

Understanding the Difference: 17-4 PH vs. 17-7 PH Precipitation Hardening Alloys



When choosing an alloy for a particular project, it may be helpful to determine your criteria for use based on the strength, corrosion resistance, magnetic qualities and stability requirements of your end product. In the aerospace market, some of the most sought after alloys are precipitation hardening or age hardening alloys.

Precipitation hardening stainless steels are a group of iron-chromium-nickel alloys. They have the ability to gain high strength through heat treatment, (like martensitic grades) and they also have good corrosion resistance (like austenitic grades). The heat treatment process and the addition of the elements Copper, Aluminum, Niobium or Molybdenum create a precipitation hardening steel.

Precipitation hardening is also known as age hardening. Unlike ordinary tempering, PH alloys must be kept at an elevated temperature for an extended period of time to allow precipitation to take place. Using this time delayed technique, or aging, increases the yield strength of the material.

Type 17-4 PH stainless steel is the most widely used of all of the precipitation-hardening stainless steels. It includes the addition of Chromium, Nickel, Copper and Niobium, making it a truly martensitic microstructure. It is further strengthened by a low temperature treatment which precipitates a copper containing phase in the alloy. In comparison to other PH alloys, 17-4 PH requires a simple heat treatment which produces a wide range of properties including high strength. Type 17-4 PH provides an outstanding combination of high strength, good corrosion resistance, and good mechanical properties at temperatures up to 600°F (316°C). 17-4 PH has slightly more Ferrite than other PH grades, making it a bit more magnetic.

17-4 PH provides toughness in both base metals and welds. It is well suited to applications that require ease of fabrication and the addition of strength/hardness for improved reliability. Its valuable combination of properties gives designers opportunities to add reliability to their products while simplifying fabrication and often reducing costs.

General applications for 17-4 PH include aircraft and gas turbines, chemical processing equipment, oil and petroleum refining equipment, and food processing equipment.

Type 17-7 PH stainless steel is a Chromium-Nickel-Aluminum, semi-austenitic stainless steel. It is another grade which offers both high strength and high corrosion resistance, excellent fatigue properties, good formability, and mechanical properties up to 800°F (427°C). It is particularly well suited for aerospace applications. 17-7 PH is the most formable of all PH grades and has the highest strength and hardness. It is less magnetic than other PH grades and offers minimal distortion upon heat treatment.

17-7 PH is commonly found in a variety of springs and washers. Applications include aerospace, chemical processing equipment, heat exchangers, oil and petroleum refining equipment, food processing equipment, and general metalworking.

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