Class. No.: 8LP30
Descriptors: transmission oil, Functional Requirements, heat exchanger

Transmission Oil Cooler

Functional Requirements

3 Types: A, B, C

Previous issues

TL 82012: 1996-11; TL 82012: 2003-03; TL 82012: 2004-04

Changes

The following changes have been made as compared to TL 82012: 2004-04:

– Standard fundamentally revised and restructured

Contents

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1 Scope

This Technical Supply Specification defines functional requirements for heat exchangers (water-type oil coolers and air-type oil coolers) made of light metal.

2 Description

Functional requirements for transmission oil cooler according to TL 82012

3 General

The objective is complete testing carried out at the sole responsibility of the supplier. The test equipment required for carrying out the procedures in this Technical Supply Specification must be located directly at the production plant. Alternative test methods are only permissible if correlation with the tests specified herein has been proven and this has been agreed upon with the purchaser.

4 Requirements

4.1 As-received condition

Free of impurities (internally and externally). Connections and openings must be sealed in a way as to prevent soiling and damage during storage, transport, and installation. For permissible soiling (internally), see Section 5.1.3, Section 5.2.3 and Section 5.3.3.

4.2 Material

According to drawing, avoidance of hazardous substances according to Volkswagen Standard VW 91101

4.3 Environmental requirements

All materials, lubricants, and surface coating materials must comply with the current edition of the Hazardous Substances Ordinance. Group requirements that go beyond the requirements in the Hazardous Substances Ordinance are stated explicitly (see VW 91101).

5 Designs

According to drawing. Requirements on drawings deviating from this Technical Supply Specification take precedence.

- Type A
  Water-type oil cooler, mounted separately on transmission
- Type B
  Water-type oil cooler, integrated in main radiator
- Type C
  Air-type oil cooler

5.1 Type A

Water-type oil cooler, mounted separately on transmission

5.1.1 Operating temperature range

Water side:	-40 °C to 135 °C
Oil side:	-40 °C to 150 °C

5.1.2 Measurement of pressure drop and cooling performance

This measurement is used for technical engineering approval (BMG – German abbreviation).

Properties according to Component Performance Specifications

Cooling performance to be achieved:	According to drawing or vehicle-specific Cooler Performance Specifications
Permissible pressure drops, on the oil side and coolant side:	According to drawing or vehicle-specific Cooler Performance Specifications

The released transmission oil indicated in the Performance Specifications or agreed upon with the engineering department must be used in each case for the measurement.

Test points (depending on the medium) as defined in Tables 1 and 2 below and measured at:

$T_{Coolant\ inlet}$	(80 ± 3) °C
$T_{Oil\ inlet}$	(110 ± 3) °C

Table 1 – ATF cooler type A

Oil flow rate [l/min]	Coolant flow rate [a)][l/min]			
11	7	10	15	20
13	7	10	15	20
15	7	10	15	20
17	7	10	15	20

a) The coolant is a mixture of 40% glysantine and 60% water

Table 2 – Transfer case oil cooler

Oil flow rate [l/min]	Coolant flow rate [a)][l/min]			
5	7	10	15	20

a) The coolant is a mixture of 40% glysantine and 60% water

5.1.3 Soiling

Oil side: Residual foreign matter specification according to oil cooler drawing based on Test Specification PV 3370

5.1.4 Pulsating compression load test

Test stand setup with connections closely resembling those used in standard production

5.1.4.1 Coolant side

Pulsating compression load capacity according to TL 874, provided the cooler has a different setup on the water side and oil side.

5.1.4.2 Oil side

See Section 6

5.1.5 Vibration resistance

This test is used for technical engineering approval (BMG).

The part under test, equipped with all released add-on parts, must be mounted on the test stand in as-installed position using the designated fastening elements and filled with a suitable fluid.

Testing according to VW 80101, Section "Testing of transmission-mounted parts."

During the test, there must not be any leakage from the oil cooler or its interfaces. After the test, the leak tightness must be ensured according to Section 5.1.7. The component must not exhibit any visible damage or deformation.

5.1.6 Exterior corrosion

Number of test parts:	5
Salt spray test:	960 h according to DIN EN ISO 9227 Neutral salt spray test (NSS)

The leak tightness according to Section 5.1.7 must still be ensured after the test.

5.1.7 Leak tightness

100% leak tightness testing by supplier

Leaks of the respective operating medium from the component on the oil side or coolant side are not permitted.

Measuring method at the supplier's premises: According to manufacturer's choice

Inspection method: It must be ensured that no bubbles occur when the component is pressurized with air or other suitable test gas under water.

Test pressure:	20 bar over-pressure on the oil side, 2,5 bar on the water side
Temperature of test medium:	ISO 554- 23/50
Test duration:	60 seconds

5.1.8 Burst test

For purposes of internal process monitoring at the contractor's premises, the burst pressure must be determined with coolers manufactured using the standard production tool and monitored statistically during standard production.

5.2 Type B

Water-type oil cooler, integrated in main radiator

5.2.1 Operating temperature range

Water side	-40 °C to 135 °C
Oil side	-40 °C to 150 °C

5.2.2 Measurement of pressure drop and cooling performance

This measurement is used for BMG.

Properties according to Component Performance Specifications.

Cooling performance to be achieved:	According to drawing or vehicle-specific Cooler Performance Specifications
Permissible pressure drops, on the oil side and coolant side:	According to drawing or vehicle-specific Cooler Performance Specifications

The released transmission oil indicated in the Performance Specifications or agreed upon with the engineering department must be used in each case for the measurement.

Test points as defined in Table 3 below and measured at:

$T_{Coolant\ inlet}$ (80 ± 3) °C

$T_{Oil\ inlet}$ (110 ± 3) °C

In the ASSY according to the drawing, i.e., the side tank of the main radiator must exhibit the original geometry, and the flow pattern on the coolant side (dependent on diagonal or U-shaped main radiator through-flow) of the ATF cooler must correspond to that of the original cooler.

The pressure drop on the coolant side is measured according to the requirements in the Component Performance Specifications of the respective main radiator.

Table 3 – ATF cooler type B

Oil flow rate [l/min]	Coolant flow rate [a)][l/min]			
11	15	40	80	120
13	15	40	80	120
15	15	40	80	120
17	15	40	80	120

a) The coolant is a mixture of 40% glysantine and 60% water

5.2.3 Soiling

Oil side: Residual foreign matter specification according to main radiator drawing based on Test Specification PV 3370

5.2.4 Pulsating compression load test

Test stand setup with connections closely resembling those used in standard production

Performed on individual oil cooler

5.2.4.1 Coolant side

Pulsating compression load capacity according to TL 874; tested as part of the test of the main radiator ASSY.

5.2.4.2 Oil side

See Section 6

5.2.5 Vibration resistance

The component is tested as part of the test of the main radiator ASSY according to TL 874.

5.2.6 Leak tightness

100% leak tightness testing by supplier

Leaks of the operating medium from the component are not permitted.

Measuring method at the supplier's premises: According to manufacturer's choice

Inspection method: It must be ensured that no bubbles occur when the component is pressurized with air or other suitable test gas under water.

Test pressure:	20 bar over-pressure
Temperature of test medium:	ISO 554- 23/50
Test duration:	60 seconds

5.2.7 Burst test

For purposes of internal process monitoring at the contractor's premises, the burst pressure must be determined with coolers manufactured using the standard production tool and monitored statistically during standard production.

5.3 Type C

Air-type oil cooler

5.3.1 Operating temperature range

Air side	-40 °C to 55 °C
Oil side	-40 °C to 150 °C

5.3.2 Measurement of pressure drop and cooling performance

Used for BMG

Properties according to Component Performance Specifications

Cooling performance to be achieved:	According to drawing or vehicle-specific Cooler Performance Specifications
Permissible pressure drops, on the oil side and air side:	According to drawing or vehicle-specific Cooler Performance Specifications

The released transmission oil indicated in the Performance Specifications or agreed upon with the engineering department must be used in each case for the measurements.

$T_{Air\ inlet}$	(22 ± 1) °C
$T_{Oil\ inlet}$	(110 ± 3) °C

Table 4 – ATF cooler type C

Oil flow rate [l/min]	Air mass flow per dm^2 [kg/s]			
11	0,02	0,04	0,07	0,10
13	0,02	0,04	0,07	0,10
15	0,02	0,04	0,07	0,10
17	0,02	0,04	0,07	0,10

5.3.3 Soiling

Residual foreign matter specification according to oil cooler drawing based on PV 3370

5.3.4 Pulsating compression load test

Test stand setup with connections closely resembling those used in standard production

5.3.4.1 Oil side

See Section 6

5.3.5 Vibration resistance

Used for BMG

The part under test, equipped with all released add-on parts, must be mounted on the test stand in as-installed position using the designated fastening elements and filled with a suitable fluid.

Vibration test according to TL 874 Section "Vibration resistance"

During the test, there must not be any leakage from the oil cooler or its interfaces.

After the test, the leak tightness must be ensured according to Section 5.3.7.

The component must not exhibit any visible damage or deformation.

5.3.6 External corrosion

Number of test parts:	5
Salt spray test:	1 200 h according to DIN EN ISO 9227 Neutral salt spray test (NSS)

The leak tightness according to Section 5.3.7 must still be ensured after the test.

5.3.7 Leak tightness

100% leak tightness testing by supplier

Leaks of the respective operating medium from the component are not permitted.

Measuring method at the supplier's premises: According to manufacturer's choice

Inspection method: It must be ensured that no bubbles occur when the component is pressurized with air or other suitable test gas under water.

Test pressure:	20 bar over-pressure
Temperature of test medium:	ISO 554- 23/50
Test duration:	60 seconds

5.3.8 Burst pressure

For purposes of internal process monitoring at the contractor's premises, the burst pressure must be determined with a cooler manufactured using the standard production tool and monitored statistically during standard production.

6 Pulsating compression load test, oil side

A Wöhler curve must be recorded by means of a pulsating compression load test with R = 0 (100% pulsating load, R = underload P_U/overload P_O):

Number of test parts:	16 parts (8 parts each at 2 levels)
Test medium:	Released transmission oil
Test temperature:	(135 ± 3) °C (oil)
Test frequency:	f = 1,7 Hz ± 0,1 Hz sinusoidal between P_U and P_O
Underload:	P_U 0,1 bar + 0,1 bar over-pressure
Test duration:	Until oil escapes

6.1 Procedure for determining the Wöhler curve

Note: With unknown coolers, it is useful to start by testing one cooler. Depending on the running time, the test level can then be adapted for the 8 coolers.

The results of the Wöhler curve test must be provided as shown in Figure 1.

6.1.1 Basic cooler

Load level 1 (high overload P_O):

A load level must be found at which the 8 test parts fracture within a running time of approximately 10 000 to 300 000 cycles. Unless specified otherwise, a starting upper load level of P_O = 25 bar overpressure must be used.

Load level 2 (low overload P_O):

A load level must be found at which the 8 test parts fracture within a running time of approximately 300 000 to 2 000 000 load cycles.

6.1.2 Heavy-duty cooler type

Load level 1 (high overload P_O):

A load level must be found at which the 8 test parts fracture within a running time of approximately 10 000 to 300 000 load cycles. Unless specified otherwise, a starting upper load level of P_O = 34 bar overpressure must be used.

Load level 2 (low overload P_O):

A load level must be found at which the 8 test parts fracture within a running time of approximately 300 000 to 2 000 000 load cycles.

6.2 Requirements

Pulsating compression load strength (read off from Wöhler curve) must be greater than:

Basic cooler	At 500 000 load cycles > 14 bar over-pressure
Heavy-duty cooler	At 1 000 000 load cycles > 20 bar over-pressure
Standard deviation	$s_{log} \leq 0,15$ (for every test level)

Entry fields

Cooler testing: Finned cooler, manufacturer XYZ

Load level 1: 32 bar

Part	Amplitude	Running time	Position of crack/note
T1	32	95000	Starter crack on fin
T2	32	129000	Starter crack on fin
T3	32	119000	Starter crack on fin
T4	32	79000	Starter crack on inlet fitting
T5	32	46000	Starter crack on inlet fitting
T6	32	85000	Starter crack on fin
T7	32	98000	Starter crack on fin
T8	32	101000	Starter crack on fir

Load level 2: 19 bar

Part	Amplitude	Running time	Position of crack/note
T9	19	536000	Crack next to inlet fitting
T10	19	921000	Crack on soldering
T11	19	1590000	Crack on soldering
T12	19	1210000	Crack on soldering
T13	19	979000	Crack on soldering
T14	19	836000	Starter crack on fin
T15	19	1010000	Starter crack on fin
T16	19	910000	Starter crack on fin

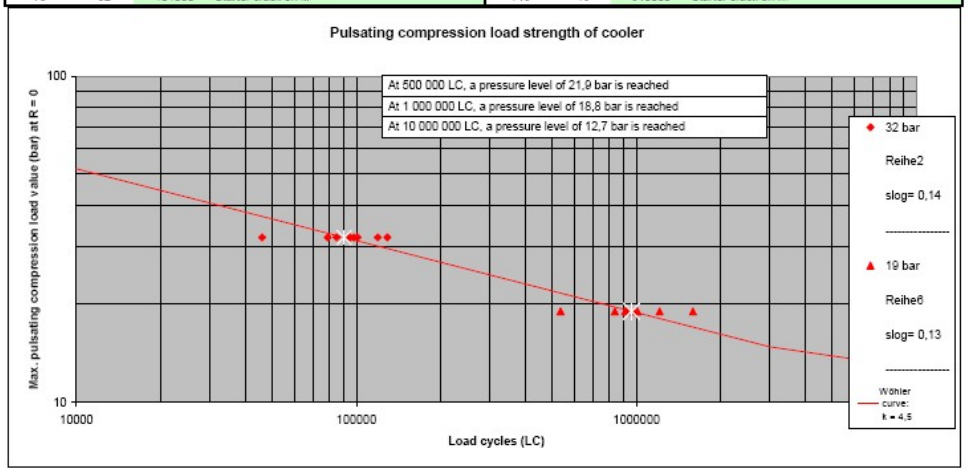

Figure 1 – Wöhler curve evaluation sheet

7 Referenced documents

The following documents cited in this standard are necessary for application.

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

PV 3370	Automatic Transmission, Manual Transmission with Special Requirements; Testing for Residual Foreign Matter and Interior Cleanliness
TL 874	Radiator; Functional Requirements
VW 80101	Electrical and Electronic Assemblies in Motor Vehicles; General Test Conditions
VW 91101	Environmental Standard for Vehicles; Vehicle Parts, Materials, Operating Fluids; Avoidance of Hazardous Substances
DIN EN ISO 9227	Corrosion tests in artificial atmospheres - Salt spray tests
ISO 554	Standard atmospheres for conditioning and/or testing; Specifications