Workplace Solutions

Crimping

A permanent connection

Whitepaper

Contents

1 Introduction

Crimping is a joining method that connects two components with each other by means of a defined pressing procedure. The method forms a secure connection between the conductor and contact and has largely replaced the soldering process.
Crimping is the creation of a homogeneous, permanent connection between the conductor and connecting element. This type of connection is achieved using high-quality precision tools.

The essential requirements for crimp connections are defined in DIN EN 60352-2. This standard also outlines the testing methods and application instructions for crimped connections. In addition, it describes some of the advantages of a crimped connection.

Possible advantages of crimped connections:
- Efficient manufacture of connections on any production scale.
- Processing with fully or semi-automatic crimping machines or manual crimping tools.
- No cold solder joints.
- The spring characteristics of the spring contacts are not affected by soldering heat.
- No health risks from heavy metal and soldering agent fumes.
- Conductor flexibility behind the crimped connection is maintained.
- No burnt, discoloured or overheated conductor insulation.
- Good connections with reproducible electrical and mechanical values.
- Easy monitoring of production.

In order to obtain an optimum crimp, it is essential that the tool, the conductor and the respective crimp contact are suitably matched with each other. This then results in a UL-approved crimped connection. This white paper explains the background behind crimping and the essential relationships between the individual processes through to achieving an optimal crimp. The main focus is on crimped connections of wire-end ferrules which are produced using manual tools.

2 Components of a crimped connection

A crimped connection can be divided into different groups of components. The cable is a basic prerequisite for the crimping process. A contact is also required for a crimp. On the one hand, there are wire-end ferrules and on the other hand, a variety of different contacts, such as insulated and turned contacts as well as flat-blade connectors. The appropriate processing tools are also required to create the crimp.

2.1 Cable

The main component of a cable is the conductor, which is an electrically conductive transmission medium usually made of copper. The conductor can be divided into different conductor classes. The conductor classes are standardised in IEC/DIN EN 60228 (VDE 0295).

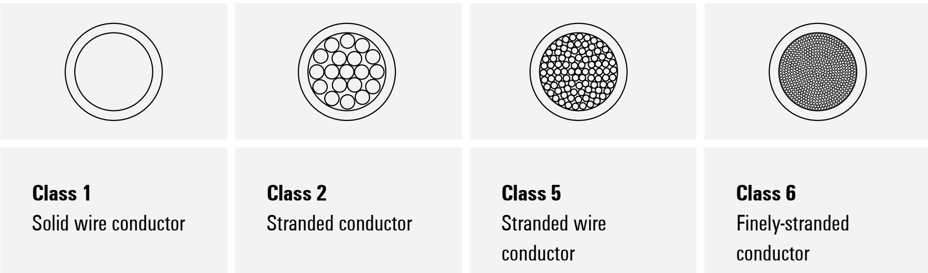


Figure 1: Overview of the conductor classes

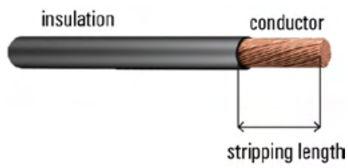


Figure 2: Structure of a cable

Insulation is another component of the cable. The insulation is made of a non-conductive plastic which protects against residual currents, contact, environmental influences and damage.
The type of insulation varies in each case according to the area of application.

There are fundamental differences in the dimensional specification of the wire cross-section. In Europe, wire cross-sections are specified in square millimetres (mm²). In the USA, wire cross-sections are specified in the unit American Wire Gauge (AWG). This unit is a gauge for copper wires. A low AWG value corresponds with a cable with a larger cross-section. The following table gives an overview of the relationship between the most common cross-section sizes. However, it should be noted that the AWG sizes do not correspond with one hundred per cent of the sizes of the rated cross-section.

Rated cross-section mm²	AWG	Corresponding metric cross-section mm²
0.2	24	0.205
0.34	22	0.324
0.5	20	0.519
0.75	18	0.82
1	-	-
1.5	16	1.3
2.5	14	2.1
4	12	3.3
6	10	5.3
10	8	8.4
16	6	13.3
25	4	21.2
35	2	33.6
50	0	53.5

Table 1: Conversion of the common American conductors [According to standard DIN EN

2.2 Contact

There are various wire-end ferrules and different crimp contacts. Some of these contacts are crimped to the conductor, others are crimped to the conductor and the insulation. A selection of crimp contacts is shown below:

- Stamped contacts
- Turned contacts
- Coaxial connectors
- Insulated/non-insulated connectors
- Modular plug connectors
- ...

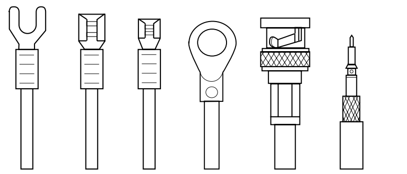


Figure 3: Selection of possible crimp contacts

Only the crimped connection with wire-end ferrules is considered and explained in more detail in the following.

2.2.1 Wire-end ferrules

Wire-end ferrules are available in various cross-sections and in different designs. They are available with and without a plastic collar, and as open or closed versions. The closed version has become established on the market. Twin wire-end ferrules are a special type of wire-end ferrule. These are suitable for two conductors.

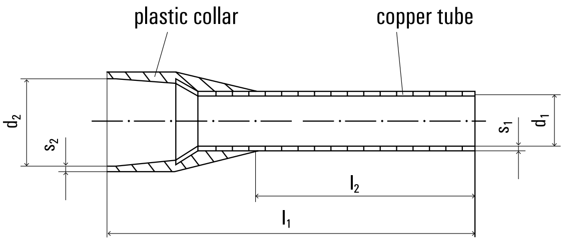


Figure 4: Closed version of a wire-end ferrule

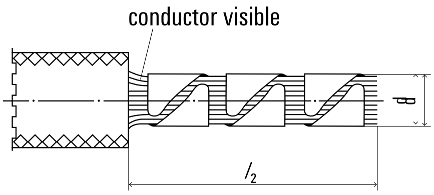


Figure 5: Open version of a wire-end ferrule

The wire-end ferrules are designed to protect the individual strands of a conductor, by preventing individual strands from being separated or damaged for example. Wire-end ferrules with an additional plastic collar provide an additional insertion aid due to the conical shape in the inner diameter of the collar. It also prevents the angular edges of the conductor insulation from getting caught in the insertion funnel of the contact point. The different colour variants provide a visual aid for cross-section detection. It must also be possible to use the wire-end sleeves with class 2, 5 and 6 conductors (see Chapter 2.1).

Figure 6: Wire-end ferrule

The requirements for wire-end ferrules with and without plastic collars are defined in standard DIN 46228, which specifies the essential basic conditions and parameters.

Figure 7: Twin wire-end ferrule

What is important is that the plastic collar of the wire-end ferrule does not offer any anti-kink protection, as is usually the case with insulated cable lugs for example. The plastic collar also does not provide any mechanical insulation support and must therefore not be subjected to excessive bending or tension. For this reason, the relevant standards must be observed during installation. According to DIN VDE 0298-300, cables may only be laid within a certain bending radius. For example, for PVC insulated cables with conductor diameters of ≤ 20 mm, this equates to six times the conductor diameter. In practice, this means that no significant tension may be applied to the AEH plastic collar.

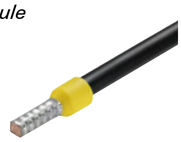


Figure 8: Example of a wire-end sleeve connection

Figure 9: Risk of breakage due to overload – bending radius too small

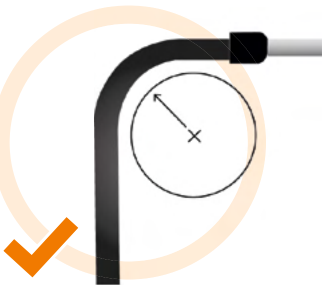


Figure 10: Correct bending radius

2.3 Processing tools

Automatic or semi-automatic crimping machines are usually used for processing larger series of wire-end ferrules. The most well-known way of performing a crimped connection is with manual tools. Specific tools are used depending on the processing cross-section and type of crimp contact.

2.3.1 Manual tools

Manual tools are available in various designs. Some tools include fixed inserts where the crimp dies and crimp frames are optimally adjusted to each other, and others have exchangeable dies. This variant should be considered as a compromise for the fixed inserts. Due to the clever design of the crimp die it is possible to achieve an almost linear crimping movement. It is common for crimping tools to have an integrated ratchet with unlocking mechanism. This ratchet ensures that a crimping operation is carried out completely. The entire crimping force of the tool is transferred to the wire-end ferrule and the conductor. The tool then opens automatically. In case of improper operation, it is possible to unlock the tool manually and remove the wire-end ferrule before performing the entire crimping process. Mechanical crimping tools are typically used for small to medium cross-sections.

Manual tools can also differ in terms of crimping dies. There are single-station tools as well as multi-station tools. With single-station tools, the crimping die is developed in such a way that only one crimping station is available. All cross-sections that are approved for the tool can be processed in this crimping die. In addition, no further adjustments need to be made to the tool, as these are usually equipped with a spring-loaded frame. The multi-station tools consist of several crimping stations. In order to ensure that the optimum result is achieved in each crimping operation, the crimping stations are subdivided for the different cross-section ranges. When using this type of tool, it is important to make sure that the wire-end ferrules are crimped in the appropriate crimping station. Otherwise, a secure connection cannot be guaranteed.

DIN 41641-1 stipulates that the service life of a crimping tool must last for at least 50,000 crimping cycles. After this number of crimping cycles, the crimping parameters should not have changed significantly.

3 Crimping process and preparatory measures

3.1 Cutting

The process chain for cable processing always starts with cutting the conductor or cable. Care must be taken to make sure that the cable is separated to a high quality standard.

This includes:
- A straight, smooth cut without deformation of the conductor (see Figure 12)
- Avoid shearing or pulling out the conductor and avoid squeezing the cable (see Figure 11)

Figure 11: Possible error patterns when cutting

Figure 12: Example of a clean cut

3.2 Stripping

After cutting the conductor, it is prepared for the next stage or for crimping. First, a predetermined length of insulation is removed without damaging the conductor. The subsequent contact point or the wire-end ferrule to be processed determines how much of the conductor insulation needs to be removed. Care must also be taken here to make sure that the cable is stripped to a high quality standard (see Figure 14). Stripping errors are listed in DIN IEC 60352-2.

This includes:
- In the stripped area, the conductor must be clean and free from the rest of the insulating sleeve (see Figure 13-1),
- No damage to the individual wires of the wire-stranded conductor in the stripped area (partially or completely separated) (see Figure 13-2),
- The individual wires must be twisted correctly. If the twist is slightly spread out by the stripping process, it can be restored to its original shape by turning it slightly (see Figure 13-3).

Figure 13: Examples of stripping errors

Figure 14: Example of a correctly stripped cable

3.3 Crimping

After stripping, suitable contacts or wire-end ferrules can be crimped onto the ends of the cable. The crimping of wire-end ferrules is considered in the following.

The wire-end ferrule is pushed onto the conductor as far as possible. The insulation of the conductor either touches the sleeve or inside the plastic collar it touches the conical end. The sleeve tube must be completely filled by the conductor. DIN 46228-4 recommends that a conductor cross-section of at least 90% of the nominal size is used.

During the crimping process, is must be noted that the wire-end ferrules are only designed for stranded-wire conductors according to VDE 0295 class 5. Deviations must be checked. For wire-end ferrule crimped connections, it is recommended that the conductor protrudes up to 1 mm forward out of the ferrule tube up to a cross-section of 6 mm². For cross-sections of > 6 mm², the protruding conductor part measures up to 2 mm. (Figure 15)

Once the wire-end ferrule has been placed on the conductor according to the specifications, the connection is placed in the tool to be crimped. It must be ensured that the crimp is made slightly in front of the plastic collar. The crimping process is complete as soon as the integrated ratchet with tool unlocking mechanism opens automatically. For sleeve lengths that cannot be produced in one work step, they are produced from the starting side to the funnel side.

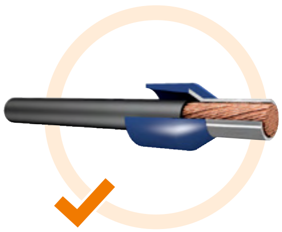


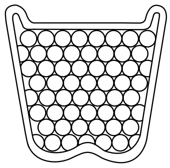
Figure 15: Conductor strands protruding out of the copper tube

The DIN EN 60352-2 standard also recommends that the tools and crimp contacts of a manufacturer should be used. This is the only way to guarantee consistently high-quality workmanship. Otherwise, the user is responsible for the quality.

4 Typical press shapes for wire-end ferrules

There are various press shapes that can be used when processing wire-end ferrules. There is no universal definition for the optimum press shape. Each press shape offers individual advantages as well as disadvantages. These must be weighed up in relation to their subsequent application.

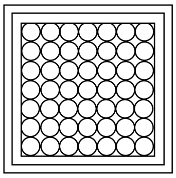
- Trapezoid crimp shape



Advantages:
- Stable contact under load in the screw terminal system, has a low deformation in the connection system
- A continuously smooth surface after the crimping process
- One crimping die for the entire cross-section range

Disadvantages:
- No neutral insertion direction into the connection system

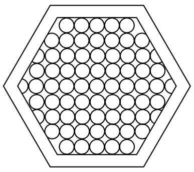
- Square crimp shape



Advantages:
- Neutral insertion direction when connecting into the contact point
- Maximum contact area
- Well suited for square connection compartments
- One crimping die for the entire cross-section range

Disadvantages:
- No continuous smooth surface after the crimping process
- Severe deformation after connection in the terminal

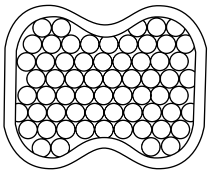
Hexagon (hexagonal crimp shape)



Advantages:
- Neutral insertion direction when connecting into the contact point
- Well suited for circular connection compartments
- One crimping die for the entire cross-section range

Disadvantages:
- No continuous smooth surface after the crimping process
- Severe deformation after connection in the terminal

- WM crimp shape



Advantages:
- Stable contact under load in the screw terminal system, has the lowest deformation in the connection system
- Considered the most compact crimp for wire-end ferrules
- A continuously smooth surface after the crimping process
- Press shape corresponds with EN 60947-1

Disadvantages:
- No neutral insertion direction into the connection system
- Cannot be done in the form of a universal die; requires different crimping stations

4.1 Contact point

For safe contacting, both the press shape and the connection type are important. After all, not every press shape is suitable for every contact point. In some cases, the manufacturers of the contact points specify which press shapes should be used. The most commonly used shape is still the trapezoidal crimp.

The size of the connection compartment is the space that is available in a contact point to accommodate a conductor. A terminal must not only be able to accommodate a conductor of its own nominal size, but must also be able to safely contact a conductor that is two sizes smaller. Two types of gauges are used in relation to the connection compartment size. Firstly, there is the A-shaped gauge, which more or less fits with a rectangular cross-section. Secondly, there is the B-shaped gauge, which has a round cross-section (see Figure 17). With the A-shaped gauge, there are two positions for inserting into the contact point: the "flat" insertion position and the "vertical" insertion position. Usually the "flat" insertion position is used first. If it is not possible to insert in this insertion position, the "vertical" insertion position is used (see Figure 16).

The connection compartment sizes are described in two standards, DIN EN 60999-1 and DIN EN 60947-1, which vary only slightly from each other; the most widely used description is that in DIN EN 60947-1, which is stated below (see Table 2).

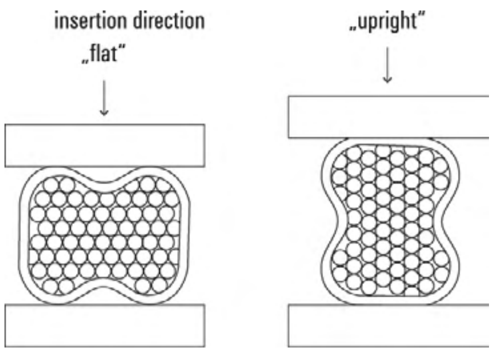


Figure 16: Illustration of the load direction

The connection compartment sizes are described in two standards, DIN EN 60999-1 and DIN EN 60947-1, which vary only slightly from each other; the most widely used description is that in DIN EN 60947-1, which is stated below (see Table 2).

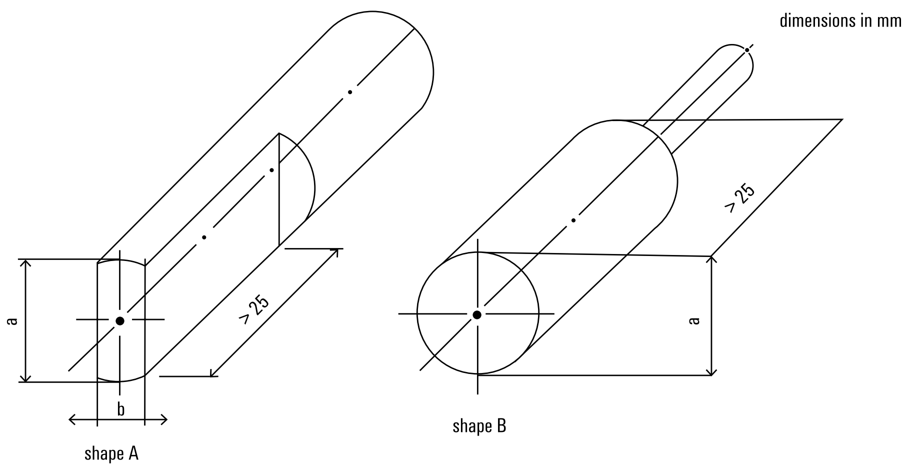


Figure 17: Gauges for the connection compartment size of a contact point

Cross-section		Gauge					
		Shape A			Shape B		
Flexible conductor mm²	Solid conductor (solid or stranded) mm²	Designation	Diameter *a* mm	Width *b* mm	Designation	Diameter *α* mm	Permissible deviations for *α* and *b* mm²
1.5	1.5	A1	2.4	1.5	B1	1.9	0 -0.05
2.5	2.5	A2	2.8	2.0	B2	2.4	
2.5	4	A3	2.8	2.4	B3	2.7	
4	6	A4	3.6	3.1	B4	3.5	0 -0.06
6	10	A5	4.3	4.0	B5	4.4	
10	16	A6	5.4	5.1	B6	5.3	
16	25	A7	7.1	6.3	B7	6.9	0 -0.07
25	35	A8	8.3	7.8	B8	8.2	
35	50	A9	10.2	9.2	B9	10.2	
50	70	A10	12.3	11.0	B10	12.0	0 -0.08
70	95	A11	14.2	13.1	B11	14.0	
95	120	A12	16.2	15.1	B12	16.0	
120	150	A13	18.2	17.0	B13	18.0	
150	185	A14	20.2	19.0	B14	20.0	
185	240	A15	22.2	21.0	B15	22.0	0 -0.09
240	300	A16	26.5	24.0	B16	26.0	
Note: For conductor cross-sections of differently shaped solid or stranded standard conductors which are not included in the table, a suitable section of this unprepared conductor may be used as a gauge, whereby the insertion force must not exceed 5 N.							

Table 2: Connection compartment sizes according to DIN EN 60947-1

5 Actuating forces

In principle, the user cannot influence the actuating forces. These depend on the interaction between the contact type, the respective conductor and the internal lever transmission of the crimping tool. The force is designed to achieve an optimum crimping result. The progression of the force from actuation to actuation is to be considered as constant. The ratchet on the crimping tool prevents insufficient crimping force. Further explanations of the tool can be found in Chapter 2.3.1 Manual tools. The actuation forces are not an indication of a crimp's quality. It can be stated, however, that if the crimp quality is suitable, the actuating forces are also sufficient.

5.1 Determination of the actuating force according to DIN 41641-1

The actuating force is the output load resulting from the adjustment via the tool's spring deflection. It is determined using a test device. This is done by placing a measuring point at an angle of 90 ± 10° to the handle lever 32 ± 2 mm from the end of the handle with the grip plate. The actuating force is then recorded by a measuring sensor (see Figure 18). The force required to actuate the tool must not exceed 500 N. According to DIN 41641-1, the crimping force on the crimping jaws must be achieved no later than by this value.

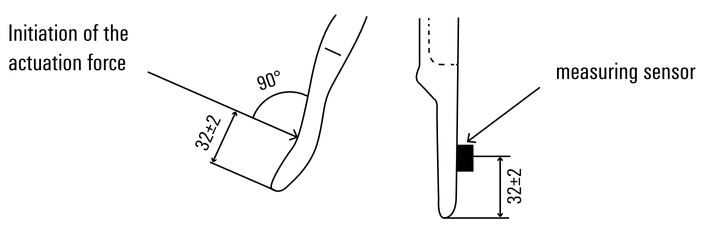


Figure 18: Arrangement of the tool in the test device on the tool test bench

6 Explanation of errors and testing methods

When crimping wire end ferrules, a large number of errors can occur if the specifications from the standards and individual specifications from the manufacturers are not taken into account. Possible causes that lead to errors are improper handling, incorrect assignment of the wire end ferrules to the crimping station of the crimping tool, incorrect selection of the conductor cross-section area for which the wire end ferrule is suitable, incorrect positioning of the wire end ferrule in the crimping profile of the crimping tool or an incorrectly selected one stripping length. If these specifications are taken into account in advance, many mistakes can be avoided.

6.1 Errors that can occur during crimping[3]

- Cracking at the side edges and stamp impressions (see Figure 19- 2.3),
- Bursting of the wire-end ferrule (see Figure 19 - 3)
- Asymmetrical crimp shape (see Figure 19 - 4)
- Strong burr formation on the side edges (see Figure 19 - 4)
- Individual wires pushed back, protruding out of the collar (see Figure 19 - 5)
- Individual wires crushed (see Figure 19 - 1)
- Sleeve not filled by the conductor
- Plastic collar damaged by crimping jaw
- Conductor insulation is not pushed into the plastic collar
- Wire-end ferrule is bent in longitudinal direction after crimping.

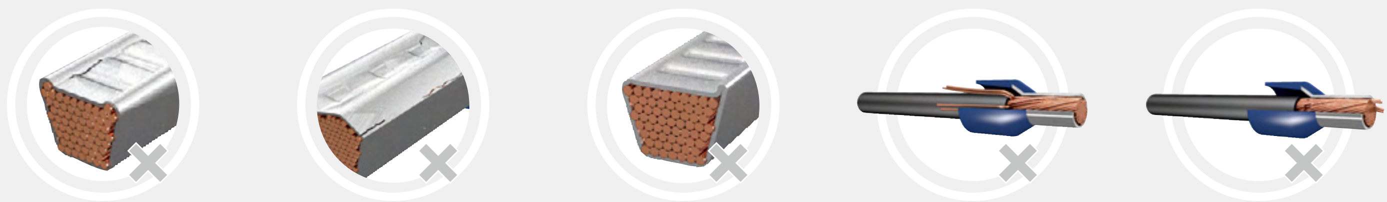


Figure 19: Overview of some crimping errors

6.2 Testing a crimp connection with wire-end ferrule

Testing the crimp connection with a wire-end ferrule can be divided into tests and checks covering different aspects: dimensional check, visual check, conductor extraction force test and various tests with regard to the contact point.

For the dimensional check, a wire-end ferrule is crimped onto a class 5 stranded-wire conductor using a crimping tool, according to DIN EN 60228. The sleeve dimension of the crimp for wire-end ferrules from 2.5 mm² must not exceed the contour of the plug gauge assigned to the stranded-wire conductor cross-section, according to DIN EN 60947-1. More detailed information about the gauges can be found in Chapter 4.1. Contact point.

Basically, when testing the wire-end ferrule connection, the crimp shape is assessed and inspected for possible cracking. Other inspection characteristics that are examined during the visual check are included in the list of errors in Chapter 6.1. Errors which can occur during crimping.
Usually, there is no point checking the crimp density or the microsection, as a wire-end ferrule connection is often used in a terminal system so it is deformed again during use. Therefore, the behaviour of the crimped wire-end ferrule in the terminal system is also tested.

For the test in the terminal system, the conductor with a crimped-on wire-end ferrule is inserted into defined connection compartments and loaded. This involves assessing the insertion into the contact point, the change under load up to 1.5 or 1.8 times the IEC torque for a screw terminal, the deformation and the changes following the bending test.
No damage, such as a burst sleeve, must be visible after the test. The tested wire-end ferrule connection must not jam severely when removing it from the terminal system and must be easy to reinsert into the system in the same position. The connection is tested for multiple connections and the connection compartment size is recorded both before and after the load. With the bending test (also called a flexural test), the connection to be tested is tightened to the maximum torque according to IEC. During this test the tight fit of the cable is checked. The structure of this kind of test device is illustrated in Figure 18. The test is considered passed if after two cycles of the bending test no conductor breakage occurs with the crimp or if the position of the wires in the crimp has changed too much.

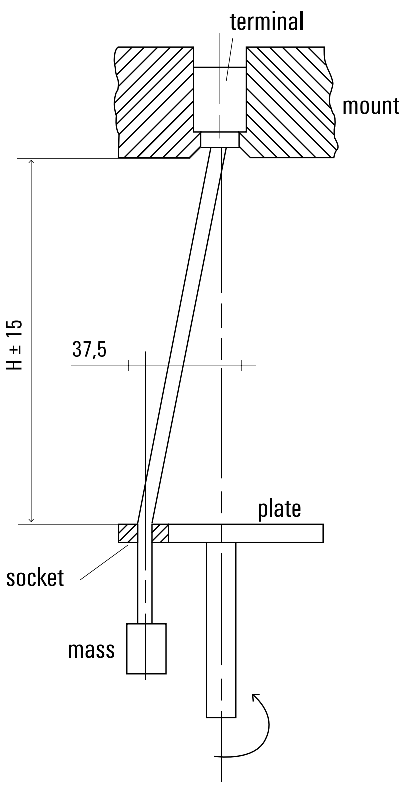


Figure 20: Structure of a test device

Another wire-end ferrule connection test is the tensile test. The connection is tested without the plastic sleeve. If the wire-end ferrule has a plastic sleeve, this must be removed.
The conductor is guided through a hole template and clamped at both ends in the tensile testing machine. The tension occurs in the axial direction of the connection. The test speed is 25 mm/min and is applied for 1 minute with virtually no jerking. The respective conductor extraction values, which apply to the wire-end ferrules, are recorded in DIN 60999-1. During the test, the conductor must not noticeably move in the wire-end ferrule or be pulled out (DIN 46228-4). Below is an overview of the extraction values for different types of contacts, which are dealt with in different standards.

AWG	mm^2	DIN 60999-1 DIN 60947-1 DIN 46228-1/4	UL 486 F	DIN 60352-2
24	0.2	10 N	20 N	28 N
22	0.34	15 N	20 N	40 N
20	0.5	20 N	20 N	60 N
18	0.75	30 N	30 N	85 N
-	1	35 N	35 N	108 N
16	1.5	40 N	40 N	150 N
14	2.5	50 N	50 N	230 N
12	4	60 N	60 N	310 N
10	6	80 N	80 N	360 N
8	10	90 N	90 N	380 N
6	16	100 N	100 N	
4	25	135 N	135 N	
2	35	190 N	190 N	

Table 3: Conductor extraction force values of different standards

7 Glossary of standards

The most important standards relating to crimped connections with wire-end ferrules are outlined below.

DIN EN 60352-2: Solderless connections – Part 2: Crimped connections – General requirements, test methods and practical guidance
This standard explains the basics for a crimped connection. This includes all preparations for crimping and what needs to be considered, such as stripping. It also explains the crimping process, the various testing methods and the causes of errors. This standard therefore provides a general overview of crimping.

DIN 46228-1: Wire-end ferrules – Tubular end-sleeves without plastic sleeve
This standard applies to tube-shaped wire-end ferrules without a plastic sleeve, which prevent splicing of the individual wires of stranded, finely-stranded and superfine-stranded copper conductors, and make it easier to insert them into terminals. It provides general information on the dimensions, requirements and various testing options for this kind of wire-end ferrule.

DIN 46228-4: Wire-end ferrules – Tubular end-sleeves with plastic sleeve
This standard applies to tube-shaped wire-end ferrules with a plastic sleeve, which prevent splicing of the individual wires of stranded, finely-stranded and superfine-stranded copper conductors, and make it easier to insert them into terminals. It covers various topics including the dimensions, requirements and various testing for this kind of wire-end ferrule.

DIN EN 60947-1: Low-voltage switchgear and controlgear – Part 1: General rules
Among other things, this standard provides information about the connection compartment size of a terminal and explains what needs to be observed.

DIN EN 60999-1: Connecting devices – Electrical copper conductors; Safety requirements for screw-type and screwless-type clamping units - Part 1: General requirements and particular requirements for clamping units for conductors from 0.2 mm^2 up to and including 35 mm^2
Among other things, this standard provides information on the connection of the conductors, as well as on the design requirements and various tests. It also defines the tensile forces for a wire-end ferrule connection.

DIN 41641-1: Manual crimping tools – Concepts, requirements, testing
This standard defines uniform requirements and assessment criteria for manual crimping tools. It provides explanations of general terms and defines the various tests for a tool.

8 Summary

Crimping is an extremely complex and diverse subject. Many standards and guidelines must be observed, which could only be outlined roughly in this white paper. Taking into account all the specifications and guidelines, crimping results in a reliable, permanent and secure connection.

Weidmüller has been developing and producing professional tools to meet the most stringent requirements for over 40 years. When developing new products, Weidmüller always has one goal in mind: Weidmüller wants to make work easier, optimise work processes and help to ensure the productivity of a company in the long term. Weidmüller offers a wide range of high-quality and practical mechanical crimping tools – with the right press shape for every type of connection.
This means it is possible to create reliable, durable and stable crimped connections of the highest quality for the desired cross-section. Crimped connections made with Weidmüller tools also comply with international standards and regulations. With the combination of Weidmüller's crimping tools and wire-end ferrules, a UL-certified connection is also guaranteed.

Weidmüller tools benefits in brief:
- Our tools certification ensures increased safety and handling
- Reliable crimping – self-adjusting crimp inserts provide stability during crimping and prevent operator errors
- Perfect ergonomics – combination of optimised mechanics and carefully selected geometries ensures effortless operation
- Outstanding crimp quality – Weidmüller's high quality standards guarantee the best crimped connections

Weidmüller's crimping tools are suitable for wire-end ferrules with and without plastic collars according to DIN 46228 Part 1 and Part 4. They contain a ratchet that guarantees a high-quality crimp. The tools also have an unlocking mechanism in the event of operating errors.
The special feature of the crimping tools for wire-end ferrules is the spring-loaded frame of the PZ 10 HEX, the PZ 10 SQR and the PZ 6 Roto. This makes it possible to compensate for small deviations in the nominal cross-sections of the conductors in a crimp. In addition, each of these tools has a fixed crimping die, which is suitable for a defined cross-section range. The PZ 10 HEX produces a hexagonal crimp shape, the PZ 10 SQR a square crimp shape and the PZ 6 Roto a trapezoidal crimp shape. An additional special feature of the PZ 6 Roto is the rotating crimping die. Thanks to this die, the tool can be adapted to the specific working environment. The special feature of the PZ 6/5 is that the connection compartment size complies with the standard. This crimping tool has a crimping die with different crimping stations for the different cross-sections. The press shape created using this tool is the WM crimp shape.

With Weidmüller, you have a strong partner by your side to support you in all work phases with perfectly coordinated solutions for your workshop. Based on many years of practical experience in panel building, Weidmüller offers you a comprehensive portfolio to effectively speed up your processes and increase your quality.

Exclusion of liability

The content of this white paper describes certain technical problems and sketches out potential solutions or approaches to solutions to correct these problems. The solutions or approaches sketched out in this white paper are estimates or assumptions based on the current state of Weidmüller's technical knowledge and – unless otherwise explicitly described in this document – are neither all-encompassing nor relate to historical events or facts. The estimates or assumptions presented in this white paper, therefore, can be subject to certain risks and factors that have not been taken into account, and that could lead to deviations in reality. In this respect, Weidmüller provides no guarantee that the information presented in this white paper is complete or up to date. Any use of this content is at the user's own risk, and Weidmüller excludes any guarantee or liability resulting from use of the information presented in this document.

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The contents of this document must be treated as strictly confidential.

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Produktmanager / Product Manager

Martin Limberg (born 1990) is Product Manager and responsible for a large part of the hand tools within the Weidmüller Group, including crimping and stripping tools.
Inspired by LEAN methods, he focuses not only on individual products, but also develops new approaches to holistic workplace design.
He began his career at Weidmüller in 2016 after completing his master's degree in industrial engineering at RWTH Aachen University.

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