

VOLKSWAGEN AG	Charge Air Coolers Functional Requirements	TL 82132
Konzernnorm		
<p>Descriptors: charge air cooler, end tanks, test, corrosion test</p> <p>Changes The following changes have been made as compared to the October 1989 issue:</p> <ul style="list-style-type: none"> – TL restructured – Section 'Service life' revised – Test bench draft removed <p>Previous issues First issue: 03.85 Last change: 10.89</p> <p>1 Scope This Technical Supply Specification (TL standard) specifies requirements and tests for:</p> <ul style="list-style-type: none"> – Charge air coolers made from light alloys for supercharged gasoline and diesel engines (engines with superchargers/exhaust-gas turbochargers). – End tanks made from aluminum or plastic. <p>2 General requirements Approval of first supply and changes according to Volkswagen standard VW 01155. Environmental requirements according to VW 91100 shall be fulfilled. Type according to drawing; deviating requirements in drawings take precedence over this Technical Supply Specification.</p> <p>2.1 As-received condition The parts must be free of impurities that could lead to disturbance of the function. Open holes and ports must be sealed using caps and/or plugs that are easily removable without auxiliary equipment.</p>		
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2.2 Operating temperature range

Depends on engine type or material of the end tanks (see Table 1)

Table 1 - End tanks

Material	Operating temperature range
PA 6.6 GF	-40 °C to +180 °C
PA 4.6 GF PA 6.6 LGF50	-40 °C to +190 °C
PPA GF	-40 °C to +210 °C
PPS Al	-40 °C to +230 °C

2.3 Materials

According to drawing.

3 Functional requirements

3.1 Performance requirements

Only for release and samples.

3.1.1 Cooling performance

Heat flow	according to drawing
Air flow mass on cooling-air side	according to drawing
Air flow mass on charge-air side	according to drawing
Intake temperature on cooling-air side	according to drawing
Intake temperature on charge-air side	according to drawing
Test medium	air

3.2 Pressure loss

3.2.1 Cooling-air side

According to drawing.

3.2.2 Charge-air side

According to drawing.

Pressure measuring points	according to drawing
Permissible deviation from drawing specifications	$\leq 10 \%$
Test medium	air
Test temperatures	according to drawing

3.3 Static leak tightness (100% testing by manufacturer)

Test medium	Air
Requirement	Component leakage is not permissible.
Test pressure	At least 2,5 bar over-pressure or maximum pulsation pressure according to Section 4.1.2 (short-term test); the higher value shall be used.

Standard-production tests shall be performed such that components which are not leak-tight when subjected to water are reliably detected.

4 Service life

4.1 Pressure pulse test

The charge-air coolers are evaluated in a short-term and a long-term test.

The test levels of pressure amplitude, test medium and test chamber temperature depend on the vehicle loads; therefore they have to be redefined for the short-term and the long-term test and specified in the component drawing.

Test frequency	$f = 0,3$ to 1 Hz
Course of pressure	sinusoidal (depending on system)
Test medium	air

4.1.1 Pulsating pressure load, long-term test

Test pressure	according to drawing
Test chamber temperature	according to drawing
Test medium temperature	according to drawing
Number of specimens	$n = 4$
Requirement:	
Number of load cycles (LC), average	$N \geq 1\,000\,000$ cycles
Standard deviation	$S_{\log} \leq 0,15$
Final number of load cycles	$N = 1\,200\,000$ cycles

4.1.2 Pulsating pressure load, short-term test

Test pressure	according to drawing
Test chamber temperature	according to drawing
Test medium temperature	according to drawing
Number of specimens	n = 8
Requirement:	
Number of load cycles, average	$N \geq 100\,000$ cycles
Standard deviation	$S_{\log} \leq 0,15$
Final number of load cycles	$N = 200\,000$ cycles

4.2 Vibration resistance

Test procedure:

The vibration test is performed in assembly with the mounting bracket and all add-on parts of the cooling module. Components carrying media shall be filled and sealed tightly using plugs.

A minimum stress-cycle curve (mean-value line) is calculated from the available load spectrum for 14 400 km EVP (elimination loop for passenger vehicles, Ehra proving grounds) using the EGPF Development Guideline 03/99. From this, 3 key values are specified for the oscillation test.

Point 1 in the LC range of the minimum stress-cycle curve $N = 10 \times 10^6$ load cycles

Point 2 in the LC range of the minimum stress-cycle curve $N = 5 \times 10^6$ load cycles

Point 3 in the LC range of the minimum stress-cycle curve $N = 1 \times 10^6$ load cycles

Direction of oscillation	Z-direction
Vibration frequency	in component resonance or acc. to vehicle measurement
Acceleration measuring point	according to measuring point of vehicle measurement (on cooling module)
Number of specimens	1 per test level
Requirement	the minimum stress-cycle curve (mean value line) must be exceeded
Standard deviation in LC direction	$S_{\log} \leq 0,2$
Final number of load cycles	1,2 times the minimum stress-cycle curve
Test chamber temperature	$T = +100\,^{\circ}\text{C}$

4.3 Exterior corrosion

Function and leak tightness shall be ensured.

Corrosion (e.g. surface damage such as graining, blooming) is only permissible on the locations specified in the drawing which are damaged or unprotected due to the manufacturing method.

Salt spray fog	960 h DIN EN ISO 9227 NSS
Cycle test (release only for painted parts)	60 cycles acc. to Test Specification PV 1210

4.4 Thermal shock resistance (only for release)

Number of specimens	3
Test medium	heated/non-heated air
Test medium temperature, cooler intake	
Lower temperature point	$T = (30 \pm 5)^{\circ}\text{C}$
Upper temperature point	acc. to drawing, depending on long-term test
Test frequency	6 to 12 temperature cycles per h
Requirement:	
Number of cycles	$N = 2\,000$ without failure
Leak tightness	Component leakage is not permissible.
Test pressure	At least $p = 2,5$ bar over-pressure or maximum pulsation pressure according to Section 4.1.2 (short-term test); the higher value shall be used.

5 Referenced standards¹

PV 1210	Body and Add-On Parts, Corrosion Test
VW 01155	Vehicle Supply Parts; Approval of First Supply and Changes
VW 91100	Environmental Standard for Vehicles; Vehicle Parts, Materials, Operating Fluids; Policy, Specifications
DIN EN ISO 9227	Corrosion Tests in Artificial Atmospheres - Salt Spray Tests

¹ In this Section terminological inconsistencies may occur as the original titles are used.