APM 2354, UNS S31603 HOT ISOSTATIC PRESSED (HIP) PRODUCTS

DATASHEET

APM 2354 is a powder metallurgical, molybdenum alloyed austenitic steel, with corrosion properties superior to ASTM 304 and 304L. The grade is commonly used for heat-exchangers and condensers in the chemical, petrochemical, pulp and paper and food industries.

The chemical composition of the grade conforms to ASTM A182-F61, ASTM 316L, and UNS S31603.

STANDARDS

- Uns: S31603
- EnNumber: 1.4435

Approvals

- ASTM A988
- ASME N-834

CHEMICAL COMPOSITION (NOMINAL)

Chemical composition (nominal) %

C	Cr	Mo	Ni	N
<0.03	17	2.7	11.5	<0.1

FORMS OF SUPPLY

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

APPLICATIONS

APM 2354 is used for a wide range of industrial applications where steels of type ASTM 304 and 304L have insufficient corrosion resistance. Typical examples are: heat exchangers, condensers, pipelines, cooling and heating coils in the chemical, petrochemical, pulp and paper and food industries. In applications requiring higher strength and corrosion resistance the APM 2377 (22Cr Duplex) or APM 2327 (25Cr Super Duplex) alloys are an attractive alternative to austenitic steels in structures subjected to heavy loads.

The good mechanical and corrosion properties make APM 2377 and APM 2327 an economical choice in many applications by reducing the life cycle cost of equipment.

MECHANICAL PROPERTIES

Mechanical properties at 20ºC (68ºF)

	Minimum*	Typical
Proof strength, $R_{p0.2}$, MPa (ksi)	220 (32)	270 (40)

Mechanical properties at 20ºC (68ºF)

Tensile strength, R_m, MPs (ksi)	515 (75)	580 (85)
Elongation, A	40%	60%
Impact strength CVN at 20ºC, J (ft lb)	150 (110)	>200 (148)

Typical mechanical properties at 354ºC (670ºF)

Proof strength, $R_{p0.2}$, MPa (ksi)	165 (24)
Tensile strength, R_m, MPa (ksi)	430 (62)
Elongation, A	38%

PHYSICAL PROPERTIES

Density: 8.03 g/cm^3, 0.29 lb/in^3

Mean coefficient of thermal expansion, 30-100°C: **16.5x10^{-6}/°C**

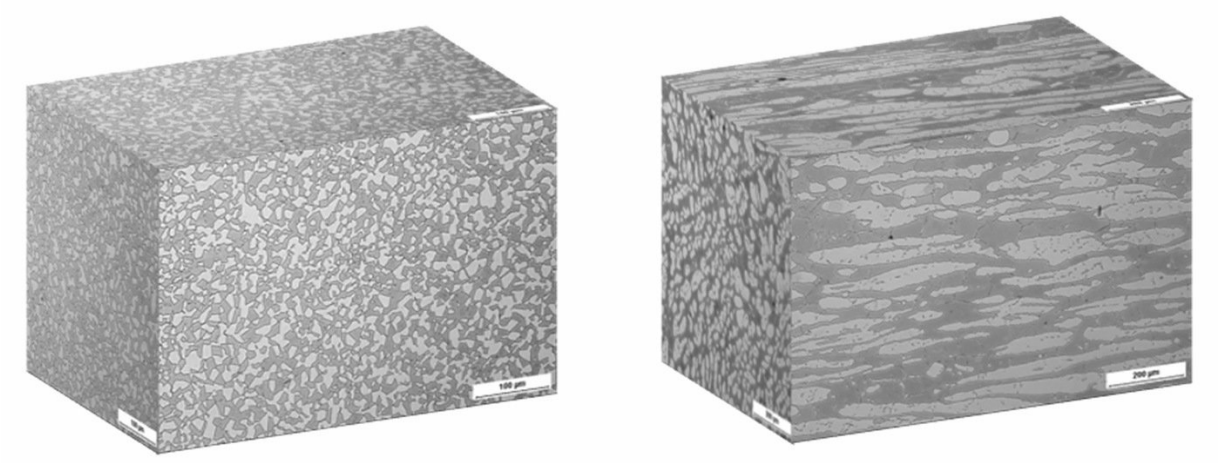
Modulus of elasticity*

Temperature, ºC	MPa	Temperature, ºF	ksi
20	200	68	27.6

* (x10^3)

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.

CORROSION RESISTANCE

Pitting corrosion

Resistance to these types of corrosion improves with increasing molybdenum content. Thus, the molybdenum-alloyed APM 2354 has substantially higher resistance to attack than steels of type ASTM 304 and 304L.

Stress corrosion cracking

Austenitic steels are susceptible to stress corrosion cracking. This may occur at temperatures above 60°C (140°F) if the steel is subjected to tensile stresses and at the same time comes into contact with certain solutions, particularly those containing chlorides. Such service conditions should therefore be avoided. Conditions when plants are shut down must also be considered, as the condensates which are then formed can

develop conditions that lead to both stress corrosion cracking and pitting.

In applications demanding high resistance to stress corrosion cracking, duplex (austenitic-ferritic) steels, such as APM 2377 or APM 2327 are recommended.

HEAT TREATMENT

Products are delivered in the heat-treated condition. If additional heat treatment is needed due to further processing, solution annealing at 1060ºC + quenching in water is recommended.

WELDING

The weldability of APM 2354 is good. Suitable welding methods are manual metal-arc welding with covered electrodes and gas-shielded arc welding with the TIG and MIG methods as first choice. Preheating and post-weld treatment are not normally necessary.

Since the material has low thermal conductivity and high thermal expansion, welding must be carried out with a low heat input and with welding plans well thought out in advance so that the deformation of the welded joint can be kept under control. If, despite these precautions, it is foreseen that the residual stresses might impair the function of the weldment, we recommend that the entire structure be stress relieved. See under Heat treatment.

As filler metals for gas-shielded arc welding we recommend wire electrodes and rods Sandvik 19.12.3.L and 19.12.3.LSi. In shielded metal-arc welding (SMAW) covered electrodes Sandvik 19.12.3.LR are recommended. If flux cored arc welding is preferred, the electrodes Sandvik 19.12.3.L T0 or Sandvik 19.12.3.L T1 should be used.

For further information on welding parameters, post weld heat treatment etc. please contact us.

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

Due to its sensitivity to work harden if machined too quickly, low cutting speed, heavier feed and good lubrication are recommended.

The isotropic microstructure of HIPed material gives excellent machining properties. Machining behavior of the material is the same throughout the entire part and the same in all directions. For more information on machining APM 2354 visit Sandvik Coromant.