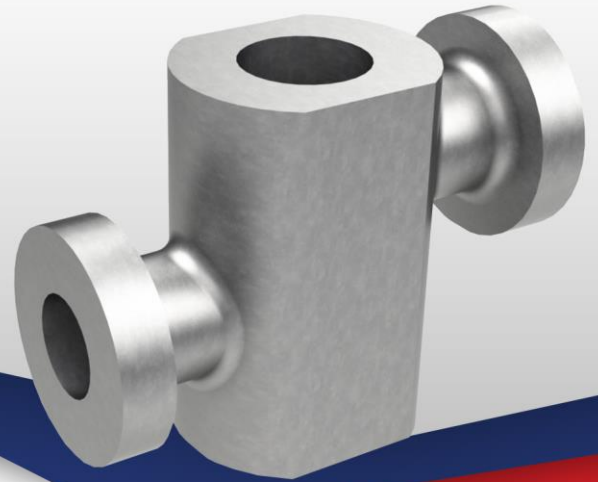


APM 9982 & 9982S UNS N06625

HOT ISOSTATIC PRESSED (HIP) PRODUCTS



Material Data Sheet



APM 9982 and APM 9982S is an austenitic nickel-chromium alloy characterized by extremely good corrosion resistance in widely varying acidic and chloride containing environments. High strength and excellent fabrication properties. Both can be used in a wide range of temperatures from -196°C to 815°C (-321°F to 1500°F). Typical uses include hydraulic and instrumentation systems, heat-exchangers and high-temperature applications. However, it should be noted that prolonged exposure to temperatures above 600°C (1100°F) may lead to embrittlement. APM 9982S is a high strength version with yield strength above 517 MPa (75 ksi). The powder is manufactured with vacuum melting, ensuring a high cleanliness with excellent material properties.

STANDARDS & APPROVALS

- ASTM: B834
- UNS: N06625
- ISO: NW6625
- EN Number: 2.4856

CHEMICAL COMPOSITION (NOMINAL)

C	Cr	Mo	Nb	Fe	P	S
<0.025	21.5	8,7	3.5	<5	<0.015	<0.015

Balance Ni.

FORMS OF SUPPLY

Components can be supplied in a wide range of dimensions and shapes because of the flexibility provided by powder metallurgy and near net shape technology. The products are supplied in the solution annealed and water quenched condition.

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APPLICATIONS

APM 9982 is an extremely versatile nickel alloy, suitable for use in both oxidizing and reducing acidic environments, such as:

- Hydrochloric acid
- Nitric acid
- Phosphoric acid
- Chloride containing environments

The grade can also be used for a wide range of temperatures from -196°C to 815°C (-321°F to 1500°F).

Typical areas of use include hydraulic systems, heat-exchangers and high-temperature applications.

- Some industrial examples are:
- High temperature aerospace
- Chemical process industry
- Power industry

MECHANICAL PROPERTIES

Hot isostatic pressed components have isotropic properties, meaning the mechanical properties are similar in all directions.

Mechanical properties at 20°C (68°F)

	APM9982	APM9982S**
Proof strength, $R_{p0.2}$, MPa (ksi)	>414 (60)*	>517 (75)
Tensile strength, R_m , MPa (ksi)	>827 (120)*	>965 (140)
Elongation, A	>30%*	>20%
Reduction of area, Z	>35%	>35%
Hardness, HRC	<32	<35
Impact strength CVN at -46°C, J (ft lb)	>50 (37)	>40 (30)

* Minimum values according to ASTM B834

** Custom process, available on request

Modulus of elasticity

Temperature, °C	GPa	Temperature, °F	msi
20	205	68	29.7

PHYSICAL PROPERTIES

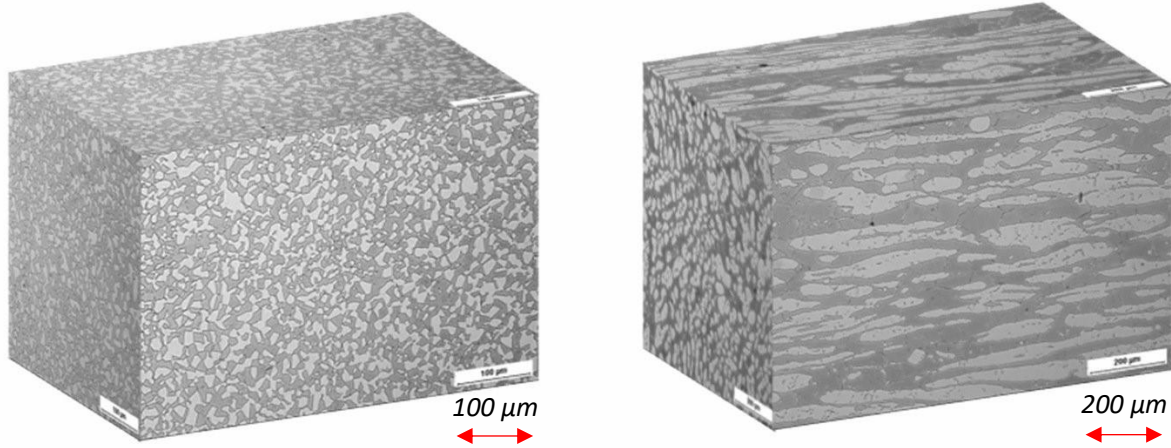
Density: 8.44 g/cm³, 0.305 lb/in³

Mean coefficient of thermal expansion, 20-100 °C: 12.9x10⁻⁶/°C

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MICROSTRUCTURE

Hot isostatic pressed components have isotropic properties, meaning the mechanical properties are similar in all directions.



Fine isotropic microstructure of HIPed material vs. forged bar. Note scale marker bar.

Fine isotropic microstructure of HIPed material vs. forged bar. Note micrographs show duplex material for illustration.

CORROSION RESISTANCE

APM 9981 and 9982 shows very good resistance to pitting corrosion, intergranular corrosion and is virtually immune to stress corrosion cracking in chloride-containing environments. The grade is able to withstand general corrosion in both severe oxidizing and non-oxidizing acids.

Resistance in chloride environments is also extremely good owing to the high PRE number, ≥ 48 .

Pitting Resistance Equivalent, PRE

$$\text{PRE} = \% \text{Cr} + 3.3 \times \% \text{Mo} + 16 \times \% \text{N}$$

In addition to its excellent wet corrosion resistance, APM 9981 and 9982 is also able to resist oxidation and scaling at high temperature.

HEAT TREATMENT

The products are delivered in the heat-treated condition. If additional heat treatment is needed due to further processing, the following is recommended. Solution annealing 1080-1160 °C (1970-2120 °F) followed by water quench or air cooling. Note that APM9982 cannot be heat treated without losing strength.

WELDING

APM 9982 and 9982S is readily joined by conventional welding processes and procedures. welding are manual metal-arc welding (MMA/SMAW) and gas-shielded arc welding, with the TIG/GTAW method as first choice.

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For APM 9982 and 9982S, heat-input of <1.2 kJ/mm and interpass temperature of <100°C (210°F) are recommended. A string bead welding technique should be used.

Recommended filler metals for TIG/GTAW or MIG/GMAW welding are ISO 18274 S Ni 6625/AWS A5.14 ERNiCrMo-3

Recommended filler metals for MMA/SMAW welding are ISO 14172 E Ni 6625/AWS A5.11 ENiCrMo-3

Note that strength level of APM9982S may be reduced during welding.

Fabrication

Fabrication of all stainless steels should be done only with tools dedicated to stainless steel materials. Tooling and work surfaces must be thoroughly cleaned before use. These precautions are necessary to avoid cross contamination of stainless steel by easily corroded metals that may discolor the surface of the fabricated product.

MACHINING

Nickel corrosion, temperature-resistant alloys, such as APM 9982 and 9982S, are classified as moderate to difficult to machine. It should be emphasized that despite this these alloys can be machined using conventional production methods at satisfactory rates. During machining these alloys work harden rapidly, generate high heat during cutting, weld to the cutting tool surface and offer high resistance to metal removal because of their high shear strengths. Some key points which should be considered during machining operations: Use highly rigid overpowered machines, Work piece and tool should be held a rigidly as possible, use sharp tools.

Disclaimer: Recommendations are for guidance only, and the suitability of a material for a specific application can be confirmed only when we know the actual service conditions. Continuous development may necessitate changes in technical data without notice. This datasheet is only valid for MTC Powder Solution materials.