SALOMON'S METALEN B.V.

17-4PH (Grade 630)

17-4PH (Grade 630) martensitic precipitation hardening stainless steel has a combination of highhardness and strength after suitable heat treatment. It also has similar corrosion and heat resistance to Grade 304. The terms "Type 630" and "17-4PH" refer to the same grade. The great benefit of this grade (and of other precipitation hardening grades of stainless steel) is that they are generally supplied in the solution treated condition, in which they are just machinable, and then can be age hardened to achieve quite high strengths. This aging treatment is so low in temperature that there is no significant distortion. These grades are therefore well suited to production of long shafts, which require no re-straightening after heat treatment.

Corrosion Resistance
Good resistance to a wide range of corrosive environments; approaching that of Grade 304 stainless steel. Like 304, this grade is subject to pitting and crevice corrosion in warm chloride environments. Grade 630 has been used for boat shafting for fresh water, and in sea water with the addition of cathodic protection.
Highly resistant to stress corrosion cracking if aged at 550°C or higher. Higher aging temperatures give better SCC resistance. 17-4PH is resistant to sulphide stress cracking (SSC) if highly aged; NACE MR0175 permits the use of 17-4PH but only in a double age hardened condition (refer to MR0175 and ASTM A564M).
In solution treated Condition A the grade has lower resistance to stress corrosion cracking, and lower ductility compared to aged conditions. It should not generally be used in the solution treated condition, even if the hardness is considered satisfactory.

Heat Resistance
This grade has good oxidation resistance, but to avoid reduction of its mechanical properties and hardness it should not be used above its age hardening temperature. Prolonger exposure in the range 370-480°C should be avoided if ambient temperature toughness is critical.

Heat Treatment
- **Solution treatment (Condition A)**

Heat at 1040°C for ½ hour and cool to 30°C maximum in air. Oil quenching may be used for small non-intricate sections.
- **Hardening (Aging)**

After solution treatment a single low temperature "age hardening" treatment is employed to achieve required properties, as below. This treatment results in no distortion and only superficial discolouration. A slight decrease in size (shrinkage) takes place during the hardening; this is approximately 0.05% for Condition H900 and 0.10% for H1150.
Typical mechanical properties achieved after solution treating and then age hardening at the indicated temperatures are as in the table in the following page. The Condition is designated by the age hardening temperature in °F (Condition A is solution treated, ie not aged).

Welding
17-4PH can be successfully welded by all standard methods. Preheating is not necessary. Properties comparable to those of the parent metal may be achieved in the weld metal by post-weld heat treatment. As for other high strength steels precaution should be taken in design and welding procedures to avoid concentration of weldment stresses.

Machining
This steel is usually supplied in the solution treated condition, in which it can be machined. Machinability is similar to Grade 304.

Typical Applications
Gears, bolts and valve components. Plastic moulding dies. High strength pump shafts and boat propeller shafts. Engine components. In general applications where some level of corrosion resistance is needed in conjunction with high strength or hardness.

Specified Properties
These properties are specified for bar products in ASTM A564/A564M; round bar is the most commonly available product form for this grade. Similar but not necessarily identical properties are specified for other products such as plate and forgings in their respective specifications.

Composition Specification (%)

Grade		C	Mn	Si	P	S	Cr	Ni	Cu	Nb+Ta
630	min.	-	-	-	-	-	15.0	3.0	3.0	0.15
	max	0.07	1.00	1.00	0.040	0.030	17.5	5.0	5.0	0.45

Mechanical Property Specification

Condition	Hardening		Tensile Strength (MPa)	Yield Strength 0.2% Proof (MPa)	Elongation (% in 50mm)	Hardness	
	Temp (°C)	Time (h)				Rockwell C (HR C)	Brinell (HB)
A	-	-	1105 typ.	1000 typ.	15 typ.	38 max	363 max
H900	480	1	1310	1170	10	40	388
H925	495	4	1170	1070	10	38	375
H1025	550	4	1070	1000	12	35	331
H1075	580	4	1000	860	13	32	311
H1100	595	4	965	795	14	31	302
H1150	620	4	930	725	16	28	277

Single property values are minima except as noted as typical or maximum.

Values from ASTM A564M; these values apply only to certain size ranges. The specification should be consulted for the complete details of these properties and of heat treatment procedures.

Solution treatment is at 1040°C followed by cooling as required.

Specialist double-aging treatments H1150M and H1150D are also possible – refer to ASTM A564M.

Physical Properties (typical values in the annealed condition)

Grade	Density (kg/m³)	Elastic Modulus (GPa)	Mean Coefficient of Thermal Expansion			Thermal Conductivity		Specific Heat	Electrical Resistivity
			0-100°C (µm/m/°C)	0-315°C (µm/m/°C)	0-538°C (µm/m/°C)	at 100°C (W/m.K)	at 500°C (W/m.K)	0-100°C (J/kg.K)	(nΩ.m)
630	7750	196	10.8	11.6	-	18.4	22.7	460	800

Grade Specification Comparison

Grade	UNS	Euronorm		Swedish	Japanese
	No	No	Name	SS	JIS
630	S17400	1.4542	X5CrNiCuNb16-4	-	SUS 630

These comparisons are approximate only. The list is intended as a comparison of functionally similar materials **not** as a schedule of contractual equivalents. If exact equivalents are needed original specifications must be consulted.

Possible Alternative Grades

Grade	Why it might be chosen instead of 630 (17-4PH)
431	431 has higher toughness than 630. Better availability in some sizes.
416	Free machining martensitic stainless steel - better machinability. Lower cost but lower corrosion resistance.
316	Higher corrosion resistance of 316 is needed, but with much lower strength than 630.
1.4462	Much better corrosion resistance than 630, with a lower strength (but not as low as 316).