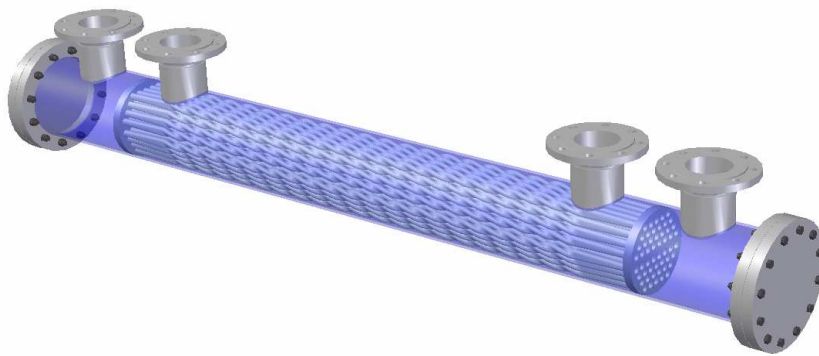


Dec 2007

The Twisted Tube Heat Exchanger AlfaTwist

Examples of deliveries

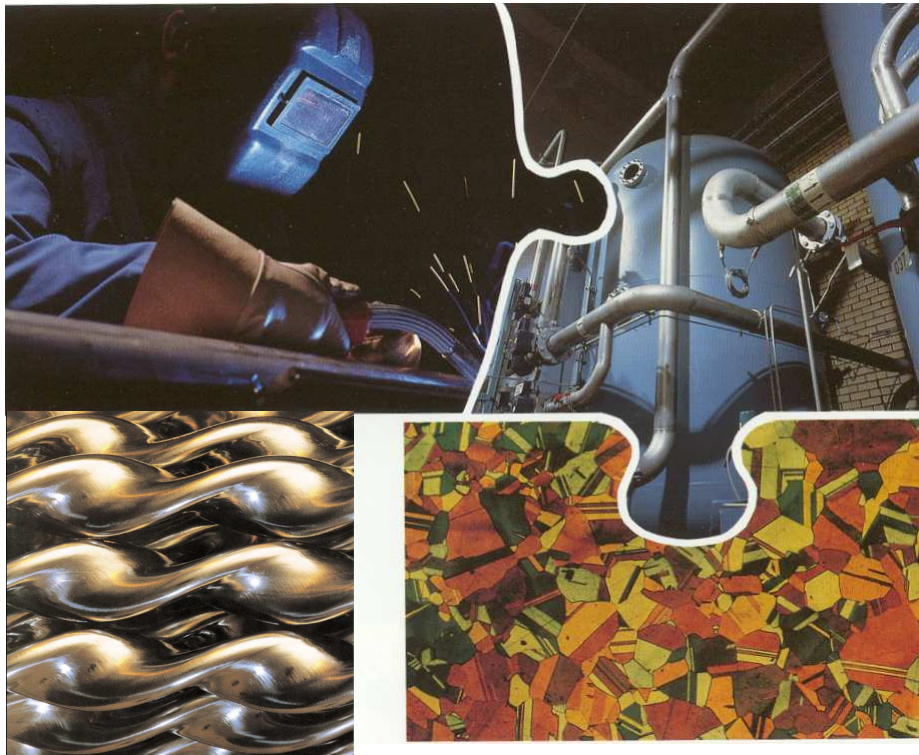


Siljan Allards AB

www.siljanallards.com

Siljan Allards is one of Sweden's largest manufacturers of stainless process equipment. The combination of

- Ca 35 years of experience with stainless steel manufacturing
 - Large, ca 10.000 sqm, and adequate work shops
 - Very experienced and skilled personnel
 - Productive machinery
 - One of Scandinavia's largest pickling plant for surface treatment
 - Large capacity for thermal and mechanical design
 - Very high knowledge of the microstructure and properties of stainless steels, including welding metallurgy, plate forming, corrosion and mechanical properties.
- makes us very efficient as well as secures a high quality.



One of our main products is shell & tube heat exchangers in carbon steel, stainless steel and nickel base alloys and in different executions, both as conventional heat exchangers with round tubes and as the twisted tube heat exchanger *AlfaTwist*.

We have a complete organization for thermal and mechanical design, manufacturing and testing of shell & tube heat exchangers.

We also have resources to support and solve thermal and mechanical problems in existing shell & tube heat exchangers, to perform retubing as well as controlling if existing heat exchangers are leak proof, do tube plugging work and repair work.

In this brochure we give a number of examples of twisted tube heat exchangers which we have designed and manufactured the last years

Compact, efficient heat exchangers with twisted tubes, the AlfaTwist heat exchanger

Allards and Siljan Allards have since the beginning of the 80:s manufactured a large number of heat exchangers equipped with twisted tubes.

In total, ca 700 twisted tube heat exchangers have been delivered to be used in the following applications:

- Power plants in Sweden, Norway, Finland and China.
- Pulp- & paper mills in Sweden, Norway and Finland.
- Chemical plants in Sweden, Finland, Denmark, Norway and Venezuela.
- Refineries and petrochemical plants in Sweden and Finland.
- Pharmaceutical and food manufacturing plants in Sweden, Norway, Denmark and Finland.
- The vehicle industry in Sweden.
- Steel plants in Sweden and Finland.



The experiences with the twisted tube heat exchangers are very positive. The heat transfer capacity has in general been higher than expected. Problems with damages due to vibrations as well as fouling problems have been solved. Since the AlfaTwist heat exchanger is very compact, space has been saved, which has lowered the total investment costs. The customers satisfaction is very high.

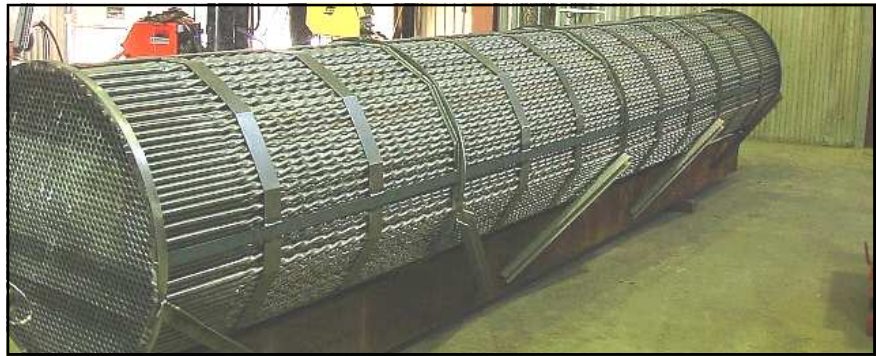
Worth mentioning is the experience in a large vehicle plant in Sweden, where one had large problems with fouling on the tube side of heat exchangers with round tubes.

After the installation of twisted tube heat exchangers, the fouling problem disappeared, the reason being that the turbulent flow in the twisted tubes drastically decreased the fouling on the inside of the tubes.



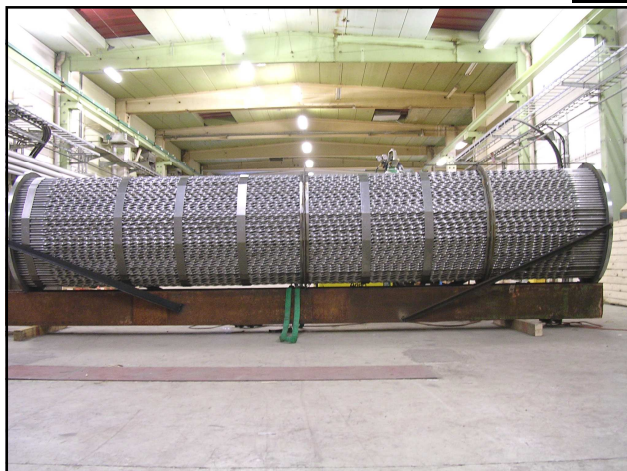
A twisted tube heat exchanger, AlfaTwist, supplied to Vattenfalls power plant in Uppsala, Sweden, in 2005.

The twisted tube bundle below. "It sounds like a spinning cat" the chief engineer said, when this heat exchanger was taken into service. In the same power plant there is a twisted tube heat exchanger installed in 1983, still performing in an excellent way and in 1983 solving vibration problems in a conventional shell & tube heat exchanger.



Twisted tube heat exchanger manufactured and delivered to a large power plant in northern Sweden.

The twisted tube bundle in the picture below.





Twisted tube heat exchanger for a power plant in central Sweden. Rebuilt to decrease the pressure loss. Shell in carbon steel, tubes in the stainless steel 1.4301/304.

With such a design of a shell & tube heat exchanger, the following problems are eliminated:

- General corrosion of carbon steel tubes.
- Vibration damages of tubes at baffle plates
- Vibration damages of tubes at tube sheet

In general, a twisted tube heat exchanger has a lower weight and smaller dimensions.

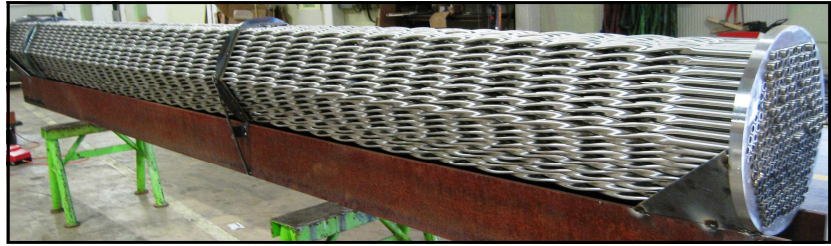
The twisted tube heat exchanger AlfaTwist installed as a condenser in a power plant in central Sweden. Significantly more efficient than a conventional shell & tube heat exchanger, needs less space and the risk for damages of tubes due to corrosion is eliminated.

The support construction was also manufactured by Siljan Allards.



The twisted tube heat exchanger AlfaTwist, with stainless steel tubes, for a power plant in central Sweden

Tube bundle above, the complete heat exchanger below.



Rebuilding of a twisted tube heat exchanger AlfaTwist for a power plant in central Sweden.

The steam inlet was modified for increased capacity. The twisted tube bundle in carbon steel was switched to a tube bundle in stainless steel, 1.4301/304.

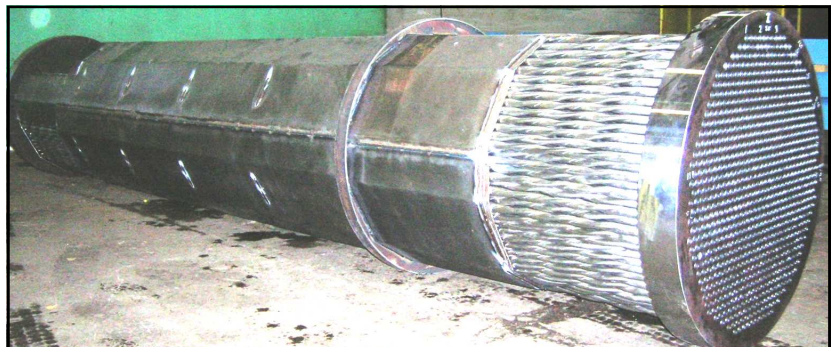
Below the tube bundle with stainless steel tubes.

To the left: The heat exchanger installed and ready for its duty during the winter season.



This heat exchanger represents the most efficient and reliable on the market:

- The geometry of the twisted tube improves the thermal efficiency and decreases the size of the heat exchanger.
- Possible vibration damages of tubes are eliminated since the twisted tubes support each other along the whole tube length.
- The selection of stainless steel tubes eliminates the corrosion of carbon steel tubes.





A twisted tube heat exchanger delivered to a power plant in central Sweden.

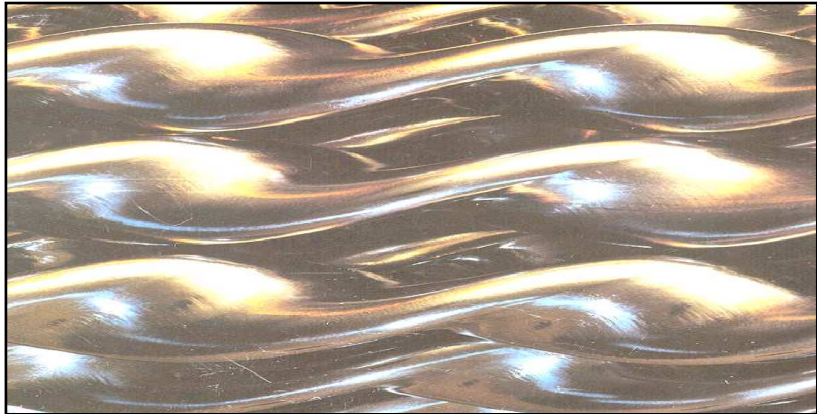
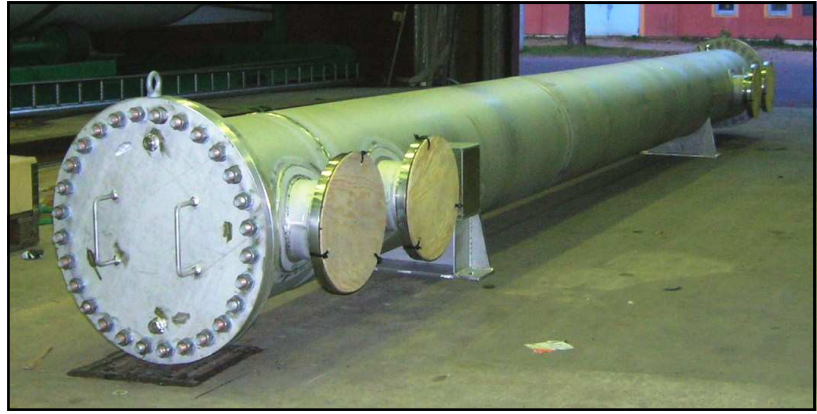
Four twisted tube heat exchangers to be installed in a power plant in China.



The twisted tube heat exchanger AlfaTwist, manufactured in the stainless steel 1.4432/316L high Mo for the cooling of black liquor; The customer, a paper mill in northern Sweden, has since many years three heat exchangers of this type, is very satisfied, needed an increased cooling capacity and ordered one more of the same type.

When twisted tubes are used, the fouling is reduced as compared to round tubes.

If cleaning still becomes necessary, the covers at both ends are removable and the tubes can be cleaned using a high pressure probe.



Twisted tube heat exchanger, AlfaTwist, in 1.4404/316L, during installation in a paper mill in central Sweden.

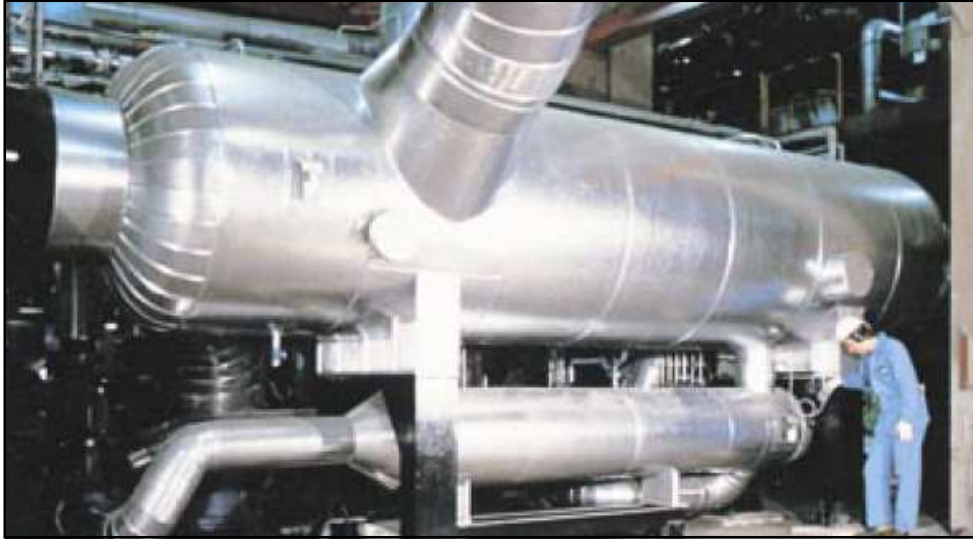


Twisted tube heat exchanger in 1.4404/316L for a chemical plant in central Sweden.



Twisted tube heat exchanger with tubes in the super duplex stainless steel 1.4410/S32750 to be installed in a corrosive environment in a food manufacturing plant in southern Sweden.





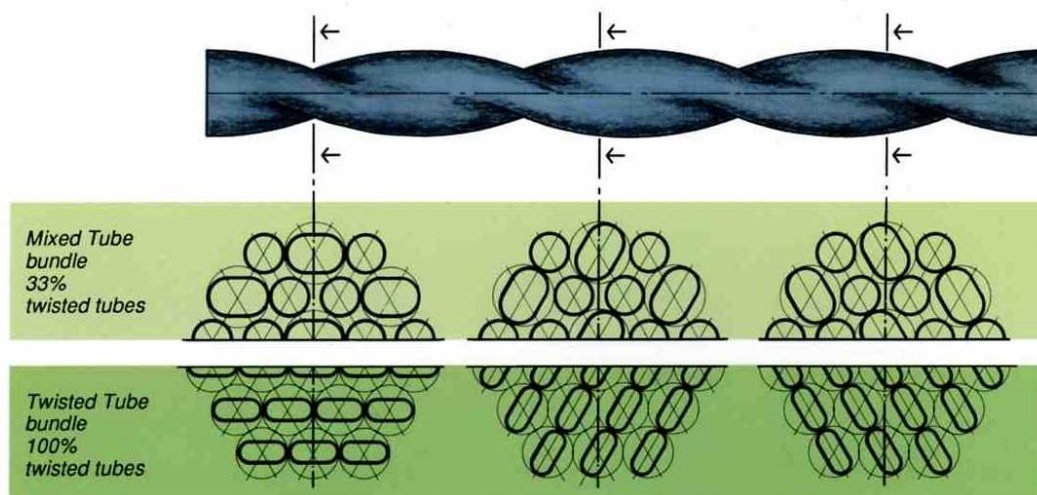
Condenser
in a power
plant in
central
Sweden

Liquor cooler in
a paper mill
in Sweden



Thick liquor hea-
ter in a paper
mill in Sweden

The twisted tube heat exchanger AlfaTwist; Properties and advantages.



Thermally flexible and effective.

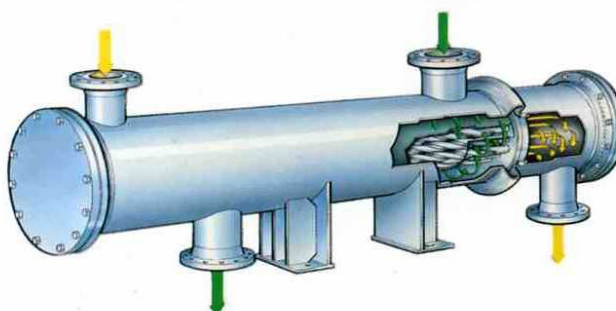
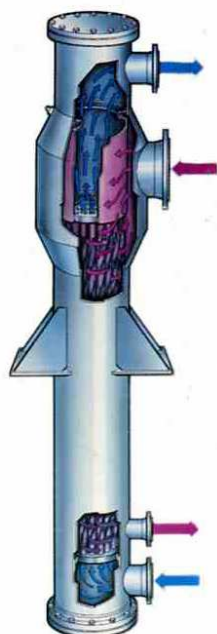
In the twisted-tube heat exchanger, the tubes are profiled by flattening and twisting in such a way that they mutually support each other at a large number of contact points along their entire length, thus totally eliminating the risk of tube vibration.

The tubes can be arranged on either a triangular or a rectangular pitch, and the cross-section of the tubes can be varied. A large deformation will give a small cross-section on the tube-side in relation to the shell-side, while a small deformation will produce the opposite result. In this way, the heat exchanger can be adapted to optimally suit the thermal duty for which it is intended.

Twisted tubes can be combined with straight tubes without losing the tube-support function – a so-called mixed-twist construction – this being of value in certain applications including some condensation duties.

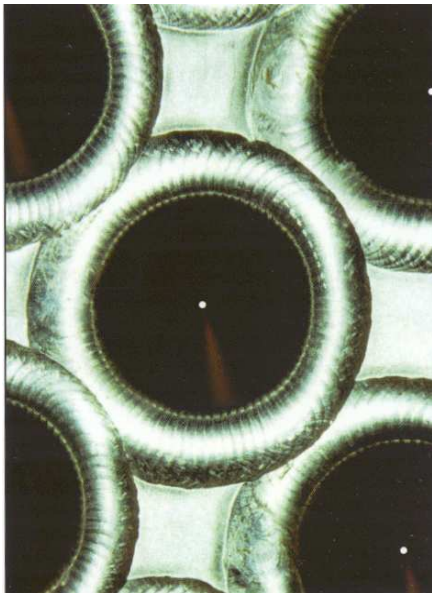
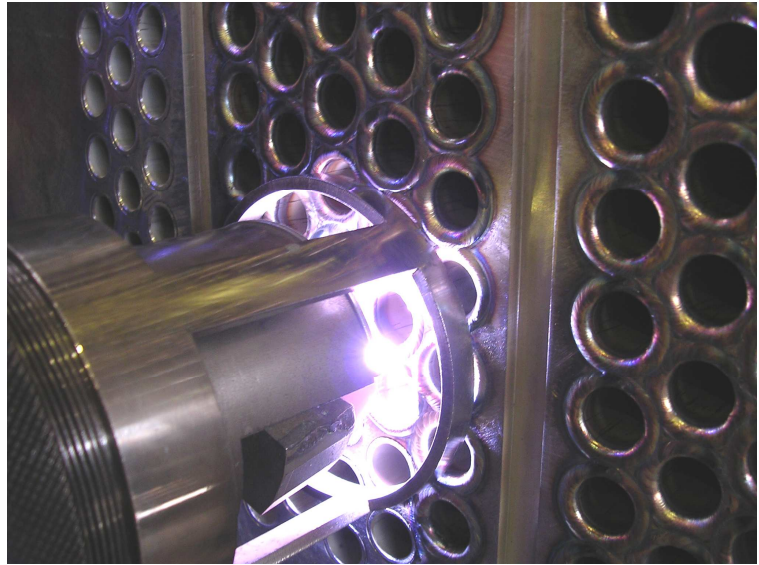
The twisted-tube construction reduces fouling tendency firstly due to the increased linear velocity in the tube and secondly due to the tube's helical geometry imparting a swirling motion to the fluids.

It has been experimentally confirmed that the deformation of the tube does not adversely affect the mechanical properties of the tube material.



Examples of manufacturing steps

TIG-orbit tube-to-tube sheet welding; Efficient, highest quality.



Weldments after TIG-orbit welding.; Highest quality.

Expansion of tubes into tube sheet. Close control of expansion force. Measurements of the expansion using special instruments.



Short about quality and technique

Quality assurance: We apply the quality system, ISO 9001-2000, for welding EN 729-2.

Thermal design: We use the design program HTFS /Aspentech, which regularly is updated. Vibration control is always made.

Mechanical design: We use the Visual Vessel Design program, regularly updated. We can perform calculations according to ; PED 97/23/EC-EN 13445, PD5500:2000 and ASME.

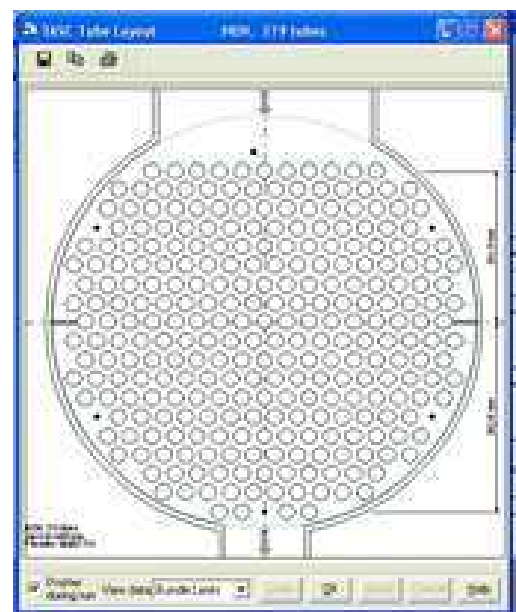
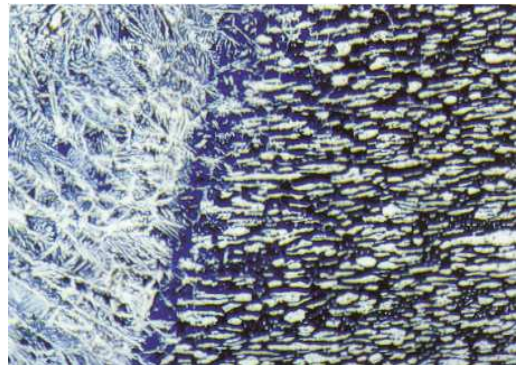
Welding: We have welding procedures for about 550 combinations of materials, dimensions, geometries, welding methods and standards.

Welding methods: GTAW, MAW, GMAW, PAW and UP welding. Mechanized welding is performed to a large extent.

Welding qualifications according to

EN 288-3
EN 288-6
PD 5500
ASME
Norsok M 601 och 602
NACE
AD Merkblatt HP 2/1

Materials: Carbon steel, low alloyed steel, stainless standard and special steels, nickel base alloys and high temperature materials



You are welcome to contact us for more information.

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