

Group Standard

VW 75147

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Wiring Harnesses in Motor Vehicles Quality Requirements for Products and Processes

Preface

Detailed requirements and procedures are stipulated in the Group Quality Assurance and Procurement Guideline for the Wiring Harness Product Audit. All specifications apply to the condition of wiring harnesses upon delivery to the Volkswagen Group.

Previous issues

VW 75147: 2005-11

Changes

The following changes have been made compared with VW 75147: 2005-11:

- Standard restructured
- Sections 3 and 4 revised
- Referenced standards updated

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The English translation is believed to be accurate. In case of discrepancies, the German version is alone authoritative and controlling.

Numerical notation acc. to ISO convention.

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1 Scope

This standard defines quality requirements and tests for wiring harnesses in motor vehicles. It applies to all vehicle wiring harnesses manufactured in production.

2 General requirements

Only parts released by Volkswagen must be used.

The standard must be applied during production by

- all plants of Volkswagen AG and production locations of subsidiaries that produce wiring harnesses and build vehicles,
- all external suppliers that manufacture corresponding products and supply to purchaser plants of Volkswagen AG as well as their supplying manufacturing locations of the same corporate group, module/sub-suppliers, outsourced production and „extended workbenches“.

To ensure the proper mechanical and electrical functioning of the electric system, all parts must comply with the valid specifications (drawings, Technical Supply Specifications, national, international, and Volkswagen in-house standards) and the evaluation criteria of this standard as well as the Guideline for the Wiring Harness Product Audit (see B2B supplier platform, Quality Assurance).

The use of parts which do not conform to the specification must be safeguarded by obtaining a deviation permit (AVON) and the written approval of the responsible electrical engineering department

(Organizational Directive OA 700/3). The general quantity limitation and/or periods of validity of deviation permits (AWE) (generally 90 days) must be taken into consideration in this respect.

3 Wiring harness ASSY

3.1 Marking/identification

Wiring harnesses must be clearly labeled. The wiring harness labels must be designed and attached in accordance with the drawing specifications. The label must be legible and resistant to decomposition for the entire life cycle of the vehicle. The scope of identification is stipulated in the drawings or the Performance Specifications. It must be possible to assign customer-specific wiring harnesses (KSK) clearly to the vehicle (e.g. using the code).

3.2 As-received condition

In the as-received condition, the wiring harness must not be damaged nor bent or rolled together in a manner that could influence its operation. This applies in particular to areas which include washer fluid hoses (see Section 4.3.2), antenna lines and optical fibers.

The packaging must be coordinated with the purchaser plant.

Handling optical fibers

- When handling optical fibers the specifications according to **VW 60539-1** must be observed.
- The optical fiber must not be bent, i.e. bend radii lower than 25 mm are not permitted, and this must be ensured by using appropriate holders during the production of the wiring harness and appropriate packaging.
- Contact with, scratching or soiling of the end surfaces must be prevented using protective caps which are to be removed only during testing.
- As optical fibers are sensitive to pinching (the signal quality decreases), pinching must be avoided.

3.3 Function tests

3.3.1 Electric test

Manufactured wiring harnesses must be fully function tested.

Additional requirements on the electrical function test:

Wiring harnesses must be fully tested in the ASSY for polarity reversal, short-circuit, line interruption. A label, which is printed automatically after the OK test, or another appropriate compulsory marking, generally serves as proof of an OK test result (see Section 3.1).

The primary lock of the contacts must be verified for housings without secondary lock. Closed secondary locks and push back are accepted proofs.

Test labels are only printed out after the function test has been completed (with OK status). A new electrical function test is mandatory for all reworked parts before delivery.

Each wiring harness must not be tested more often than three times on the electrical test table. If the third test still reveals errors, the affected wiring harness must be scrapped and a new one must be produced.

3.3.2 Mechanical/visual test

The mechanical/visual test comprises the verification of component availability, identity and position as per wiring harness drawing. A wear-free check as to the straightness of contact pins up to 1,2 mm must be integrated in the test table module.

Washing water piping/vacuum lines are generally inspected in the ASSY for their presence, passage, and for leak-tightness. The test is carried out with an air pressure of 500 kPA.

3.3.3 Leak tightness test

All sealed housings must be subjected to a pressure test (leakage test).

3.3.4 Test table

Sprung measuring pins must be used for the connection on the test table. Their function (spring force) must be tested regularly as per manufacturer specifications. All functions must be ensured by regular test and maintenance works (electrical, latch test, leak tightness test).

4 Components

4.1 Contact elements

4.1.1 Contact range

All contact elements must comply with the detail and standard parts drawings.

The contact area must be free of defects.

For all contact elements, the form and positional tolerances (release drawings) must be observed.

Screwing surfaces of cable sockets must be even, free of burrs, without lettering or embossing.

4.1.2 Contact elements with open crimp sleeves

Crimp connections must be realized according to VW 60330.

In general, proof of the required process capability must be furnished for all crimp variants during first sampling. Metallographic sections must be provided upon purchaser request.

4.1.2.1 Wire/conductor crimp

In the case of double crimps, the parallel arrangement of both conductors is only permitted if it can be ensured that the insulation crimp encompasses both conductors equally.

4.1.2.2 Sealed design with individual line seal

The crimp edges must hold the individual line seals securely in position.

The individual line seal must not be damaged by the crimp.

The end of the conductor insulation must be visible between the wire crimp and the seal.

4.1.3 Contact elements with closed crimp sleeve

See DIN EN 60352-2, downstream VW 60330 is valid.

4.1.4 Special designs

4.1.4.1 Flat conductor connector

4.1.4.1.1 Crimping technology

Specified crimp heights are a critical quality feature. The correct positioning and alignment (X/Y axes) of crimp contacts must be observed.

The instructions in the manufacturer's test specifications must be observed.

4.1.4.1.2 Laser brazing technology

The instructions in the manufacturer's test specifications must be observed.

4.1.4.1.3 Penetration technology (flat conductor multi-crimp connections)

Contact elements and housing must not be damaged by the crimping process. The instructions in the manufacturer's test specifications must be observed.

4.2 Splice connectors (potential connectors)

Splice connectors must be designed as ultrasonic weld joint as per [VW 60307](#) or as crimp connector as per [VW 60330](#) and [DIN EN 60352-2](#).

4.2.1 Crimp connectors

The splice and crimp connectors must be treated as contact elements. They are subject to technical engineering approval.

The crimp connectors must be adjusted according to the entire conductor cross-section pressed into them.

The crimp must have an inlet and outlet bellmouth (see [Figure 1](#)).

The cut-off tabs must not come into contact with the conductor insulations.

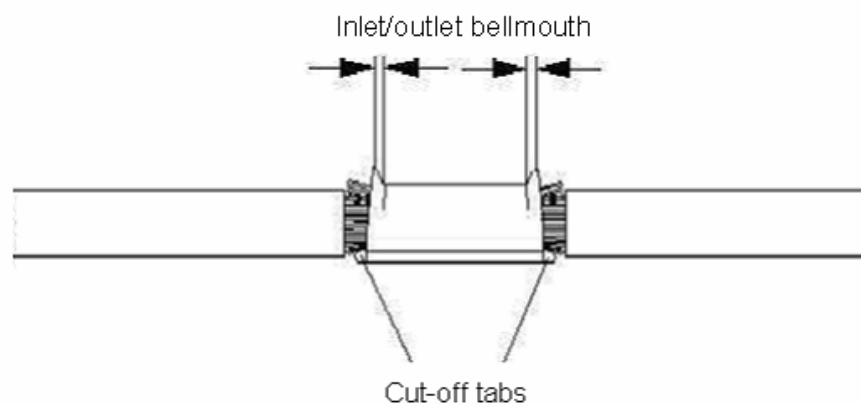


Figure 1

4.2.1.1 Unsealed design

For crimp splices, (unless otherwise specified product-specifically) the conductor ends must project a max. 3 mm axially from the nodes. The edge of the cut-off tab is used as the reference point.

The insulation variants must comply with the drawings and standards. The splice connectors must be insulated with at least 3 layers of wrapping tape. The insulation must be centered and should extend at least 10 mm on both sides over the non-insulated areas. The insulation must be secured against moving and be completely sealed; it must not display any gaps.

4.2.1.2 Sealed design

Splice connectors in damp spaces must be made fully waterproof by means of a heat-shrinkable plastic tube according to TL 82324, which is fitted with an internal layer of thermoplastic adhesive.

Only transparent labeled tubes must be used in order to make it possible to identify clearly the positioning and the type of heat shrink tubing.

Water leak tightness must be tested during production with air pressure in the water bath and via the insulation resistance. In the case of splice connectors, the leak tightness must be proven for the relevant weld node configurations.

4.2.2 Ultrasonic weld connector

Ultrasonic weld connections must comply with VW 60307.

The welding energy must not affect the contacts. This must be ensured by sufficient distance (at least 400 mm) or by appropriate damping methods.

Copper strands oxidize and insulation material ages. Copper oxides and ageing residues may affect unfavorably the welding process. It might be impossible to process them with the set parameters. The storage time of pre-cut material waiting for release of the manufacturing process must not exceed 8 weeks. The insulation of the line is to be removed immediately before the welding.

In symmetrical ultrasonic weld connectors, the intermixing of the individual wires must be ensured by using insertions tools.

In the case of ultrasonic weld connections, the process capability must be proven for the relevant weld case.

- During processing, the contamination of the conductor surfaces with impurities (e.g. sweat from hands, grease etc.) must be excluded by taking suitable measures.
- Different conductor structures (fine wires with normal) must be released on a case-by-case basis (ABS).
- For release by the supplier (production) the actual yard goods must be welded; production releases must be documented.

4.2.2.1 Unsealed design

See Section 4.2.1.1.

4.2.2.2 Sealed design

See Section 4.2.1.2.

4.3 Housing

4.3.1 Unsealed

Plug housings and all related latch elements must be completely and properly mounted and must not display any damage. Secondary locks must be closed in the wiring harness' as-received condition. Contact parts must be properly locked in the plug housing chambers.

4.3.2 Sealed

The same requirements apply as in [Section 4.3.1](#).

All seals must be present in the plug housing.

Sealing lips of the individual line seals must not project from the sealing channel and must not be damaged.

All sealing lips of blind plugs must be positioned within the housing chamber of the plug housing after assembly and seal it (min. 1,0 mm to max. 3,0 mm).

4.4 Lines

4.4.1 Individual lines

Individual lines must comply with the corresponding Volkswagen release drawings and are subject to technical engineering approval according to [VW 60306](#).

The line insulation must be free of defects.

Lines and line insulation must not be damaged.

All individual lines in the wiring harness ASSY must comply with the design specifications with respect to cross-section and feature the required color combination (basic color + code color).

4.4.2 Twisted lines

Twisted lines must comply with [VW 75205](#) and are subject to technical engineering approval. Any existing reinforced twisting for protection against fraying is part of the technical engineering approval.

In the case of twisted lines, the line ends must be untwisted. Target: (50 ± 20) mm

Before contacting, the twist at the line ends must be removed.

4.4.3 Sheathed lines

The line insulation must be free of defects.

Lines and line insulation must not be damaged.

The insulation of the individual lines must not be torn or cut as a result of removing the sheath.

4.4.4 Special lines

4.4.4.1 Flexible flat cables according to [VW 60553-1](#)

No delaminations, bubbles, bends, folds or waviness are permitted for flexible flat cables.

Films must not be cracked, the cover and base film must not be damaged (no holes or missing insulation material). The cut edges of the film must not display any damage or burr formation. Electrical bridges between conductors and conductor breaks are not permitted.

Film perforations must ensure good separability of branches, but there must not be any film separation however.

The bend radius must not be less than the min. 0,5 mm for flexible flat cable harnesses, film folds (e.g. 90° branches) must generally be wrapped.

4.4.4.2 Optical fibers according to VW 60539-1

All connecting pieces and protective caps must be present on the optical fibers.

Damage to the optical fiber sheath is not permitted.

The specifications with respect to optical attenuation of an optical fiber equipped with ferrules must be observed. The requirements of the test level budget according to VW 60539-3 apply.

The contact retention force of the ferrules on the optical fiber must be > 60 N.

Scratched or soiled end surfaces of the optical fiber are not permitted.

The optical fiber must not be bent, bending radii < 25 mm are not permitted.

Attenuation must be tested before delivery of the wiring harness.

No damage must occur when the end surfaces are being cleaned. Cleaning residues are not permissible.

An attenuation test after cleaning is absolutely essential.

4.4.4.3 Coaxial cables

Individual lines are subject to technical engineering approval according to VW 75206-1.

See LAH V03 825.

Coaxial lines must not be bent and/or radially deformed.

4.5 Windings

Adhesive tapes according to VW 60360-1 must be used for applications in the engine compartment. Adhesive tapes must be cut.

Adhesive tapes are subject to technical engineering approval.

The winding direction must comply with the specifications.

The adhesive tape must not display any wrinkles.

Overlap about 30% to 50%.

4.6 Line protection

Line protection systems (corrugated hoses according to VW 60155), connectors and end pieces must be evaluated according to TL 82347.

In addition, the following applies:

- The assembly of corrugated hoses must be performed using a winding tool recommended by the manufacturer or one that is similarly suitable.
- Corrugated hoses must only be cut on the corrugated peak.
- Insulation hoses must be free of folds and must overlap at the adhesion points by at least 20 mm.
- In case of not bonded hoses an overlap of at least 50 mm is needed.
- Leakage of adhesive must not fix other components in place or stick together the lines in the hose.

4.7 Cable ties

Cable ties are subject to technical engineering approval according to VW 74136-1.

Cable ties must be cut flush after assembly using an appropriate tool.

Cable tie guns must be assigned to the intended usage and must be monitored.

Sharp-edged or oblique cuts are not permitted.

Cable ties of types A and B (internal-toothed) must be wound underneath. Shapes A and B must not be used for new designs.

Type C (external-toothed) can be wound underneath.

4.8 Grommets

4.8.1 Assembled grommets/boots

Grommets, plugs and seals must be assembled in accordance with the drawing. Damage to the sealing elements, sealing lips and grommets is not permitted.

Dimensioned grommets must be secured against moving.

Appropriate tools that were released by the cable manufacturer must be used for cable manufacture.

4.8.2 Foamed grommets

Foamed grommets must be positioned in accordance with the specifications in the coordinate network.

Leaks in the foamed grommets on the cable bundle and on the body seal are not permitted.

Foamed grommets must be completely formed, particularly in the functional area.

The Shore hardness of foamed molded parts must comply with the specification.

In the case of foamed grommets, no lines must be visible in the functional area.

4.8.3 Injection-molded grommets

See Section 4.8.2.

The lines must not be damaged by the injection-molding process (melting of the insulation).

4.9 Cable guides

Cable guides must comply with the drawings, i.e. be correctly positioned and firmly assembled. When using cable ties for securing to the wiring harness, it is important to ensure that the tie locks do not

hinder the subsequent installation in the vehicle. The lines must not be damaged by the edges of the cable routings.

4.10 Electrical threaded connections

Electrical threaded connections must comply with [VW 80135](#).

5 Other applicable documents

The following documents cited in this Standard are necessary to its application.

Some of the cited documents are translations from the German original. The translations of German terms in such documents may differ from those used in this Standard, resulting in terminological inconsistency.

Standards whose titles are given in German may be available only in German. Editions in other languages may be available from the institution issuing the standard.

TL 82324	Heat-Shrink Tubes; Functional Requirements
TL 82347	Corrugated Hose; Functional Requirements
VW 60155	Corrugated Hose System; Corrugated Hose
VW 60306	Electric Wiring in Motor Vehicles; Single-Wire, Unshielded
VW 60307	Ultrasonically Welded Electric Lines
VW 60330	Crimp Connections; Solderless Electrical Connections
VW 60360-1	Protection Systems for Wiring Harnesses in Motor Vehicles Adhesive Tapes; Test Guideline
VW 60539-1	Lichtwellenleiter (LWL) im Kraftfahrzeug; Handhabungsvorgaben für Kunststoff-LWL
VW 60539-3	Lichtwelleneiter (LWL) im Kraftfahrzeug; Optische Messtechnik für die Datenübertragung im Kraftfahrzeug
VW 60553-1	Mehradrige, ungeschirmte flexible Flachleitungen für einen Nennspannungsbereich von ≤ 60 V; Prüfungen
VW 74136-1	Mounting Fixture for Cables; Cable Ties; Basic Form
VW 75205	Twisted Cables
VW 75206-1	Radio-Frequency Cables in Motor Vehicles; Coaxial Cables
VW 80135	Threaded Joints for Electrically Conductive Connections; General Requirements
DIN EN 60352-2	Solderless connections - Part 2: Crimped connections - General requirements, test methods and practical guidance