

Air Tank- Durability test

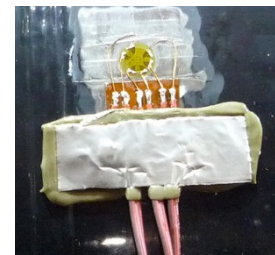
Frauenthal Automotive in co-operation with the Technical University of Ostrava has carried out durability tests of its pressure vessels. The aim was to re-test the actual number of stress vibrations when used under the realistic conditions.

→ Standard requirements on the air tank durability

- The standard limits the air tank durability by the maximum number of the stress cycles.
- Use outside the following limits is considered non-standard:
 - When using the stress cycles with $\Delta p < 20\%$ of the operating pressure PS, the vessels are considered as high-durability products.
 - When using the stress cycles with $\Delta p > 20\%$ of the operating pressure PS, max. 1,000 stress cycles are allowed. (Acc. to AD 2000 S1)

→ Technical data of the tested vessel

- Volume: 35 L
- Operating pressure PS: 12.5 bar
- Diameter: 310 mm
- Length: 529 mm
- Material: P275 SL
- Wall thickness: 2 mm
- Operating temperature range: $-50^{\circ}\text{C}/+100^{\circ}\text{C}$



→ Testing method

- Number of tested vessels: 3
- Testing medium: Hydraulic oil
- Climatic chamber test
- Monitoring of the material tension using strain gauges

		1. TEST PHASES	2. TEST PHASES
STRESS CYCLE		1.25-12.5 bar	0-12.5 bar
Δp		11.25 bar \triangleq 90% PS	12.5 bar \triangleq 100% PS
CYCLES	T=20°C	170,000 cycles	2,000 cycles
	T=-50°C	10,000 cycles	
	T=100°C	20,000 cycles	
	Σ	<u>200,000 cycles</u>	<u>2,000 cycles</u>

→ Evaluation

Reading of the material tension using strain gauges

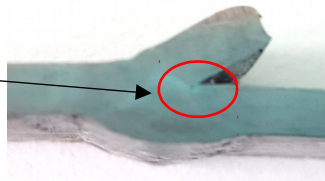
- Maximum allowed tension for the material P275SL → 275 MPa

	AXIAL TENSION σ_1	TANGENTIAL TENSION σ_2
MAXIMUM	145 MPa	54 MPa
AVERAGE	85 MPa	35 MPa

Macroscopic analysis

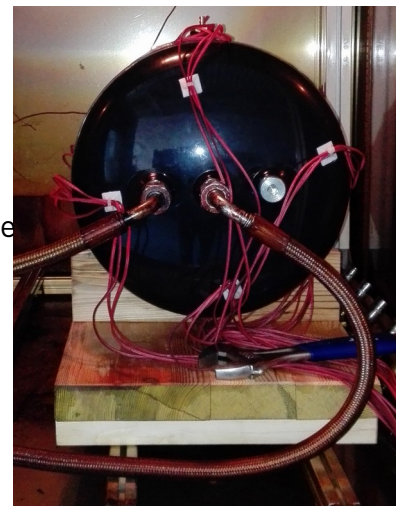
- To support the notch effect and thus the conditions for creating the circumferential weld cracks, the special vessels were manufactured for this durability test, the parameters of which were below the defined specifications.

Critical spot
Upon the test completion,
no cracks were found



→ Durability test results

- All the vessels passed the test 200,000 stress cycles at Δp 90% of the operating pressure PS
- 2,000 stress cycles at Δp 100% of the operating pressure PS
- max. 1,000 stress changes (permissible acc. to the standard) greatly exceeded
- Material tension was well below the yield point of the vessel material
- No leakages
- No cracks



In this test, the Frauenthal vessels / tanks showed at least 200 times longer durability than the maximum limit specified in the standard.



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