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Crimp Connections

Solderless Electrical Connections

Previous issues

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Changes

The following changes have been made as compared to VW 60330: 2008-07:

– Standard completely revised

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1 Scope

This standard specifies the definitions, requirements, and test criteria for evaluating solderless electrical crimp connections that are produced using crimp barrels and multi-stranded, fine stranded, and ultra-fine stranded conductors made of flexible copper. The specifications in this standard apply only to single cable crimps.

This standard also specifies the requirements for producing, testing, and evaluating crimp connections. In individual cases, the standard part drawings of the contacts and cable lugs provide detailed crimp specifications. In addition to this, the contact manufacturers supply processing specifications containing additional information that must also be taken into consideration. Specifications in the respective standard part drawing take precedence.

2 Definitions

The terms and definitions in this standard are specified in the IEV 581.

Designations see Figure 1 and Figure 2.

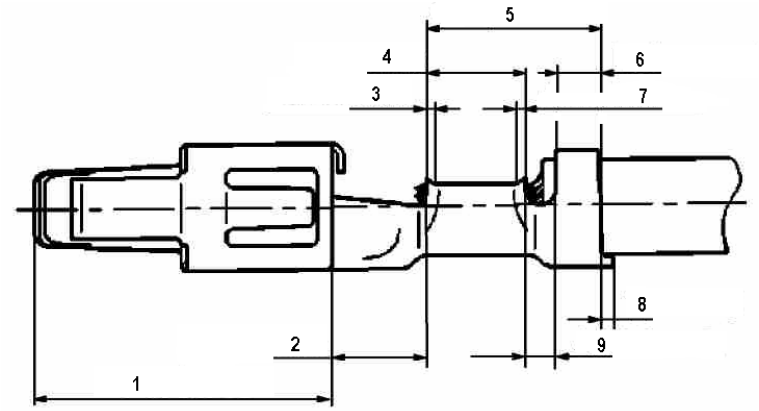

Figure 1

Legend

1	Contact range
2	Connection A
3	Front bellmouth
4	Conductor crimp
5	Crimp connection
6	Insulation crimp
7	Rear bellmouth
8	Cut-off tab
9	Connection B

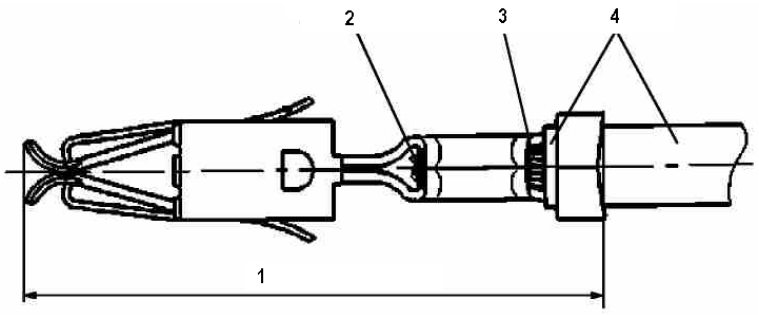

Figure 2

Legend

1	Contact element
2	Conductor end
3	Conductor
4	Insulation

2.1 Crimp connection

2.1.1 Open crimp barrel

Open crimp barrels are conductor crimps, insulation crimps, or single-wire seal crimps with a U-shaped, V-shaped, or preshaped opening. Open crimp barrels are customary in punched contact

elements. The crimping operation simultaneously closes the open crimp barrel while separating the contact element from the transport strip.

2.1.2 Closed crimp barrel

Conductor crimps, insulation crimps, or single-wire seal crimps with closed contour have closed crimp barrels. They are customary in tubular cable lugs. Closed crimp barrels are usually conductor crimps. Single-wire seal crimps or insulation crimps in the form of closed crimp barrels require significant effort and, thus, are seldom implemented.

2.1.3 Conductor crimp

Connection between the contact element and the stranded conductor. The conductor crimp must ensure the permanent electrical connection between the contact element and the stranded conductor.

2.1.4 Insulation crimp

Connection between the contact element and the cable at the outer diameter of the insulation. The insulation crimp is designed to absorb mechanical loads and vibrations to prevent them from affecting the conductor crimp. For the design types of the insulation crimp, refer to Section 3.3.6.

2.1.5 Single-wire seal crimp

Connection between the contact element and the single-wire seal by means of compression deformation. The single-wire seal crimp must ensure permanent fit of the single-wire seal on the contact element.

For the design types of the single conductor sealing crimp, refer to Section 3.3.7.2.1 and Section 3.3.7.2.

2.1.6 Connection A

Transition area between the contact area and the conductor crimp.

2.1.7 Connection B

Transition area between the conductor crimp and the insulation crimp.

3 Requirements

3.1 General requirements

Crimp connections must be implemented according to the drawing specifications in their respective valid version. The contact part manufacturer is required to specify the component-specific crimp dimensions (crimp height, crimp width, etc.), which are documented in the standard part drawing. These specified crimp dimensions must be adhered to exactly. Depending on the wire cross-sections and contact elements to be processed, the wear part profiles or crimpers and the anvil profiles must be properly matched.

3.2 Cable

Only copper cables with bare or surface-treated strands that have been released by Volkswagen must be used; VW 60306 applies.

This crimp standard is strictly not applicable to solid cables, aluminum conductors, or flat ribbon cables. The electrical conductor must not be dip-tinned or soldered.

Cable material whose properties have been adversely affected must not be used.

After 2 years of storage at the latest, proof must be provided that the cable material can still be used. The cable material must continue to comply with the requirements in VW 60306 and the relevant standard part drawing.

3.2.1 Stripping

Special tools must be used for stripping. The length of insulation to be stripped must be defined by the cable manufacturer, taking into consideration the applicable specifications.

The strands must not be scored or otherwise damaged when insulation is stripped.

No more than x% of the available strands may be cut off, depending on the cable type. The calculated number is always truncated to the next integer value. In addition, no more than 30 individual strands must be cut off for cables with a cross-section of 25 mm² or more.

x = 5 for cables ≤ 0,5 mm²

x = 8 for cables ≥ 0,75 mm²

Example 1: Number of strands = 7 (conductor type A; 0,35 mm ^{2}) 5% of 7 strands = 0,35 strands, which yields 0 after truncation. No strands must be cut off.

Example 2: Number of strands = 32 (conductor type B; 1,0 mm ^{2}) 8% of 32 strands = 2,56 strands, which yields 2 strands after truncation. No more than 2 strands must be cut off.

It is not permissible for strands to protrude; see Figure 3.

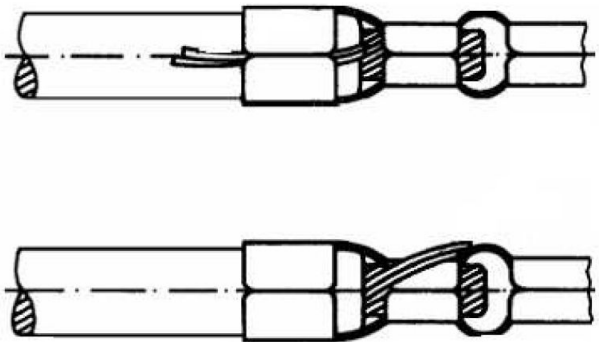

Figure 3 – Protruding strands

If the stripped cable is not processed immediately, the stripped ends must be protected from fanning out (e.g., by means of insulation barrel).

Fanning out of the strands is not permissible; see Figure 4.

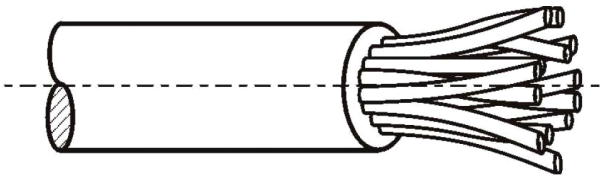

Figure 4 – Fanned out stranded wire

Unclean cutting of the insulation, damage to the insulation, or the presence of insulation residues on the stripped portion of the conductor is not permitted; see Figure 5.

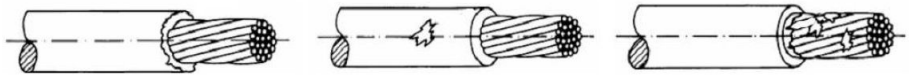

Figure 5 – Defective insulation

Strands must not be overtwisted in order to prevent severing or damaging of the strands during the crimping operation; see Figure 6.

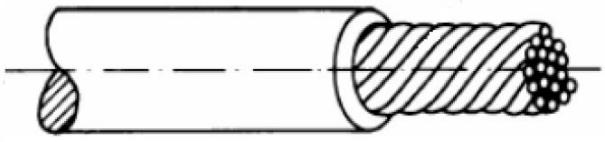

Figure 6 – Overtwisted conductor end

3.2.2 Conductor end

The conductor end (see Figure 7) terminates at a point not before the conductor crimp end but no more than 1 mm beyond it. The plugging, latching, or bolting function of the contact element must not be impaired by the projecting end of the conductor.

For cable lugs, the conductor end also must not extend into the bolt-on surface.

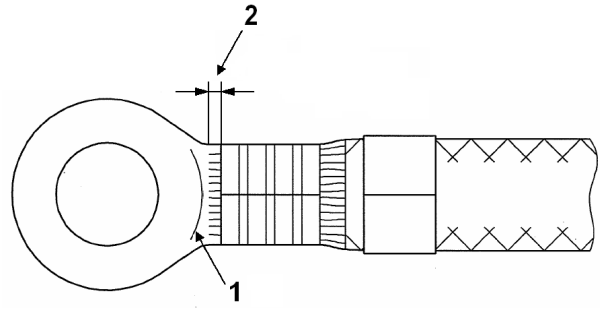

Figure 7 – Maximum projection of conductor end

Legend

1 Extended outer diameter
2 Conductor projection

For plug contacts intended for use with collective seals, strands (see Figure 8) must not protrude.

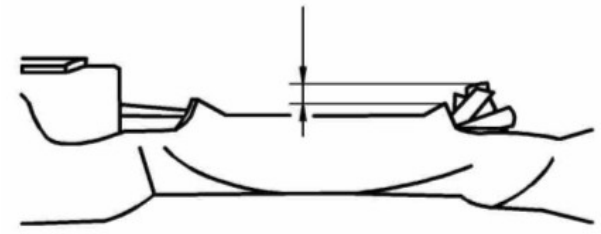

Figure 8 – Protruding strands

The insulation end must be visible in the window between the wire crimp barrel and insulation crimp barrel. No cable insulation must be caught in the conductor crimp.

3.3 Requirements for the crimped contact element

3.3.1 Contact elements

The contact elements used must conform to the requirements and specifications of the standard part drawing. There must not be any mechanical damage or twisting/bending of the transport strip or contact elements.

Contact material whose properties have been adversely affected must not be used.

After 2 years of storage at the latest, proof must be provided that the contact material can still be used. The contact material must still comply with the requirements in VW 75174 and the relevant standard part drawing.

3.3.2 Damage

The contact range (see Figure 1) and the locking pins must not be damaged or deformed after the crimping operation. Deformations of the contact range of the contact element as a result of crimping are not permitted.

3.3.3 Bending and twisting

If the standard part drawing does not contain any specifications, the following requirements apply: Lateral bending of the longitudinal axis in the crimp area must not exceed 3° towards either side; see Figure 9.

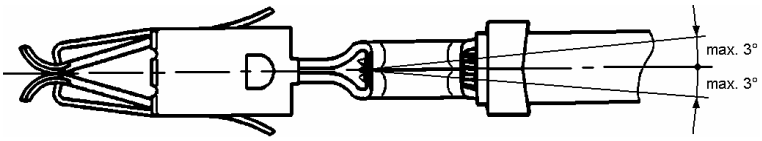

Figure 9 – Lateral bending

Bending of the longitudinal axis in the crimp area must not exceed 5° up or downward. Twisting of the crimp area towards the contact body must not exceed 5°; see Figure 10.

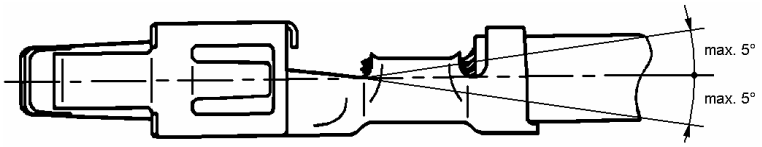

Figure 10 – Bending of the longitudinal axis of the contact element

3.3.4 Dimensions of conductor crimp

See Figure 11.

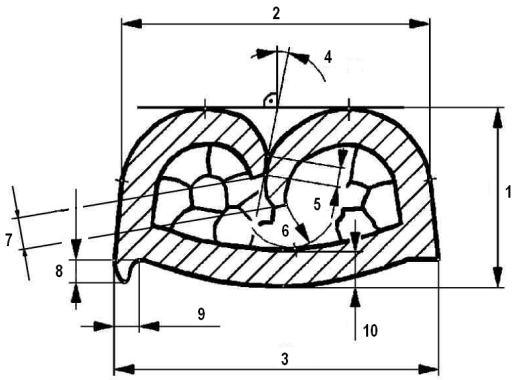

Figure 11 – Dimensions of conductor crimp

Legend

1	Ch Crimp height
2	Cb Crimp width
3	Cbm Measurable crimp width
4	αw Supporting angle
5	La Supporting height
6	Fa Barrel end clearance
7	CFE Distance between crimp barrel ends
8	Gh Burr height
9	Gb Burr width
10	Sb Base thickness

The thickness of the contact material (s) in the crimp area must be taken from the standard part drawing. Limits are specified for the indicated crimp dimensions. Any deviating values specified in standard part drawings are binding.

The specified crimp dimensions must be adhered to according to the quality assurance matrix and documented by the harness manufacturer.

3.3.4.1 Crimp height

Measurable in a non-destructive manner.

Not tool-dependent, i.e., adjustable dimension of the crimp connection.

The crimp height is specified by the contact element manufacturer and is documented on the standard part drawing of the relevant contact element.

If crimp height tolerances are not specified on the standard part drawing of the contact element, the following general tolerances apply to the crimp height:

Crimp height range (mm)	Tolerance (mm)
0,22 to 0,5	± 0,03
0,5 to 2,5	± 0,05
> 2,5	± 0,1

Crimp height measurement see Section 4.5.1

3.3.4.2 Crimp width

Tool-dependent, i.e., non-adjustable dimension of the crimp connection.

The crimp width is specified by the contact element manufacturer and is documented along with the corresponding tolerance on the standard part drawing of the relevant contact element.

3.3.4.3 Measurable crimp width

Measurable in a non-destructive manner.

The width of the crimp at the crimp base can be determined with a micrometer, for example. It is specified by the manufacturer of the contact element.

3.3.4.4 Supporting angle

Can only be determined by means of a microsection.

The supporting angle must not deviate more than 30° from the vertical.

$\alpha w \leq 30°$

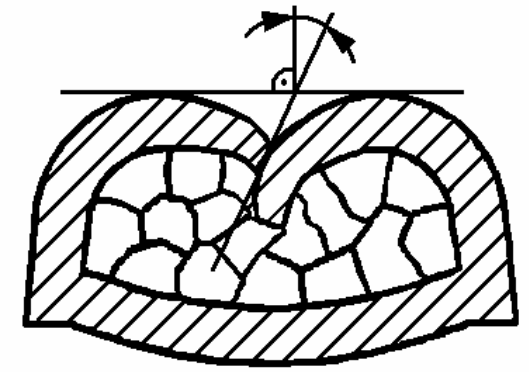

Figure 12 – Supporting angle

3.3.4.5 Supporting height

Can only be determined by means of a microsection.

The crimp barrel must be closed along its entire length between the bellmouths. The rolled-in crimp barrel ends touch and support each other. As a minimum requirement, the supporting height of the crimp barrel ends must be equal to the contact material thickness; see Figure 13.

La ≥ 1,0 × S

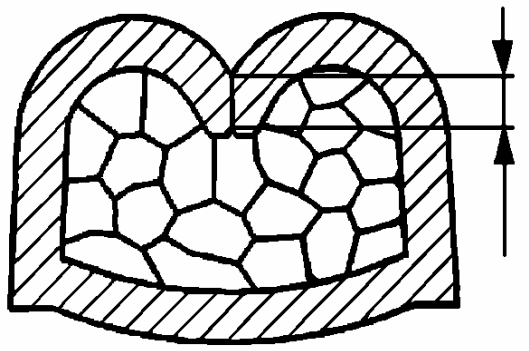

Figure 13 – Supporting height

3.3.4.6 Barrel end clearance

Can only be determined by means of a microsection.

Uneven rolling-in of the two crimp barrel ends is permissible, provided that the requirements for the supporting length, supporting angle, and distance between crimp barrel ends are adhered to. None of the crimp barrel ends must abut the inner wall of the crimp barrel; see Figure 14.

Fa ≥ 0,5 × S

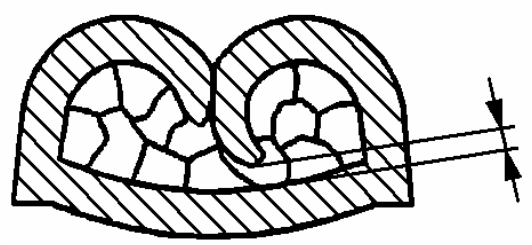

Figure 14 – Symmetry and rolling-in depth

3.3.4.7 Distance between crimp barrel ends

Can only be determined by means of a microsection.

Distance between the opposite, rolled-in crimp barrel ends (see Figure 15).

CFE = $x_1 - x_2$

CFE ≤ 0,5 × S

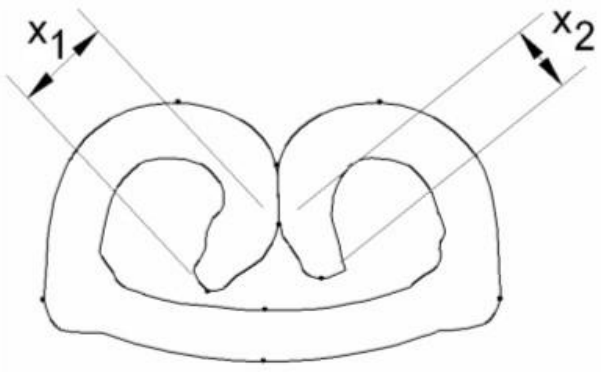

Figure 15

3.3.4.8 Burr height

The height of the burr is affected by the degree of wear of the crimping tool and the feed settings; see Figure 16.

Gh ≤ 1 × S

3.3.4.9 Burr width

Gb ≤ 0,5 × S

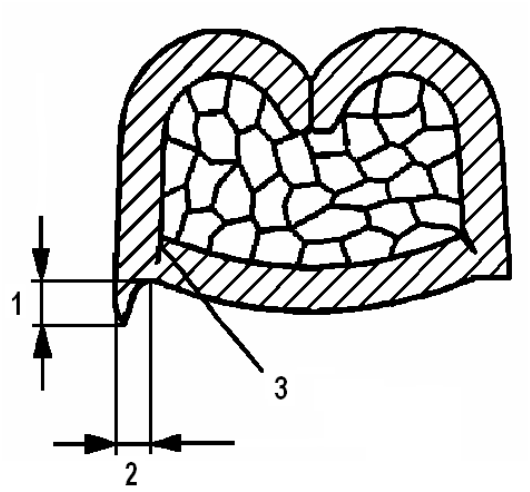

Figure 16 – Burr at crimp base

Legend

1	Burr height
2	Burr width
3	Crack

3.3.4.10 Base thickness

Can only be determined by means of a microsection (see Figure 17).

Sb ≥ 0,75 × S

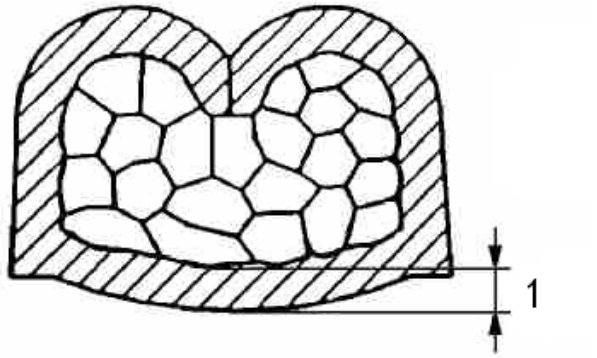

Figure 17 – Base thickness

Legend

1	Base thickness

3.3.4.11 Degree of compression

Can only be determined by means of a microsection.

The manufacturer of the contact elements ensures that a good degree of compression is achieved when the specified crimp dimensions are complied with. A good degree of compression is characterized by a completely filled crimp barrel, in which the strands in the wire crimp area are completely compressed in a honeycomb structure.

3.3.5 Shape of conductor crimp

3.3.5.1 Crimp length

The conductor crimp must be closed along the entire length between the front and rear bellmouths (see Figure 18). The rolled-in barrel ends support each other.

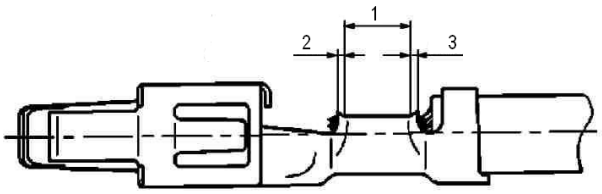

Figure 18 – Crimp length and bellmouth

Legend

1 Crimp length
2 Front bellmouth
3 Rear bellmouth

3.3.5.2 Cracks

Cracks can be caused by several unfavorable circumstances, especially at the crimp base. Cracks must be distinguished from wrinkles that can occur at the inside of the rolled-in areas.

No cracks permissible, see Figure 19.

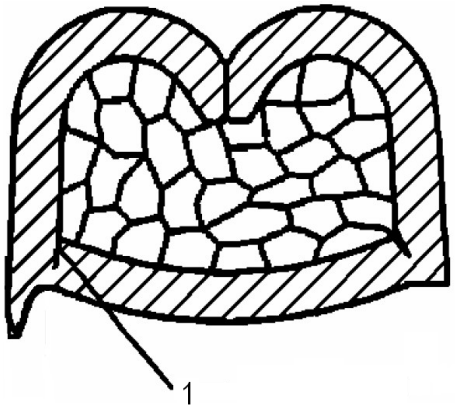

Figure 19 – Crack in the crimp base

Legend

1 Crack

3.3.5.3 Bellmouth

A bell-shaped runout (bellmouth) is required at the rear edge of the conductor crimp (towards the cable, see Figure 18). This bellmouth is to prevent notching or cutting off of single strands.

No bellmouth is prescribed at the front edge of the conductor crimp (towards the contact). A front bellmouth of equal or less size as the rear bellmouth is permissible.

3.3.6 Insulation crimp

The insulation crimp of the contact element must be configured in conformance with the standard part drawing for a thin- or thick-walled insulated cable according to VW 60306.

The bending test according to DIN EN 60352-2 (movement of the conductor over 3 cycles) must be fulfilled. Within the framework of technical engineering approval (BMG), proof is provided that compliance with this bending test is ensured when using contacts, connectors, cables and single-wire seals approved by Volkswagen. This means that under these circumstances, the cable manufacturer's bending test is not necessary.

3.3.6.1 Position deviations of the insulation crimp barrel ends

The crimp barrel ends may tip within a range of 5° to the front and 3° to the rear; see Figure 20.

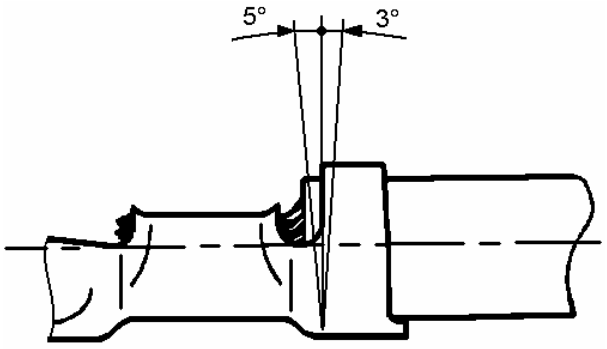

Figure 20 – Position deviations of the insulation crimp barrel ends

3.3.6.2 Insulation crimp type A (F-crimp)

See Figure 21 and Figure 22.

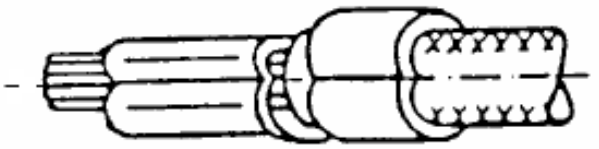

Figure 21 – Type A (F-crimp)

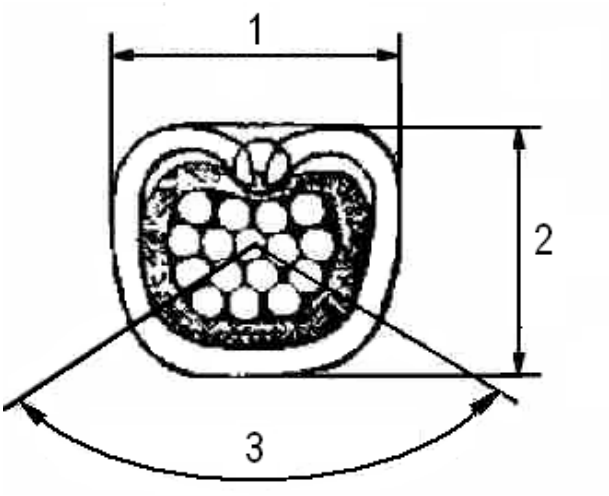

Figure 22 – Dimensions of insulation crimp type A

Legend

1	Crimp width
2	Crimp height
3	Wrap angle

Compliance with the crimp width and crimp height dimensions specified in the standard part drawing is mandatory.

At least 1/3 of the cable circumference (120°) must be encompassed by the insulation crimp.

The crimp claws must enter into the insulation. The insulation may be punctured by the crimp claw, but this must not cause any damage to the strands.

3.3.6.3 Insulation crimp, type B (wrap crimp)

See Figure 23 and Figure 24.

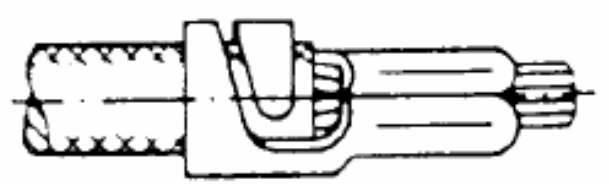

Figure 23 – Type B (wrap crimp)

At maximum cable diameter, the crimp barrel ends must overlap for a distance that is greater than or equal to their material thickness.

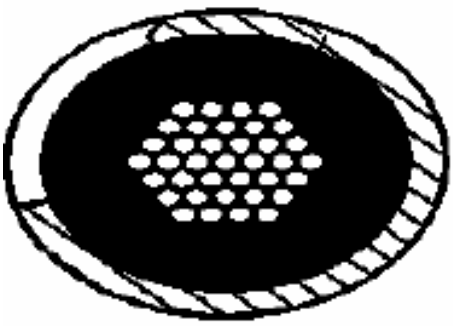

Figure 24 – Section of insulation crimp type B

3.3.6.4 Insulation crimp type C (overlap crimp)

See Figure 25 and Figure 26.

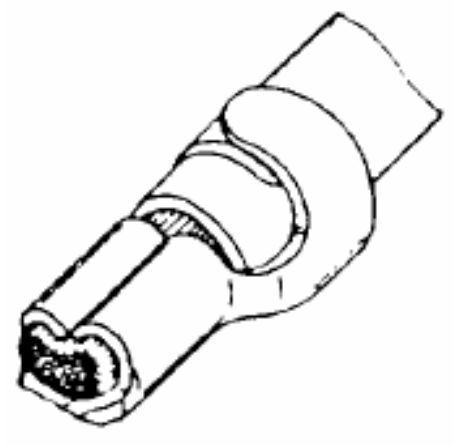

Figure 25 – Insulation crimp type C

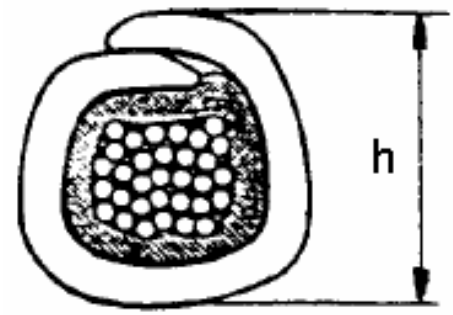

Figure 26 – Section of insulation crimp type C

At least 2/3 of the cable circumference must be encompassed by the insulation crimp. The encirculation must be closed (overlap). The insulation can be punctured by a crimp claw, but this must not cause any damage to the strands.

The bending test according to DIN EN 60352-2 (movement of the conductor over 3 cycles) must be fulfilled.

3.3.7 Single-wire seal crimp

The crimp barrel ends must be rolled in to the extent that the single-wire seal is maintained reliably when the contact is fitted into the connector housing.

3.3.7.1 Position of the single-wire seal

The insulation crimp barrel must snugly wrap around the single-wire seal over the entire length. The single-wire seal must not be damaged or punctured by the crimp barrel ends. The position of the single-wire seal conforms to the drawing specification; see Figure 27.

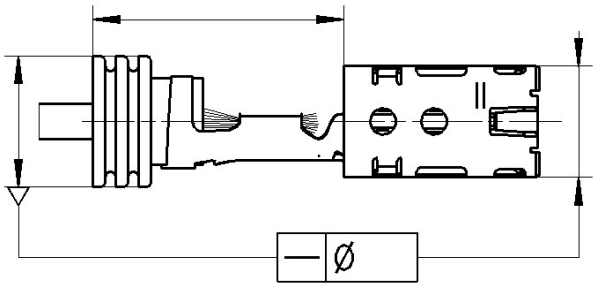

Figure 27 – Position of single wire in the crimp pattern of the standard part drawing

3.3.7.2 Symmetrical O-shaped single-wire seal crimp (O-crimp)

The insulation crimp barrel wraps around the single-wire seal by a maximum of 360°. Overlapping of the crimp barrel ends is not permissible; see Figure 28.

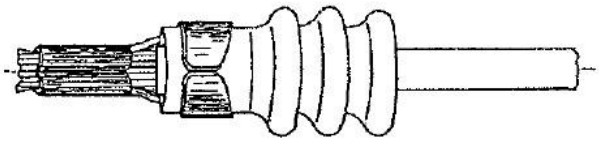

Figure 28 – Symmetrical O-shaped single-wire seal crimp

3.3.7.2.1 Asymmetrical O-shaped single-wire seal crimp (wrap crimp)

The insulation crimp barrel ends wrap around the single-wire seal by more than 360°, see Figure 29.

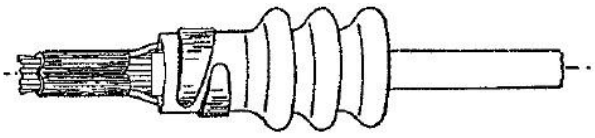

Figure 29 – Asymmetrical single-wire seal crimp

Cut-off tab and burr must not impair the fitting ability into the housing and the plug-in function of the contact.

For plug contacts intended for use with collective seals, the length of the cut-off tab must not exceed 0,3 mm. The cut-off tab must not stick out; a separation burr is only permissible on the side facing the conductor insulation. Cut-off tab and separation burr must not damage the collective seal or single-wire seal.

The requirements also apply to removal and refitting of the contact element during subsequent re-work.

3.4 Further requirements

3.4.1 Cut-off tab

The cut-off tab (see Figure 30) is still visible to some extent (separation burr) and may have a length up to the equivalent of one contact material thickness, but must not exceed 0,5 mm.

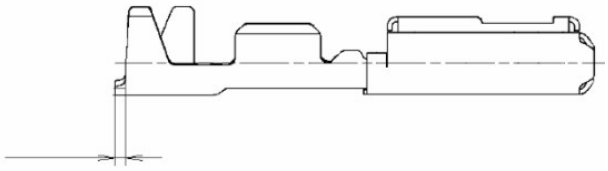

Figure 30 – Cut-off burr

The permissible burr on the cut edge as a function of contact material thickness s is as follows:

Material thickness [mm]	Burr (mm)
$s \leq 0,4$	Max. 0,05
$0,4 < s \leq 0,8$	Max. 0,1
$s > 0,8$	Max. 0,15

Cut-off tab and burr must not impair the fitting ability into the housing and the plug-in function of the contact.

For plug contacts intended for use with collective seals, the length of the cut-off tab must not exceed 0,3 mm. The cut-off tab must not stick out.

Cut-off tab and separation burr must not damage the collective seal or single-wire seal.

The requirements also apply to removal and refitting of the contact element during subsequent re-work.

3.5 Special crimp types

3.5.1 Double-wire crimps

In preparation.

3.5.2 Closed crimp barrels

In preparation.

4 Producing the crimp connection

Non-destructive measurement of the crimp connection quality is only possible to a limited extent. Consequently, the required quality of the crimp connection and, thus, its functional capability can only be achieved in the presence of

- Proper tools and wear parts
- Proper machines
- Preventive maintenance of the indicated machines, tools, and wear parts
- Expert operation
- Effective and reliably applied process assurance based on crimp force monitoring

The details of the process are defined in the quality assurance matrix.

4.1 Tools

The use of genuine crimping tools and inserts (wear parts) is prescribed because the contact part manufacturer is responsible for the system. The respective standard part drawings of the contact part manufacturer, which are made available to the cable manufacturer via the Volkswagen systems, form the basis for this.

The contact part manufacturer has the system responsibility for the contact part.

The cable manufacturer is responsible for the entire crimping process.

Justified deviations from these specifications require approval by the Design Engineering departments responsible for contact development and the Quality Assurance departments of the vehicle manufacturer.

Crimping tools and wear parts which have been confirmed by the crimping manufacturer for use in the respective crimp are considered genuine crimping tools and genuine wear parts. In any event, the crimp dimension specifications of the contact drawing and of the present crimping standard must be adhered to.

4.1.1 Test scope for alternative crimping tools

The contact manufacturer must check the crimps produced using the tool to be approved according to the specifications set forth in VW 75174:

- Incoming inspection (VW 75174, TG0)
- Dimensional check (VW 75174, TG1), including crimp dimensions in the microsection according to Section 3.3.4
- Conductor extraction values (VW 75174, TG10)
- Crimp stability

  Conductors up to 1 mm^2: Slow-motion test according to VW 75174-2

  Conductors larger than 1 mm^2: Only temperature shock test according to VW 75174-2, but with T_o = 130° and number of cycles = 500.

4.1.2 Release recommendation

The suitability of alternative crimping tools and alternative wear parts must be confirmed by the contact manufacturer based on the specified tests by means of a release recommendation acc. to Appendix A to the cable manufacturer.

The contact manufacturer is responsible for the specifications set forth in this release recommendation.

The cable manufacturer must document the release recommendation in the first-sample test report. The process responsibility remains with the cable manufacturer.

In addition, the cable manufacturer must transmit the release recommendation to the Design engineering departments responsible for contact development and the QA department of the vehicle manufacturer.

4.2 Crimping devices

Crimping devices, which include both automatic cable manufacturing equipment and table presses (semi-automatic equipment), must be equipped with a device for continuous automatic monitoring of crimp quality.

Crimping devices must be equipped in such a way that faulty parts can be sorted out reliably.

4.3 Crimp force monitoring

Crimp force monitoring involves a load/displacement measurement during the working stroke of the crimping tool: The load/displacement curve of an OK crimp varies within a desired characteristic curve. This desired curve is determined by a teach-in process after every:

- Change in the tool settings
- Change of tool clamping/tool
- Change of contact roll

To ensure the quality of the crimp connections produced, the teach-in crimp must be evaluated based on a microsection (Section 4.5.2.2) and the crimp dimensions that can be measured as a result (see Section 3.3.4):

- After each change of the contact roll and after each change of the yard goods if conductors ≤ 0,35 mm^2 are used. Producing a microsection after changing the yard goods can be omitted if the conductor type and manufacturer remain the same and if corresponding microsections are already available.
- After each change of contact roll and each change of the yard goods if 0,5 mm^2signal conductors are used. Producing a microsection after changing the yard goods can be omitted if the conductor type and manufacturer remain the same and if corresponding microsections are already available. 0,5 mm^2 signal conductors are marked as such in the harness drawing.
- For load conductors > 0,5 mm^2, a microsection is produced after n crimping operations.

  n = 1/6 × total service life, but at least once a year

  n = at least every 30 000 cycles for all contacts for which the tool service life is not yet known

4.4 Non-destructive testing

4.4.1 Crimp dimensions

4.4.1.1 Crimp width

The crimp width is a primary tool-dependent dimension; Section 4.1 applies. Suitable measuring means must be used.

4.4.1.2 Crimp height

The crimp height is a dimension that can primarily be affected during the crimping process and that is crucial for the crimp resistance values and the stability of these values.

The crimp height measurement is taken in the center of the conductor crimp with suitable measurement means. See Figure 31 for an example of a special measurement device (crimp height micrometer).

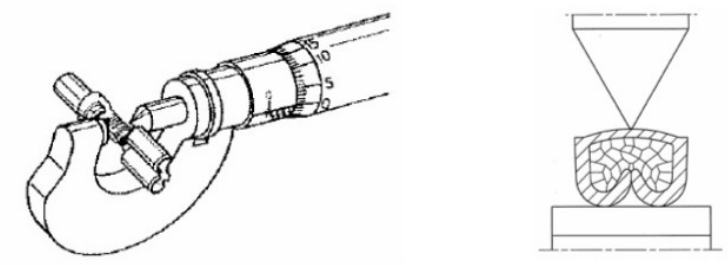

Figure 31 – Crimp height measurement by means of special micrometer

4.5 Destructive testing

4.5.1 Conductor extraction force

The conductor extraction force from the conductor crimp is measured according to VW 75174 as an accompanying manufacturing check and without insulation support; see Table 1. The following minimum values for conductor extraction force are required for low-pressure contacts:

Table 1

Cable cross-section	Contact size				
	0,63	1,2 /1,5	2,8	4,8	9,5
0,09 mm²	-	-	-	-	-
0,14 mm²	-	-	-	-	-
0,22 mm²	-	-	-	-	-
0,35 mm²	50 N (75 N)				-
0,5 mm²	60 N (85 N)				-
0,75 mm²	85 N (105 N)				-
1,0 mm²	-	108 N (125 N)		140 N (162 N)	-
1,5 mm²	-	150 N (180 N)	150 N (180 N)		-
2,5 mm²	-	-	200 N (235 N)		

Cable cross-section	Contact size				
	0,63	1,2 /1,5	2,8	4,8	9,5
4,0 mm²	-	-	-	310 N (325 N)	
6,0 mm²	-	-	-	(450 N)	450 N
10,0 mm²	-	-	-	-	500 N
16,0 mm²	-	-	-	-	1 500 N
25 mm²	-	-	-	-	1 900 N

NOTE 1 If for production reasons, the conductor extraction force is measured with insulation crimp, the values in the square brackets apply. For receptacles and cable lugs, the values according to VW 75173-1 apply.

4.5.2 Microsection

The microsection is located in the center of the conductor crimp, perpendicular to the longitudinal axis. The microsection plane must not be located within any of the transverse embossings in the wire crimp (see Figure 32).

Attention must be paid that the machining direction is opposite the direction of the crimp opening so that no forces occur during grinding that could open the crimp.

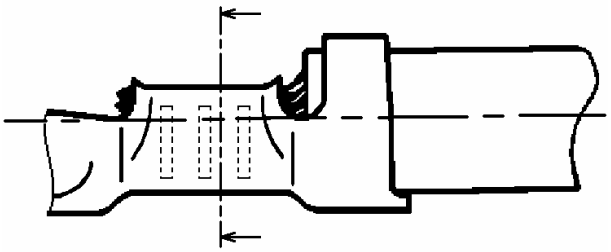

Figure 32 – Microsection plane

4.5.2.1 Metallographic sample preparation for technical engineering approval (BMG)

In order to evaluate the crimp quality achieved with the crimping tool, microsections taken crosswise through the conductor crimp must be prepared.

For tests that are not conducted during production, the part must preferably be cast in synthetic resin to prevent changes to the crimp when the microsection is prepared.

To facilitate the evaluation, the surface of the crimp must be polished and etched following separation.

Evaluation criteria as specified in Section 4.5.2.2 and Section 4.5.1.

4.5.2.2 Preparation of microsections for tests conducted during production

For standard production monitoring, the embedding of samples in synthetic resin is not required when producing microsections. Microsections are produced using suitable devices and taking into consideration the relevant manufacturer specifications.

Unless otherwise specified, the QA matrix applies.

The following specifications must be documented:

- Contact part no.
- Contact supplier
- Part number and manufacturer of the reeled cable
- Microsections and measured values if applicable

4.5.3 Testing of insulation crimp

4.5.3.1 Insulation crimp testing for technical engineering approval (BMG)

The insulation crimp is assessed after testing according to DIN EN 60512-16-8 "Connectors for electronic equipment – Tests and measurements – Part 16-8: Mechanical tests on connections and terminations – Test 16h: Insulating grip effectiveness (crimped connections)".The acceptance criterion is that the insulation must still be encompassed after the test is performed.

4.5.3.2 Insulation crimp testing during production

Determination and documentation of the specified crimp widths and crimp heights using suitable measurement equipment. Unless otherwise specified, the QA matrix applies.

4.5.4 Examples for NOK (not OK) microsections

The following Figures (Figure 33 and Figure 37) are examples for NOK crimp connections.

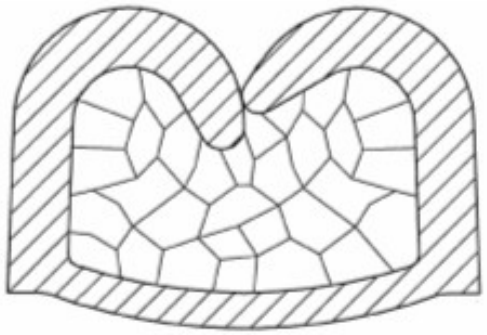

Figure 33 – Crimp tip is supported on the barrel end

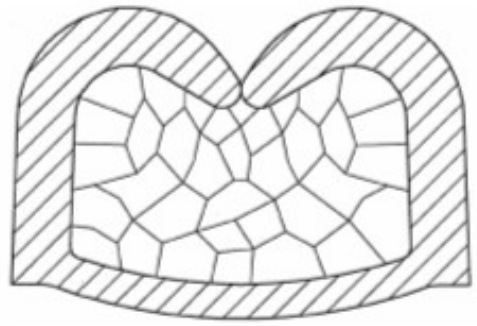

Figure 34 – Insufficient supporting height

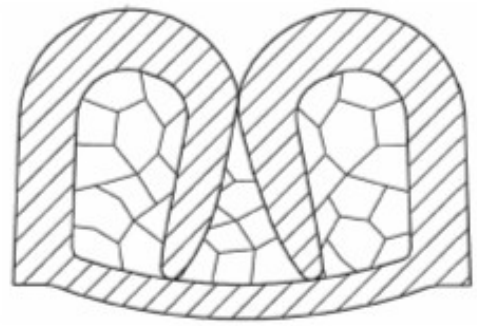

Figure 35 – Crimp claws too long

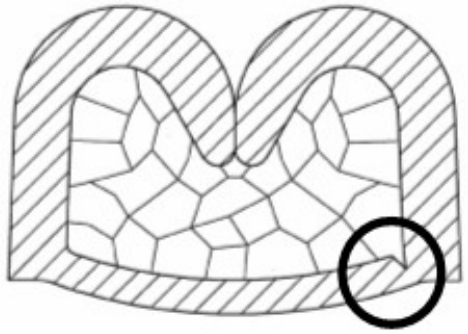

Figure 36 – Crimp cracked

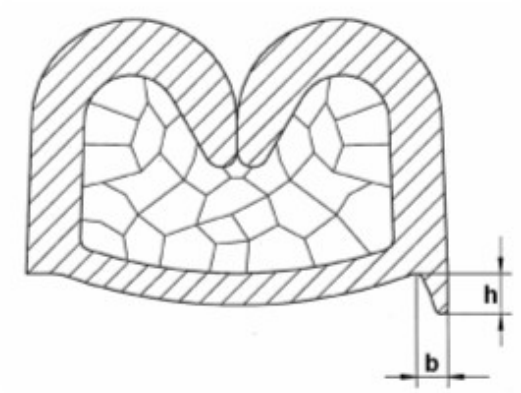

Figure 37 – Impermissible burr formation

5 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.

VW 60306	Electric Wiring in Motor Vehicles; Single-Wire, Unshielded
VW 75147	Harnesses in Motor Vehicles; Quality Requirements for Products and Processes
VW 75173-1	Blade Terminal Connections; Requirements; Test
VW 75174	Motor Vehicle Push On Connectors; Test Guidelines
VW 75174-2	Vehicle Contacts, Slow Motion Tests
DIN EN 60352-2	Solderless connections - Part 2: Crimped connections - General requirements, test methods and practical guidance
DIN EN 60512-16-8	Connectors for electronic equipment - Tests and measurements - Part 16-8: Mechanical tests on connections and terminations - Test 16h: Insulating grip effectiveness (crimped connections)

Appendix A (informative)

A.1 Release recommendation form.

See Figure A.1.

Release recommendation for alternative crimping tools
VW 60330

Originator:	Company: Location:	Phone:	Internal No.:

Contact No.:	Drawing date **(design status):**
	Contact manufacturer:
Designation:	Contact, manufacturing site/country:
EC/ECE label (type approval no.):	DUNS number (Supplier no. if applicable):
Crimping tool manufacturer	
Crimping tool (type, manufacturer no., etc.)	
Wear parts set manufacturer	
Wear parts set (type, manufacturer no., etc.)	

Motivation:

☐ New crimping tool ☐ New crimping tool manufacturer ☐ Additional supplier

☐ New wear parts ☐ ☐ New manufacturing site

☐ New crimp dimensions ☐

Other:

Test		Test report no.	Date
TG 0	Incoming inspection		
TG 1	Dimensional check, including crimp dimensions in microsection according to VW 60330 Section 3.3.4		
TG 10	Conductor extraction values		
TG 31	Crimp stability Conductors up to and including 1 mm²: SMT acc. to VW 75174-2 Conductors larger than 1 mm²: Only temperature shock testing acc. to VW 75174-2, but with To=130° and number of cycles = 500.		

According to above mentioned test reports, crimped contacts of standard part number N xxx xxx xx processed using the above-mentioned crimping tool and wear parts have been tested. The samples provided by the originator are in compliance with the requirements of test groups 0, 1, 10 and 31 of VW 75174.

The test results prove that processing the contact N xxx xxx xx according to the specifications of the standard part drawing is possible using the above mentioned tool.

The cable manufacturer is responsible for proof of processing capability and stability when using this tool as well as for repeatable manufacturing.

Notes

Release recommendation is ☐ **granted** ☐ **revoked**

Company | Phone | Date | Name head of central laboratory | Signature

Figure A.1

A.2 VW 60330 QA matrix: release testing

See Table A.1.

Table A.1

Section No.:	Dimensions/characteristics/ attributes	Technical engineering approval (BMG) of contact	Contact first-sample test report	Release recommendation for alternative crimping tool	Machine suitability (tool release) (cmk)	Process suitability (standard production release) (cpk/ppk)
	To be carried out by	VW/ Audi	Cable manufacturer	Contact manufacturer	Cable manufacturer	Cable manufacturer
3.3.2	Damage of contact range / locking pins	b	b	b	b	b
3.3.3	Contact - bending/twisting	b	b	b	m	b
3.3.4.1	Crimp height Ch	m	m	m	m	m
3.3.4.10	Base thickness Sb*	m	m	m	b	b
3.3.4.11	Degree of compression*	m	m	m	-	b
3.3.4.2	Crimp width Cb	m	m	m	m	-
3.3.4.3	Crimp width Cbm	m	m	m	b	m
3.3.4.4	Supporting angle αw*	m	m	m	b	b
3.3.4.5	Supporting height La *	m	m	m	b	b
3.3.4.6	Barrel end clearance Fa*	m	m	m	-	b
3.3.4.7	Distance between crimp barrel ends CFE*	m	m	m	b	-
3.3.4.8	Burr height Gh*	m	m	m	b	b
3.3.4.9	Burr width Gb*	m	m	m	b	b
3.3.5.3	Crimp bellmouths	b	b	b	m	b
3.3.6	ISO crimp height	m	m	m	m	m
3.3.6	ISO crimp width	m	m	m	b	m
3.3.6	ISO crimp design	m	m	m	b	m
3.3.7	Position of single strand sealing	m	m	m	b	m
3.4.1	Cut-off tab / punching burr	b	b	b	m	b

Section No.:	Dimensions/characteristics/ attributes	Technical engineering approval (BMG) of contact	Contact first-sample test report	Release recommendation for alternative crimping tool	Machine suitability (tool release) (cmk)	Process suitability (standard production release) (cpk/ppk)
	To be carried out by	VW/ Audi	Cable manufacturer	Contact manufacturer	Cable manufacturer	Cable manufacturer
4.6.1	Extraction force	m	m	m	3	m
4.6.2	Microsection (for each cavity and cross-section)	5	5	5	-	3
	Headroom	m	m	m	-	m
	Variation range	m	m	m	b	m

m measure
b assess (measure if required)
* assess by means of microsection

A.3 VW 60330 QA matrix: Testing during production

See Table A.2.

Table A.2

Section No.:	Dimensions/characteristics/ attributes	Cable first-sample test report: VW 75147: Section 5.1.2	Verification of crimp quality VW60330, Section 4.3		Intervention in tool configuration (e.g. replacement of wear parts)
			Signal cables (≤ 0,35/0,5 mm²)	Other than signal cables	
	To be carried out by	Cable manufacturer	Cable manufacturer	Cable manufacturer	Cable manufacturer
3.3.2	Damage of contact range / locking pins	b	b	b	b
3.3.3	Contact - bending/ twisting	b	b	b	b
3.3.4.1	Crimp height Ch	m	m	m	m
3.3.4.10	Base thickness Sb*	b	b	-	b
3.3.4.11	Degree of compression*	b	-	-	-
3.3.4.2	Crimp width Cb	-	-	-	-
3.3.4.3	Crimp width Cbm	m	m	m	m
3.3.4.4	Supporting angle αw*	b	b	-	b
3.3.4.5	Supporting height La *	b	b	-	b

Section No.:	Dimensions/characteristics/ attributes	Cable first-sample test report: VW 75147: Section 5.1.2	Verification of crimp quality VW60330, Section 4.3		Intervention in tool configuration (e.g. replacement of wear parts)
			Signal cables (≤ 0,35/0,5 mm²)	Other than signal cables	
	To be carried out by	Cable manufacturer	Cable manufacturer	Cable manufacturer	Cable manufacturer
3.3.4.6	Barrel end clearance Fa*	b	b	-	b
3.3.4.7	Distance between crimp barrel ends CFE*	-	b	-	b
3.3.4.8	Burr height Gh	b	b	b	b
3.3.4.9	Burr width Gb	b	b	b	b
3.3.5.3	Crimp bellmouths	b	b	b	b
3.3.6	ISO crimp height	m	m	m	m
3.3.6	ISO crimp width	m	m	m	m
3.3.6	ISO crimp design	m	b	b	b
3.3.7	Position of single strand sealing	m	b	b	b
3.4.1	Cut-off tab / punching burr	b	b	b	b
4.6.1	Extraction force	m	m	m	m
4.6.2	Microsection (for each cavity and cross-section)	3	1	-	1
	Headroom	m	-	-	-
	Variation range	m	-	-	-

m measure
b assess (measure if required)
* assess by means of microsection