Technical information

ISO THREAD (ANGLE 60°)

Thread	Pitch (mm)	Ø Outside (mm)	Tapping drill Ø (mm)
M2	0,40	2,00	1,60
M2,5	0,45	2,50	2,05
M3	0,50	3,00	2,50
M4	0,70	4,00	3,30
M5	0,80	5,00	4,20
M6	1,00	6,00	5,00
M7	1,00	7,00	6,00
M8	1,25	8,00	6,80
M10	1,50	10,00	8,50
M12	1,75	12,00	10,20
M14	2,00	14,00	12,00
M16	2,00	16,00	14,00
M18	2,50	18,00	15,50
M20	2,50	20,00	17,50
M22	2,50	22,00	19,50
M24	3,00	24,00	21,00

Other thread types BSP

Thread 55° (inc ✈)	Ø Hole for tapping (mm)	Pitch (mm)	No. threads per inch (T.P.I)	Outside diameter (mm)
1/8 BSP	8,75	0,91	28	9,73
1/4 BSP	11,80	1,34	19	13,16
3/8 BSP	15,25	1,34	19	16,66
1/2 BSP	19,05	1,81	14	20,96
5/8 BSP	21,03	1,81	14	22,91
3/4 BSP	24,50	1,81	14	26,44
7/8 BSP	28,25	1,81	14	30,20
1 BSP	30,75	2,31	11	33,25
1 1/4 BSP	39,50	2,31	11	41,91
1 1/2 BSP	45,24	2,31	11	47,80
1 3/4 BSP	51,00	2,31	11	53,75
2 BSP	57,00	2,31	11	59,61

Technical information

Thread BSF

Thread 55° (inc ⅛)	Ø Hole for tapping (mm)	Pitch (mm)	No. thread per inch (T.P.I)	Outside diameter (mm)
3/16 BSF	3,97	0,79	32	4,76
1/4 BSF	5,30	0,98	26	6,35
5/16 BSF	6,75	1,15	22	7,94
3/8 BSF	8,25	1,27	20	9,53
7/16 BSF	9,70	1,41	18	11,11
1/2 BSF	11,11	1,59	16	12,70
9/16 BSF	12,70	1,59	16	14,29
5/8 BSF	14,00	1,84	14	15,88
3/4 BSF	16,75	2,12	12	19,05
7/8 BSF	19,84	2,31	11	22,23
1 BSF	22,75	2,54	10	25,40

Thread BSW

1/8 BSW	2,55	0,64	40	3,18
3/16 BSW	3,70	1,06	24	4,76
1/4 BSW	5,10	1,27	20	6,35
5/16 BSW	6,50	1,41	18	7,94
3/8 BSW	7,94	1,59	16	9,53
7/16 BSW	9,36	1,81	14	11,11
1/2 BSW	10,50	2,12	12	12,70
9/16 BSW	12,10	2,12	12	14,29
5/8 BSW	13,50	2,31	11	15,88
3/4 BSW	16,27	2,54	10	19,05
7/8 BSW	19,25	2,82	9	22,23
1 BSW	22,00	3,18	8	25,40

Thread BA

0-BA	5,10	1,00	25,38	6,00
1-BA	4,50	0,90	28,25	5,30
2-BA	4,00	0,81	31,35	4,70
3-BA	3,45	0,73	34,84	4,10
4-BA	3,00	0,66	38,46	3,60
5-BA	2,65	0,59	43,10	3,20
6-BA	2,30	0,53	47,85	2,80
7-BA	2,05	0,48	52,91	2,50
8-BA	1,80	0,43	59,71	2,20

Technical information

Thread UNF

Thread 60° (inc ✈)	Hole Ø for tapping (mm)	Pitch (mm)	No. threads per inch (T.P.I)	Outside diameter (mm)
2-64 UNF	1,90	0,40	64	2,18
3-56 UNF	2,15	0,45	56	2,51
4-48 UNF	2,40	0,53	48	2,84
6-40 UNF	2,95	0,64	40	3,51
8-36 UNF	3,55	0,71	36	4,17
10-32 UNF	4,10	0,79	32	4,83
12-28 UNF	4,65	0,91	28	5,49
1/4-28 UNF	5,50	0,91	28	6,35
5/16-24 UNF	6,90	1,06	24	7,94
3/8-24 UNF	8,50	1,06	24	9,53
7/16-20 UNF	9,90	1,27	20	11,11
1/2-20 UNF	11,40	1,27	20	12,70
9/16-18 UNF	12,90	1,41	18	14,29
5/8-18 UNF	14,50	1,41	18	15,88
3/4-16 UNF	17,46	1,59	16	19,05
7/8-14 UNF	20,42	1,81	14	22,23
1-12 UNF	23,25	2,12	12	25,40

Thread UNC

Thread 60° (inc ✈)	Hole Ø for tapping (mm)	Pitch (mm)	No. threads per inch (T.P.I)	Outside diameter (mm)
2-56 UNC	1,85	0,45	56	2,18
3-48 UNC	2,10	0,53	48	2,51
4-40 UNC	2,35	0,64	40	2,84
6-32 UNC	2,84	0,79	32	3,51
8-32 UNC	3,50	0,79	32	4,17
10-24 UNC	3,90	1,06	24	4,83
12-24 UNC	4,55	1,06	24	5,49
1/4-20 UNC	5,30	1,27	20	6,35
5/16-18 UNC	6,60	1,41	18	7,94
3/8-16 UNC	8,00	1,59	16	9,53
7/16-14 UNC	9,40	1,81	14	11,11
1/2-13 UNC	10,80	1,95	13	12,70
9/16-12 UNC	12,25	2,12	12	14,29
5/8-11 UNC	13,50	2,31	11	15,88
3/4-10 UNC	16,50	2,54	10	19,05
7/8-9 UNC	19,45	2,82	9	22,23
1-8 UNC	22,25	3,18	8	25,40

Stainless steel types

Austenitic stainless steel - Generality

General remarks about austenitic stainless steel
The basic structure of austenitic stainless steel is the well-known alloy of 18% CHROMIUM and 8% NICKEL. The CHROMIUM and NICKEL content can be increased to improve corrosion resistance. In order to do this, supplementary elements such as Molybdenum can also be added.
AUSTENITIC STEELS are non-magnetic and cannot be heat-treated or tempered. Cold working or work hardening is the only way to harden this type of steel but the process must happen quickly. The steel can later be converted back to its initial state if is annealed. This solution is used as a replacement for heat treatment.

Type Z8CNF18.09

(stainless steel 303)
- Colour code: white
- Austenitic: non-magnetic
- SULPHUR added to facilitate machining.
- Good corrosion resistance
- Weldability: acceptable (but in general oxyacetylene welding is not recommended)
- Cold forming is possible but bends with sharp angles should be avoided.
- **Applications:** Production by batch machining, automated machines...

Type Z4CN19.10FF

(stainless steel 304)
- Colour code: yellow
- Austenitic: non-magnetic
- This is the most common type of stainless steel used
- Machining quality: acceptable
- Good corrosion resistance
- Good weldability (but in general oxyacetylene welding is not recommended)
- Cold forming gives very good results (slightly magnetic when cold-formed)
- **Applications:** hospitals, laundries, all general mechanical applications.

Type Z3CND18.14.08

(stainless steel 316L)
- Colour code: red
- Austenitic steel: non-magnetic
- High corrosion resistance, especially against salt water and acids.
- Machining quality: acceptable
- Good weldability
- Cold forming gives very good results (non-magnetic when reheated, slightly magnetic when cold-formed)
- **Applications:** petrochemical industry, marine environments, hospitals, catering.

Type Z6DNT18.10

(stainless steel 321)
- Colour code: blue
- Austenitic steel: non-magnetic
- Machining quality: acceptable
- Good corrosion and oxidation resistance
- Very good weldability
- Cold forming gives very good results (non-magnetic when reheated, slightly magnetic when cold-formed),
- **Applications:** petrochemical industry, in general all mechanical applications...

Martensitic steels

- These steels, which generally contain 13% Chromium, are the least corrosion-resistant stainless steels. They should therefore be used when corrosive conditions are relatively rare. Their main application is for cutlery.

Austenitic steels

- This type of stainless steel is by far the most widely-used. It resists most types of corrosion and is principally used in food preparation areas, dairies, breweries, and other processing plants, as well as in several parts of the chemical industry.

Ferritic steels

- The most commonly used ferritic steel is Z8C17 (stainless steel 430) which contains 17% Chromium. They have a greater corrosion resistance than martensitic steels, without being as efficient as standard austensitic steels. They are generally used for decorative trim on car motors and household appliances.

Le molybdenum

- Molybdenum, when added to austenitic steel, greatly improves corrosion resistance. Type 316 stainless steels contain between 2 and 3% Molybdenum.
- This type of steel is principally used in chemical and petrochemical industries where resistance to chlorine, as an example, is necessary. Nevertheless, it is important to mention that these steels are not resistant to all types of chemical attacks (such as hydrochloric or oxalic acid, especially when hot or in high concentrations).

Stainless steel types

Mechanical properties

Mechanical properties, softening temperatures and intergranular corrosion tests of austenetic stainless steel

Type of steel	Proff stress $R_p0,2$ min N/mm²	Proff stress $R_p01,0$ min N/mm²	Tensile strength R_m.min N/mm²	Elongation A.min	Hardness Hv. max †	Condition	Softening temperature range min	Softening temperature range max	Intergranular sensitivisation time test min
Z1CN17.08	215	250	540	40%	220	Softened	1000°C	1120°C	Nil
Z1CN18.12	180	215	480	40%	135	Softened	1000°C	1120°C	30
Z4CN19.10ff	195	230	500	40%	190	Softened	1000°C	1120°C	15
Z5CN17.08	195	230	500	40%	190	Softened	1000°C	1120°C	15
Z7CN18.09	195	230	500	40%	190	Softened	1000°C	1120°C	Nil
Z5CN18.11ff	185	220	490	40%	185	Softened	1000°C	1120°C	Nil
Z2CND17.12	190	225	490	40%	195	Softened	1000°C	1120°C	30
Z2CND18.13	205	240	510	40%	205	Softened	1000°C	1120°C	15
Z6CND17.11.02	205	240	510	40%	205	Softened	1000°C	1120°C	15
Z2CND19.15.04	195	230	490	40%	195	Softened	1000°C	1120°C	30
Z6CNT18.10	200	235	500	40%	200	Softened	1000°C	1120°C	30
Z6CNNb18.10	205	240	510	40%	200	Softened	1000°C	1120°C	30

Mechanical properties and softening temperatures for ferritic and marsentic steels

Type of steel	Proof stress $R_p0,2$ min N/mm²	Tensile strength R_m.min N/mm²	Elongation A.min	Hardness HV max †	Condition	Softening mini	Softening max.	Hardening ‡ mini.	Hardening ‡ max.	Tempering mini.	Tempering max.
Ferritic steels											
28C12	245	420	20%	190 175	Softened	1000°C	1120°C	Nil			
28CA12	245	420	20%	190 175	Softened	1000°C	1120°C	30			
28C17	245	430	20%	190 175	Softened	1000°C	1120°C	15			
Martensic steels											
210C13	-	-	-		Softened	700°C	780°C				
					Quenched			950°C	1020°C		
					Hardened					650°C	750°C
230C13	-			230 220	Softened	700°C	780°C				
					Quenched			950°C	1050°C		
					Hardened					150°C	250°C
					Softened	700°C	780°C	-	-	-	-
	420			175							

1 N/mm² = 1 mp_a

• Stretching was measured with flat test-parts of gauge length 50mm or $5.65\sqrt{s_0}$. for cylindrical test-parts a gauge length of $5.64\sqrt{s_0}$ was used

† For parts of sufficient thickness, the Brinell hardness test can be used, applying the same hardness limit values for HB as those given for HV

‡ Only as an indication.

Stainless steels: Manufacturing guide

	301S1	302S25	304S16	304S12	305S19	303S21	303S41	309S24	310S24	316S16
Blanking	B	B	B	B	B	—	—	B	B	B
Brazing	B	B	B	B	B	B	D	B	B	B
Buffing	A	A-B	A-B	B	A-B	B	D	B	B	B
Coining	B-C	B	B	B	A-B	A	D	B	B	B
Drilling	C-D	C	C	C	C	B-C	B	C	C	C
Embossing	B-C	B	B	B	B	—	C	B	B	B
Cold-forging	C	B	B	B	B	B	D	B-C	B-C	B
Hot-forging	B	B	B	B	B	B	B	B	B	B
Hardenning by cold work										
a) Annealed 1000psi	115,00	90,00	85,00	82,00	80,00	—	—	90,00	95,00	90,00
kg/mm²	80,80	63,30	59,70	58,00	56,20	—	—	63,30	66,80	63,30
b) 25% Réduction 1000psi	169,00	142,00	138,00	140,00	130,00	—	—	130,00	126,00	134,00
kg/mm²	119,00	100,00	97,00	98,00	91,00	—	—	91,00	89,00	94,00
c) 50% Réduction 1000psi	220,00	180,00	178,00	182,00	170,00	—	—	169,00	165,00	165,00
kg/mm2	155,00	127,00	125,00	128,00	119,00	—	—	119,00	116,00	116,00
Hardened by heat treatment	No	No	No	No	Non	No	No	No	No	No
Machining	C	C	C	C	C	B-C	B-C	C	C	C
Magnetic	Non†	Non†	Non†	Non†	Non††	Non††	Non†	Non†	Non††	Non†
Punching	C	B	B	B	B	—	—	B	B	B
Polishing	A	A	A	A	A	A	D	B	B	B
Roll forming	B	A	A	A	A	—	—	B	A	A
Sawing	C	C	C	C	C	C	B	C	C	C
Shearing	B	B	B	B	B	B	C	B	B	B
Soldering	B	B	B	B	B	B	C-D	B	B	B
Spinning	D	B-C	B-C	B-C	A	—	—	B-C	B	B
Spot-welding (Résistance)	A	A	A	A	A	B	D	A	A	A
Welding (coated electrodes)	B	A-B	A	A	A	B	D	B	B	A
Welding (oxyacetylene)	D	D	D	D	D	D	D	D	D	D
Welding metal insert gas arc	A-B	A-B	A	A	A	B-C	D	A	A	A
Welding tungsten inert gas arc	A	A	A	A	A	B	D	A	A	A

A = Excellent **B** = Good **C** = Acceptable **D** = Not recommended

† Develops magnetism after cold working
†† Develops less magnetism after cold working
* Severe sharp bends to be avoided

Stainless steel types

Characteristics of stainless steels

Stainless steel types		Description	Application
304	Z4CN19.10FF	18% CHROMIUM, 9% NICKEL Forming : good	Sinks, architectural pieces, car exhausts, cutlery, kitchenware, piping.
304L	Z1CN18.12 Z1CN18.09	LESS CARBON THAN STAINLESS STEEL 304	Breweries, dairies, food and pharmaceutical industries, kitchenware, sinks
305	Z8CN18.12	18% CHROMIUM, 12% NICKEL. Forming: good	Same as stainless steel 310.
309	-	23% CHROMIUM, 14% NICKEL High oxidation resistance	
310	-	25% CHROMIUM, 20% NICKEL High oxidation resistance	Ovens, mettallurgical factories, heat exchangers
316	Z3CND17.11.01	17% CHROMIUM, 11% NICKEL 2.5% MOLYBDENE High corrosion resistance	Chemical and petrochemical plants, architectural pieces, breweries
316L	Z2CND17.12	Less CARBON than STAINLESS STEEL 316	
317	-	18% CHROMIUM, 12% NICKEL 2.5% MOLYBDENE et TITANIUM High corrosion resistance	Chemical and petrochemical factories, acetic acid distilleries
317L 317	Z2CND19.15.04	Less CARBON than STAINLESS STEEL	
321	Z6CNT18.10	18% CHROMIUM, 10% NICKEL and TITANIUM	Aircraft parts, chemical and petrochemical industries, heating elements
325	-	CONTAINS SULPHUR: EASIER TO USINAGE MACHINE THAN STAINLESS STEEL 321, ONLY AVAILABLE IN BARS	
347	Z6CNNb 18.10	18% CHROMIUM. 10% NICKEL and NIOBIUM Sensitivisation and nitric acid resistance	Transformation factories, aircraft parts

Characteristics of stainless steels

Steel type		Description	Applications
Martensic steels: Magnetic, tempering possible, moderate corrosion resistance			
410	Z10C13	12% CHROMIUM	Pump and turbine parts, general mechanics, knife blades, valves
416	Z11CF13	Contains sulphur: easier to machine par than stainless steel 410	Construction, railway carriages, mine-carts
420	Z20C13	Heat-resistant	
431	Z15CN16.02	17% CHROMIUM, 2 1/2% NICKEL Only available in bars	
Ferritic steels : magnetic, chrome steels, chlorides give corrosion resistance			
430	Z8C17	17% CHROMIUM	Sinks, Architectural parts, decorative car parts
434	-	12% CHROMIUM and TITANIUM Resistant to atmospheric corrosion and chipping	Car exhaust systems
409	Z3CT12	12% CHROMIUM and TITANIUM Weldable up to thicknesses of 2.5mm	Construction, railway carriages, mine-carts
403	Z8C12	Modified stainless steel 409, weldable in reinforced section, forming possible	
Austenitic steels: non-magnetic, chromium and nickel steels, good weldability, good general corrosion resistance			
301	Z11CN17.08	17% CHROME, 7% NICKEL Forming: possible	General construction, springs, marine chafing plates and protective plates
302	Z10CN18.09	18% CHROMIUM, 9% NICKEL Forming: good	Same as stainless steel 304
303	Z8CNF18.09	Easier to machine than stainless steel 302, only available in bars	