HFI-welded steel pipes for abrasive media

Material solutions taking account of the corrosive effect of the transported medium

MANNESMANN
LINE PIPE
A Member of the Salzgitter Group

Product description

Solids such as ores, tar sands or fly ashes are transported in slurry pipelines over many kilometers. These are solid media with a small grain size that are either dry or mixed with liquids, mostly water. Depending on their corrosive effect, a variety of pipe designs are suitable for transporting these abrasive media:
- pipes with an abrasion-resistant lining
- pipes made from abrasion-resistant steels

The abrasion-resistant lining is made from polyurethane resin. Pipes with this lining are offered in cooperation with Roplast GmbH, a subsidiary of Rosen GmbH based in Lingen, Germany. An application example can be viewed at the following link: www.rosen-group.com/global/solutions/industry-case-studies/mining/kouribgas-slurry-pipe.html

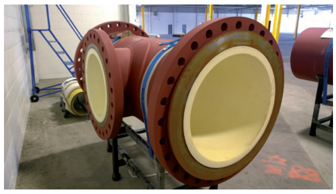
The lining can be adapted to the medium and operating conditions involved. For media with slight or no corrosive effect, steels with appropriate abrasion resistance are available. The overleaf material datasheet provides information about the abrasion-resistant material Dura L.

Applications

Abrasion-resistant pipes can be found in a wide variety of applications:
- Tar sand production
- Ore transportation
- Fly ash transportation

The pipe connections used are predominantly mechanical, such as flange or coupling joints. Given the abrasive medium and corrosive environment, gaps should be avoided. Specifications concerning the tolerances at the pipe ends can be taken into account. The design of the connections allows the pipe to be rotated. In addition, pipe routing can be easily modified.

Coupling for grooved pipe



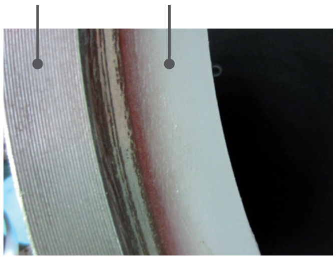
Flange connection for a T-piece

Product properties

The measures for increasing abrasion resistance ensure a longer service life compared to standard pipe designs. Smooth surfaces provide for increased production as well as reducing pump output and the associated energy consumption. Lined pipe can be cold bent, the permissible bending radius being about 40 times the outside diameter.

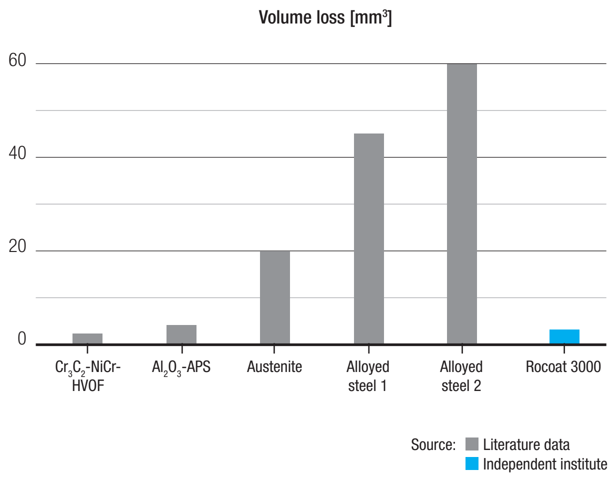
Composite structure: Steel pipe with polyurethane lining (Rocoat 3000)

Steel   Polyurethane (PUR)



Internal lining surface

The results of the abrasion test to ASTM G75 confirm the outstanding properties of polyurethane linings. For example, Rocoat proves extremely resistant compared to alloyed steels. In terms of resistance, Rocoat 3000 is comparable to the aluminum oxide layers (Al_2O_3-APS) applied using a plasma process, or the chromium-carbide-based ceramic layers (Cr_3C_2-NiCr-HVOF) applied by high-speed flame spraying.



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Dura L material

Scope of application

This datasheet covers welded steel pipe which features the properties described below in the delivery condition. All the pipes used have been subjected to induction annealing of the weld.

The processor or fabricator must make sure that their calculation, design and working processes match the material and application besides being state-of-the-art. Processing must be performed in accordance with SEW 088.

Chemical composition

C %	Si %	Mn %	P %	S %	Al %	Cu %	Cr %	Ni %	Mo %	N %	B %
0.30 - 0.37	0.15 - 0.55	1.45 - 1.80	max. 0.025	max. 0.010	0.010 - 0.060	max. 0.15	max. 0.15	max. 0.15	max. 0.05	max. 0.010	max. 0.0005

Mechanical properties at room temperature

Yield strength $R_{t0,5}$ min. in N/mm² for wall thicknesses < 12.7 mm	Tensile strength R_m in N/mm² for wall thicknesses < 20 mm	Elongation at rupture A in %
min. 413	min. 620	min. 22

- The test is carried out on longitudinal specimens
- Hardness measurement, min. individual value 210 HB
- Vickers small-load test HV1 according to ISO 6507 on the first pipe of each coil

Micro-hardness is measured in high-carbon areas at four selected points across the wall thickness.
HV to HB conversion: 1:1.

Hydrostatic test

- Scope of testing: each pipe
- Holding time: min. 5 seconds
- Test pressure level: calculated on the basis of the minimum wall thickness and a guaranteed yield strength utilization of 90 %.

Geometrical properties

- Wall thickness tolerance: - 0.5 mm / + 15 %
- Diameter tolerance: ± 0.5 % of outside diameter (measured with tape measure)
- Ovality: 1.5 % of outside diameter (measured with slide gauge)
- Pipe ends: cut off vertical to the pipe axis
- Geometry of the scraping area:
  - External scraping: smooth
  - Internal scraping: + 1.52 mm / - within the wall thickness tolerance
- Out-of-straightness: max. 2 mm/m
- Lengths: according to order specifications

Nondestructive testing

Weld: 100 % ultrasonic defect detection, incident angle of acoustic wave: 45°. Calibration with N10 groove.

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