Multilam Technology

The Multilam Principle

Multifunctional contact interface for static and dynamic contact applications
Better contacts

The MC Multilam brought substantial improvements in relation to conventional contact systems.

Advantages

The Multilam soon developed into a whole system of contact elements. Its users recognised its outstanding advantages and within a short time a wide range of new application possibilities had evolved.

Basis for solutions

This brochure is intended to show the principle and application of the Multilam and serves as an aid for designers and engineers in the development of high-quality and reliable contact systems.

Further developments

Multi-Contact uses the Multilam in all connectors in its product range, and is constantly developing new components – also in collaboration with customers.

Experience

Multi Contact offers total solutions because the installation and correct selection of the Multilams require experience and know-how accumulated over many years.

There is always a solution

With this extensive know-how Multi-Contact will be pleased to support you in your search for the best solution.

RoHSready

Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment

An ingenious idea

The success story of Multi Contact is based on the development of specially formed hard copper strips for electrical contact, the so-called MC Multilams.
Contents

The Multilam principle 4

The various types of Multilams 5

Special forms of Multilam 6

General contact technology 7 – 11

Application range of the Multilams, temperatures, plugging cycles, current-carrying capacity and calculation of current-carrying capacity 12 – 13

Technical data and typical applications of Multilams 14 – 19

Special design features 20 – 21

List of terms with explanations 22
The Multilam Principle

The louver contacts are produced from strips, and allow electrical contact to be made via a large number of defined, current carrying contact points. Each louver forms an independent, spring loaded current bridge, so that the many parallel louvers substantially reduce the overall contact resistance.

Contact arrangement with torsion spring-type Multilam

The contact resistance $R_e$ of a Multilam louver can be found by the following formula:

$$R_e = R_l + 2(R_e + R_f)$$

- $R_{e1}/R_{e2}$ = constriction resistance
- $R_l$ = internal resistance of louver
- $R_{f1}/R_{f2}$ = film resistance
- $I$ = nominal current

The contact resistance $R_g$ of the Multilam is determined as follows: (Parallel connection of louvers)

$$\frac{1}{R_g} = \frac{1}{R_{k1}} + \frac{1}{R_{k2}} + \frac{1}{R_{k3}} + \frac{1}{R_{kn}}$$

$$R_g = \frac{R_l}{n}$$

$n =$ number of louvers
The various types of Multilams

MC Multilams based on the torsion spring principle

Characteristic features of the Multilams

- high resistance to heat
- high electrical and thermal conductivity
- sufficiently high contact forces
- high number of contact cycles
- large operating range (LA-CUT)

- excellent resistance to corrosion
- easy to process (form- and electroplate) small space requirement
- low cost contact elements
- resistance to vibration
- long product life
Special forms of Multilams for special requirements

LA-CU

MC Torsion spring Multilam

Functional division between spring element (steel strip) and electrical conducting element (Cu louver)

Features
- very good electrical and thermal conductivity
- excellent spring characteristics
- low but adequate contact force keeps wear rates to an absolute minimum
- security against excessive elongation
- compact width, saves space
- resistant to high temperatures (up to 180°C)

LA-CUT

MC Torsion spring Multilam

Functional division between spring element (steel strip) and electrical conducting element (Cu louver)

Angular misalignment absorption
Angular absorption +/-2° dependent on the installation mode, diameter and plug-in depth

Features
- excellent electrical conductivity
- high continuous current-carrying capacity
- high short-circuit current-carrying capacity
- large radial tolerance absorption
- large operating range
- angular misalignment absorption
- easy to machine recess
- easy to install
General Contact Technology

Connector Definitions

Plug connectors are electrical connectors that must not be connected or disconnected when in use for their intended purpose (under load).

Connectors: – are designed to be disconnected without load only

Plug and socket devices: – are designed to be connected and disconnected under load

Contact requirements

- Adequate contact force to break through the oxide film
- Constant contact force over its working life
- Constant contact resistance over its working life
- Good heat dissipation during continuous operation
- Low contact resistance
- Good thermal-shock resistance in event of short-circuit
- Low constriction resistance $R_c$, i.e. many and large a-spots

Parameters influencing the constriction resistance:

- The contact force: the higher the contact force, the lower the constriction resistance
- The hardness of the contact material: the harder the material, the higher the constriction resistance

With increasing temperature, the constriction resistance increases and then gradually breaks down when softening and melting temperatures are reached.

The higher the constriction resistance increases, the higher the risk of contact welding!
Flat contact surfaces

With flat contact surfaces there is no real danger of a welding effect, because the constriction resistance is spread out over many contact points. Flat contact surfaces are very susceptible to the formation of pollution films.

When contact parts close, contact areas with different electrical characteristics are formed.

Contact parts with pollution film

Contact parts closed

Top view

- apparent contact area
- film barrier within the supporting contact area
- quasi-metallic contacts
- effective contact area (a-spots)

Cu-rail under the microscope
**Formation of contact transitions**

**Flat contact**
Current paths evenly distributed, but oxide film may not be completely broken through

**Point contact**
Current paths restricted, oxide film is broken through but there is a high risk of welding

\[
R_s = \frac{\rho}{2 \cdot a \cdot n}
\]

\[
R_e = \frac{\rho}{2 \cdot a \cdot \sqrt{n}}
\]

- \(\rho\) = specific resistance of the contact material
- \(R_s\) = constriction resistance
- \(n\) = sum of the a-spots
- \(a\) = radius of the effective contact areas (a-spots)

**Assessment of contact quality**

The quality of a connector can be assessed by measuring the voltage drop at the rated current (DC) over the point of contact. The values in the following table are based on practical experience:

<table>
<thead>
<tr>
<th>Class</th>
<th>Voltage drop at rated current (DC)</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>&lt; 5mV</td>
<td>very good</td>
</tr>
<tr>
<td>2</td>
<td>5mV – 12mV</td>
<td>good</td>
</tr>
<tr>
<td>3</td>
<td>13mV – 25mV</td>
<td>sufficient, usable</td>
</tr>
<tr>
<td>4</td>
<td>26mV – 50mV</td>
<td>critical unsure</td>
</tr>
<tr>
<td>5</td>
<td>51mV – 100mV</td>
<td>unusable</td>
</tr>
<tr>
<td>6</td>
<td>&gt; 100mV</td>
<td>failed</td>
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</table>

[www.multi-contact.com](http://www.multi-contact.com)
Comparison between electrical, mechanical and thermal characteristics of copper alloys and spring contact materials

<table>
<thead>
<tr>
<th>Material</th>
<th>Electrical conductivity $m \times m^2 \times mm^2$</th>
<th>Thermal conductivity $W/m \times K$</th>
<th>Vickers hardness $HV$</th>
<th>Bending stress limit $N/mm^2$</th>
<th>Max. working temperature $°C$</th>
<th>Application</th>
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<tbody>
<tr>
<td>CuZn Brass</td>
<td>15.5</td>
<td>121</td>
<td>150 – 180</td>
<td>&gt; 290</td>
<td>85</td>
<td>Spring contact</td>
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<tr>
<td>CuSn6 Spring bronze</td>
<td>9.5</td>
<td>75</td>
<td>160 – 220</td>
<td>370</td>
<td>125</td>
<td>Plug connectors</td>
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<tr>
<td>CuBe2 Beryllium-copper</td>
<td>12</td>
<td>113</td>
<td>max. 450 hardened</td>
<td>max. 1050 hardened</td>
<td>180</td>
<td>Soldering tabs</td>
</tr>
<tr>
<td>CuNi18Zn20 Nickel silver</td>
<td>3.3</td>
<td>33</td>
<td>170 – 200</td>
<td>&gt; 390</td>
<td>125</td>
<td>Parts for switches</td>
</tr>
<tr>
<td>CuNi9Sn2 Wieland L49 Ca72</td>
<td>6.4</td>
<td>48</td>
<td>160 – 190</td>
<td>&gt; 440</td>
<td>125</td>
<td>Substrate material</td>
</tr>
<tr>
<td>NiBe Nickel-Beryllium</td>
<td>4</td>
<td>38</td>
<td>440 – 510 hardened</td>
<td>max. 1600 hardened</td>
<td>350</td>
<td>For higher temperatures</td>
</tr>
<tr>
<td>Cu</td>
<td>57</td>
<td>380 – 390</td>
<td>60 – 120</td>
<td>250</td>
<td>–</td>
<td>Cu-data for comparison purposes</td>
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Comparison between plating materials Au, Ag and Sn for connectors

<table>
<thead>
<tr>
<th>Contact requirements</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• low contact force</td>
<td>• high thermal conductivity</td>
</tr>
<tr>
<td></td>
<td>• high electrical conductivity</td>
<td>• abrasion resistant</td>
</tr>
<tr>
<td></td>
<td>• good chemical stability</td>
<td>• suitable for plating</td>
</tr>
<tr>
<td></td>
<td>• low contact force allowed</td>
<td>• low cost</td>
</tr>
<tr>
<td></td>
<td>• very good electrical / thermal conductivity</td>
<td>• corrosion resistant</td>
</tr>
<tr>
<td></td>
<td>• DRY-CIRCUIT applications, low current and low voltage</td>
<td>• relatively soft</td>
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<tr>
<td></td>
<td>• good soldering characteristics</td>
<td>• diffusion barrier required</td>
</tr>
<tr>
<td></td>
<td>• subject to sulphide tarnishing</td>
<td>• not free from pores with thin layers</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Material</th>
<th>Thickness in µm</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
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<tr>
<td>Au</td>
<td>0.15 – 2.5</td>
<td>– good chemical stability</td>
<td>– high cost</td>
</tr>
<tr>
<td></td>
<td></td>
<td>– low contact force allowed</td>
<td>– relatively soft</td>
</tr>
<tr>
<td></td>
<td></td>
<td>– very good electrical / thermal conductivity</td>
<td>– diffusion barrier required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>– DRY-CIRCUIT applications, low current and low voltage</td>
<td>– not free from pores with thin layers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>– good soldering characteristics</td>
<td></td>
</tr>
<tr>
<td>Ag</td>
<td>5 – 10</td>
<td>– excellent electrical conductivity</td>
<td>– subject to sulphide tarnishing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>– excellent thermal conductivity</td>
<td>– more expensive than Sn</td>
</tr>
<tr>
<td></td>
<td></td>
<td>– easy to form when cold</td>
<td>– minimum contact force</td>
</tr>
<tr>
<td></td>
<td></td>
<td>– for medium and high currents</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>– low abrasion</td>
<td></td>
</tr>
<tr>
<td>Sn</td>
<td>1 – 10</td>
<td>– low cost</td>
<td>– only for low no. of plugging cycles n &lt; 100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>– easy to plate</td>
<td>– higher plug-in and withdrawal force</td>
</tr>
<tr>
<td></td>
<td></td>
<td>– easy to tin at low temperatures</td>
<td>– higher contact force necessary 3,5N – 5N</td>
</tr>
<tr>
<td></td>
<td></td>
<td>– good soldering characteristics</td>
<td>– higher abrasion</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>– susceptible to oxidation</td>
</tr>
</tbody>
</table>
Basic requirements for the design of connectors

**Vibration**
- vibration proof
- shock proof

**Insulation**
- insulating
- high dielectric strength
- form stable
- rugged

**Contact element**
- heat resistant
- elasticity

**Efficiency of contact**
- current capacity
- voltage capacity
- contact resistance

**Type of connection**
- soldering
- clamping
- AxiClamp
- crimping
- wrapping

**Contact area**
- plugging cycles
- plating thickness
- material
- abrasion

**Contact failure**
- corrosion
- oxide film
- environment condition
- misalignment

**Contact characteristics**
- contact resistance
- insulation resistance

**Standardization**
- assembly dimensions
- contact spacing
- specifications
- number of poles

**Contact pressure**
- adequate
- constant

**Contact heat**
- thermal resistance
- power dissipation
- thermal conductivity

**Contact testing**
- electrical
- dimensions
- mechanical
- thermal
- climatic

**Frequency characteristics**
- capacitance
- reflection factor
- shield
- surge impedance

**Price of contact**
- contact plating
- insulation
- termination type
- contact elements

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**plug-in force**

**sliding force**

**withdrawal force**
Fields of application of Multilams

There is now a range of some 50 different Multilams, each of which is designed for a specific application. Multilams with a very thin strip thickness of 0.8mm to 0.125mm are used where many plugging cycles are required. Connectors for few plugging cycles and permanent contacts for press-fitting are equipped with thicker Multilams, e.g. 0.3mm to 0.5mm. For extreme load conditions such as in switchgear, which are characterised by a large number of plugging or sliding operations and high short-time currents, it is recommended to have the connector fitted with guide rings.

Temperatures

The Multilams (Cu-Be alloy) are suitable for use at temperatures up to 180°C. In case of short circuits, temperatures up to 250°C can be tolerated for a short time. The use of other alloys for Multilams – e.g. NiBe – results in reduced current-carrying capacity and conductivity. High-temperature connectors for temperatures from 350°C – 400°C can be supplied with Multilams made of NiBe alloy. Multilams can also be used at extremely low temperatures. Experiments in liquid helium at 4,2K have been successfully carried out.

Plugging cycle

The sliding forces of our connectors depend on several parameters such as the type of Multilam, plating, the base materials of the contact parts, the applied lubricant etc. The data provided here can be regarded as typical values. The coefficients of friction typically vary around 0.35.

In the technical data we state the sliding force per louver for a mean friction coefficient of $\mu_r = 0.35$. As a general rule the following equation applies:

$$ F_s = n \cdot \mu_r \cdot F_k $$

Standard high-current connectors are silver-plated to 5 – 10µm. These platings are suitable for approximately 5,000 plugging cycles, provided they are coated with a thin film of lubricant before being used for the first time. For larger numbers of up to 30,000 plugging cycles, the Multilams and the contact surface which slides over them can be plated with a thicker layer of silver and a thin film of lubricant applied before their first use. Plugging cycles up to 100,000 or more require special silver plating on both the Multilam’s and the contact surfaces.

If more than 5,000 plugging cycles are required, MC recommends special guide rings and “soft” (thin strip material) Multilams. Since “soft” Multilams have a reduced current-carrying capacity, it may be necessary to fit several Multilams in parallel.

Example

2-pole high temperature contact for an ambient temperature of 350°C.

See

Strip thickness (Thickness of the Multilam strip) pages 14, 16, 18, 22

See

Lubricant, page 22

See

Sliding force per louver / medium spring deflection, pages 14, 16, 18, 22

See

$F_r = \text{Sliding force of a contact}$

$n = \text{Number of louvers}$

$\mu_r = \text{Friction coefficient}$

$F_k = \text{Contact force per louver accord. to table}$

pages 14, 16, 18

Example

Multilam contact with guide rings
Current-carrying capacity

The current-carrying capacity of connections with Multilams depends upon a number of factors which can essentially be assigned to two categories: contact resistance and environmental conditions. Below the categories are further subdivided and the relevant factors are named.

1. Internal resistance of the Multilam
   - Material resistance depends on the length and the conductive cross-section
   - Material of the louvers

2. Contact resistance between the louver and the contact parts
   - Contact force $F_k$
   - Size of the contact points
   - Coating of the Multilam and the contact parts
   - Oxidation, pollution layers
   - Surface roughness of the contact parts

3. Resistance of the contact parts
   - Material
   - Cross section of the contact parts

4. Environmental conditions
   - Ambient temperature
   - External temperature influences
   - Environmental conditions

The electrical values for Multilams stated in the table on pages 14 – 19 are based on optimum conditions. That means, for instance, that contact surfaces with a roughness of N6 must be provided with suitable and clean coatings, not oxidised or polluted. The ambient temperature is 20°C and the electrically conducting cross-sections of the contact parts must be adequate.

Approximative calculation of the current-carrying capacity

(Calculated with the values from tables on pages 14 – 19)

Number of louvers $n$ for round contacts:

$$ n = \frac{d \cdot \pi}{r} $$

Number of louvers $n$ for flat contacts:

$$ n = \frac{l}{r} $$

Total resistance $R_g$ of a contact:

$$ R_g = \frac{R_k}{n} $$

The rated continuous current $I_n$ and the short-circuit currents $I_{Ik}$ (for 1s, 2s and 3s) and the rated peak withstand current are all calculated in the same manner with the appropriate values:

$$ I_{\text{whole Multilam}} = n \cdot I_{\text{per louver}} $$

$$ n = \text{Number of louvers} $$

$$ I = \text{currents} $$
## Technical data and typical applications of MC Multilams

<table>
<thead>
<tr>
<th>Multilam type</th>
<th>Typical Sizes</th>
<th>Applications</th>
<th>Dimensions</th>
<th>Mechanical data</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Width of Multilam</td>
<td>Thickness of Multilam’s strip</td>
<td>Contact spacing</td>
<td>Sliding force 1 per louver with medium spring deflection</td>
</tr>
<tr>
<td>LAQ/...</td>
<td>mm</td>
<td>b mm</td>
<td>s mm</td>
<td>r mm</td>
</tr>
<tr>
<td>LAQ/0,15</td>
<td>&gt; Ø 25</td>
<td>26</td>
<td>0,15</td>
<td>5</td>
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<td>LAQ/0,20</td>
<td>&gt; Ø 25</td>
<td>26</td>
<td>0,2</td>
<td>5</td>
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<td>LAQ/0,25</td>
<td>&gt; Ø 25</td>
<td>26</td>
<td>0,25</td>
<td>5</td>
</tr>
<tr>
<td>LAQ/0,30</td>
<td>&gt; Ø 25</td>
<td>26</td>
<td>0,3</td>
<td>5</td>
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<tr>
<td>LAQ-G</td>
<td></td>
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<td>LAQ/0,08</td>
<td>Ø 8 – Ø 20</td>
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<td>Ø 8 – Ø 20</td>
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<td>Ø 8 – Ø 20</td>
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<td>Ø 15 – Ø 20</td>
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<td>Ø 8 – Ø 20</td>
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<td>Ø 25 – Ø 70</td>
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<td>Ø 25 – Ø 70</td>
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* The sliding force is normally determined on the end product
* see catalogue 1 Power line
### Electrical data

<table>
<thead>
<tr>
<th>Rated current (A) per louver</th>
<th>Contact resistance (mΩ) per louver</th>
<th>Short circuit current (kA) per louver at</th>
<th>Rated peak withstand current (kA) per louver</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_n$</td>
<td>$R_m$</td>
<td>$I_{s1}(1s)$</td>
<td>$I_{p}$</td>
</tr>
<tr>
<td>A</td>
<td>mΩ</td>
<td>kA</td>
<td>kA</td>
</tr>
<tr>
<td>0</td>
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<td>0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8,</td>
<td>0, 0.2, 0.4, 0.6, 0.8, 1.0, 1.2, 1.4, 1.6, 1.8</td>
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<tr>
<td>7</td>
<td></td>
<td>0.9, 1.0</td>
<td>1.0, 1.2, 1.4, 1.6, 1.8, 2.0, 2.2, 2.4, 2.6, 2.8</td>
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<td>35</td>
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<tr>
<td>63</td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:**

- valid for Multilams made from hard copper, silver-plated (mating part Cu, silver-plated)

---

![Image](https://example.com/image.png)
## Technical data and typical applications of MC Multilams

<table>
<thead>
<tr>
<th>Multilam type</th>
<th>Typical Sizes</th>
<th>Applications</th>
<th>Dimensions</th>
<th>Mechanical data</th>
<th>Thermal data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>mm b s r F\textsubscript{a} F\textsubscript{s} µr °C °C K/W</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LA-CU</td>
<td>LA-CU/0,15-0,5</td>
<td>Ø 12 – Ø 400</td>
<td>Switches disconnectors earth, connectors sliding and rotary contacts</td>
<td>12 0,15 (Cu 0,5) 3,5 7 2,5</td>
<td>180 250 25</td>
</tr>
<tr>
<td>LA-CUT</td>
<td>LA-CUT/0,25</td>
<td>Ø 50</td>
<td>Switches disconnectors earth, connectors sliding and rotary contacts</td>
<td>26 0,25 (Cu 1) 4 10 1 – 2 $^\text{1)}$</td>
<td>150 250 25 – 30</td>
</tr>
<tr>
<td>LA-CUT</td>
<td>LA-CUT/0,25/0</td>
<td>Ø 50</td>
<td>Switches disconnectors earth, connectors sliding and rotary contacts</td>
<td>30 0,25 (Cu 1) 4 10 1 – 2 $^\text{1)}$</td>
<td>150 250 25 – 30</td>
</tr>
</tbody>
</table>

$^1)$ The sliding force is normally determined on the end product
## Electrical data

<table>
<thead>
<tr>
<th>Rated current (A) per louver</th>
<th>Contact resistance (mΩ) per louver</th>
<th>Short circuit current (kA) per louver at</th>
<th>Rated peak withstand current (kA) per louver</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_{n1}$/$A$</td>
<td>$I_{n2}$/$A$</td>
<td>$R_k$/mΩ</td>
<td>$I_{k1}$/kA</td>
</tr>
<tr>
<td>0</td>
<td>10</td>
<td>20</td>
<td>30</td>
</tr>
</tbody>
</table>

*Valid for MC Multilam Contacts, silver-plated (mating part Cu, silver-plated)*
## Technical data and typical applications of MC Multilams

<table>
<thead>
<tr>
<th>Multilam type</th>
<th>Typical Sizes</th>
<th>Applications</th>
<th>Dimensions</th>
<th>Mechanical data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Width of Multilam</td>
<td>b mm</td>
</tr>
<tr>
<td>LAIII</td>
<td>Ø 2 – Ø 20</td>
<td>Test cables, probes</td>
<td>12</td>
<td>0,125</td>
</tr>
<tr>
<td>LAII/0,125</td>
<td>Ø 2 – Ø 20</td>
<td>Test cables, probes</td>
<td>12</td>
<td>0,150</td>
</tr>
<tr>
<td>LAII/0,20</td>
<td>Ø 2 – Ø 20</td>
<td>Test cables, probes</td>
<td>12</td>
<td>0,200</td>
</tr>
<tr>
<td>LAII/0,30</td>
<td>Ø 2 – Ø 20</td>
<td>Test cables, probes</td>
<td>12</td>
<td>0,300</td>
</tr>
<tr>
<td>LAIV</td>
<td>Ø 0,5 – Ø 4</td>
<td>Test cables, probes, miniature sockets</td>
<td>8</td>
<td>0,100</td>
</tr>
<tr>
<td>LAIV/0,10</td>
<td>Ø 0,5 – Ø 4</td>
<td>Test cables, probes, miniature sockets</td>
<td>8</td>
<td>0,125</td>
</tr>
<tr>
<td>LAIV/0,15</td>
<td>Ø 0,5 – Ø 4</td>
<td>Test cables, probes, miniature sockets</td>
<td>8</td>
<td>0,150</td>
</tr>
<tr>
<td>LAV</td>
<td>Ø 0,5 – Ø 4</td>
<td>Miniature sockets</td>
<td>5</td>
<td>0,100</td>
</tr>
<tr>
<td>LAV/0,10</td>
<td>Ø 0,5 – Ø 4</td>
<td>Miniature sockets</td>
<td>5</td>
<td>0,125</td>
</tr>
<tr>
<td>LAV/0,15</td>
<td>Ø 0,5 – Ø 4</td>
<td>Miniature sockets</td>
<td>5</td>
<td>0,150</td>
</tr>
<tr>
<td>LAVII</td>
<td>Ø 0,8 – Ø 2,36</td>
<td>Miniature sockets</td>
<td>3</td>
<td>0,125</td>
</tr>
</tbody>
</table>

*The sliding force will be determined by the end product*

*No indication of guide values possible, these values depend on the final use*
# Electrical Data

<table>
<thead>
<tr>
<th>Rated Current (A) per Louver</th>
<th>Contact Resistance (mΩ) per Louver</th>
<th>Short Circuit Current (kA) per Louver at</th>
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</tr>
</thead>
<tbody>
<tr>
<td>( I_{n1} ) A</td>
<td>( R_k ) mΩ</td>
<td>( I_{s1}(1s) ) kA</td>
<td>( I_p ) kA</td>
</tr>
<tr>
<td>0.0, 0.1, 0.2, 0.3, 0.4</td>
<td>0.5, 0.6, 0.7, 0.8, 0.9, 1.0</td>
<td>0.04, 0.08, 0.12, 0.16, 0.20, 0.24, 0.28, 0.32, 0.36</td>
<td>0.1, 0.2, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.9</td>
</tr>
</tbody>
</table>

## Notes

1. Valid for Multilams made from hard copper, gold-plated
2. No indication of guide values possible, these values depend on the final use
Special design features

With MC Multilam technology, users have available an extremely flexible and individually adaptable contact interface.

**Cylindrical contacts**
The Multilams are fitted on cylindrical contact rings. Either in a socket (female), the mating part being a rigid pin, or on a pin (male) and the mating part a rigid socket. Also for dynamic applications (axial movement or rotatable).

**Flat contacts**
Suitable for connecting busbars, either as a connector or a clamping unit. This allows connection and disconnection with large busbars.

**Spherical contacts**
Accommodate angular misalignments and axial movements (sliding).

**Fork contacts**
Suitable for connecting busbars to the plug-in module system. Connections to parallel busbars can easily be made with “floating” fork contacts.
The first step to a solution for your own contact

is a simple form to be filled in online with your contact requirements. 

You will find this form under:
www.multi-contact.com > Downloads > Online Forms > Checklist / Inquiry Form

Send the generated pdf-form, together with possible additions or additional requirements by mail to:
basel@multi-contact.com
Glossary

Strip thickness \( s \)
Thickness of the Multilam strip without plating.

Leaf spring Multilam
Individual louvers have a spring action as a result of their curved shape. Leaf spring Multilam bands are usually gold or nickel plated.

Torsion spring Multilam
MC Multilam type with individual louvers which deflect under torsion. They are made from copper alloy and are usually silver plated.

Definition \( I_{n1}, I_{n2} \)
- \( I_{n1} \): Nominal current under normal environmental conditions and good contact quality according to table, page 9. \( I_{n1} \) is the basis for MC design.
- \( I_{n2} \): Nominal current under optimal environmental conditions and sufficient contact quality according to table, page 9.

Internal resistance of the louver
results from the specific resistance of the louver material, the distance the current must travel through the louver and the active cross-section.

Standards
IEC 61984 (VDE 0627):
Safety requirements and tests for plug connectors.
IEC 61010-031 (VDE 0411-031):
Safety regulations and hand-held accessories for test and measurement.
IEC 62271-1 (VDE 0671-1):
High voltage switchgear and switch devices – general definitions.

Contact force \( F_c \)
is defined as the spring force of a louver at medium deflection.

Contact resistance
is the resistance of the point of contact between the Multilam and the contact parts.

Multilam recess
Groove milled into the contact part for the “floating” mounting of a Multilam louver.

RoHS – 2002/95/EC
European Directive 2002/95/EC (“RoHS” for short) restricts the use of certain hazardous substances in household equipment. Multilam strips are component parts, and as such are not directly affected by this directive. They also contain none of the substances which are scheduled under the directive and can therefore be safely incorporated in devices to which the directive applies.

Multilam louver
Individual contact element of a Multilam strip; there are either leaf spring louvers or torsion spring louvers.

Contact spacing \( r \)
is the distance between the centres of two Multilam louvers.

Sliding force \( F_s \)
is the purely frictional force of the deflected Multilam. The stated figures are average values obtained with a thin lubricant film and after 20 – 30 mating cycles. The values are higher in new connectors. The sliding force is determined in the end product, since its value is not determined solely by the Multilam.

Plug-in force \( F_{pi} \)
is the maximum force needed in order to deflect the Multilam when mating the connector. It is made up of the spring force and the frictional force. The plug-in force is determined in the end product, since its value is not determined solely by the Multilam. It should be noted that the plug-in force is always greater than the sliding force. The plug-in force is usually not indicated.

Lubricants
MC recommends the following lubricants:

- **Grease (general electrical contacts):**
  - METALON HT-1,5-50ML (73.1052)
  - KONTASYNTH BA100 SPRAY (73.1051)*
- **Sliding grease:**
  - in SF6-Gas: Barrierta I EL-102*
- **Press-fitting and sealing grease:**
  - Barrierta I S-402 or Barrierta I MI-202*
  - * from Klüber Lubrication, Munich.
Advanced Contact Technology

You will find examples of successful applications using MC Multilam technology in our catalogue.

Success Stories

An overview of all our catalogues are shown in the publication.

Product line

www.multi-contact.com