0,10	2,00	0,040	0,030	0,75	9,00-13,0	17,0-20,0	-	-	5	0,10	0,10	2304	1,4028	SUS 420 J2	420 S37	420
TP XM-15	0,08	2,00	0,030	0,030	1,50-2,50	17,50-18,50	17,0-20,0	-	-	-	-	-	2320	1,4016	SUS 430	430 S15	430
TP XM-29	0,060	11,50-14,50	0,040	0,030	1,00	2,25-3,75	17,0-20,0	-	-	-	-	-	2321	1,4057	SUS 431	431 S29	431
TP XM-19[8]	0,060	4,00-6,00	0,040	0,030	1,00	11,50-13,50	20,5-23,50	1,50-3,00	-	0,10-0,30	-	-	-	-	-	-	-

1 For small diameter or thin walls or both, where many drawing passes are required, a carbon maximum of 0,040 per cent is necessary in grades TP 304L and TP 316L. Small outside diameter tubes are defined as those less than 0,500in. (12,7mm) in outside diameter and light wall tubes as those less than 0,049in. (1,24mm) in average wall thickness (0,044in. (1,2mm) in minimum wall thickness).
2 The titanium content shall be not less than five times the carbon content and not more than 0,60 per cent.
3 The titanium content shall be not less than four times the carbon content and not more than 0,06 per cent.
4 The columbium plus tantalum content shall be not less than ten times the carbon content and not more than 1,00 per cent.
5 The columbium plus tantalum content shall be not less than eight times the carbon content and not more than 1,0 per cent.
6 The method of analysis for nitrogen shall be a matter of agreement between the purchaser and manufacturer.
7 Maximum, unless otherwise indicated.
8 Vanadium content 0,10 - 0,30 per cent.