MANUFACTURING PROCESS OF WELDED TUBES
SOLAR TOWER RECEIVER APPLICATION

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New generation of superduplex stainless steel premium tubes

Umbilicals market for Oil & Gas:

- Super Duplex 2507 tubes
- ID ½” to 1½” → 2”
- WT 1.0 to 3.4 → 4.5 mm
- Laser seam welded tubes
- AYS_{0.2}>750MPa , UTS>900MPa
- One plant located at Venarey-les-Laumes
- Qualified by IOC and BV
TUBES FOR UMBILICALS CHARACTERISTICS

► High quality grade 2507 (UNS S32750 / EN 1.4410) strip
  • PREN ≥ 42.5
  • Suitable pitting and crevice corrosion resistance
  • Excellent resistance to SSC and HISC tests

► Control:
  • NDT performed over the entire length of the finished tubes (100%).
  • Hydrostatic test performed internal hydrostatic pressure

► Tight dimensional tolerances
  • No internal and external weld bead
  • Wall Thickness (WT): +/- 5%
  • Outside Diameter (OD): +/- 0.1mm (including ovalisation)

► Excellent tube mechanical properties
  • Optimised strength
    » YS₀₂ > 750MPa
    » UTS > 900MPa
  • Elongation ≥ 25%
  • Excellent fatigue properties
Capacity and capability increase

Renewable energies with first focus on tubes for CSP
TUBES FOR RECEIVERS

- Nominal Internal Diameter:
  - 1/2
  - 5/8
  - 3/4
  - 7/8
  - 1
  - 1 1/4
  - 1 1/8
  - 1 1/2

- Wall Thickness:
  - 0.85
  - 1.00
  - 1.15
  - 1.14
  - 1.20
  - 1.00
  - 1.15
  - 1.43
  - 1.82
  - 1.70
  - 1.25
  - 1.06

- ID and WT:
  - ID 47.8 mm x WT 1.5 mm
  - ID 46.8 mm x WT 2 mm

- Dimensions:
  - 12.70 mm x 1.00 mm
  - 19.05 mm x 1.06 mm
  - 19.05 mm x 1.25 mm
  - 19.05 mm x 1.70 mm
  - 19.05 mm x 1.82 mm

- Note: The image shows a graph with VU1 range and VU2 range, indicating different specifications for tube sizes and wall thicknesses.
**TUBES FOR RECEIVERS**

**Solar**
- Welded rolled tube for molten salt application in solar tower technology

**Tubes for Receivers**

**Specification**
- Material: Ni based alloy (Haynes 230)
- Dimensions: ID 47.8 mm x WT 1.5 mm
  ID 46.8 mm x WT 2 mm
- Cold worked
- Laser welded
- External and internal weld bead shall be properly removed
- Solution annealed (1177°C - 1245°C)
- NDT tests (Eddy Current) of the whole tube

**Process Flow Diagram**
- **Strip Preparation & Forming**
- Laser welding
- Weld bead finishing
- Heat treatment
- Sizing & polishing
- NDT control & marking

**Key Points**
- Forming rollers give progressively a round shape to the strip
- CO₂ laser is used
  - Energy can reach 8KW
- Bead are internally and externally rolled
  - External surface is brushed
- Heating then cooling inside an 10 m long tunnel in a controlled atmosphere
- US: 100% of the tube is controlled
- EC: 100% of the tube is controlled
- OD and WT control

**Coiled strip** -> **Intermediate reel**
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- External and internal weld bead shall be properly removed
- Solution annealed (1177°C - 1245°C)
- NDT tests (Eddy Current) of the whole tube
- Tubes with plain ends cut and deburred
- Hydrostatic tests up to 6.9 MPa

**Tube preparation line**
- Straight tube preparation
- Hydrostatic test

**Laboratory**
- Cutting
- Ends preparation
- Pressure test
- Cleaning
- Drying
- Packing

**Customer tubes**

**Intermediate reel**

**Sizing & straightening**
TUBES FOR RECEIVERS

➢ Receiver (straight) tubes: Grades 625 or Haynes 230
➢ In accordance to VU dimension range
➢ Industrialization study on Haynes 230 in Vallourec Umbilicals:
  ➢ Forming
  ➢ Laser welding
  ➢ Heat treatment
  ➢ Microstructure
  ➢ Mechanical properties

Tensile tests

Tensile tests on Haynes 230 strip:
• Mechanical properties at room temperature
• Tensile specimens (1.6 mm and 2 mm)
THANKS FOR YOUR ATTENTION