

## 15-5PH, UNS 15500, 1.4545, X5CrNiCuNb15-5 - Turbine Blade Steels Datasheet

15-5PH, UNS 15500, 1.4545, X5CrNiCuNb15-5 martensitic precipitation hardened, chromium-nickel-copper stainless steel 15-5PH, 1.4545, UNS S15500, X5CrNiCuNb15-5, AMS 5659, AMS 5826, AMS 5862, ASTM A564 (XM-12), ASTM A693 (XM-12), ASTM A705 (XM-12), SA 564, SA 693, A705

15-5PH, UNS 15500, 1.4545, X5CrNiCuNb15-5 high-alloy stainless steel, has transverse toughness and ductility, hardness capability, excellent mechanical properties, strength and hardness, good strength and corrosion resistance, environmental resistance including acetic acid, salt, nitric acid or sodium hydroxide at low concentrations. 15-5PH Stainless steels are known as high-alloy steels with good corrosion resistance thanks to the large amounts of chromium available in these steels. Most of the stainless steels contain about 10% of chromium.

15-5PH, UNS 15500, 1.4545, X5CrNiCuNb15-5 is mainly used in the aerospace industry for particularly heavy-duty parts and components of machinery exposed to corrosive and loading environments, petrochemical, chemical, food and paper industries. AMS 5659, AMS 5826, AMS 5862, ASTM A564 (XM-12), ASTM A693 (XM-12), ASTM A705 (XM-12), SA 564, SA 693, A705, SIEMENS 802 242 98, SIEMENS 802 246 98

- AMS 5659 (Bar & Forgings)
- AMS 5862 (Sheet / Plate)
- ASTM A564 (Grade XM-12)
- ASTM A705 (Grade XM-12)
- ASME SA564
- Boeing BMS 7-240
- Boeing BMS 7-351
- SPP Canada Aircraft SPPCA-EN-SOW-0036 (Capability)
- Liebherr LAT 1-9037
- AMS-STD-2154 (Ultrasonic Inspection)

### Chemical Composition

Grade	Chemical Composition WT %											
	C	Mn	Si	P	S	Cr	Ni	Mo	Cu	Nb	Ti	N
ASTM 15-5PH	Max 0.07	Max 0.7	Max 1.0	Max 0.035	Max 0.030	14.5-15.5	4.5-5.5	-	2.5-3.2	0.15-0.35	-	Max 0.05
1.4545, X5CrNiCuNb15-5	Max 0.07	Max 1.0	Max 1.0	Max 0.030	Max 0.015	14.0-15.5	3.5-5.5	Max 0.5	2.5-4.5	Max 0.45	-	-
AMS UNS S15500	Max 0.07	Max 1.0	Max 1.0	Max 0.030	Max 0.015	14.0-15.5	3.5-5.5	Max 0.5	2.5-4.5	0.15-0.45	-	-
A693 XM-12	Max 0.07	Max 1.0	Max 1.0	Max 0.040	Max 0.030	14.0-15.5	3.5-5.5	-	2.5-4.5	0.15-0.45	-	-

### Mechanical Properties

- H900 Specimen Orientation - Longitudinal / Transverse

- Tensile Strength  $R_m$  Ksi: 190 / 190
- Yield Strength at 0.2% Offset Ksi: 170 / 170
- Elongation in 2 Inches or 4D %: 10 / 6
- Reduction of Area %: 35 / 20
- H925 Specimen Orientation - Longitudinal / Transverse
  - Tensile Strength  $R_m$  Ksi: 170 / 170
  - Yield Strength at 0.2% Offset Ksi: 155 / 155
  - Elongation in 2 Inches or 4D %: 10 / 7
  - Reduction of Area %: 38 / 25
- H1025 Specimen Orientation - Longitudinal / Transverse
  - Tensile Strength  $R_m$  Ksi: 155 / 155
  - Yield Strength at 0.2% Offset Ksi: 145 / 145
  - Elongation in 2 Inches or 4D %: 12 / 8
  - Reduction of Area %: 45 / 32
- H1025 Specimen Orientation - Longitudinal / Transverse
  - Tensile Strength  $R_m$  Ksi: 145 / 145
  - Yield Strength at 0.2% Offset Ksi: 125 / 125
  - Elongation in 2 Inches or 4D %: 13 / 9
  - Reduction of Area %: 45 / 33
- H1100 Specimen Orientation - Longitudinal / Transverse
  - Tensile Strength  $R_m$  Ksi: 140 / 140
  - Yield Strength at 0.2% Offset Ksi: 115 / 115
  - Elongation in 2 Inches or 4D %: 14 / 10
  - Reduction of Area %: 45 / 34
- H1150 Specimen Orientation - Longitudinal / Transverse
  - Tensile Strength  $R_m$  Ksi: 135 / 135
  - Yield Strength at 0.2% Offset Ksi: 105 / 105
  - Elongation in 2 Inches or 4D %: 16 / 11
  - Reduction of Area %: 50 / 34

Condition

Cond A
H900
H925
H1025
H1075
H1100
H1150

- +H900

- Tensile strength,  $R_m$ : Min 1170 MPa
- Yield point,  $R_e$ : Min 1000 MPa
- Elongation, A: Min 5%
- HB Hardness: Min 375

- +H925

- Tensile strength,  $R_m$ : Min 1205 MPa
- Yield point,  $R_e$ : Min 1035 MPa
- Elongation, A: Min 5%
- HB Hardness: Min 375

- +H1025

- Tensile strength,  $R_m$ : Min 1035 MPa
- Yield point,  $R_e$ : Min 965 MPa
- Elongation, A: Min 9%
- HB Hardness: Min 311

- +H1075
  - Tensile strength,  $R_m$ : Min 1000 MPa
  - Yield point,  $R_e$ : Min 795 MPa
  - Elongation, A: Min 9%
  - HB Hardness: Min 277
  
- +H1100
  - Tensile strength,  $R_m$ : Min 930 MPa
  - Yield point,  $R_e$ : Min 760 MPa
  - Elongation, A: Min 9%
  - HB Hardness: Min 269
  
- +H1150
  - Tensile strength,  $R_m$ : Min 860 MPa
  - Yield point,  $R_e$ : Min 670 MPa
  - Elongation, A: Min 10%
  - HB Hardness: Min 269
  
- +H1150M
  - HB Hardness: Min 310
  
- +H1150DBL
  - HB Hardness: Min 310

Material		Ultimate Tensile Strength (ksi)	0.2 % Yield Strength (ksi)	Elongation % in 2D	% Reduction of Area	Rockwell C Hardness
Alloy 15-5 PH Sheet/Plate AMS 5862	Cond A	-	-	-	-	38 max
Alloy 15-5 PH Sheet/Plate AMS 5862	H900	190	170	5	-	40-47
Alloy 15-5 PH Sheet/Plate AMS 5862	H925	170	155	5	-	38-45
Alloy 15-5 PH Sheet/Plate AMS 5862	H1025	155	145	5	-	35-42
Alloy 15-5 PH Sheet/Plate AMS 5862	H1075	145	125	5	-	33-39
Alloy 15-5 PH Sheet/Plate AMS 5862	H1100	140	115	5	-	32-38
Alloy 15-5 PH Sheet/Plate AMS 5862	H1150	135	105	8	-	28-37

## Physical Properties

Properties	Metric	Imperial
Thermal expansion co-efficient (@-73.0-21.0 ° C/-99.4-69.8 ° F)	10.4 $\mu\text{m/m}^\circ\text{C}$	5.78 $\mu\text{in/in}^\circ\text{F}$
Thermal conductivity (@150 ° C/302 ° F)	17.8 W/mK	124 BTU in/hr.ft <sup>2</sup> . ° F

## Heat Treatment

UNS S15500 Precipitation heat treating parameters

- Condition H900
  - Temperature: 900 ° F  $\pm$  10 ° F (482 ° C  $\pm$  6 ° C)
  - Time: 1 hour + 15 minutes, -0
- Condition H925
  - Temperature: 925 ° F  $\pm$  10 ° F (496 ° C  $\pm$  6 ° C)
  - Time: 4 hours + 30 minutes, -0
- Condition H1025
  - Temperature: 1025 ° F  $\pm$  10 ° F (552 ° C  $\pm$  6 ° C)
  - Time: 4 hours + 30 minutes, -0
- Condition H1075
  - Temperature: 1075 ° F  $\pm$  10 ° F (579 ° C  $\pm$  6 ° C)
  - Time: 4 hours + 30 minutes, -0
- Condition H1100
  - Temperature: 1100 ° F  $\pm$  10 ° F (593 ° C  $\pm$  6 ° C)
  - Time: 4 hours + 30 minutes, -0
- Condition H1150
  - Temperature: 1150 ° F  $\pm$  10 ° F (621 ° C  $\pm$  6 ° C)
  - Time: 4 hours + 30 minutes, -0

## Welding Properties

UNS S15500 is welded by shielded fusion or resistance methods and AWS E/ER630 is the filler metal used for this process.

## Machining Properties

UNS S15500 can be machined in all attainable conditions and machining in H1150M is recommended for this alloy to obtain best tool life.

## Similar or Equivalents Steel Grade



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DIN 1.4545, 1.4545.4, 1.4545.9, AISI XM-12, AMS XM-12, EN X5CrNiCu15-5, EN 1.4545, AMS 5346, AMS 5347, AMS 5348, AMS 5356, AMS 5357, AMS 5400, A747 Type 15-5, J92110, SA 747 Type 15-5, CB7Cu-2, A959 grade XM-12, 15Cr-5Ni, 15-5, 15-5PH, 15-5 PH, UNS S15500, AMS 5658, AMS 5659, AMS 5826, AMS 5862, AMS 5750, A 564 Type XM-12, A 694 grade XM-12, A 705 grade XM-12, 1.4545, X5CrNiCuNb15-5, X3CrNiCuNb15-5-4, Acidur 4545, N701, SF 15/5, 05Cr15Ni5Cu4Nb, Z5CNU15-05, EZ7CNU15.05, Z 5 CNU 15-05, PH15-5, XM-12, UNS S15500, 15Cr-5Ni, DIN X4CrNiCuNb164, X5CrNiCu15-5, DIN 1.4540, DIN 1.4545, SAE 15-5