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17-4 PH & 15-5 PH
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Abstract

17-4 PH and 15-5 PH are extremely useful and versatile precipitation-hardening stainless steels. Armco 17-4 PH is well suited for the magnetic particle inspection requirements of Aerospace Material Specification. Armco 15-5 PH and 17-4 PH are produced in billet, plate, bar, and wire. Also, 15-5 PH is able to meet the stringent mechanical properties required in the aerospace and nuclear industries. Both products are easy to heat treat and machine, making them very useful in many applications.

Introduction

HEAT TREATMENT

Heat treatment is procedure of heating and cooling a material without melting. It may involve temperatures above, below, and at the ambient. Typical objectives of heat treatment are hardening, strengthening, softening, and stress relief. Heat treatment will improve formability, machinability, and dimensional stability.

My mentor Larry Cooper and I discussed my research project. He wanted me to study 2 stainless steels. The two stainless steels are 17-4 PH and 15-5 PH. Larry developed some questions that he wanted me to find answers. I went to the library to collect some information about 15-5 PH and 17-4 PH, and studied the differences between them, and their condition of heat treatment.

Furnaces are used to heat treat stainless steels. Here is the list of Furnaces:

	Temperature
1. West Pit Furnace	0 - 1150 F
2. Linderg # 1	0 - 1150 F
3. Linderg # 2	0 - 1150 F
4. Linderg # 3	0 - 2300 F
5. HeviDuty Pit	0 - 2000 F
6. Harrop	0 - 2100 F

Also, there are other materials:

1. Water - 4 feet in diameter by 8 feet deep.
2. Oil - 4 feet in diameter by 8 feet deep.

Water and oil are used for cooling the material if necessary.

Conclusion

What are their conditions of heat treatment?

Heat treatment for 17-4 PH

Condition	Hardening temperature	Hardening temperature	Type of cooling	R/C hardening
H 900	900 F	1 hour	Air	C40/47
H 925	925 F	4 hours	Air	C38/45
H 1025	1025 F	4 hours	Air	C35/42
H 1075	1075 F	4 hours	Air	C32/39
H 1100	1100 F	4 hours	Air	C31/38
H 1150	1150 F	4 hours	Air	C28/37
H 1150-M	1400 F	2 hours	Air	C24/30

17-4 PH - Solution treated at 1900 F (30 minutes). Quenched in oil, causing the steels to flare up.

Heat treatment for 15-5 PH

Condition	Hardening temperature	Hardening temperature	Type of cooling	R/C hardening
H 900	900 F	1 hour	Air	C40/47
H 925	925 F	4 hours	Air	C38/45
H 1025	1025 F	4 hours	Air	C35/42
H 1075	1075 F	4 hours	Air	C32/39
H 1100	1100 F	4 hours	Air	C31/38
H 1150	1150 F	4 hours	Air	C28/37
H 1150-M	1400 F	2 hours	Air	C24/30

15-5 PH - Solution treated at 1900 F (30 minutes). Quenched in oil, causing the steels to flare up.

What is different between 17-4 PH and 15-5 PH? What is their composition?

17-4 PH and 15-5 PH are different in the percentage of Nickel, Copper, and Chromium. Here is a chart of their composition:

Composition

17-4 PH

	%
Carbon	0.07 max.
Manganese	1.00 max.
Phosphorus	0.04 max.
Sulfur	0.03 max.
Chromium	15.00-17.50
Nickel	3.00-5.00
Copper	3.00-5.00
Columbium plus Tantalum	0.15-0.45

15-5 PH

	%
Carbon	0.07 max.
Manganese	1.00 max.
Phosphorus	0.04 max.
Sulfur	0.03 max.
Chromium	14.00-15.50
Nickel	3.50-5.50
Copper	2.50-4.50
Columbium plus Tantalum	0.15-0.45

The benefit combination:

17-4 PH

- * High strength
- * High hardness
- * Excellent corrosion resistance
- * Easy heat treatment

15-5 PH

- * High strength
- * High hardness
- * Excellent transverse resistance
- * Good forgeability