

**Screw Termination**

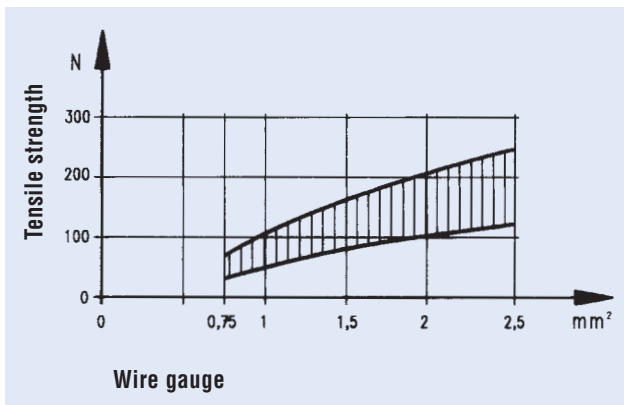
Screw clamps are designed acc. to EN 60999-1/VDE 06095.1. Chart 1 below shows the screw size depending on wire size and the required clamping and testing torque.

**Chart 1**

Wire size (mm <sup>2</sup> )	1,5	2,5
Screw size	M 3	M 3
Test torque (Ncm)	50	50

Diagram 1 below shows the range of tensile strength for a screw connection with a clamp screw M3, fastened with a torque of 50 Ncm, depending on the wire size.

**Diagram 1**



This comparison chart allows a cross reference between American Wire Gauge (AWG) and metric wire sizes (mm<sup>2</sup>).

**Chart 2**

AWG	Wire composition	Wire diameter	Wire size
30	1 x 0,25	0,25 mm	0,05 mm <sup>2</sup>
	7 x 0,10	0,36 mm	0,06 mm <sup>2</sup>
28	1 x 0,32	0,32 mm	0,08 mm <sup>2</sup>
	7 x 0,13	0,38 mm	0,09 mm <sup>2</sup>
26	1 x 0,40	0,40 mm	0,13 mm <sup>2</sup>
	7 x 0,16	0,48 mm	0,14 mm <sup>2</sup>
	19 x 0,10	0,51 mm	0,15 mm <sup>2</sup>
24	1 x 0,51	0,51 mm	0,21 mm <sup>2</sup>
	7 x 0,20	0,61 mm	0,23 mm <sup>2</sup>
	19 x 0,13	0,64 mm	0,24 mm <sup>2</sup>
22	1 x 0,64	0,64 mm	0,33 mm <sup>2</sup>
	7 x 0,25	0,76 mm	0,36 mm <sup>2</sup>
	19 x 0,16	0,81 mm	0,38 mm <sup>2</sup>
20	1 x 0,81	0,81 mm	0,52 mm <sup>2</sup>
	7 x 0,32	0,97 mm	0,56 mm <sup>2</sup>
	19 x 0,20	1,02 mm	0,62 mm <sup>2</sup>
18	1 x 1,02	1,02 mm	0,79 mm <sup>2</sup>
	19 x 0,25	1,27 mm	0,96 mm <sup>2</sup>
16	19 x 0,29	1,44 mm	1,23 mm <sup>2</sup>
14	19 x 0,36	1,80 mm	1,95 mm <sup>2</sup>
12	19 x 0,46	2,29 mm	3,09 mm <sup>2</sup>
10	37 x 0,40	3,10 mm	4,60 mm <sup>2</sup>
8	133 x 0,29	4,0 mm	8,80 mm <sup>2</sup>
6	133 x 0,36	5,5 mm	13,5 mm <sup>2</sup>

It is to be noted that wires of the same AWG number but with different composition have slightly different mm<sup>2</sup>.

**Crimp Termination**

A crimp connection is a non-detachable electrical connection between a wire and a crimp contact produced with the crimp technology. Precise crimping dies which are matched to the crimp barrel and the wire size and a defined deformation result in a reliable electrical connection. There are open crimp barrels (stamped contacts) and closed crimp barrels (turned contacts).

- The main advantages of crimp connections are:
- Efficient termination of contacts
  - Reproducible terminations achieve consistent electrical and mechanical results

The requirements for crimp connections are defined in IEC 60352 Part 2 / DIN EN 60352 Part 2.

An important point of the quality of a crimp connection is the achieved tensile strength of the termination. Easily measured, the tensile strength is a practicable means for quality control purposes. Diagram 2 below shows the required minimum tensile strength for open and closed barrels depending on the wire size.

**Assembly instructions**

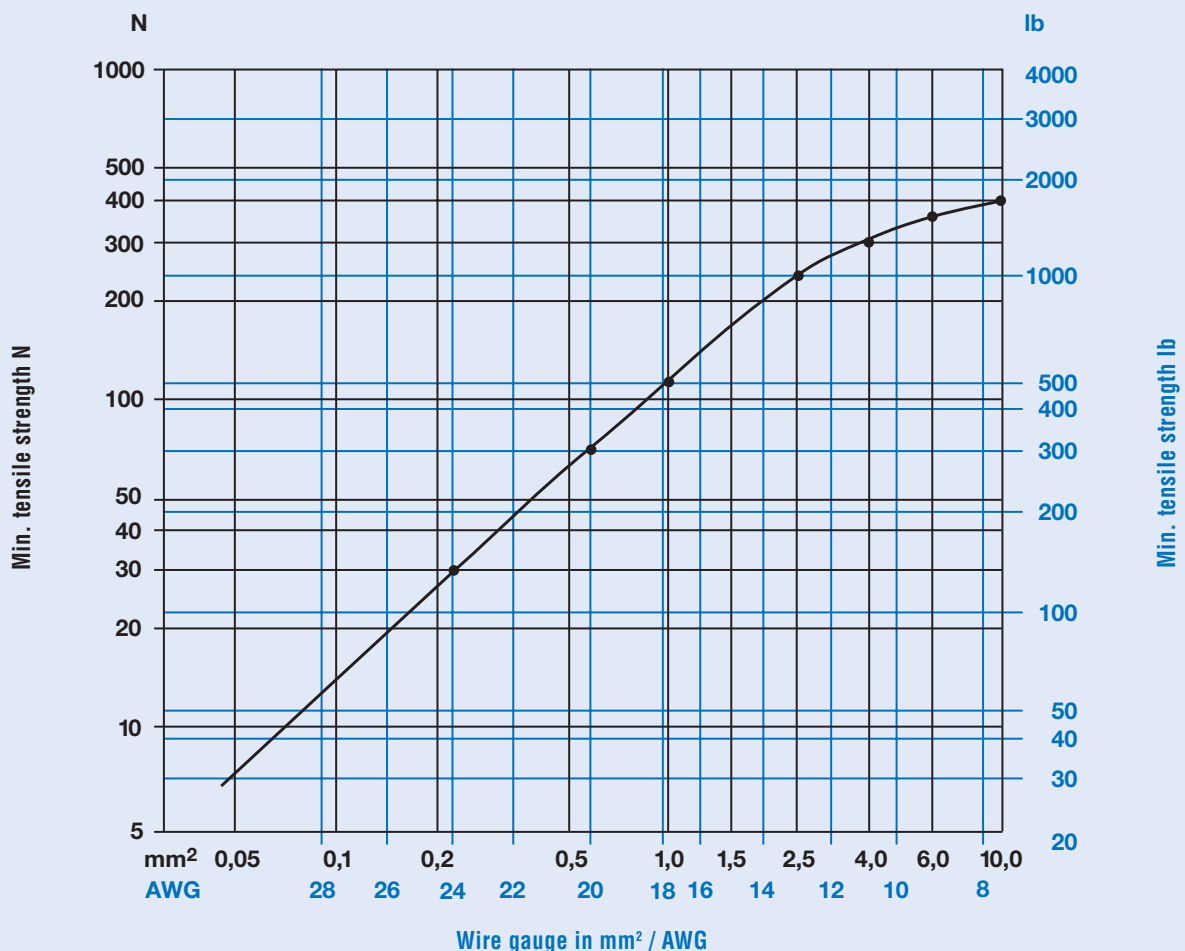
For crimp contacts use the released crimp tool.

The insertion and extraction of crimp contacts shall only be approved with the corresponding insertion/extraction tool.

**A detailed description of the crimp technology can be found in our crimp tooling catalogues.**

**Crimp contacts are in this catalogue on page 10.**

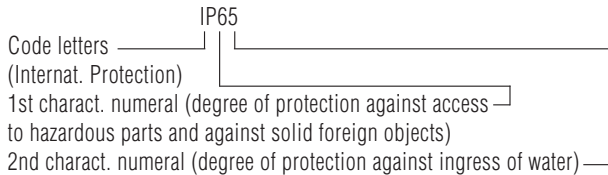
**Diagram 2**



**Degree of Protection**

Electrical devices to which connectors belong to have to be protected for safety reasons from outside influences like dust, foreign objects, direct contact, moisture and water. This protection is provided on industrial connectors by its housings with their latching devices and sealed cable entries. The degree of protection can be selected depending on the type of intended use. The standard IEC 60529 and/or DIN EN 60529/VDE 0470 Part 1 has specified the degree of protection and divided into several classes.

The degree of protection is indicated in the following way:



The following charts 4 and 5 give an overview about all protection degrees.

**Chart 4**

1st charact. numeral	Brief description	Definition
0	Non-protected	–
1	Protected against access to hazardous parts with the back of a hand. Protected against solid foreign objects of $\geq 50\text{mm } \varnothing$ .	The probe, sphere of $50\text{mm } \varnothing$ , shall not fully penetrate and shall have adequate clearance from hazardous parts.
2	Protected against access to hazardous parts with a finger. Protected against solid foreign objects of $\geq 12,5\text{mm } \varnothing$ .	The jointed test finger of $12\text{mm } \varnothing$ , $80\text{mm}$ length, shall have adequate clearance from hazardous parts. The probe, sphere of $12,5\text{mm } \varnothing$ , shall not fully penetrate.
3	Protected against access to hazardous parts with a tool. Protected against solid foreign objects of $\geq 2,5\text{mm } \varnothing$ .	The probe of $2,5\text{mm } \varnothing$ shall not penetrate at all.
4	Protected against access to hazardous parts with a wire. Protected against solid foreign objects of $\geq 1\text{mm } \varnothing$ .	The probe of $1\text{mm } \varnothing$ shall not penetrate at all.
5	Protected against access to hazardous parts with a wire. Dust-protected.	The probe of $1\text{mm } \varnothing$ shall not penetrate. Intrusion of dust is not totally prevented, but dust shall not penetrate in a quantity to interfere with satisfactory operation of the device or to impair safety.
6	Protected against access to hazardous parts with a wire. Dust-tight.	The probe of $1\text{mm } \varnothing$ shall not penetrate. No intrusion of dust.

**Chart 5**

2nd charact. numeral	Brief description	Definition
0	Non-protected	–
1	Protected against vertically falling water drops	Vertically falling drops shall have no harmful effects.
2	Protected against vertically falling water drops when enclosure tilted up to $15^\circ$	Vertically falling drops shall have no harmful effects when the enclosure is tilted at any angle up to $15^\circ$ on either side of the vertical.
3	Protected against spraying water	Water sprayed at an angle up to $60^\circ$ on either side of the vertical shall have no harmful effects.
4	Protected against splashing water	Water splashed against the enclosure from any direction shall have no harmful effects.
5	Protected against water jets	Water projected in jets against the enclosure from any direction shall have no harmful effects.
6	Protected against powerful water jets	Water projected in powerful jets against the enclosure from any direction shall have no harmful effects.
7	Protected against the effects of temporary immersion in water	Intrusion of water in quantities causing harmful effects shall not be possible when the enclosure is temporarily immersed in water for 30 min. in $1\text{m}$ depth.
8	Protected against the effects of continuous immersion in water	Intrusion of water in quantities causing harmful effects shall not be possible when the enclosure is continuously immersed in water under conditions which shall be agreed between manufacturer and user but which are more severe than for numeral 7.
9K <sup>1)</sup>	Protected against water during high pressure/steam jet cleaning	Water projected in powerful jets with high pressure against the enclosure shall have no harmful effects.

<sup>1)</sup> Remark: Numeral acc. to DIN 40050 part 9, vehicles IP code.



**1. General Remarks**

These connectors are designed and produced in conformity with the low voltage directive (73/23/EWG) respectively Gerätesicherheitsgesetz (German law) and are especially in accordance with the standards DIN EN 61984 / IEC 61984 (VDE0627); IEC 60664-1 (VDE 0110-1) and IEC 60529.

The connectors may be used only within the technical ratings. All technical data refer to mated connectors under live conditions. The safety of the connector system depends on the correct selection of products, proper assembly of the connector device and a precise fit of the connectors.

**2. Application Remarks**

Connectors with / without breaking capacity must be used according to specified technical ratings. The technical data represents the initial value of mated parts under predetermined conditions and length of time. These values could change with different test parameters or product requirements. The connectors of the eco|mate<sup>m</sup> series are designed for the areas of application including the construction and installation of controlling and electrical devices. The product has been tested for the intended purposes only. If the connection is used other than originally intended, or in another manner that we have not previously tested, the consumer assumes full responsibility.

All rated data for the connectors listed in this catalogue are based on over-voltage category III <sup>1)</sup> and pollution degree 3 <sup>2)</sup> for electronic applications. Connectors were completely mated according to their respective safety locking mechanism. Selection and testing of connectors with / without breaking capacity to meet specific product or industrial requirements such as rated voltage and the related clearances and creepage distances are the responsibility of the user.

**3. Assembling Remarks**

Protection against electrical shock of the termination of the connectors shall be secured by correct mounting. Connectors of the same or different series being mounted side by side may be protected against incorrect mating by the use of coding options. Care must be taken to ensure the parts are correctly mated and screws are tightened with the proper torque.

**4. Termination Remarks**

Cable connectors are effectively secured when using the strain relief (internal strain relief clamp or clamping ring). When the connector contains a simple gland bushing for retention without clamping ring the cable should have a strain relief close behind the connector. All cable properties or specifications must be compatible with the connector design and materials. Designated wire conductors must be terminated to the correct poles in the connector. Crimp contacts must be fully inserted into the plastic housing and strain relief assured with a slight tug on the wire. Wire should be stripped correctly according to printed specifications to insure no electrical contact can be made between the conductors. There should be no nicked or cut strains during the stripping action.

**5. Safety Classification acc. to DIN EN 61984 / VDE 0627 / IEC 61984**

Style	enclosed mated	enclosed unmated	protective earthing contact	finger safety mated	finger safety unmated	hand back safety mated	connector with breaking capacity <sup>1)</sup>	rewirable	Cable clamp	
									with	without
Male cable connector	•	•	•	•	NA	•	•	•	•	•
Female cable connector	•		•	•	•	•	•	•	•	•
Male receptacle screw / crimp	•	•	•	•	NA	•	•	•		•
Female receptacle screw / crimp	•		•	•	• <sup>3)</sup>	•	•	•		•
Male receptacle solder	•	•	•	• <sup>3)</sup>	NA	• <sup>3)</sup>	•	•		•
Female receptacle solder	•		•	• <sup>3)</sup>	• <sup>3)</sup>	• <sup>3)</sup>	•	•		•

<sup>1)</sup> Overvoltage category III: Equipment intended for the use in installations or parts of it in which lightning overvoltages do not need to be considered, however switching overvoltages generated by the equipment, and for cases where the reliability and the availability of the equipment or its dependent circuits are subject to special requirements. Examples are protecting means, switches and sockets.

<sup>2)</sup> Pollution degree 3: Conductive pollution occurs or dry non-conductive pollution occurs which becomes conductive due to condensation which is to be expected.

<sup>3)</sup> Protection against electrical shock of the termination of the connectors shall be secured by correct mounting.

NA ≠ not applicable