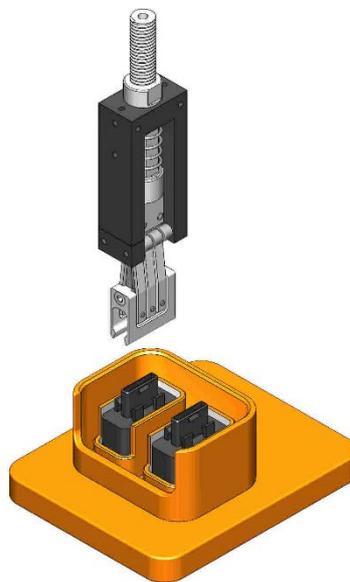


## Automated testing of high-voltage plug connectors with integrated protection covers

For secure, scratch-free contacting

There are more electric cars today than ever before. More and more manufacturers are turning their attention to the development of hybrid vehicles because these have already taken over the trend for electric power systems. As they require a higher voltage and current in the vehicle, even more is demanded of the connector plug used. For safety reasons, they must be equipped with a protection cover, which should prevent unintentional contact harmful to technicians or operators in the test field.



*Figure 1: Contacting a flat connector with protection cover cap*

With the high-current clamp for flat contacting, HKF-615 from INGUN, comes a new, simplified test solution for functional tests of power modules with integrated plug connectors. This high-current clamp not only allows a scratch free test, but also automatically exposes the contact point on the flat connector during measurement. Figure 2 shows the contacting procedure with this new test probe. First docking takes place, then the protection cover is released, and finally the protection cover cap is displaced to allow clearance of the flat connector. The contacts, which actually transmit the power, are brought into position over the flat connector with the same mechanical movement. An electrical connection between the flat connector and the contact clamp occurs in the subsequent working position. The contacting itself occurs simultaneously via silver rivets with a large surface area and results in a secure current transmission of up to 225 A.

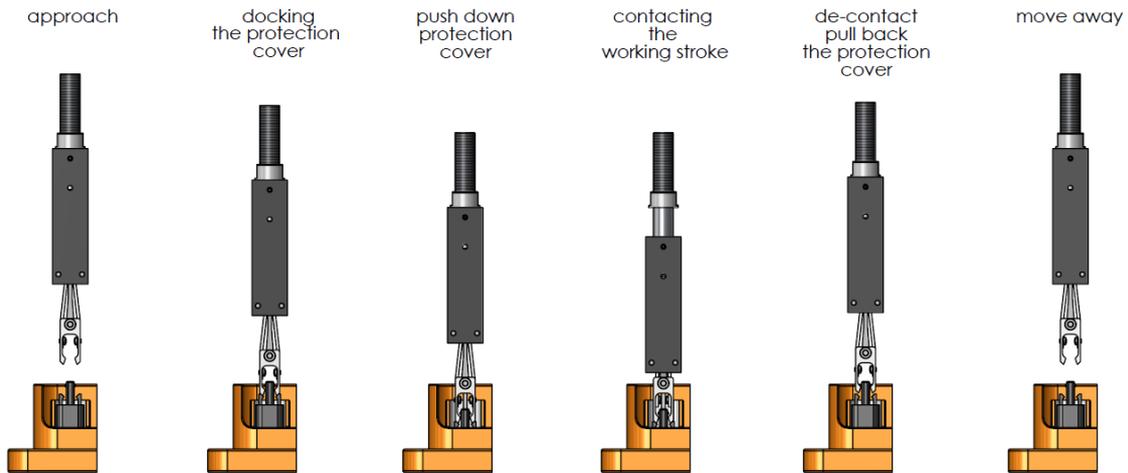


Figure 2: Contacting a flat connector with protection cover cap with INGUN HKF-615

When de-contacting, the electrical contact is disconnected before the probe draws the protection cover cap back over the flat connector, and the test probe is returned to its home position. It can be seen in figure 2 that the contact is entirely scratch free and, most notably, takes place in one single working step. This saves considerable time and, therefore, costs.

A measurement with a thermal imaging camera (see figure 3) reveals that the hottest point on the contact area is between the contact clamp and the unit under test (UUT). The current strength is specified by the temperature profile, which can be seen in figure 4. This temperature profile stabilises (in this example at 73.2 °C) when current is stable. At 225 A, the difference of the atmospheric temperature is typically 40 °C lower than the temperature of the clamp ( $\Delta T = 40$  K). Based on an atmospheric temperature of 21 °C, a temperature of approximately 61 °C is to be expected. When a maximum permissible temperature is specified, the maximum permanent current possible can be determined from the graph in figure 4.

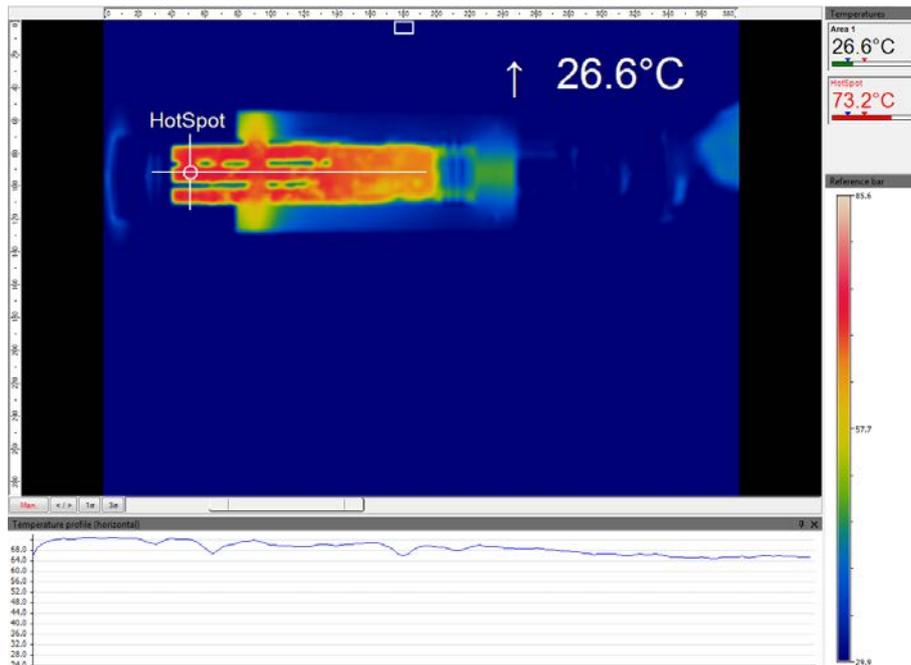


Figure 3: Thermal image of 250 A current load

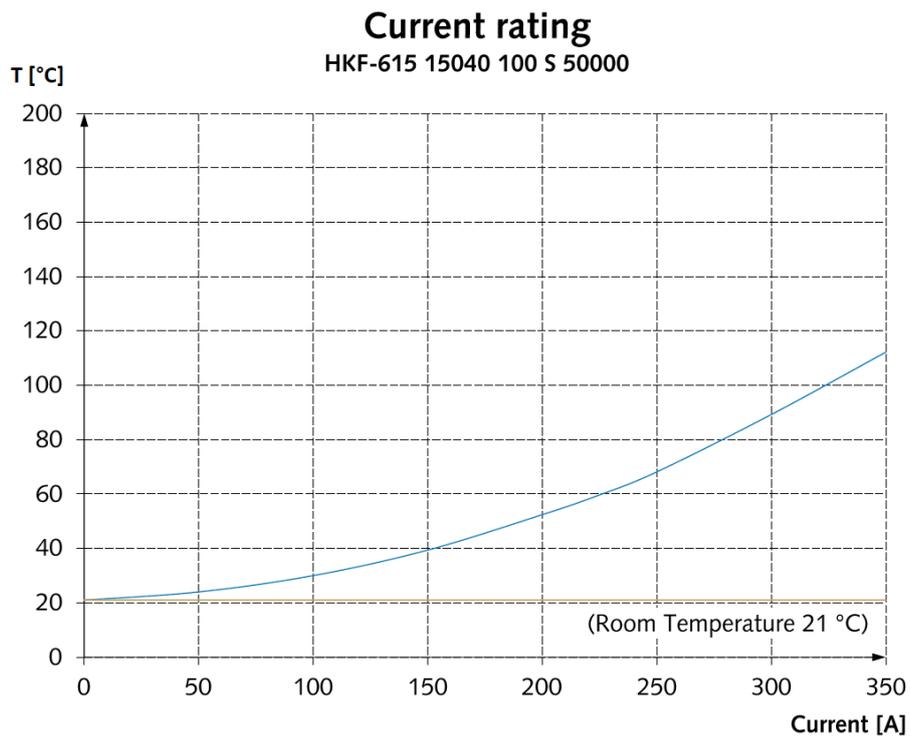


Figure 4: Current-temperature graph in steady-state mode

Similarly, Kelvin measurements can be carried out. An electrically-insulated inner conductor which enables a voltage tap directly on the unit under test (UUT) is available separately.

Further information about the high-current clamp for flat contact “HKF-615” is available from the manufacturer:

INGUN Prüfmittelbau GmbH  
 Max-Stromeyer-Straße 162  
 78467 Konstanz  
 Tel. +49 7531 / 8105-0  
 Fax +49 7531 / 8105-65  
[info@ingun.com](mailto:info@ingun.com)