

# Visual inspection of crimped connections

## Insulation crimping

**B or F-Crimp**

Insulation is enclosed and fixed  
The crimp flanks are closed

**Note:** In case of double crimping with differing cross-sections and/or outer diameters, the smaller cable is ALWAYS at the bottom!

**Overlapping crimp**

Insulation is enclosed and fixed  
The crimp flanks "overlap"

**Note:** In case of double crimping with differing cross-sections and/or outer diameters, the smaller cable is ALWAYS at the bottom!

**O or enclosed crimp**

Insulation is enclosed and fixed.  
The crimp flanks "overlap" one another

**Mismatch Cross-section contact**

**Insulation pierced**

**Crimp too high**

**Iso-crimp overfilled**

**Insulation pierced**

**Mismatch Cross-section contact**

**Insulation pierced**

**Crimp too high**

**Insulation pierced**

**Note:** The same quality standards apply for processing single wire seals

**Iso-crimp is "overpressed"**

**Iso-crimp too large**

**Insulation not enclosed**

**Contact twisted**

10°

The twisting between the crimp zone and the contact body must be a maximum of 10°!

**Crimp flank bent**

**Insulation damaged**

No damage to the insulation permissible!  
Pressure marks must be visible!

## Wire crimping

0.03–0.56 mm <sup>2</sup>	(AWG 32–20)	0.25 +/- 0.15 mm
0.30–0.81 mm <sup>2</sup>	(AWG 22–18)	0.25 +/- 0.15 mm
0.50–2.50 mm <sup>2</sup>		0.40 +/- 0.20 mm
2.50–6.00 mm <sup>2</sup>		0.60 +/- 0.30 mm

**Insert slope**  
(trumpet, bell mouth) must be visible!

**Position deviation**  
Insulation crimp

3° 5°

**Insertion slope allowed**

**Dividing tab must be present!** (max. 0.5 mm)

**Crimp flanks are closed, support each other and are uniformly curled**

**Asymmetry:**  
Max. material thickness

Min. half material thickness

**Burr height less than material thickness**

Burr height less than half material thickness

**Individual strands are not enclosed in wire crimp – insertion error**

**Crimp not closed**

**Crimp is overpressed**  
**Crimp too low**

**Cracks in crimp base and severe burr formation**

**Wire crimp is not closed and is overfilled**

**Mismatch: conductor cross-section contact**

**Crimp flanks hit upon the crimp contact base**

**Mismatch: conductor cross-section contact**

**Crimp not filled**

**Crimp too high**  
**Mismatch**

**Crimp flanks curl unevenly**

**Mismatch: conductor cross-section contact**

**Contact is not centred to the tool**

## Position of the conductor in the crimp contact

**Conductor and insulation must be visible!**

**End of the conductor must be visible!**

**Cable inserted too short**

**Cable stripped too short**

**Cable inserted too far**

**Cable stripped too long**

**Strands cut off or broken**

**Strands are broken in the wire crimp**

## Functional zone of crimp contacts

**Horizontal ± max. 3°**

**Axial shift**

**Vertical ± max. 5°**

**Dividing tab too long and deformed**

**Note:**  
Divider tab must be visible.  
Length max. 0.5 mm

**Contact functional zone damaged and deformed**

**Transition damaged**

**Note:** Crimp contacts with damaged, bent and deformed functional zones (snap locks etc.) must NOT be "straightened out" and must always be disposed of as "bad parts"!

## Definition of insulation crimp height in accordance with DIN 41 611 Part 3

The insulation is not stripped, but only inserted in the insulation crimp zone and crimped.  
The 30° deflection is applied without extraction force.

The cable must not fall out!

Wire crimp without cable

## Extraction force in accordance with DIN 46 249 Part 1, SEN 245010 and EN 60352-2: 2006

**Always perform extraction tests with insulation crimp open!**

Individual wires break off irregularly beyond the insert slope = Test OK!

**Individual wires break irregularly beyond the insert slope = Crimp too low!**

**Crimp too high!**

**Note:** It is not sufficient to simply measure the conductor extraction force, as it could have the same value for different compression levels!  
Inspection of the crimp dimensions is required!

Nominal conductor cross-section mm <sup>2</sup>	Nominal size (plug width)		Extraction force (N) min.	
	2.8	3.2	2.8	Nominal size 4.8–9.5
0.14	2.8		20	20
0.25	2.8		40	40
0.50	2.8	4.8 6.3	60	80
0.75	2.8	4.8 6.3	70	120
1.00	2.8	4.8 6.3	80	160
1.50		4.8 6.3		200
2.50		4.8 6.3		250
4.00		6.3 9.5		350
6.00		6.3 9.5		500

For different conductor cross sections the lower extraction force is definitive in each case. The extraction forces for the nominal size 2.8 arise from the lower material thickness. Except: DIN 46 249 Part 1.

Extraction forces in accordance with SEN 245010: The SEN 245010 standard applies the most stringent QA requirements for a crimp connection in international comparison.	Cross-section	Extraction for
	0.75–50 mm <sup>2</sup>	150 N per mm <sup>2</sup>
	–95 mm <sup>2</sup>	120 N per mm <sup>2</sup>
	over 95 mm <sup>2</sup>	100 N per mm <sup>2</sup>

**Pull-Out Force of Crimp Connections**  
Testing has to be in accordance with Test 16d of IEC 60512.

Wire Gauge	Pull-Out Force	Wire Gauge	Pull-Out Force
mm <sup>2</sup>	AWG	mm <sup>2</sup>	AWG
0.05	30	6	1.3
0.08	28	11	1.5
0.12	26	15	2.1
0.14		18	2.5
0.22	24	28	3.3
0.25		32	4.0
0.32	22	40	5.3
0.5	20	60	6.0
0.75		85	8.4
0.82	18	90	10.0
1.0		108	

IEC 60760, Section 17 and IEC 61210, table 9, show the same values for validation of crimp connections.

## Measuring crimping dimensions

**Crimp dimensions and tolerances for the crimp contact under test are to be taken from the relevant processing specification!**

**Anvil**

**Measuring tip**

5.000 mm

0.25 mm 0.001 mm

