

VOLKSWAGEN AG	Expansion-Type Hose Lines Requirements and Testing	TL 82415
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Konzernnorm		
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Descriptors: expansion-type hose lines, line, steering, power steering

Preface

The contents of AK-LH 03 „Index n“ were used without alteration in this TL standard.

The contents of AK-LH 03 were elaborated in the VDA¹ team "Hydraulic Steering System" of the automotive companies AUDI AG, Bayrische Motoren Werke AG, Daimler Chrysler AG, Porsche AG and Volkswagen AG.

Changes

See change documentation

Previous issues

1988-12; 2001-09

Additional in-house requirements

Technical Supply Specifications (TL standards) are part of the drawing.

Drawing requirements take precedence.

Approval of first supply and changes acc. to Volkswagen standard VW 01155.

The environmental requirements as specified in VW 91100 must be fulfilled.

¹ VDA: German Association of the Automotive Industry

Continued on 16 pages of AK-LH 03

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The English translation is believed to be accurate. In case of discrepancies the German version shall govern. Numerical notation according to ISO practice (see VW 01000).

Norm vor Anwendung auf Aktualität prüfen / Check standard for current issue prior to usage.

	Expansion-Type Hose Lines Requirements and Testing	Team Performance Specification LH 03 "Index n"
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Team comprising staff members of the following companies: Audi AG, Bayerische Motoren Werke AG, DaimlerChrysler AG, Porsche AG, Volkswagen AG

CHANGE DOCUMENTATION			
Suffix	Brief description	Date	Name
a	First version	08/93	Thon
b	Concerning Section 4.1.1: operating pressure of standard and temperature types used to be 130 bar Concerning Section 4.1.8a: Table "t _{an} /t _{ab} " Type II added, all p _{max} specifications omitted Concerning Section 4.1.9, Figure 5: pressure increase 0-100 %, 5 % restriction of tolerance band	11/93	Thon
c	Concerning Section 4.1.1 Table: burst pressure for standard and temperature hose types used to be 520 bar Note 1: short-term used to be 48 h; marking added; Concerning Section 4.1.4: dirt quantity used to be 1 mg/10 cm, max. elongation ≤ 200 μm for soft parts, ≤ 20 μm for solid parts; Concerning Section 4.1.6.2: 100% leak tightness test omitted; Concerning Section 4.1.6: used to be Section 4.1.6.1	03/95	Dittmann
d	Section 4.8.1 completely revised	12/95	Dittmann
e	Temperature cycle test completely revised; Section 4.1.4: change in length added	Draft	Dittmann
f	Section 4.1.1: nominal value added, footnote 2 burst pressure added Section 4.1.4: entire pressure range added Section 4.1.6: manufacturer-specific added Section 4.1.8: requirement at burst pressure omitted Section 4.1.12: Table 1 and 2 combined to a new Table, Figure 2 omitted, test procedure for oil temperatures exceeding 50 °C supplemented Section 4.2.1: terms cover and core changed, new nominal values for hardness Section 5.1: note on VDA regulation		
g	Section 4.1.1: "(max. operating pressure)" removed in row "length change" Section 4.1.6: "acc. to drawing" added Section 4.1.9: "... free of corrosion etc. ..." added (solids), (elastomer components), residual quantity of dish detergent added. Freon added. Section 4.1.12: failure condition in more detail, number of specimens added, test until failure / max. 100 000 load cycles added, Table 1 added Section 4.2.13: "nominal value range" used to be "Nominal value, in as-received condition", "standard production variation" used to be "tolerance", footnote 3) acc. to DIN 53504 added Section 4.2.2/4.2.3: terms cover/insert/core replaced.	01/97	Dittmann

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h	<p>Legends added to all Tables and Figures, table of contents corrected, "4.1.1.1 marking" replaced by "marking", Section 4.1.1: "outer bend radius" replaced by "inner bend radius", Section 4.1.3 "shall be determined" and "measurements shall be" (paragraphs 1 and 2) added, Section 4.1.4: "Under pressure" replaced by "On new components, under pressure", "Test carried out subsequently..." omitted, "During temperature cycle test" supplemented by "..., unpressurized" Section 4.1.5.: "solder nipple" replaced by "hose nipple", Section 4.1.10. Figure 2 added, Section 4.1.11: room temperature set from $(23 \pm 1) \text{ }^\circ\text{C}$ to $(23 \pm 3) \text{ }^\circ\text{C}$ in entire document Section 4.1.12: <u>Test sequence</u>: "...temperature stages (I - V)" instead of "(I - VI) $\pm 2 \text{ }^\circ\text{C}$", <u>Note</u>: "... must not exceed the temperature deviation specified in Table 2, Note 1" supplemented Section 4.2.2: terms "inside layer" and "outside layer" interchanged in Table section "Tensile strength" and "elongation at tear"; Note 1) "DBL..." mentioned twice, Note 2) supplemented</p>	03/97	Buchholz
i	<p>Section 4.1.1, Table 1: - Column "Standard type III" added - For standard types I and II, oil temperature values set to same values as ambient temperatures - Oil and ambient temperature values (maximum, long-term and short- term) changed for temperature type - "Inside diameter" supplemented by "(nominal width)" 4.1.12 - Figure 3: Double dimensioning (R250) removed, since length 800 and distance 500 are specified - Table 2: HNBR/CR supplemented in column CSM/CSM - Temperatures for HNBR/HNBR stage V changed to $135 \text{ }^\circ\text{C}$ - Permissible temperature deviation changed to $\pm 3 \text{ }^\circ\text{C}$ - Figure 4: "$p_{\max} = \dots$" supplemented by "$\dots \pm 3 \text{ bar}$" - Test sequence: "... Failure of specimen" replaced by "... until all DUTs have failed"</p>	09/98	Buchholz
k	<p>Section 4.1.1, Table 1: - Column "Pressure type" omitted - Columns "Pressure type I" and "Pressure type II" added - "Operating pressure" changed to "Max. operating pressure" 2 Definitions / Other specifications - DIN 20 024 invalid, replaced by DIN 20 018-4 Sections 4.1.2, 4.1.4 and 4.1.8: - "DIN 20 024" changed to "DIN 20 018-4" Section 4.1.10: "Pull-out strength of the hose from fitting" extended</p>	06/00	Buchholz
l	<p>Section 4.1.4: "Marking of initial measuring length in unpressurized state" added Section 4.1.5: first sentence ("... positive-engagement connection...") omitted Section 4.1.8: " Mechanical damage..." changed to "Cracks not permissible." 4.1.12 "Requirement": failure condition changed Table 2: - column "hold time ..." added - 1) changed to "... of the hose that is closest to the pressure generator"</p>	01/01	Buchholz

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m	4.1.12 - Free hose length and installation redefined - Figure 3 changed - Figure 4: p_{max} for pressure types redefined 5 New wording 6 New wording 7 New wording	02/01	Buchholz
n	Section 4.1.9: Cleanliness - Additional remark "abrasive particles" - Additional remark: definition of hard and soft particles	04/07	Bochert

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1 Aim and scope

1.1 Aim

These Performance Specifications are a summary of the tests required prior to the release of expansion-type hoses used in steering systems. The development objective consists in enabling suppliers to deliver a completely pre-tested supply scope at their own responsibility.

1.2 Scope

The performance specifications are a part of the drawing. They apply to all expansion-type hoses having a respective note in the drawing.

2 Definitions / further specifications

Daimler Chrysler Supply Specification DBL 6623.60	Transmission fluid
Volkswagen AUDI SEAT Technical Supply Specification TL 521 46	Central Hydraulic System Fluid; Lubricant Requirements
DIN 20 018-4	Textile-Reinforced Hoses – Part 4: Testing
DIN 50 021	Spray Tests with Different Sodium Chloride Solutions
DIN 51 221	Tensile Test Machines
DIN 53 508	Testing of Rubber - Accelerated Aging
DIN 53 509 T01 A	Testing of Rubber - Determination of Resistance to Ozone Cracking - Part 1: Static Conditions
DIN 53 530	Testing of Organic Materials; Separation Test on Fabric Plies Bonded Together
VDA Test Sheet 521-01	Elastomers; Exposure to Test Oils
VDA Guideline 260	Marking of Components made from Polymer Materials

3 Objectives

Objectives to be pursued shall be both compliance with deadline, quality, cost and weight targets and environmental compatibility as well as recyclability.

4 Requirements

4.1 Hose line

4.1.1 Area of application/ general hose design

See Table 1

Notes	¹⁾ Short-term: 96 h, over complete service life
	²⁾ Increase in volume and burst pressure at room temperature (23 ± 3) °C
	³⁾ Preferred material
	⁴⁾ Optionally HNBR/HNBR; for temperatures, see "Temperature type"

Marking:

Hose material:	Marking according to VDA Guideline 260 (specification by the German Association of the Automotive Industry)
Crimped fitting:	Date of manufacture/year Part number Company designation customer/supplier

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Expansion-type hose		Standard type I	Standard type II	Standard type III	Pressure type I	Pressure type II	Temperature type
Max. operating pressure	bar	120	120	120	135	155	120
Min. burst ₂ pressure	bar	480	480	480	540	620	480
Oil temperature - minimum	°C	-35	-35	-35	-35	-35	-35
- maximum (long-term)	°C	+110	+100	+110	+110	+110	+135
- maximum (short-term)	°C	+130	+120	+130	+130	+130	+150
Ambient temperature - minimum	°C	-35	-35	-35	-35	-35	-35
- maximum (long-term)	°C	+110	+100	+100	+110	+110	+135
- maximum (short-term) ¹⁾	°C	+130	+120	+120	+130	+130	+150
Increase in volume ²⁾ at 100 bar	%	Nominal value acc. to drawing ± 5 %	Nominal value acc. to drawing ± 5 %	Nominal value acc. to drawing ± 5 %	Nominal value acc. to drawing ± 5 %	Nominal value acc. to drawing ± 5 %	Nominal value acc. to drawing ± 5 %
Length change	%	+2 to -4	+2 to -4	+2 to -4	+2 to -4	+2 to -4	+2 to -4
Materials ³⁾ - inside layer		CSM	NBR	HNBR	CSM ⁴⁾	CSM ⁴⁾	HNBR
- reinforcement		2 polyamide layers	2 polyamide layers	2 polyamide layers	2 polyamide layers	2 polyamide layers	2 polyamide layers
- outside layer		CSM	CR	CR	CSM ⁴⁾	CSM ⁴⁾	HNBR
Inside diameter (nominal width)	mm	10 ± 0,5	10 ± 0,5	10 ± 0,5	10 ± 0,5	10 ± 0,5	10 ± 0,5
Min. band radius, inner bend radius	mm	100	100	100	100	100	100

Table 1: Area of application/ general hose design (Remark: Notes can be found on the [previous](#) page)