VOLKSWAGEN

AKTIENGESELLSCHAFT

Group Standard

TL 82048

Issue 2009-07

Class. No.: 8LE65

Descriptors: line, hose, oil cooler

Oil Cooler Line

Functional Requirements

4 Types A, B, C, D

Previous issues

TL 82048: 1995-04, 2005-02

Changes

The following changes have been made as compared to TL 82048: 2005-02:

- Standard revised and restructured
- Salt-spray test acc. to DIN 50021-SS omitted
- Testing acc. to Technical Supply Specifications TL 245 and TL 265 omitted

Contents

Technical responsibility			Standards Department
			I/EZ-11 Reinhold Eitelhuber
I/EK-42	Mr. Sebastian Simon	Tel.: +49-841-89-53334	Tel.: +49-851-89-32120

1 Scope

This standard contains functional requirements for the oil cooler line system:

steel lines or stainless steel lines with and without hose portion.

2 Description

Functional requirements for oil cooler line acc. to TL 82048

3 General information

The objective is complete testing carried out at the sole responsibility of the supplier. 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 (on the inside and on the outside). Connections and openings must be sealed in a way as to prevent soiling and damage during storage, transport, and installation. For permissible soiling (on the inside), see Section 8.2.

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 set forth in the Hazardous Substances Ordinance are to be stated explicitly (see VW 91100).

5 Types

According to drawing; drawing requirements deviating from TL 82048 take precedence.

5.1 Line with type A hose

Rubber hose with textile insert

Reinforcement:	Spun rayon (CMD) or cotton (CO)
Inner layer:	Acrylonitrile-butadiene rubber (NBR)
Outer layer:	Chloroprene rubber (CR)
Operating temperature range:	-35 °C to +100 °C, +120 °C over short periods (i.e. max. 30 min and no more than 48 h over service life)

5.2 Line with type B hose

Rubber hose (yard good or molded hose) with braided insert, optionally with two cord inserts

Reinforcement:	Polyester (PES), polyamide (PA) or aramide (AR)
Inner layer:	Ethylene acrylate polymethylene rubber (AEM)
Outer layer:	Ethylene acrylate polymethylene rubber (AEM)
Operating temperature range:	-35 °C to +130 °C, +150 °C over short periods (i.e. max. 30 min and no more than 48 h over service life)

5.3 Line with type C hose

Polytetrafluoroethylene (PTFE) corrugated hose, polytetrafluoroethylene (PTFE) spiral corrugated hose or perfluoroalkoxy (PFA) corrugated hose, perfluoroalkoxy (PFA) spiral corrugated hose

Operating temperature range:	-50 °C to +200 °C, +230 °C over short periods (i.e. max. 30 min and no more than 48 h over service life)

Coated on the outside with glass fiber fabric and reinforced using braided stainless steel.

5.4 Line with type D hose

Rubber hose (yard good or molded hose) with higher degree of expansion capability

Reinforcement:	Polyamide (PA) or polyphenylene sulfide (PPS)
Inner layer:	Ethylene acrylate polymethylene rubber (AEM)
Outer layer:	Ethylene acrylate polymethylene rubber (AEM)
Operating temperature range:	-35 °C to +130 °C, +150 °C over short periods (i.e. max. 30 min and no more than 48 h over service life)

6 Functional tests for hoses and fittings

For hoses (yard good), the tests (Section 6.1 to Section 6.12) are to be carried out on the finished part. For molded hoses, tests are to be carried out using specimens with a defined hose geometry (see Figure 1) in the sequence of the section numbers. In this context, the specimens are distributed to batches, each of which comprising three specimens.

Table 1 – Functional tests

Hose type	Expandable and non-expandable hose (yard good)						Expandable and non-expandable molded hose			
Acc. to Sections 5.1, 5.2, 5.3, 5.4	A B D	A B D	A B D	C	C	C	B D	B D	B D	D
Batch no.	1	2	3	1	2	3	1	2	3	4
Specimen no.	1 - 3	4 - 6	7 - 9	1 - 3	4 - 6	7 - 9	1 - 3	4 - 6	7 - 9	10 - 12
Tests										
6.1	X						X			
6.2	X									X
6.3	X			X			X			
6.4	X			X						
6.5	X			X			X			
6.6	X			X			X			
6.7		X	X		X	X		X	X	
6.8		X	X							
6.9		X	X		X	X		X	X	
6.10.1		X	X							
6.10.2					X	X				
6.10.3								X	X	
6.11		X			X			X		
6.12			X			X			X	

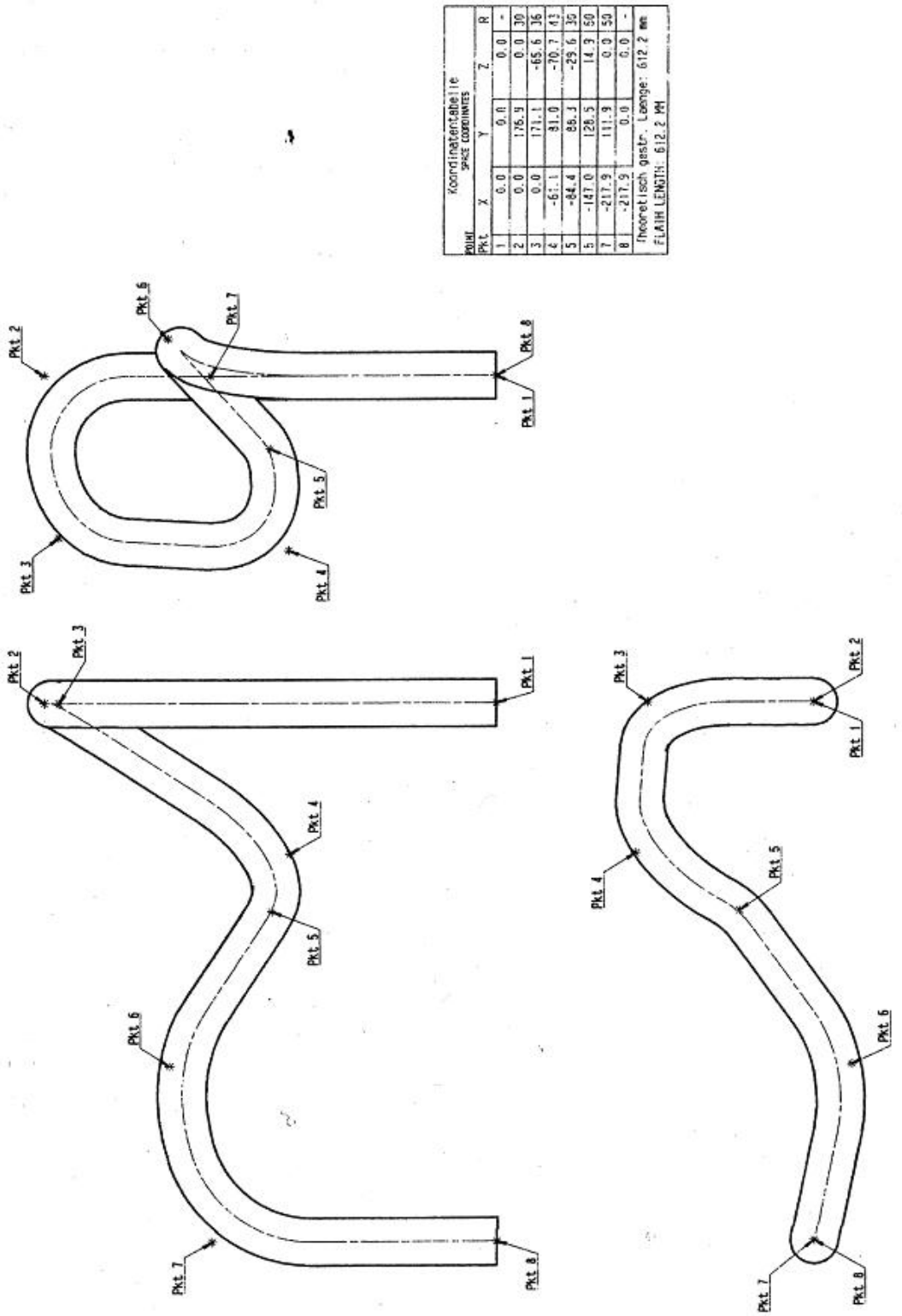

Figure 1 – Hose geometry

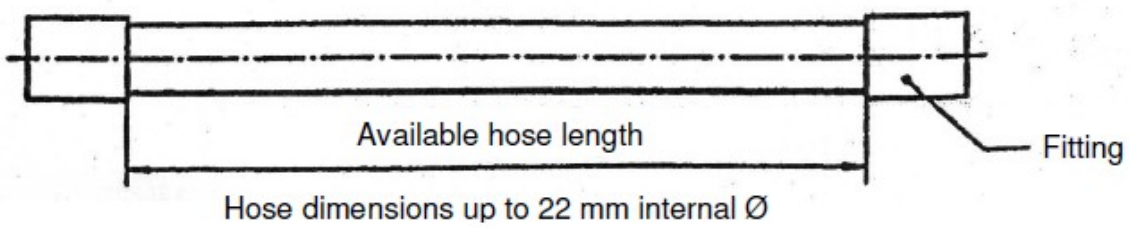

Figure 2 – Test setup, straight hose

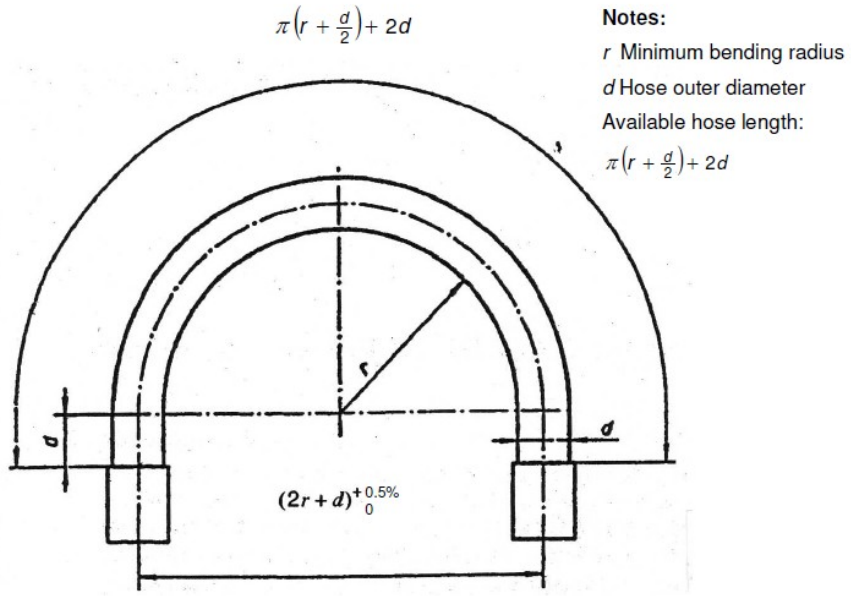

Figure 3 – Test setup, bent hose

6.1 Expansion capability

Only required for type D.

Yard good: test setup acc. to Figure 2, available hose length > 300 mm

Molded hoses acc. to Figure 1.

Requirement: > 30% for 25 bar over-pressure and a room temperature of 23/50 acc. to ISO 554

6.2 Change in length when pressurized

Only required for type D.

Yard good:	Test setup acc. to Figure 2, available hose length > 300 mm
Molded hoses:	Straight, vulcanized molded hose blank, test setup acc. to Figure 2, available hose length > 300 mm
Requirement:	± 4% in a range between 0 and 25 bar over-pressure at room temperature

6.3 Resistance to oil and hot air

The specimen must not exhibit any defects or leakage after the tests.

The loosening torques of the fittings must at least correspond to the values specified in Table 2 (depending on inner diameter of the hose or pipe) after the tests and a subsequent 24-hour acclimatization period at room temperature.

Table 2 – Loosening torques

Inner diameter of hose or pipe	Min. twisting torque (for press-fit hoses, slip-on coupling and clinched retainers)
< 9 mm	4 Nm
≥ 9 mm	7 Nm

Specimens filled with ATF (types A, B and D) or engine oil (type C) and aged in climate chamber:

Aging:	8 h at –35 °C ± 2 °C, followed by 94 h at max. long-term service temperature acc. to Section 5.1, Section 5.2, Section 5.4 or 150 °C ± 2 °C for type C
Pressure load:	20 bar over-pressure

6.4 Bending test

It must not be possible to recognize cracks with the naked eye.

Bending radius	Minimum bending radius acc. to Section 6.10.1 or Section 6.10.2.
Test temperature:	Room temperature

6.5 Leak tightness test

Component leakage is not permissible.

Measuring method acc. to manufacturer´s choice.

Audi inspection method:

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

Test pressure:	20 bar over-pressure
Temperature of test medium:	Room temperature
Test duration:	60 seconds

6.6 Burst pressure

Test setup for hoses (yard good) acc. to Figure 2.

Available hose length:	> 300 mm
Pressure increase rate:	400 bar/min
Burst pressure:	> 50 bar
Temperature of test medium:	Room temperature

6.7 Low-temperature resistance

Requirements and testing acc. to VW 2.8.1.

6.8 Ozone-resistance

Only required for type A.

Requirements and testing acc. to VW 2.8.1.

6.9 Installation test of line connections

This installation test is performed prior to the pulse test in order to ensure proper function of the line connections (slip-on couplings if required) even after multiple installation and removal in after-sales service.

Depending on the respective application, original connection fittings (slip-on couplings, if required) must be used for this purpose.

The test comprises 25 installation and 25 removal procedures per component.

The components must not exhibit any defects after completion of the test.

The components may exhibit signs of wear provided that the subsequent pulse test proves that these are non-critical.

6.10 Pulse test

6.10.1 Types A, B and D (yard good)

Test setup for hoses (yard good) acc. to Figure 3.

Original hose strappings and original connection fittings (slip-on couplings, if required) must be used for this purpose.

Minimum bending radius:	70 mm (for ATF hoses)
Available hose length:	> 300 mm
Pressure load P_O:	25 bar ± 3% over-pressure
Lowest load level P_U:	1,5 bar ± 1,5 bar over-pressure
Pressure pulse frequency:	0,7 Hz ± 0,1 Hz trapezoidal between P_U and P_O, profile acc. to DIN EN ISO 6803
Pressurizing medium:	Released ATF, optionally hydraulic fluid of similar viscosity
Medium and test temperature:	250 000 LC at upper long-term service temperature (± 3 °C) acc. to Section 5
Subsequently:	Cooling down to –35 °C (without pressure load), keeping temperature constant for 1 h

Continuation of pulse test (25 bar) for another 50 000 LC, during which the temperature is raised until reaching the upper long-term service temperature.

After the test, leak tightness according to Section 6.5 must be ensured.

Damage to the hoses is impermissible.

6.10.2 Type C

Test setup acc. to Figure 3.

Original hose strappings and original connection fittings (slip-on couplings, if required) must be used for this purpose.

Minimum bending radius:	Depending on inner diameter
For inner ∅ of 8 and 10 mm	r_{min} = 50 mm
For inner ∅ of 12 mm	r_{min} = 60 mm
For inner ∅ of 16 mm	r_{min} = 70 mm
For inner ∅ of 18 mm	r_{min} = 80 mm
Available hose length:	> 300 mm
Pressure load P_O:	20 bar ± 3% over-pressure
Lowest load level P_U:	1,5 bar ± 1,5 bar over-pressure
Pressure pulse frequency:	0,7 Hz ± 0,1 Hz trapezoidal between P_U and P_O acc. to DIN EN ISO 6803
Pressurizing medium:	Released engine oil, optionally hydraulic fluid of similar viscosity
Medium and test temperature:	250 000 LC at 150 °C ± 3 °C

Subsequently: Cooling down to –35 °C (without pressure load), keeping temperature constant for 1 h

Continuation of pulse test (20 bar) for another 50 000 LC, during which the temperature is raised to 150 °C.

After the test, leak tightness according to Section 6.5 must be ensured.

Damage to the hoses is impermissible.

6.10.3 Types B and D (molded hoses)

Test setup acc. to Figure 1.

Original hose strappings and original connection fittings (slip-on couplings, if required) must be used for this purpose.

Pressure load P_O:	25 bar ± 3% over-pressure
Lowest load level P_U:	1,5 bar ± 1,5 bar over-pressure
Pressure pulse frequency:	0,7 Hz ± 0,1 Hz trapezoidal between P_U and P_O, profile acc. to DIN EN ISO 6803
Pressurizing medium:	Released ATF, optionally hydraulic fluid of similar viscosity
Medium and test temperature:	250 000 LC at upper long-term service temperature (± 3 °C) acc. to Section 5

Subsequently: Cooling down to –35 °C (without pressure load), keeping temperature constant for 1 h

Continuation of pulse test (25 bar) for another 50 000 LC, during which the temperature is raised until reaching the upper long-term service temperature.

After the test, leak tightness according to Section 6.5 must be ensured.

Damage to the hoses is impermissible.

6.11 Burst pressure test after pulse test

Test setup for hoses (yard good) acc. to Figure 2.

Original hose strappings and original connection fittings (slip-on couplings, if required) must be used for this purpose.

Available hose length:	> 300 mm
Pressure increase rate:	400 bar/min
Burst pressure:	> 50 bar
Temperature of test medium:	Room temperature

6.12 Tensile test for hose fitting and slip-on coupling

Test setup for hoses (yard good) acc. to Figure 2.

Original hose strappings and original connection fittings (slip-on couplings, if required) must be used for this purpose.

Available hose length: > 300 mm
Test rate: 50 mm/min ± 1 mm/min
Test temperature: Room temperature

Table 3 – Tensile test

	Minimum pull-out force (for press-fit hoses and slip-on coupling)	
Inner diameter of hose	Hose types A, B, D	Hose type C
< 9 mm	1000 N	
≥ 9 mm	2000 N	
≤ 10 mm		1000 N
> 10 mm ≤ 13 mm		1200 N
> 13 mm		1500 N

7 Testing of pipes, fittings and retainers

7.1 Surface protection

Unless defined on the drawing, the following applies: Stainless steel parts without coating
Steel parts coated: r643 acc. to TL 244 + Sealer 300WL

Galvanic surface coatings acc. to TL 244 also cover the sealing area.

The pipe interior must be provided with a (temporary) corrosion protection. Proof of compatibility with released oils must be furnished.

Spots with excess coating material are not permissible.

7.2 Testing of corrosion behavior

Steel parts acc. to TL 244.

7.3 Thermal shock test

Steel parts acc. to DIN EN ISO 2819, Section "Thermal Shock Test".

No flaking or blistering of surface protection permissible.

7.4 Press-fit sleeves and other press-fitted areas on the components

Deviating from TL 244:	No zinc corrosion or aluminum corrosion permissible after 120 h. No base metal corrosion permissible after 480 h. Max. 10% base metal corrosion permissible after 720 h.

8 Technical properties

8.1 Roundness of bent pipes

Acc. to DIN 9004 unless otherwise specified on the drawing.

8.1.1 Deviations in diameter

[(max. outer pipe ∅ - min. inner pipe ∅) / (∅ unbent pipe)] < 0,15 unless otherwise specified on the drawing

8.1.2 Wall thickness reduction

Unless otherwise specified on the drawing, the wall thickness in the bending radius must, at any point, be at least 90% of the wall thickness of the unbent pipe.

8.2 Cleanliness

The hose lines must be delivered in a way that ensures protection from impurities. The inside of the pipe must be free of corrosion and other residues. A thin film of slushing oil may be used as corrosion protection. Type and quantity of the corrosion protection require approval by Quality Assurance.

– Residual foreign matter specification acc. to PV 3370.
– Classification acc. to drawing.

9 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.

Standards with the titles given in German are either only available in German or may be procured in other languages from the institution issuing the standard.

PV 3370	Automatic Transmission, Manual Transmission with Special Requirements; Testing for Residual Foreign Matter and Interior Cleanliness
TL 244	Zinc/Nickel Alloy Coatings; Surface Protection Requirements
TL 82048	Oil Cooler Line; Functional Requirements
VW 2.8.1	Elastomers; Material Requirements and Testing
VW 91100	Environmental Standard for Vehicles; Vehicle Parts, Materials, Operating Fluids; Policy, Specifications
VW 91101	Environmental Standard for Vehicles; Vehicle Parts, Materials, Operating Fluids; Avoidance of Hazardous Substances

DIN 9004	Aerospace; bending radii for tubes; approximate values for cold working
DIN EN ISO 2819	Metallic coatings on metallic substrates - Electrodeposited and chemically deposited coatings - Review of methods available for testing adhesion
DIN EN ISO 6803	Rubber or plastics hoses and hose assemblies - Hydraulic-pressure impulse test without flexing
ISO 554	Standard atmospheres for conditioning and/or testing; Specifications