Training tool: Introduction to Cable Processing & Crimping Technology

Reference: Tool-01-EN-EF
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Language: English

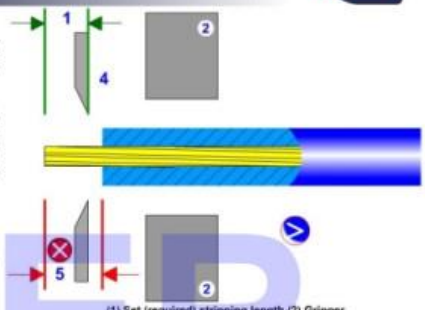
Wire processing = 20% Knowledge + 80% Experience!

In cable processing there are many factors that are decisive for an optimum quality of the finished cable harness. Some of these factors cannot be defined in setting tables or requirements and may even change during a running production.

A good example of this is the stripping of wires: Cables and wires consist of individual strands twisted into a stranded compound, sheathed with a plastic coating that serves as insulation. This insulation is designed to meet a wide variety of requirements, depending on its subsequent use (mechanical loads, temperature resistance, flame retardant, resistance to aggressive environmental conditions, etc.).

- Insulation thickness: Cables have different insulation thicknesses.
- Insulation hardness: Depending on the material used, the insulations are more or less hard.
- Reinforced insulations: Insulations can be additionally reinforced by other materials (fabric). Or consist of several layers (e.g., coaxial cable).
- Geometry of the cable: Besides round cables, there are also flat cables, which can also be twisted.
- Number of individual wire strands: The more individual strands there are in a cable, the more flexible (bendable) the cable.
- Ambient temperature: Depending on the plastic used, the insulation can become softer or harder as the ambient temperature changes (summer - winter).
- Tool wear: Increasing blurring of cutting and stripping knives directly influences the stripping result.
- Stripping properties: When using one type of wire from different manufacturers, the stripping properties may differ. This makes it necessary to readjust the machine settings.

IMPORTANT:
- First and foremost, the properties of the insulation materials in terms of hardness and toughness determine how well a cable can be stripped.
- There are no setting values for machine settings available!
- Experience teaches which parameters provide an optimal stripping result when setting the machine.
- The experience of the machine setter therefore directly determines the quality and the required time for the (cost-intensive) set-up times!



(1) Set (required) stripping length (2) Gripper
(4) Cutting/stripping knife.

The setting of the gripper pressure (A) decides how far the insulation will flow (B). Incorrect setting of the gripper pressure leads to further errors, quality losses and additional costs due to additional work steps!


ERROR: Conductor brush is too short
= The cable is "hollow".


ERROR: Variations in stripping length

In the development and design of crimp connections, the connector is divided into two basic areas: The crimping area (1) and the functional area (2).

Crimping area (1): The conductor crimping area (3) is designed for optimum crimping for the specified nominal cross-section. The insulation crimping area (4) for the diameter of the insulation of the specified wire or for a single wire sealing (5).

The functional area (2) is designed according to the desired connection variant and forms the transition to a mating connector (crimp connector) or to a component.

In principle, crimp contacts, such as the Power Timer series, were manufactured for industrial mass production, for example in the automotive sector for automatic crimping machines with crimp applicators, that can be changed quickly.

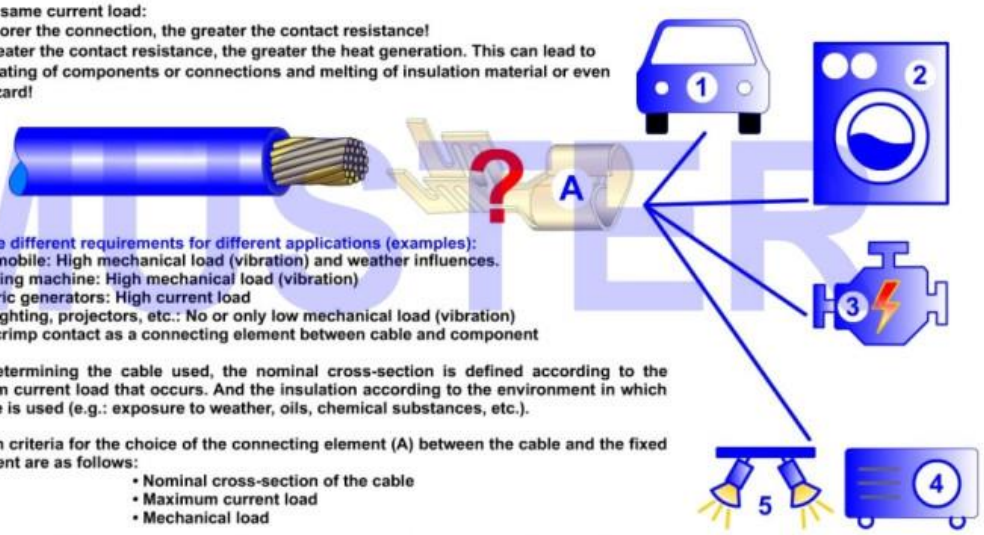
Equivalent die sets for hand crimping pliers are usually designed afterwards for maintenance. As long as the original configuration is maintained, optimal processing with the intended tool is trouble-free.

Alternative contacts from other manufacturers (with modified contact geometry) and/or the use of other cross-sections that are used to apply the function of the connector system may lead to suboptimal crimp results.

Approved cross-section ranges: Sometimes, crimp contacts are approved for several cross-sections (e.g. 0.25 to 1.0 mm²). If this cross-section range is too large, optimum crimping may not possible for all cross-sections.
Crimp applicators allow the adjustment of the settings (crimp height). Hand crimping pliers do not offer this possibility. In this case, an additional adapted die set must be used!

The objective in wire processing is to connect a flexible cable with a solid component. The aim is to achieve an electrical connection with the lowest possible contact resistance and ideal mechanical properties. "Ideal" refers to mechanical properties like durability of the connection with respect to mechanical loads, such as vibration.

With the same current load:
- The poorer the connection, the greater the contact resistance!
- The greater the contact resistance, the greater the heat generation. This can lead to overheating of components or connections and melting of insulation material or even fire hazard!



There are different requirements for different applications (examples):
(1) Automobile: High mechanical load (vibration) and weather influences.
(2) Washing machine: High mechanical load (vibration)
(3) Electric generators: High current load
(4 + 5) Lighting, projectors, etc.: No or only low mechanical load (vibration)
(A) The crimp contact as a connecting element between cable and component

When determining the cable used, the nominal cross-section is defined according to the maximum current load that occurs. And the insulation according to the environment in which the cable is used (e.g.: exposure to weather, oils, chemical substances, etc.).

The main criteria for the choice of the connecting element (A) between the cable and the fixed component are as follows:
- Nominal cross-section of the cable
- Maximum current load
- Mechanical load

The geometry of the connecting element depends on the design requirements in relation to the component or the connector housing and the mating connector.