Tech Bulletin
Magnetism in Stainless Steel Fasteners

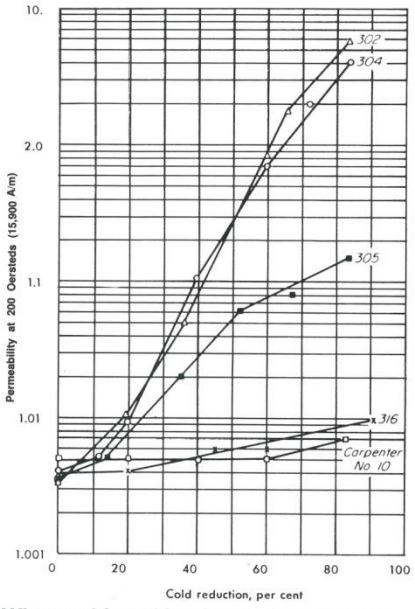
"The stainless-steel fastener I received sticks to a magnet." This is one of the more frequently heard complaints at Captive Fastener Corporation. A stainless-steel fastener being nonmagnetic is also one of the largest misconceptions amongst fastener users.

The magnetic behavior in stainless steel varies considerably, ranging from paramagnetic (nonmagnetic) in fully austenitic grades to hard or permanently magnetic behavior in the hardened martensitic grades.

All austenitic stainless steels are paramagnetic (nonmagnetic) in the fully austenitic condition as occurs in well-annealed alloys. The DC magnetic permeability range from 1.003 to 1.005 when measured at magnetizing forces of 200 oersteds (15,900 A/m). The permeability increases with cold work due to deformation-induced martensite, a ferromagnetic phase. For certain grades such as 302 and 304, the increase in magnetic permeability can be appreciable, resulting in these grades being weakly ferromagnetic in the heavily cold –worked condition.

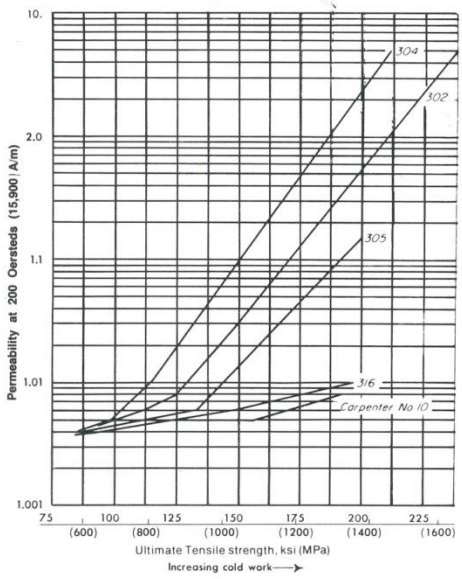
The effect of cold work on magnetic permeability is illustrated for several austenitic stainless steels in Fig 1. The relationship between ultimate tensile strength and magnetic permeability is shown in Fig 2.

Figure 1



When cold working is employed, some normally nonmagnetic austenitic steels become substantially ferromagnetic

Figure 2



Magnetic permeability of austenitic alloys subjected to cold working can also be expressed as a function of tensile strength.

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Source: Carpenter Stainless Steel, pg 243