Product MicroBridge - IDC

Application Specification
114-94928
31 MAY 23 Rev 1

TABLE OF CONTENTS

CHANGE HISTORY

Change #	Description of Changes	Date (DE)
	Basis 4.4.2 6.3.4.5 V1	
04	Extended, finalized	30.01.20
05	Updated for 180° version type 2	01.09.20
06	Added newly-defined processing specifics for 90° and 180°	23.11.20
07	Updated Tolerance of check dimension 90°	08.12.20
08	Definition of wire position in cable guide for 180°-variant adjusted; clarification in 7.5.3; remark on isolation testing	01.06.21
09	Changed template closer to TE appearance while maintaining CAQ document numbers. All requirements maintained w/o changes over previous version with document # 74709. Added note about bulging and its acceptability. Added a few clarifications. Added explanations about overhang and its implications on isolation failures. Added explicit mention of a return-stroke lock for manual presses.	16.05.23

1. INTRODUCTION

This specification covers the requirements for application of “MicroBridge IDC” receptacle connectors used in a great variety of applications and various types of electrical connections. For information about the Product’s portfolio refer to chapter 3.2.

Please note, the scope of this document does not extend to the headers of the MicroBridge family and their processing, e.g. soldering of such.

This also applies to storage conditions.

When corresponding with TE personnel, use the terminology provided in this specification to facilitate inquiries for information. Figure 1 visualizes the product in general.

MicroBridge 5p receptacles

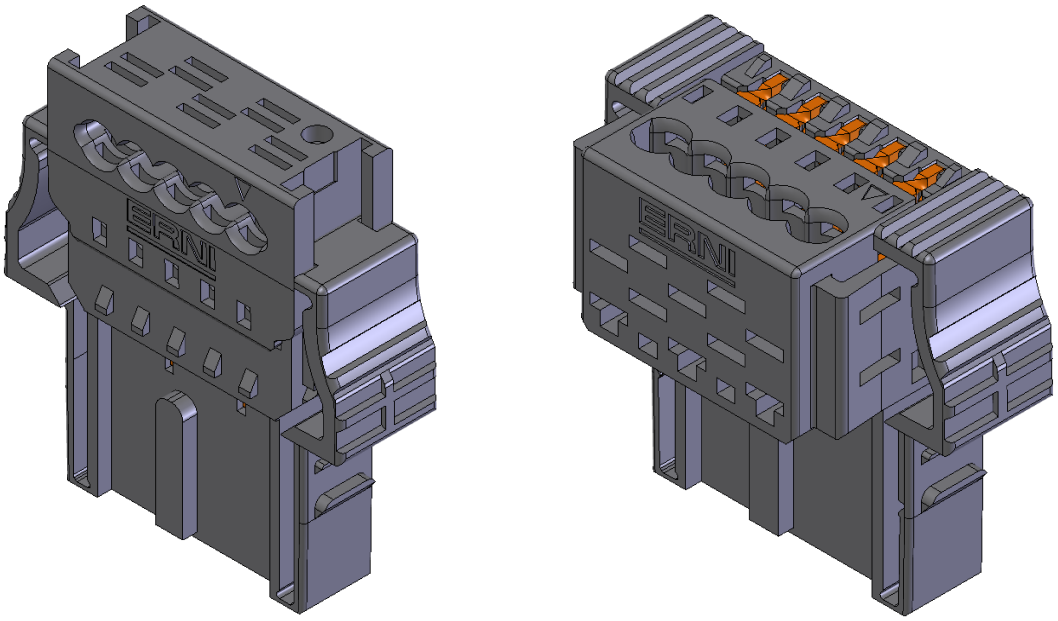


Figure 1
90° cable outlet (e.g. 524431-E, closed) *180° cable outlet (e.g. 504958-E, pre-assembled)*

2. REFERENCE MATERIAL

2.1. Revision Summary

Refer to the above-written Change History.

2.1. Notes, Terms and Abbreviations

ERNI is now an integral part of TE Connectivity (“TE”).

All processing strictly has to follow the on-hand Application Specification in order to ensure best results.

TE reserves the right to apply changes to this document without prior notice.

The Application Specification can be obtained by download from www.erni.com or www.TE.com. The edition on the website is the latest release and replaces all older versions. Make sure you regularly check there for more recent issues. If there is no Application Specification available online, please contact your

local TE representative. This also applies to the Application Specification's attachments which may change independently from the main Application Specification.

Products and product information in this document are meant to be informative in nature and do not imply any assurance of performance or product properties, like availability, qualification, approval, or fit for a certain application, if not stated explicitly. For binding information inquire directly with TE.

The visualizations in this document are of a schematical nature and have been adjusted for their respective purposes. For exact product representations please refer to product drawings and CAD models, which can be found on our website (www.erni.com or www.TE.com) or requested from TE directly.

All dimensions are specified in the unit millimeter (mm) if not explicitly stated otherwise.

"," (comma) may be used as a decimal delimiter instead of "." (period) in the course of this document and both are considered equal (2,1 = 2.1).

Six-digit numbers (now as TE numbers with a "-E" on their ends) represent TE ERNI part numbers in this document.

This document's contents have been written in a clear and distinct context. Therefore, the specific product may not be named and PRODUCT or THE PRODUCT are used as placeholders.

ABBREVIATIONS

ID	Insulation Displacement
IDC	Insulation Displacement Connection

TERMS

beams	electrical contact-making parts of the u-shaped insulation displacement contact system (sometimes also referred to as "flanks")
cable	used synonymically with Wire
holder = fixture	the part of the toolset that retains the connector under processing as desired. In the case of the tooling offerings for The Product the lower tool keeps processed parts.
pin position = pin number = number of the wire assembly position	number 1 is marked at the connector housing of the receptacles; refer to respective product drawing
number of poles = pin count = number of individual contact systems (circuits) per connector housing	
shall	must in conjunction with a requirement
should	strong recommendation in conjunction with a requirement

REFERENCES TO STANDARDS

DIN EN 60352-4
Lötfreie elektrische Verbindungen - Teil 4: Lötfreie nichtzugängliche Schneidklemmverbindungen; Allgemeine Anforderungen, Prüfverfahren und Anwendungshinweise; Deutsche Fassung EN 60352-4
[Solderless connections - Part 4: Solderless non-accessible insulation displacement connections - General requirements, test methods and practical guidance]

IPC-A-620 now designated IPC/WHMA-A-620
Requirements and Acceptance for Cable and Wire Harness Assemblies

LV 214 (OEM-specific equivalent VW 75174)
Kfz-Steckverbinder Prüfungen
[Motor Vehicle Connectors Tests]

2.2. Drawings

Customer drawings for product part numbers are available from www.te.com. Information contained in the customer drawing takes priority.

2.3. TE Specifications

108-94928	Product Specification, provides product performance and test results (upon availability).
107-94928	Product packaging specification (upon availability)
501-94928	Qualification Test Report (upon availability)
114-94928-1	Attachment I Permissible Cables (formerly # 074711)
114-94928-2	Attachment II Tools (Means of Production) (formerly # 074713)

3. REQUIREMENTS

3.1. Fundamentals

The acceptance criteria for cable and cable harness assemblies according to the current edition of IPC-A-620 are generally recommended for assembly of the TE ERNI connectors.

3.2. Product Features

NUMBER OF POLES

2 to 20 (depending on individual availability)

CODING (MECHANICAL CODING WITH DIFFERING HOUSING COLORS)

black, blue, green, red

ORIENTATION OF THE CABLE OUTLET

90° (angled / type P) or 180° (straight / type A)

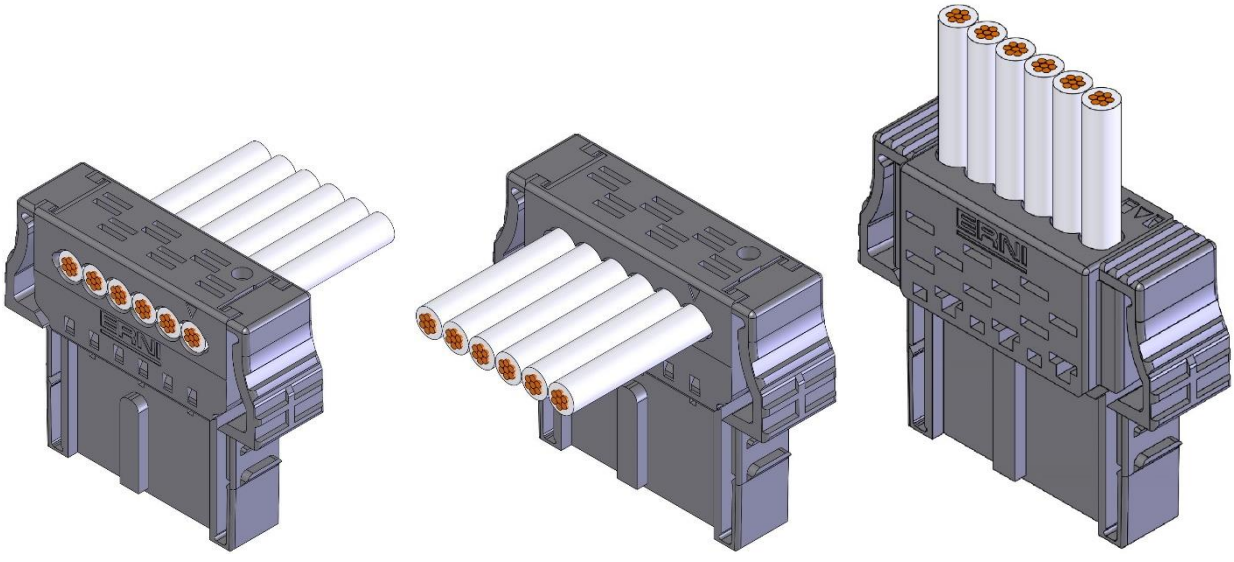


Figure 2

90° cable outlet (2 x left) *180° cable outlet (right)*

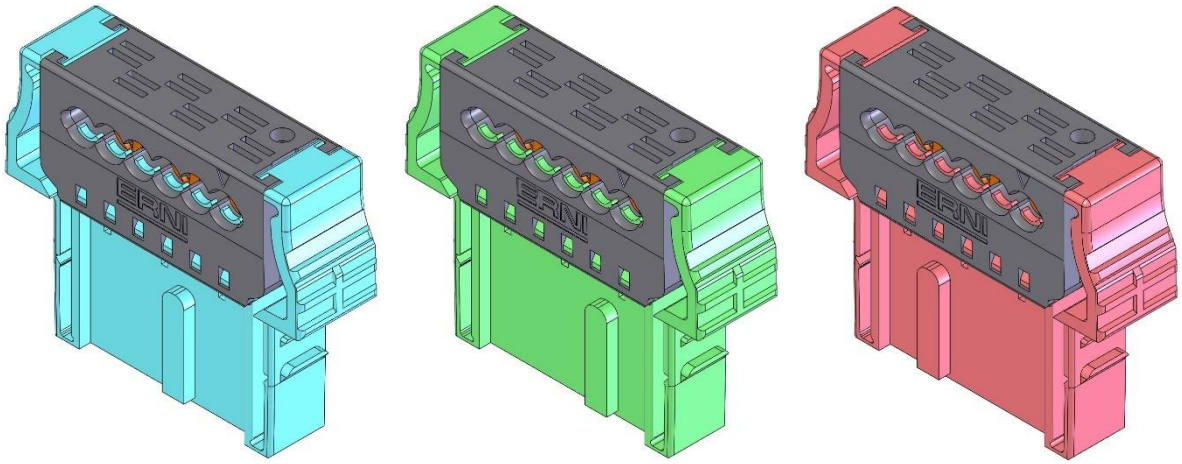


Figure 3
Visualization of further coding variants

NOTE:

The coding structures of the 6 to 20 pole receptacles are implemented identically for all numbers of poles. The coding mechanisms of the 2, 3, 4 and 5 pole receptacles are implemented differently due to their small component size.

3.3. Cable Types

Only the wiring materials listed in Attachment I are permitted.

3.4. Tools

3.4.A. General

To protect the connector against damage (due to over-pressing), only tools that limit the pressing distance (Shut Height) should be used to ensure that exceeding this limit is not possible.

Tools must have sufficient clearances where the housings “breathe”, while housing members snap into each other, so that the locking mechanism cannot be damaged during the pressing process. Despite clearance at the critical spots, a precise upright position - specifically for the 90° (angled) version - must be maintained while a connector is closed.

The usage of TE ERNI original tools is obligatory for manual processing. See Attachment II for an overview of the means of production. All other processing equipment (semi-automated or fully automated machines) must adhere to the requirements of this processing specification.

3.5. Processing Parameters

3.5.A. Pressing Forces

Forces of up to 300 Newtons per pin may be required for processing the connectors, depending on the conductor cross-section and the insulation material. Whereby this is not a nominal value for the process but a value for reference when considering various processing equipment such as hand presses or other kinds of presses and should be adjusted accordingly.

NOTES:

- Simple manual tools used on toggle presses do not have any means to measure and monitor press forces.

- If a force or force-distance monitoring is desired, specific process parameters and their tolerance must be individually determined by the customer as part of the overall process development.

3.5.B. Pressing Speed

A maximum pressing speed of 50 mm/s is recommended. Lower pressing speeds are allowed.

NOTES:

- For semi-automatic and fully automatic processing equipment the implementation of a faster travel of the upper tool, until this comes into close proximity to the connector being in process, may help save valuable processing time (e.g. 250 mm/s).
- For such equipment, a short settling time span (e.g. 250 ms) with no further movement is recommended, after the tool reached its lower dead center and before starting its travel upwards again.
- When using toggle presses in manual mode, exceeding the maximum specified pressing speed is practically impossible.

Once a pressing cycle has started, it shall not be interrupted. Hand-lever presses shall have a return-stroke lock mechanism to ensure this requirement.

3.6. Assembly

3.6.A. Position of the Wire

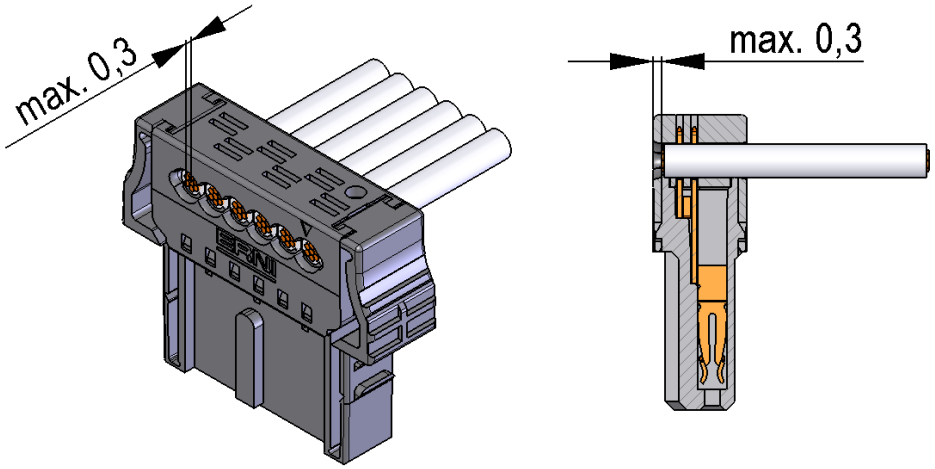
All positions of the cable guide of a receptacle connector housing shall be loaded with only one wiring material type (color is irrelevant). Unused positions must always be loaded with a wire (“dummy wire”, filling wire), even if they are not used electrically.

90° CABLE OUTLET

With a connector in the end position (i.e. cable begins or cable ends at it), the cable tail shall be aligned flush with the connector housing and the cable guide, respectively.

The maximum permissible undercut of 0.3 mm in reference to the cable guide applies to the whole bundle of wire strands, as depicted in the figure below.

Undercut is a critical parameter of the assembly and its processing and must be monitored, ensured, and achieved. Exceeding of the allowance results in reduced reliability.



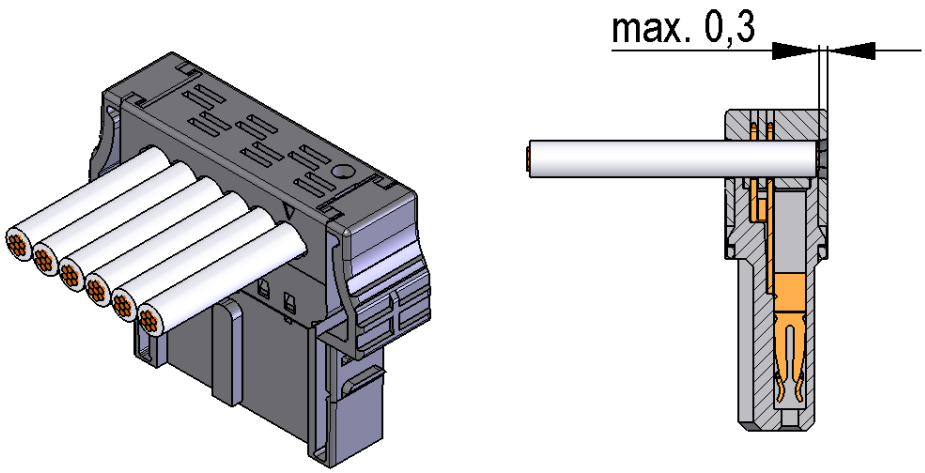


Figure 4 Undercut

The **overhang** is not critical from a connector processing perspective and can be arbitrary. Thus, assemblies with a daisy-chain configuration, i.e. more than two connectors arranged on the length of the cable, are feasible.

Overhang, in combination with insulation retraction, a bow in the wire, and possibly with sideward-bent strands, can be the reason for isolation failures during end-of-line testing and in the field. This is of particular importance for the receptacle version that accepts wires of a 0.35 mm² conductor cross-section (insulation diameter 1.1 mm to 1.27 mm) due to their thin insulation layer. With excess overhang being present, the insulation layers may be the only physical instance ensuring an isolating air gap or creepage distance. The dielectric withstanding voltage in the datasheet may hence be impaired for the completed cable assembly.

The maximum permissible overhang depends on the needs of the specific application for the cable assembly.

When the connector is in the end position (cable begins or ends), a maximum overhang of 0.3 mm is recommended.

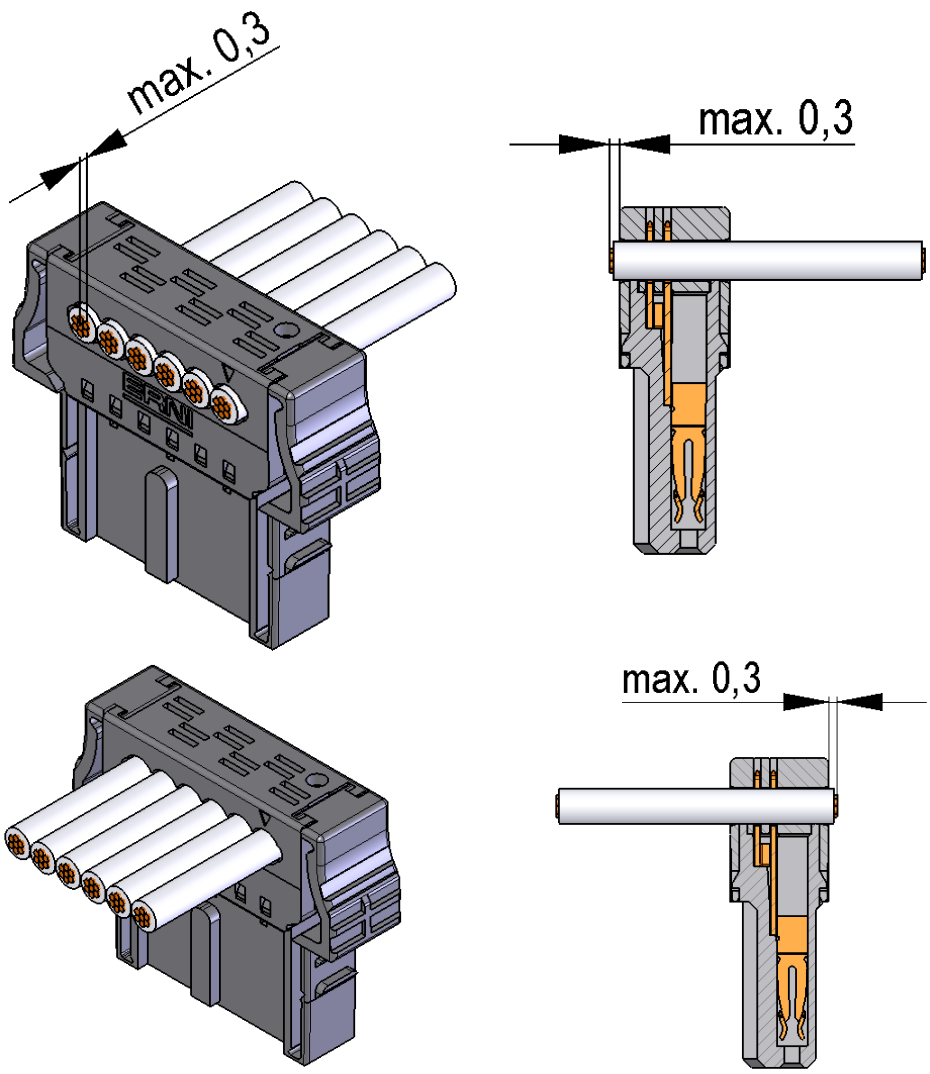


Figure 5 Overhang

180° CABLE OUTLET

It is essential to achieve sufficient insertion depth of the wires for the insulation displacement connectors with a 180° cable outlet and it is a critical parameter that must be monitored, ensured, and achieved. Failure to comply with the requirements may result in reduced reliability of the insulation displacement contacting.

The requirements to the insertion depth of the wires are different for even and odd numbers of the pin position.

For odd pin positions (1, 3, …) sufficient insertion depth is ensured if the wire completely fills the inspection window, i.e. either insulation or copper strands lie against the end of the respective inspection window (refer to the tip of the blue arrow).

For even pin positions (2, 4, …) sufficient insertion depth is ensured if the wire is visible in the respective inspection window (refer to the tip of the green arrow).

The requirements to the edges of the cut, described in section 3.6.B, must be respected.

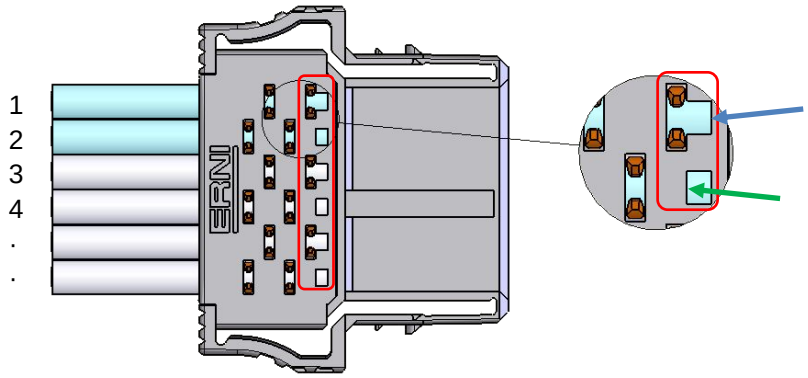


Figure 6
180° Receptacle with inspection windows and wires

3.6.B. Requirements for the Wire Ends and its Cutting Edges and Cutting Planes

The wires must be cut in a way that they can be brought to their correct final loading position without issues. A clean transection shall be achieved. The insulation shall be cut without burrs and fringes and also without a significant deformation.

The strands shall be cut within a tolerance of 0.1 mm to the same length. The bundle of strands must not be deformed in the region, where the insulation-displacement contact will cut through the insulation.

Requirements and criteria of IPC-A-620 section 3 “Preparation” are to be applied as far as applicable. Class 3 is used if there are no application-specific aspects that allowed a lower classification.

Retraction of the bundle of strands from the insulation ends (undercut position of strands in the cable) or retraction of the insulation from the ends of the strands (overhang of the strands in the wire) is allowed to be a maximum of 0.1 mm in order to achieve a correct electrical connection in the ID contact system.

Retraction ≤ 0,1 mm **Retraction > 0,1 mm**

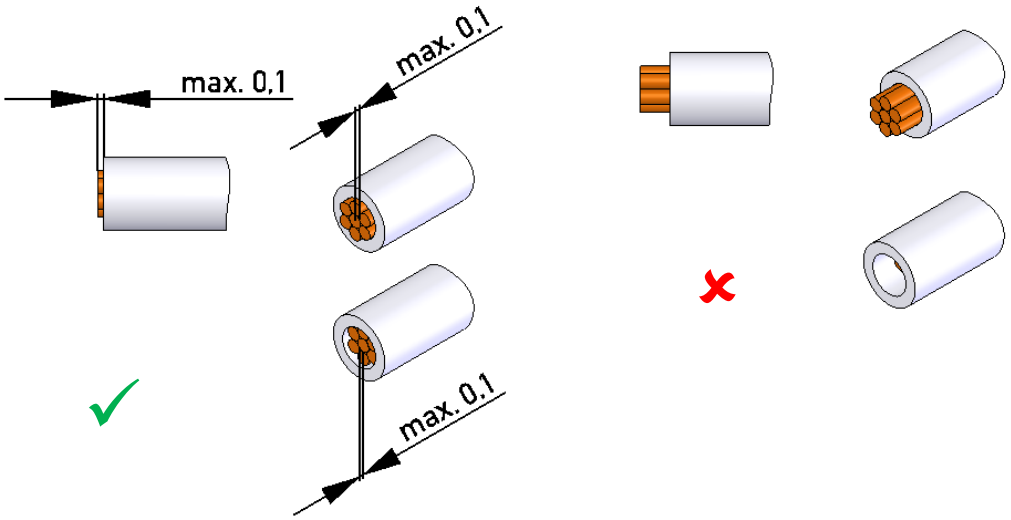


Figure 7

3.6.C. Insulation Displacement (Insulation Cutting)

Evaluated by visibility of the insulation displacement contact feature (ends of the ID flanks) in the clamping shaft.

90° CABLE OUTLET

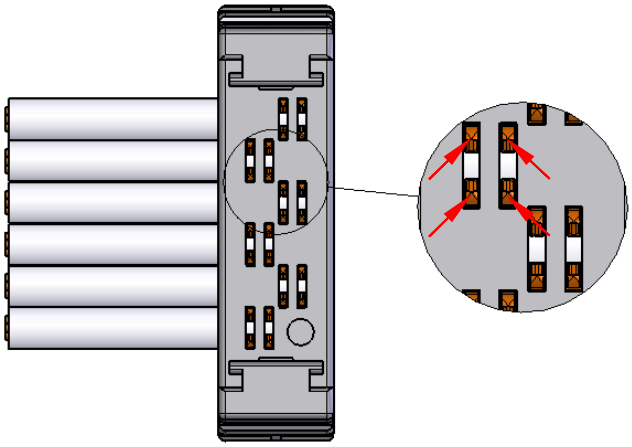


Figure 8

180° CABLE OUTLET

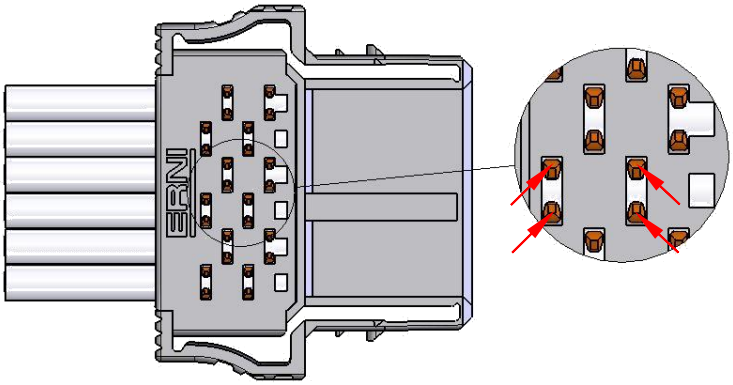


Figure 9

3.6.D. Locking of the Cable Guide

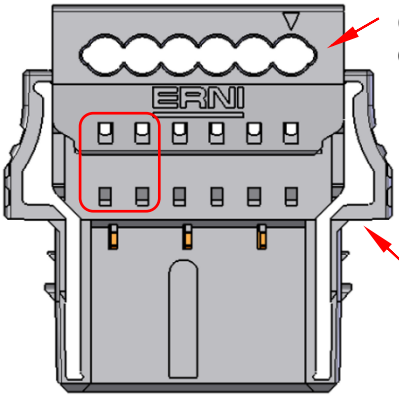
3.6.D.1. Visual Characteristics

There is a catch mechanism for each wire position in the receptacle connector housing which comprises a latching nose and a latching window. All latching noses must snap into their respective latching windows and be completely visible there.

NOTE:

Bulging of the cable guide may indicate incomplete latching. Minor bulging is acceptable if all latching noses have snapped into their respective openings.

90° CABLE OUTLET



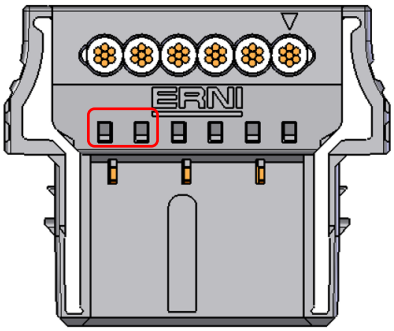
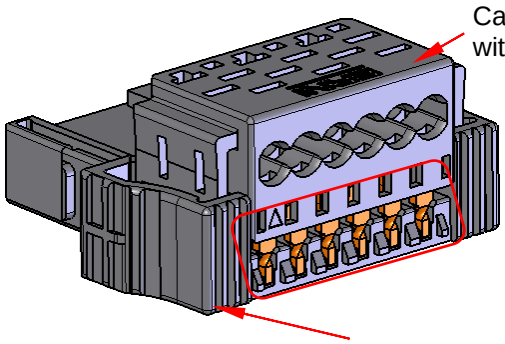


Figure 10

condition on delivery, open

Visibility of final locking of the cable guide

180° CABLE OUTLET



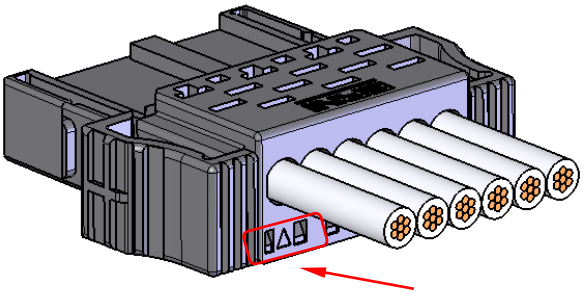


Figure 11

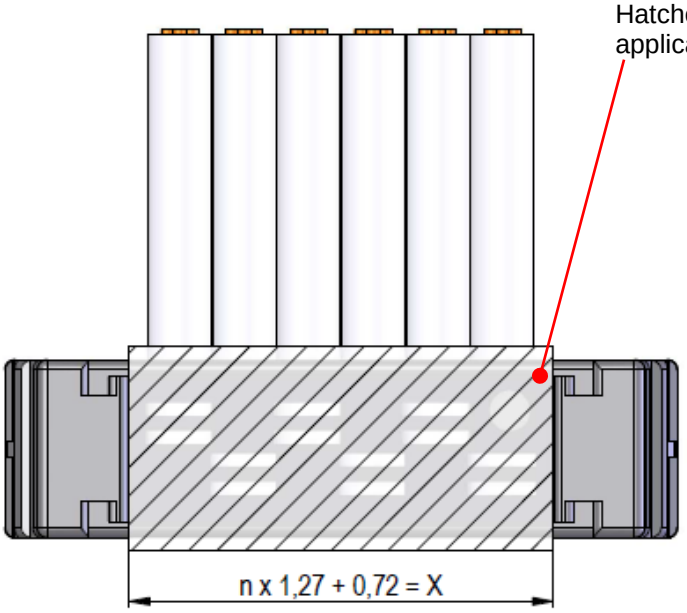
Condition on delivery, open

Visibility of final locking of the cable guide

3.6.E. Pressing (Closing) the Connectors

In this section there are important guidelines for the design of connector holding fixtures (Lower Tool) and pressing rams (Upper Tool) which must be observed unconditionally. If disregarded, there is the possibility that connectors may not reach their properties guaranteed by TE ERNI!

3.6.E.1. 90° Cable Outlet



Tolerance of left and right outer edge:
both +0.0/-0.1

Nominal width of ram in mm

18	23,58
16	21,04
14	18,50
12	15,96
10	13,42
09	12,15
08	10,88
06	8,34
05	7,07
04	5,80
03	4,53
02	3,26
Pin Count	n x 1,27 + 0,72 = X

Figure 12

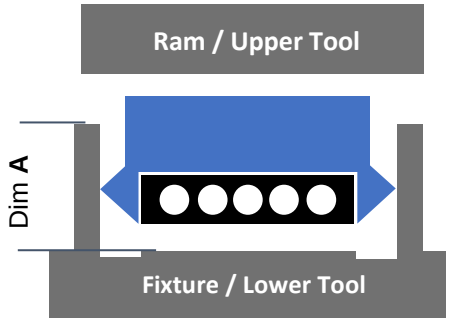
An area of support wider than that specified above (Figure 12) is not allowed for the application of pressing force during processing, while for the mating face side a full-faced support plane is explicitly needed.

While pressing the connector housings, a Shut Height that depends on the number of poles shall be reached based on the following table:

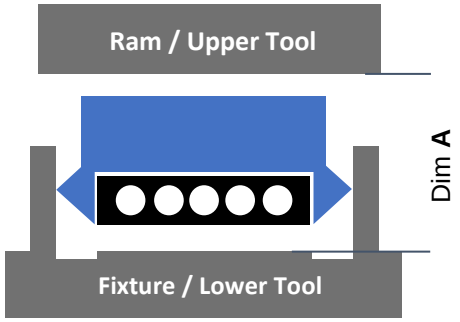
Pin Count *Polzahl*	**Absolute Nominal Shut Height - A** (Tool Opening at Bottom Dead Center) *Absolutes Verpressmaß - A (WZG-Öffnung am unteren Totpunkt - Schließhöhe)*
2	10,8
3	10,8
4	10,8
5	10,8
6	10,8
8	10,7
10	10,7
12	10,6
14	10,6
16	Inquire ERNI / *ERNI anfragen*
18	
20	

Tolerance of Shut Height **A** for all numbers of poles: +/-0.03 mm.

Definition of Shut Height = Dimension **A** (exemplary visualization):



Fixture-limited tooling setup



Stroke-limited tooling setup

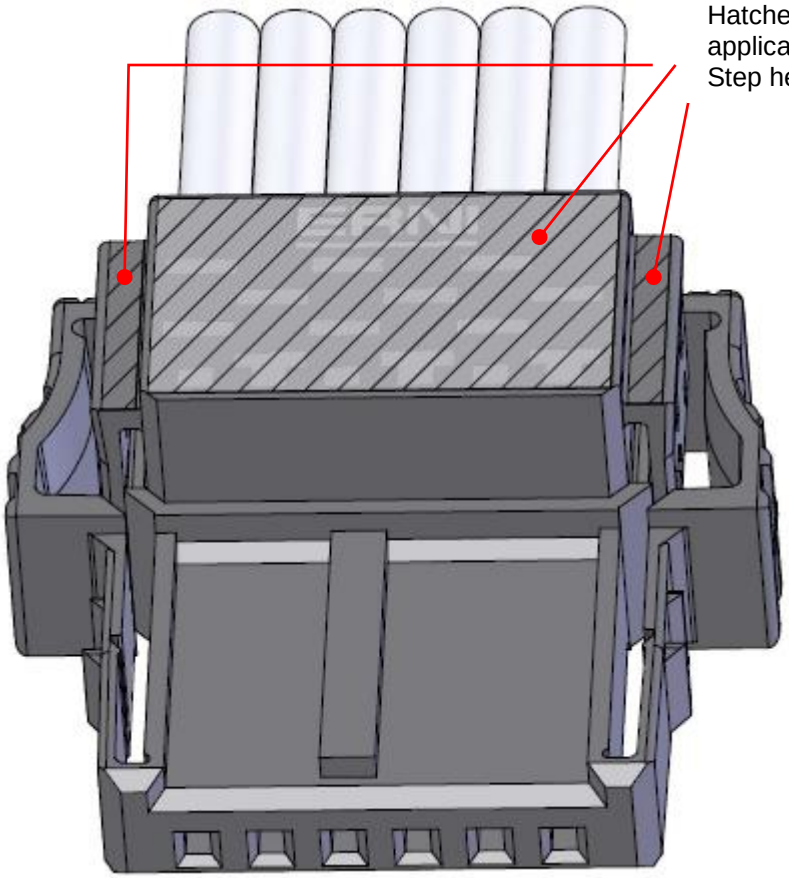
Figure 13

NOTES:

- Shut Height **A** is the dimension effective directly at the connector housing.
- In fixture-limited tooling setups the Shut Height (**A**) can be maintained independently of the press system.
- In stroke-limited tooling setups, the tolerance of dimension **A** has to be strictly maintained, as well.
- The connector housing must not tilt during the pressing process in any one of the four directions.

In stroke-limited setups, machine frame elasticity and the resulting bending of the frame's mechanical structures easily leads to a situation where dimension A cannot be maintained (also refer Chapter 3.4.A).

3.6.E.2. 180° Cable Outlet



Hatched Areas = Areas with simultaneous application of force
Step height in tool 0.6 +0/-0.05

Figure 14

3.6.E.3. Connector Housing Orientation during Pressing (Closing) the Housings

An implementation of the tool dependent from the number of poles is needed on the side of the cable guide in general. If the cable guide is orientated downward during processing, all dependencies from the number of poles can be isolated in the connector holding fixture (bottom) and a flat rock tool (below left side) independent from the number of poles can be used for pressing from the top.

This is true for the 180° (straight) and the 90° (angled) version of the receptacles. In the following schematical depiction a 90° cable outlet is shown.

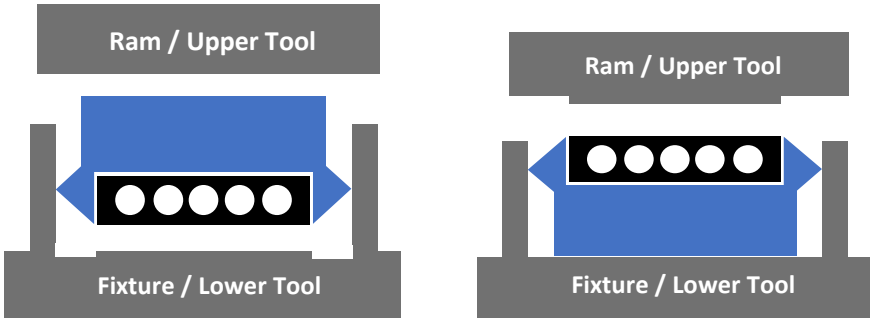


Figure 15

Processing with cable guide down *Processing with cable guide up*

3.6.E.4. Check Dimension For Closed Connectors

In the course of the fabrication of assemblies the following check dimensions (closing dimensions) of fully closed housings must be monitored, ensured and achieved.

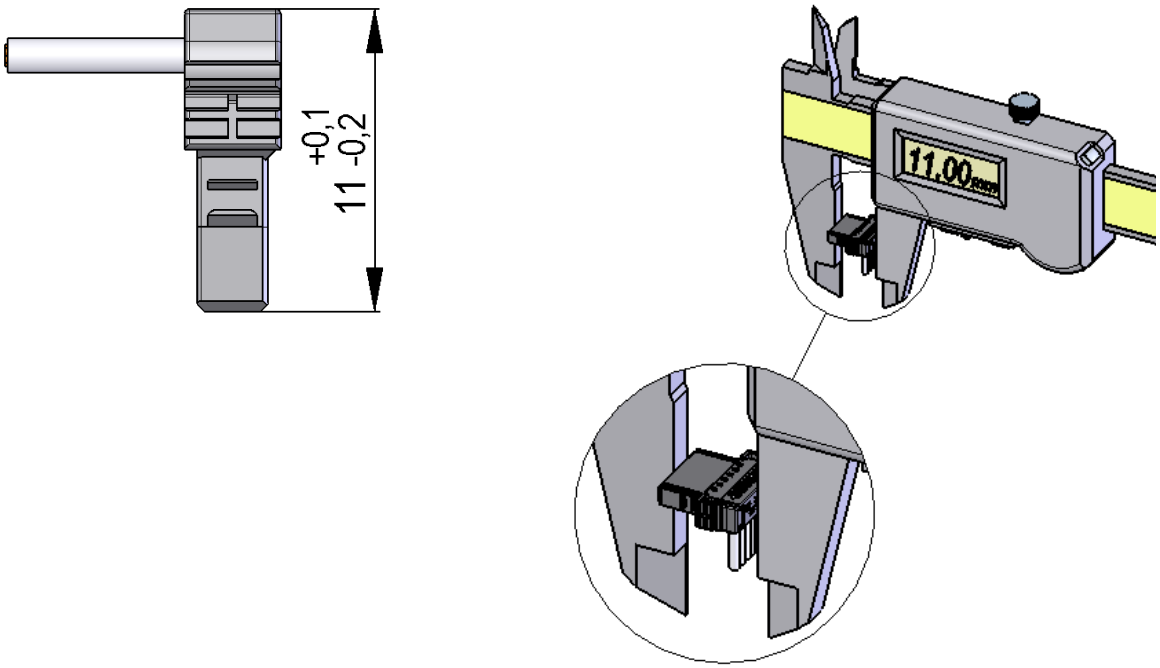


Figure 16 90° cable outlet

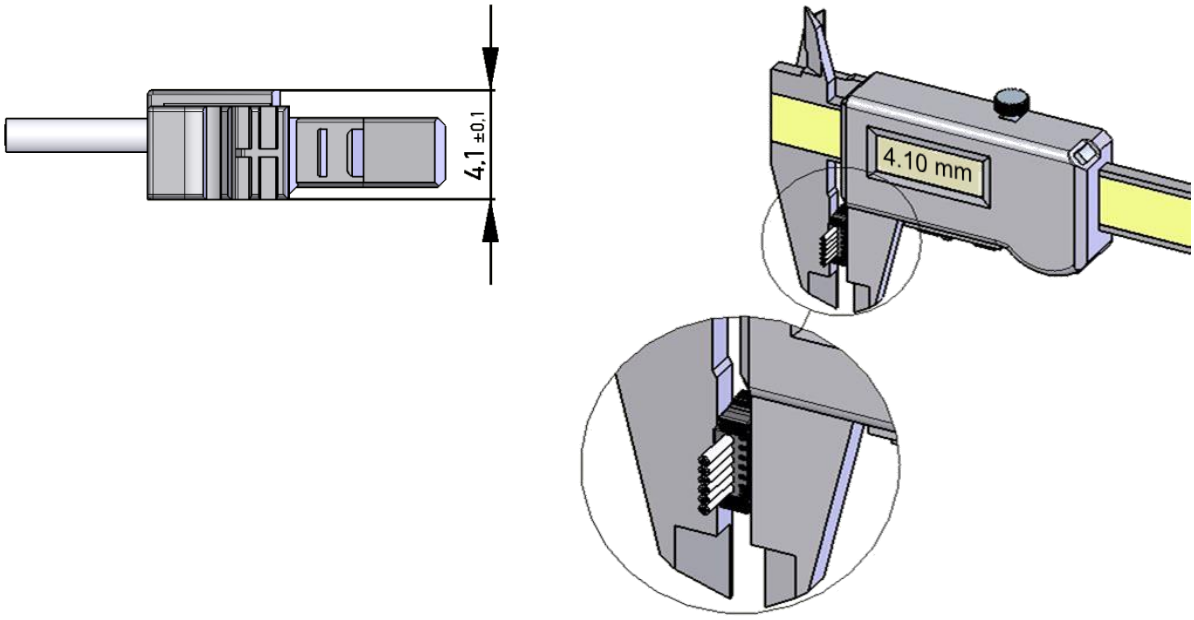


Figure 17 180° cable outlet

While taking measurements connector orientation must be as depicted above.

3.7. Inspection

3.7.A. Applicable Inspections for Quality Assurance

Insulation Displacement Fixtures – Quality Assurance Matrix (Inspection Methods and Inspection Characteristics)					
#	Inspection Characteristics	Method	Inspection Type	During Production	
				Sample	100%
1	Mechanical damage	Assessment of appearance	Visual Inspection (semi-automatic / fully automatic machine)	X	
			Visual Inspection (manual fabrication)		X
2	Cable assignment (color identification)	Assessment of wire color	Suitable sensorics / Image processing (semi-automatic / fully automatic machine)		X
			Visual Inspection (manual fabrication)		X
3	Orientation	Assessment based on mechanical shape	Mechanical test (Poka Yoke) (semi-automatic / fully automatic machine)		X
			Visual Inspection (manual fabrication)		X

Insulation Displacement Fixtures – Quality Assurance Matrix (Inspection Methods and Inspection Characteristics)					
#	Inspection Characteristics	Method	Inspection Type	During Production	
				Sample	100%
4	Displacement of insulation (cutting)	Assessment of appearance	Visual Inspection (semi-automatic / fully automatic machine)	X	
			Visual Inspection (manual fabrication)	X	
5	Undercut / Wire position in cable guide	Assurance by controlled insertion of wires into the cable guide	Path measurement within process		X
		Automatic Optical Inspection (AOI) within visible boundaries, assessment by sensory or mechanical scanning	Image processing, sensory or mechanical		
		Assessment of appearance (based on limiting sample)	Visual Inspection	X	
6	Locking of the housing	Assessment of appearance	Visual Inspection	X	
			Achieving the check dimension[1] (closing dimension)		X[2]
7	Check dimension (Closing dimension)	Dimensional check	Path measurement within process / Assure in process[1]		X
			Mechanical measurement	X	
8	Retention force	Dimensional check / measurement (destructive)	Pull-out strength (single conductor only)	X	
9	Short circuit & isolation	Dimensional check / measurement	Electrical test within process or subsequent test		X
10	Continuity	Dimensional check / measurement	Electrical test within process or subsequent test		X

[1] to be ensured by tool and equipment – refer to requirements in Chapter 3.6.E
[2] see check dimension (closing dimension)

3.7.B. Notes on Electrical Testing

A suitable contact pin has to be used for adaptation for electrical testing, with a probe head shape that permits contacting without damaging the female contact springs.

Alternatively, a male MicroBridge connector soldered onto a circuit board can be used for electrical testing. Steps should be taken to prevent latching for an optimal test process flow.

For isolation testing a high voltage is decisively. TE ERNI recommends 500 V for a duration of 0.3 to 0.5 s.