



Industrial Machinery

Large Hadron Collider Quadrupole Magnets

The European Organization for Nuclear Research (CERN) completed the installation of a 27 km long particle accelerator in mid 2008. Known as the Large Hadron Collider, the system is based on superconducting quadrupole magnets which function as magnetic lenses focussing a particle beam in both vertical and horizontal directions.

The 2 mm thick collars surrounding the coil conductors are an essential structural component of the magnets. They operate at cryogenic temperature (1.9 Kelvin) under high mechanical stresses (up to 600 MPa). The austenitic stainless steel NIROSTA 4375 used for the collars has the outstanding magnetic and mechanical properties required to ensure accurate positioning of the coils and uniformity of the magnetic fields. This chromium, manganese, nickel and nitrogen alloyed stainless steel is characterised by a minimum strength of 850 MPa and a relative permeability of 1.001-1.005 between 1.9 and 293 Kelvin.



Location/environment | FRANCE AND SWITZERLAND/100 M UNDERGROUND

Product | COLD ROLLED STAINLESS STEEL STRIPS

Fabrication process | STAMPING

Grade/surface | NIROSTA 4375/2B (CR MN NI N 20 9 7/EN 4375)

Material thickness/diameter | 2.00 MM

Weight | 860 T FOR 528 QUADRUPOLE MAGNETS

Competing material | NONFERROUS METAL

Date of completion | 2008

Manufacturer | ERNESTO MALVESTITI S.P.A., ACCEL INSTRUMENTS GMBH

Material supplier | THYSSENKRUPP NIROSTA

Source of information | THYSSENKRUPP NIROSTA

Remarks



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Pressure Chamber

This stainless steel pressure chamber is specifically made for use in the Qinshan nuclear powerplant in China. The stainless steel for this application must be produced to strict quality requirements.



Location/environment | CHINA/INDOOR

Product | STAINLESS STEEL PLATE

Fabrication process | FORMING AND WELDING

Grade/surface | Z2CN18-10, Z2CND17-12

Material thickness/diameter

Weight

Competing material | CARBON STEEL

Date of completion

Manufacturer | QINSHAN POWERPLANT

Material supplier | TISCO

Source of information | TISCO

Remarks



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Steam Turbine Blades

Coal, gas and nuclear powerplants produce electricity by heating water to create steam. The steam is driven through turbine blades at very high pressure. The blades drive the turbine which generates electricity.

The typical operating temperature of the steam is around 600° C. The blades must be tough and resistant to stress, cracking and corrosion. The super-martensitic stainless steels used in these blades are perfect for use in this application.



Location/environment | WORLDWIDE/INDOOR

Product | STAINLESS STEEL BARS

Fabrication process | MACHINED FROM BARS OR FORGED AND MACHINED, DEPENDING ON SIZE

Grade/surface | SUPER- MARTENSITIC STAINLESS STEEL (FOR EXAMPLE, 0.2C, 13CR MO V)

Material thickness/diameter

Weight

Competing material

Date of completion

Manufacturer | ALSTOM SWITZERLAND SA

Material supplier

Source of information | ISSF LONG PRODUCTS COMMITTEE

Remarks



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Industrial Machinery **Turbo Generator End Ring**

The diameter of the end ring of a turbo generator can be between 0.5 and 1.6 metres. The end ring must pass stringent tests to ensure it can operate without deformation at speeds of up to 3,600 revolutions per minute. Non-magnetic stainless steel reduces the losses in the ring that are caused by eddy currents and thermal stresses. The ring is cold formed to provide the highest yield strength and to ensure plastic deformation does not occur during operation.



Location/environment | WORLDWIDE/INDOOR

Product | FORGED RING

Fabrication process | FORGING AND MACHINING

Grade/surface | 18MN 18CR STAINLESS STEEL

Material thickness/diameter

Weight

Competing material

Date of completion

Manufacturer | ALSTOM SWITZERLAND SA

Material supplier

Source of information | ISSF LONG PRODUCTS COMMITTEE

Remarks