

# Guide to Hard Metals

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## Common Hard Metal Constructions

In many sludge and slurry applications, abrasive particles are being handled. To provide maximum life of pump parts, it is important to select the optimum material to balance both hardness and impact toughness.

Sand is often the major solids component. As a guide the typical hardness of a silica sand particle is in the range of 570-590 Brinell.

### Ni-Hard 1 ASTM A532 Class 1

Ni-Hard is a Ni-Cr Cast Iron. The microstructure reveals an iron carbide precipitate in a matrix of primarily martensite with some austenite.

The combination of carbides and martensite provide an excellent combination for resistance to low and medium stress abrasion.

Standard sand cast Ni-Hard 1 will have a Brinell hardness of 550-650.

### Super Ni-Hard ASTM A532 Class 1

Standard sand cast Ni-Hard can be modified by a cryogenic process to increase both hardness and toughness. The freezing of the sand cast material, converts a large portion of the retained austenite to martensite increasing the hardness to a range of 650-700 Brinell.

### High Chrome Iron HC-250 & ASTM A532 Class III

High Chrome materials have a microstructure of chrome carbides dispersed in a pearlitic matrix. The carbides provide the hardness while the relatively soft pearlite matrix gives an impact toughness.

As cast material is in the range of 400 Brinell, this can be annealed for machining then re-heat treated to produce a final hardness of up to 600 Brinell. Unfortunately the heat treatment procedure can induce cracking of the casting, if sections are too thick. Maximum usable hardness for complex shapes is therefore limited to 550 Brinell.

The soft pearlite matrix is partially converted to austenite during heat treating. On large sections, uneven cooling will produce austenite at the surface only. This material will work harden under impact, but will tend to fracture and spall off in time.

As a rough guide, Ni-Hard and Super Ni-Hard are more suitable for low to medium stress, low angle impact and sliding wear. This would be typical of general slurry and sludge handling pumps.

High Chrome with the pearlite matrix is more suitable for medium to high impact at higher angles. This would be typical of a dredge pump application.

