

CRAFTSMAN'S CRIBSHEET

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Miles Free – Director of Industry Research and Technology Technical Regulatory Quality Management

Dimensional Contraction of 17-4 PH Stainless Steel

The mechanical properties of 17-4 PH must be fully developed by age hardening from Condition A in order to reduce risk of failure and to take full advantage of the material's capabilities.

17-4 PH is a martensitic precipitation hardening (age hardening) stainless steel that can provide both high strength and excellent corrosion resistance.

In the annealed (solution treated condition - Condition A) the density of this material is **0.280 lb/in³**.

H 900 density is **0.282 lb/in³**.

H 1075 density is **0.283 lb/in³**.

H 1150 density is **0.284 lb/in³**.

These changes in density values show that this alloy undergoes a volume contraction when it is hardened. This volume contraction is predictable and must be taken into account if you are trying to hold close tolerances. The contraction factor for the change from Condition A to Condition H 900 ranges from 0.0004 to 0.0006 in/in or (mm/mm). Hardening from Condition A to Condition H 1150 contracts in the range of approximately 0.0009 to 0.0012 in/in or (mm/mm).

Here are three reasons to NOT use 17-4 PH in the Condition A state:

- The structure is untempered martensite. This means it has low fracture toughness.
- The structure is untempered martensite. This means it has low ductility.
- Without age hardening, this material is more susceptible to stress corrosion cracking.

17-4 PH martensitic stainless steel can achieve high strength and superior corrosion resistance when precipitation hardened from Condition A to one of



the Condition H tempers. It is used in many high performance applications made by our industry, including valve parts for oilfield and chemical plant use, fittings for aerospace and aircraft use, jet engine componentry, fasteners, shafts for pumps, Dodge Viper carburetors and many others.

In applications where high performance is mandatory, it is also mandatory to follow needed thermal treatment practices to assure the development of the range of material properties provided.

For the savvy machinist, that also means understanding the potential effect of that thermal treatment on final size because of dimensional contraction when hardened.

Material on Dimensional Contraction was taken from the "Schmolz + Bickenbach 17-4 Datasheet."

Density and European Equivalency data was taken from the "Rolled Alloys Data Sheet."

European designation note: Officially 17-4 PH is designated as UNS S17400. It is the U.S. available nominal equivalent to DIN 1.4548, X5CrNiCuNb 17-4-4.

All Craftsman's Cribsheets are available for viewing and download at short.productionmachining.com/cribsheets.