

*PSG 3000*

# **Medium-Frequency Welding Transformers Technical Information**

**Edition**

# **101**

PSG 3000

# Medium-Frequency Welding Transformers Technical Information

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Notes:

# 1 Safety instructions

The products described were developed, manufactured and tested in compliance with the fundamental safety requirements of the EU machine directive. These products normally pose no danger to persons or property if used in accordance with the handling stipulations and safety notes prescribed for their configuration, mounting, and proper operation.

**Nevertheless, there is some residual risk!**

Therefore, you should read this manual before installing, connecting or commissioning the products. Store this manual in a place to which all users have access at any time!

This manual describes the:

- PSG 3000 medium-frequency welding transformers



## 1.1 Safety instructions and symbols used in this manual

---



### **DANGEROUS ELECTRICAL VOLTAGE**

This symbol is used to warn of **dangerous electrical voltage**. Failure to observe the instructions in this manual in whole or in part may result in **personal injury**.

---



### **DANGER**

This symbol is used wherever failure to observe the instructions in whole or in part may result in **personal injury**.

---



### **CAUTION**

This symbol is used wherever insufficient or lacking compliance with instructions may result in **damage to equipment or data files**.

---

 **Note:** This symbol is used to draw the user's attention to special circumstances.

★ This symbol is used if user activities are required.

Modifications in this manual as compared to a previous edition are marked by black vertical bars in the margin.

## 1.2 Intended use

The welding transformer is controlled by the medium-frequency inverter. These welding transformers are designed for use in

- resistance welding of metals and
- are suitable for operation in industrial environments as per DIN EN 50082-2 and 50081-2 on electromagnetic compatibility (EMC).

They are not intended for any other use!




### **DANGER**

**Any use other than for the purpose indicated may result in personal injury of the user or third parties or in damage to equipment, the workpiece to be welded, or environmental damage.**

**Therefore, our products must never be used for any other than their respective intended purpose!**

---

-  **For operation in residential environments, in trade and commercial applications and small enterprises, an individual permit of the national authority or test institution is required; in Germany, please contact the Regulierungsbehörde für Telekommunikation und Post (RegTP) or its local branch offices.**

The faultless, safe functioning of the product requires proper transport, storage, erection and installation as well as careful operation.

### 1.3 No admittance for persons fitted with cardiac pacemakers

**DANGER****WARNING for persons fitted with cardiac pacemakers!**

To protect persons fitted with cardiac pacemakers, no-entry signs should be posted because pacemaker malfunction (missed pulses, total failure), pacemaker program interference or even program destruction is to be expected!!!

 **Note:** We recommend that warning signs like the one shown below are posted at every entrance to manufacturing shops housing resistance-welding equipment:



## 1.4 Qualified personnel

The requirements as to qualified personnel are based on the requirements profiles as defined by the ZVEI (Zentralverband Elektrotechnik und Elektronikindustrie - German Electrical and Electronic Manufacturers' Association) and the VDMA (Verband deutscher Maschinen- und Anlagebau - German Engineering Federation) in:

**Weiterbildung in der Automatisierungstechnik**  
**edited by: ZVEI and VDMA**  
**Maschinenbau Verlag**  
**Postfach 71 08 64**  
**D-60498 Frankfurt.**

This manual is designed for technicians and engineers with special welding training and skills. They must have a sound knowledge of the hardware components of the weld timer, the medium-frequency inverters and the welding transformers.

Interventions in the hardware and software of our products, unless described otherwise in this manual, are reserved to specialized Bosch personnel.

Tampering with the hardware or software, ignoring warning signs attached to the components, or non-compliance with the warning notes given in this manual can result in serious bodily injury or property damage.

Only skilled persons as defined in IEV 826-09-01 who are familiar with the contents of this manual may install and service the products described.

Such personnel are

- those who, being well trained and experienced in their field and familiar with the relevant standards, are able to analyze the work to be carried out and recognize any hazards.
- those who have acquired the same amount of expert knowledge through years of experience that would normally be acquired through formal technical training.



### **DANGER!**

**An exception are persons with cardiac pacemakers!**

**The strong magnetic fields occurring in resistance welding may affect the proper functioning of pacemakers. This may be fatal or cause serious personal injury!**

**Therefore, persons with pacemakers must stay clear of resistance welding systems.**

**We recommend that warning signs as per DIN 40023 are posted at every entrance to manufacturing shops housing resistance-welding equipment.**

---

Please note our comprehensive range of training courses. More information is available from our training center (Phone: +49 / 6062 / 78-258).

## 1.5 Installation and assembly

---



### **DANGEROUS ELECTRICAL VOLTAGE**

Before the modules are installed, the respective mounting station must be safely isolated from supply and properly safeguarded to prevent unintentional or unauthorized reclosing.

---



### **DANGER**

Danger of injury and of damage to property through incorrect installation!

Devices and, in particular, operating means, must be installed so as to be properly safeguarded against unintentional operation or contact.

---



### **DANGER**

Danger of personal injury and damage to property through inadequate fastening!

The place for installing the welding transformers, and their method of fastening, must be suitable for their weight!

Injuries and bruises may be caused by lifting weights which are too heavy or by sharp metal edges!

Due to the heavy weight of individual modules several persons are required for installation and assembly.

Wear safety shoes and safety gloves!

---



### **DANGER**

Non-workmanlike installation or mounting may lead to personal injury or damage to property.

Therefore, it is essential that you take the technical data (environmental conditions) into account for installation or mounting.

Installation or mounting must be carried out by skilled personnel only.

---



### **CAUTION**

Leaks in the cooling water circuit may cause consequential damage!

Cooling water leaks may damage adjacent components. Therefore, when mounting water-cooled modules, always ensure that other devices in the switchgear cabinet are well protected against leaking cooling water.

---

**CAUTION**

Damage to property through inappropriate or insufficient cooling of the welding transformers!

Water-cooled welding transformers may only be operated when the cooling water circuit is active! Condensation on water-carrying components must be prevented.

Damage to property through insufficient water quality in the cooling water circuit!

Deposits in the cooling system may reduce the water flow, thus impairing the performance of the cooling system with time.

Therefore, you should ensure that your cooling water has the following properties:

- pH value : 7 to 8.5
- Degree of hardness  $D_{\max}$  : 10 German degrees  
(1 German degree = 1.25 British degrees = 1.05 US degrees = 1.8 French degrees)
- Chlorides : max. 20 mg/l
- Nitrates : max. 10 mg/l
- Sulfates : max. 100 mg/l
- Insoluble substances : max. 250 mg/l

Tap water usually meets these requirements. However, an algicide should be added.

- ★ Make sure that all contact surfaces are bright, i.e. free of paint, plastic coating or dirt/oxidation.

## 1.6 Electrical connection

---



### **DANGEROUS ELECTRICAL VOLTAGE**

The primary voltage of the welding transformer is associated with many dangers!

Possible consequences of improper handling include death or most severe injuries (personal injuries) and damage to property. For this reason, the electrical connection must always be made by an electrical expert in compliance with the valid safety regulations, the mains voltage and the maximum current consumption of the individual units of the equipment.

The mains voltage must match the nominal voltage given on the nameplate of the product!

---



### **DANGEROUS ELECTRICAL VOLTAGE**

Working with system voltage may result in death, severe bodily injury or considerable damage to property unless the appropriate precautionary measures are taken.

Therefore, you should carefully read the safety instructions at the beginning of this manual where you will find a description of a number of features to be strictly observed! The system voltage is associated with considerable dangers!

Possible consequences of improper handling include death or most severe injuries (personal injuries) and damage to property. For this reason, the electrical connection must always be made by an electrical expert in compliance with the valid safety regulations, the mains voltage and the maximum current consumption of the individual units of the equipment.

Incorrect mains voltage may render the system dangerous or cause electrical component failure!

Therefore, please ensure the following:

- The mains voltage must match the nominal voltage given on the nameplate of the product!
  - Mains voltage fluctuation or variation from the nominal voltage must be within the specified tolerance range (see Technical Data).
  - The equipment must be appropriately fused on the mains side!
  - The welding transformers must be connected to the protective earthing (PE) circuit of the system. Please ensure that the cross-sectional area of cables used for protective conductor wiring is sufficiently large. The electrical continuity of the protective earthing circuit must be verified in accordance with EN 60204 Part 1.
  - Before carrying out any work on the mains system or welding system connections it must be ensured that the MF inverter has been safely isolated from the supply for at least 5 minutes (capacitor discharge time).
  - Proper and well insulated tools must be used for handling electric connections!
-

**DANGEROUS ELECTRICAL VOLTAGE**

Danger of life through insufficient protective conductor system!  
The welding transformers must be connected to the protective earthing (PE) circuit of the system. Please ensure that the cross-sectional area of cables used for protective conductor wiring is sufficiently large. The electrical continuity of the protective earthing circuit must be verified in accordance with EN 60204 Part 1, cf. Section 3.1.

---

**DANGEROUS ELECTRICAL VOLTAGE****Protective conductor jumper (MPE)**

The protective earth for the negative pole of the PSG 3000 can be interrupted by opening the protective earth conductor jumper at the PSG 3000. In order to protect the operating personnel against dangerous electrical voltages in the event of a break-down of the transformer primary side to the secondary side, in this case, a suitable protective measure pursuant to EN 50 063 is to be provided! In addition, the transformer is to be marked accordingly.

---

**DANGEROUS ELECTRICAL VOLTAGE**

Insufficient degree of protection may be life-threatening or cause damage to property!

Depending on the type, the protection class of the welding transformer primary terminal is IP 00 or IP 54.

To prevent accidental contact, the primary terminal must be equipped with a touch guard.

An additional terminal box of a higher class of protection must be used for connecting the welding transformers.

---

**DANGEROUS ELECTRICAL VOLTAGE**

The electrical connection must always be made by an electrical expert in compliance with the valid safety regulations, the mains voltage and the maximum current consumption of the individual units of the equipment.

Prior to connecting an MF inverter, the following must be strictly observed:

- Power OFF.
  - Provide a safeguard to prevent unintentional reclosing.
  - Verify that the system is safely isolated from supply and de-energized.
  - Connect to earth and short circuit.
  - Cover up or safeguard all live parts.
-



**CAUTION**

Connecting lines and signal lines must be laid so as to avoid negative effects on the function of the units through capacitive or inductive interference!

Interference is frequently coupled and de-coupled in long cables. Therefore, inverter cables and control cables must be routed separately.

The influence of interfering cables on cables susceptible to interference can be minimized by keeping the following distances:

- > 100 mm if cables are run in parallel for < 10 m,
- > 250 mm if cables are run in parallel for > 10 m.

**CAUTION**

Connection cables may come off and apply dangerous voltage to system components!

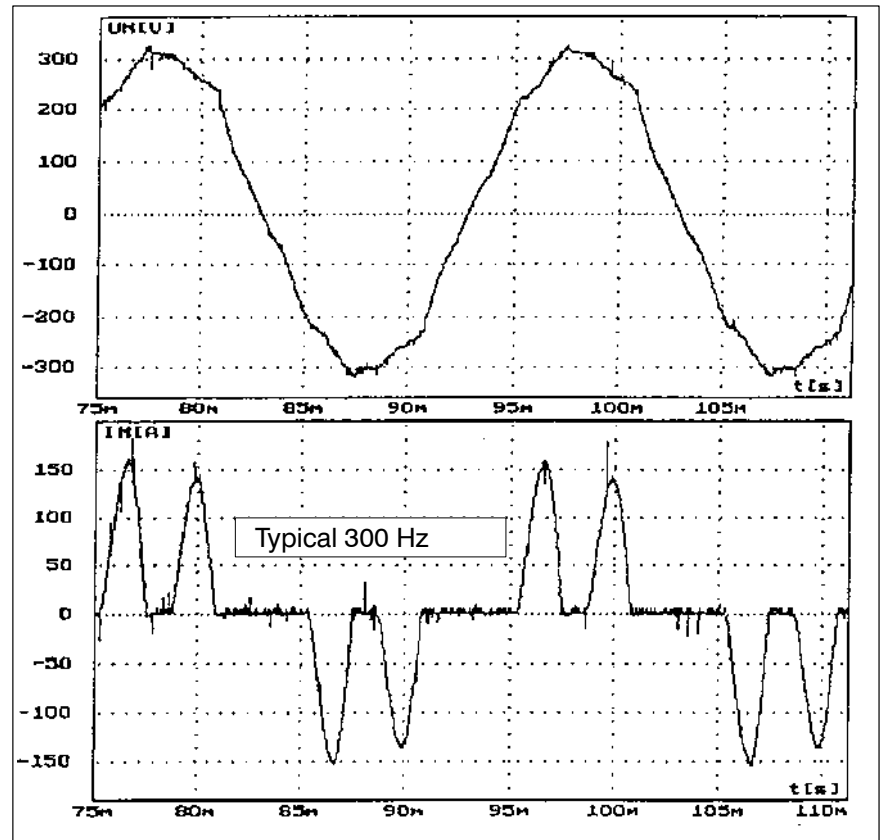
It is crucial that cables are properly fixed.

- ★ **PE connection** : Connect to a central earth point. Make sure that cable cross-sectional areas are sufficiently large!
- ★ **U connection** : Connect to U2 on MF inverter.
- ★ **V connection** : Connect to V2 on MF inverter.
- ★ **Primary side connection** : For some welding transformers, the degree of protection of the primary terminal is IP 00. Additional protection against accidental contact is required, see Section 6.2.
- ★ All conductor cross-sections must be large enough for the loads to be connected.

## 1.7 System perturbation

When operating a welding system a harmonic load must be accounted for in the mains system. This load is caused by the "B6 rectifier circuit with a smoothing capacitor".

The following figure shows the typical curve of the mains voltage (top) and the related mains current (bottom) in one phase during the welding process:




The 5th, 7th, 11th, 13th, 15th, and 17th harmonic wave are the characteristic harmonics of the mains current curve.

The harmonic component depends on the welding power.

- ☞ The harmonic content may be considerably reduced, e.g., by using smoothing reactors with 4% short-circuit voltage.

## 1.8 Ensuring EMC of the completely assembled system

 The completely assembled system complies with prEN 50240, the EMC product standard for resistance welding systems, and EN 55011 (October 1997), EMC product family standard class A, group 2, rated current > 100 A.

- Only for industrial applications.
- Safe clearance from residential areas  $\geq 30$  m.
- Safe clearance to communication systems (wireless, telephone)  $\geq 10$  m.
- Cable length of mains feeder  $\geq 10$  m.
- Interference suppression measures: When switchgear cabinet doors are open, operation of radio devices or cell phones is permitted only beyond a safe clearance of  $\geq 2$  m.
- The assessment and certificate of conformity of a competent authority concerning compliance with the fundamental EMC protection is available.

## 1.9 Operation of the welding transformers

---

**DANGER**

Danger of personal injury and damage to property through missing or false interpretation of fault messages!

Therefore, closing of the temperature contact (thermostatic switch, break contact) of the welding transformer must inhibit the connected timer!

---

**DANGER**

Danger of bruises through electrode movement!

All users, line designers, welding machine manufacturers and welding gun producers are obliged to connect the output signal of the Bosch weld timer which initiates the electrode movement so that the applicable safety regulations are complied with.

The risk of bruises can be considerably reduced by means of, e.g., two-handed start, guard rails, light barriers etc.

---

**CAUTION**

Damage to property through insufficient cooling!

Ensure proper cooling during operation. The maximum permitted cooling-water temperature must not be exceeded. Condensation on water-carrying components must be prevented.

---

**CAUTION**

Damage to property through excessive welding current!

The maximum welding current depends on the medium-frequency inverter and the welding transformer in use. It must not be exceeded. Therefore, the user must check the load in each case.

Any and all warranty excluded in case of non-compliance.

---

## 1.10 Retrofits and modifications by the user

---

**DANGER**

Retrofits or modifications may have negative effects on the safety of the unit!

Product modification may cause death, severe or light personal injury, damage to property or environmental damage.

Therefore, please contact us prior to making any modification. This is the only way to determine whether modified components are suitable for use with our products.

---

## 1.11 Maintenance, repair

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### **DANGEROUS ELECTRICAL VOLTAGE**

Prior to any maintenance work - unless described otherwise - the system must always be switched off!  
In the event of necessary measurement or test procedures on the active system, these have to be performed by skilled electrical personnel.  
In any case, suitable insulated tools must be used!

---



### **DANGEROUS ELECTRICAL VOLTAGE**

If you need to open the primary connection, disconnect the system from supply and wait at least 5 minutes after disconnecting the inverter supply before you open the housing so as to ensure that the MF inverter is de-energized.

---



### **DANGER**

Danger of life through inappropriate EMERGENCY-STOP facilities!  
EMERGENCY-STOP facilities must be operative and accessible in all modes of the system. Releasing the EMERGENCY-STOP facility must by no means result in an uncontrolled restart of the system!  
First check the EMERGENCY-STOP circuit, then switch the unit on!

---



### **DANGER**

The right to perform repair/maintenance work on the weld timer components is reserved to the BOSCH service department or to repair/maintenance units authorized by BOSCH!

---



### **CAUTION**

Only use spare parts approved by BOSCH!

---

## 1.12 Working safely

---

**DANGER**

During operation of the welding equipment welding splashes are to be expected! They may cause eye injuries or burns.

Therefore:

- wear protective goggles
  - wear protective gloves
  - wear flame-retardant clothes
- 

**DANGER**

Danger of injury from sheet metal edges and danger of burns from weld metal!

Therefore: - wear protective gloves

---

**DANGER**

In the environment of resistance welding systems, magnetic field strengths have to be expected which are above the limit values specified in VDE 0848 Part 4. Especially if manual guns are used, the limit values for extremities may be exceeded.

If in doubt, measure the field strength and take additional measures to ensure safety and health at work.

---

**CAUTION**

The strong magnetic fields occurring in the resistance welding process may cause permanent damage to wrist watches, pocket watches, or cards with magnetic stripes (e.g. EC cards).

Therefore, you should not carry any such items on you when working in the immediate vicinity of the welding equipment.

---

## 1.13 CE conformity

---



### CAUTION

The CE mark is valid for the welding transformer with respect to the Low-Voltage Directive 72/23 EEC and the standards EN 60204, Part 1 and EN 50063, cf. "Declaration of Conformity". Concerning EMC, it is always necessary to consider the entire application.

The CE mark for MF inverter - welding transformer combinations is valid for industrial applications.

For other combinations/applications, the certificate must be derived from the above, or a new certificate must be issued, if necessary. This is a responsibility of the line designer / user.

---



Notes:

## 2 Setup

### 2.1 Features

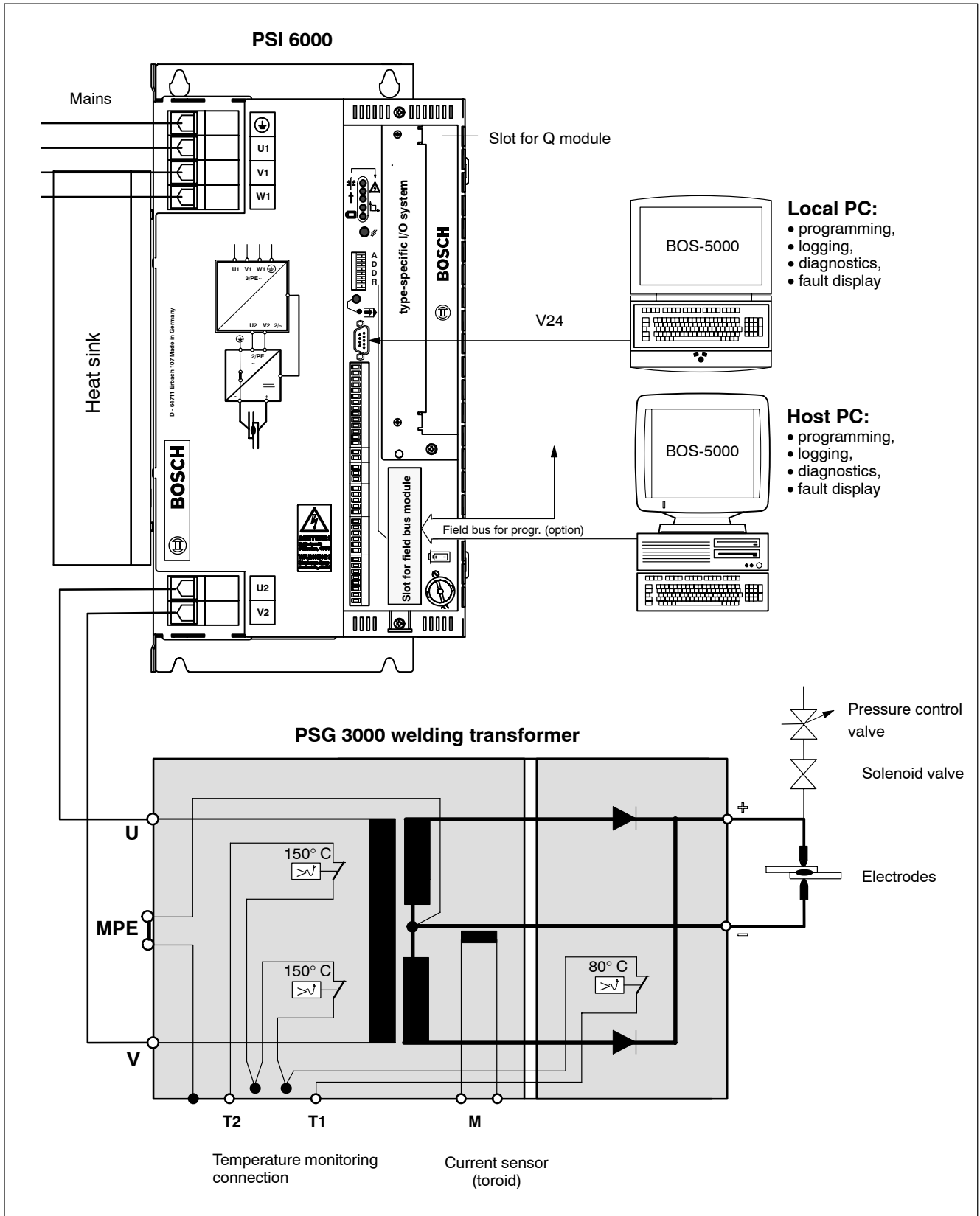
- Primary circuit temperature monitoring
- Rectifier block temperature monitoring
- Integrated diodes in secondary
- Some types with integrated current transformer in secondary
- External protective conductor jumper
- Degree of protection: transformer block IP65  
rectifier block IP00  
primary terminal compartment IP00 or IP 54,  
depending on type; terminal box of higher degree  
of protection required with IP00



#### *Medium-frequency welding transformers*

The welding transformers must be connected to a Bosch MF inverter with an output frequency of 1 kHz.

Rectifier block and primary winding temperatures are monitored and their values transmitted. Any error message occurring must invariably block the gate control.

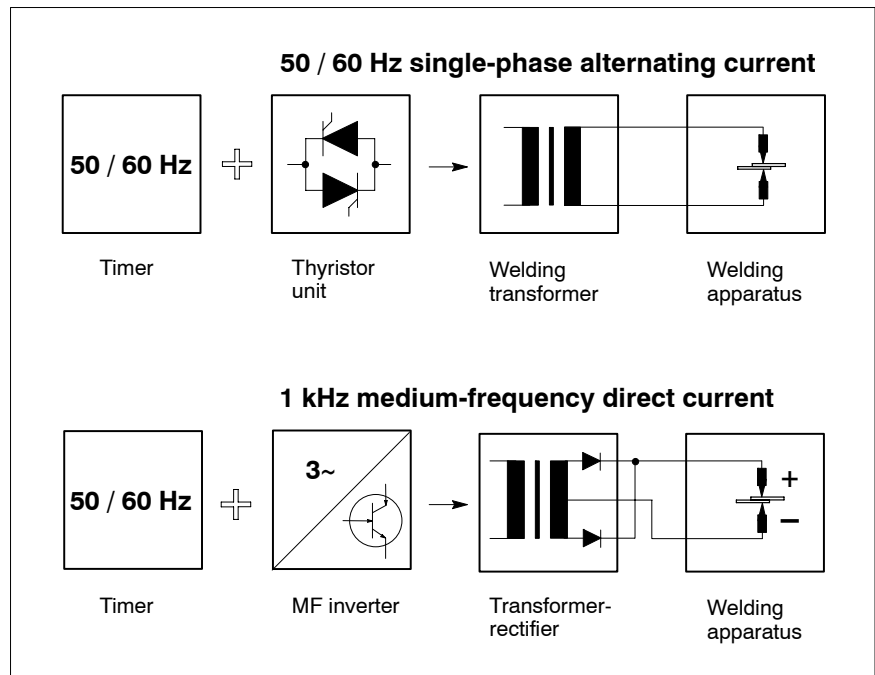


Welding system layout plan

## 2.2 Function

Medium-frequency welding technology allows efficient energy conversion using lightweight transformers. Due to the higher operating frequency, both the iron content and the size of the transformers can be reduced without affecting performance.

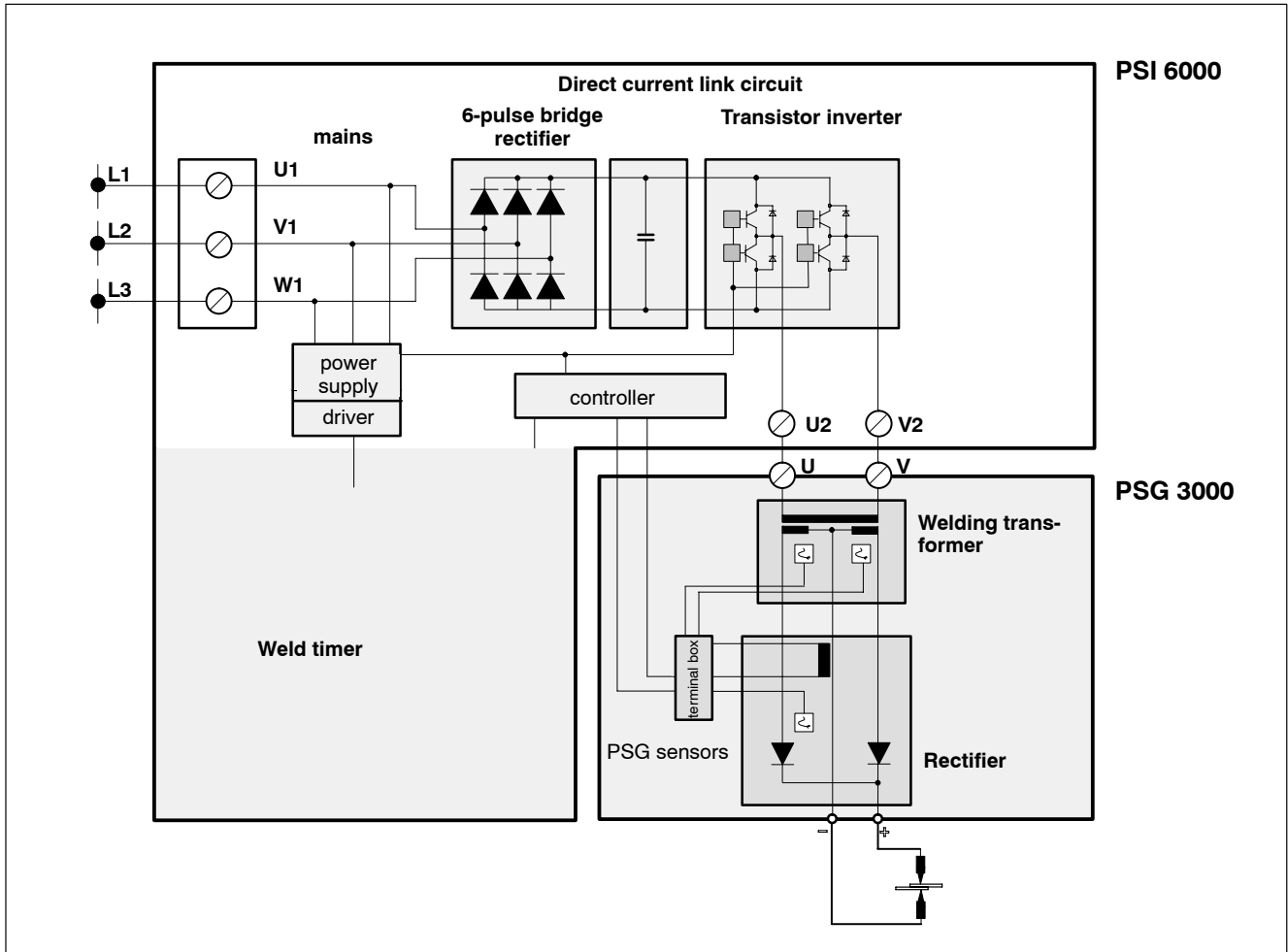
The figure below shows the difference between welding equipment with 1-phase AC and medium-frequency DC.



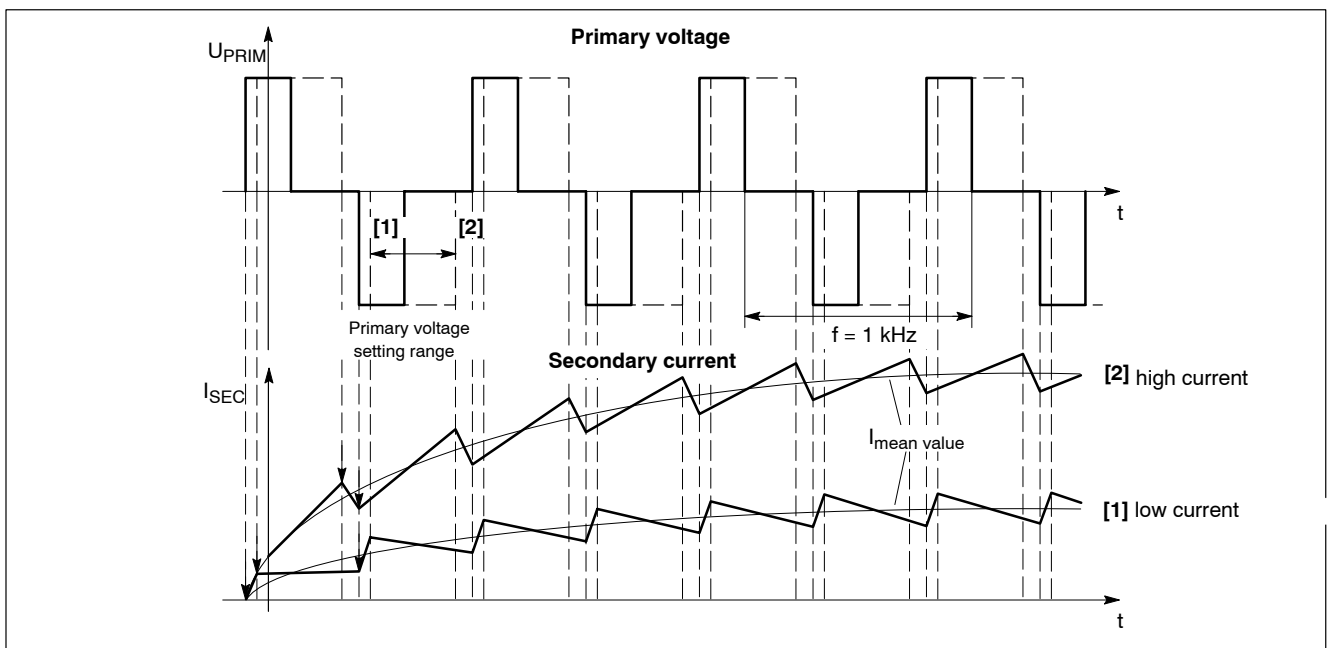
*Schematic block diagram of 1-phase AC and MF DC welding systems*

The 50 / 60 Hz mains AC is first rectified by a bridge rectifier (B6 connection). The direct current thus generated connects a transistorized H-bridge alternately to the welding transformer with a frequency of 1 kHz. The welding current is rectified in the welding transformer secondary.

Welding current amperage is controlled by adjusting the pulse width. The welding current is measured by a current sensor incorporated in the secondary circuit of the PSG 3000 welding transformer.



Block diagram of a medium-frequency inverter system



Primary voltage and secondary current in an MF welding system

### 3 Protective conductor connection

The BOSCH PSG 3000 MF transformers comply with protection class 1 in accordance with DIN VDE 0551 Part 1.

Additional protective measures as per EN 50063 (DIN VDE 0545, Part 1) must be taken for protection class 1 devices to provide protection against inadmissibly high touch voltage in case of an insulation breakdown between primary and secondary circuits. The implementation of these measures is the responsibility of the machine/system manufacturer/operator.



#### **DANGEROUS ELECTRICAL VOLTAGE**

**If these protective measures are not applied, or if they are ineffective, touching the secondary connections, the welding gun or the work-piece is associated with danger of life and limb!**

---

Welding transformers are delivered with a detachable protective conductor jumper (MPE) connected between the MF transformer secondary (negative pole) and the protective conductor terminal. This is in compliance with the protective measure of a "direct protective conductor connection" as per Section 5.1.4.1, EN 50063.

If another protective measure to EN 50063 is implemented instead of a "direct protective conductor connection", the protective conductor jumper (MPE) must be removed.

The removal of the protective conductor jumper (MPE) must be indicated on the label provided on the transformer in a permanent way.

As an additional measure for devices of protection class 1, the MF transformer housings have non-detachable connections to the transformer protective conductor terminals.



#### **DANGEROUS ELECTRICAL VOLTAGE**

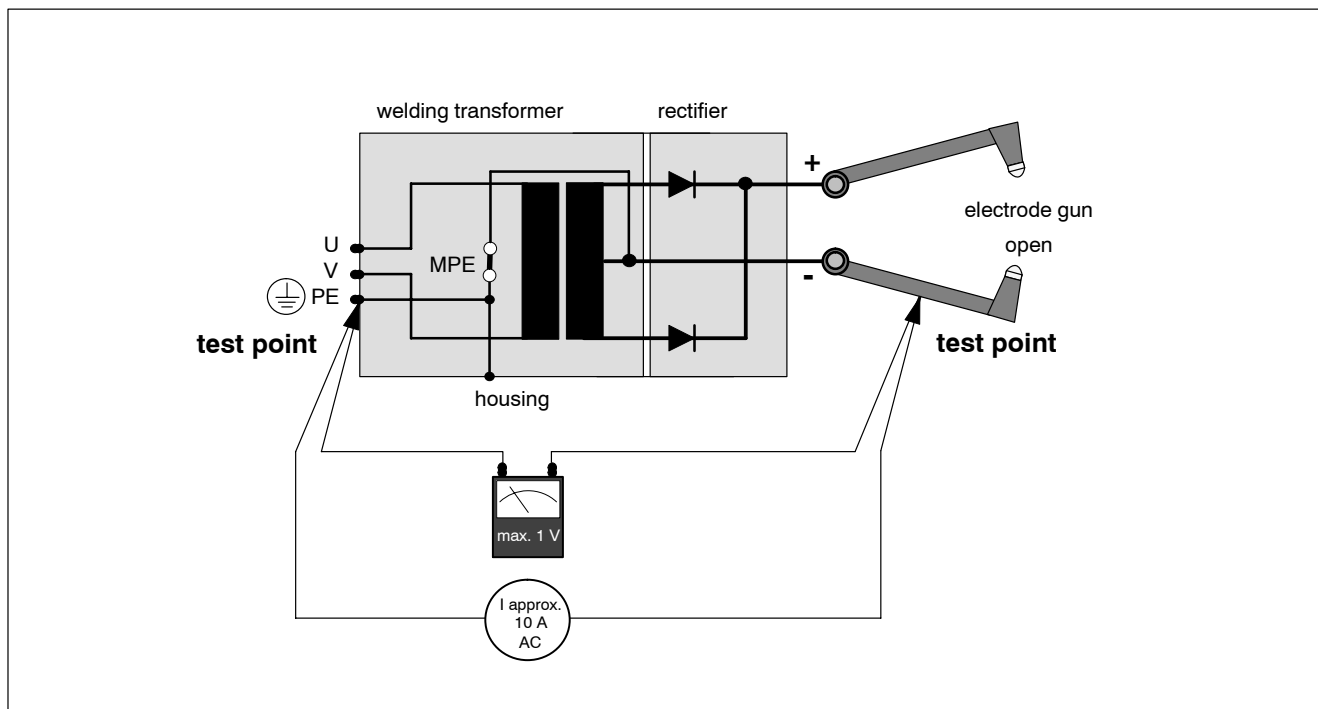
**Under certain circumstances, circulating currents (called "cross-over currents" as per EN 50063) may flow through the MPE protective conductor connection.**

**Any such circulating currents must be prevented at all events because they may interrupt the protective conductor continuity through the protective conductor jumper (MPE).**

**Interrupting the protective conductor connection will render the protective measure of a "direct protective conductor connection" ineffective. Therefore, in the case of an insulation breakdown there is danger of life!**

---

### 3.1 How to recognize a "defective" (ineffective) MPE protective conductor connection




Checking the protective conductor connection

- 1.) Inspect the protective conductor jumper (MPE) for damage.
- 2.) Perform the following measurement with the protective conductor jumper (MPE) installed!
  - Supply an AC current of approx. 10 A between the PE terminal of the transformer and the negative pole of the rectifier/electrode gun.
  - The voltage measured between the PE terminal and the test point (negative pole) must not exceed 1 V (cf. EN 60204, Section 20.2 and Table 7).



#### DANGEROUS ELECTRICAL VOLTAGE DANGER OF LIFE!

If a voltage  $> 1$  V is measured, the jumper (MPE) between the protective conductor and the negative pole of the rectifier is defective (ineffective). This defect may have been caused by circulating currents.

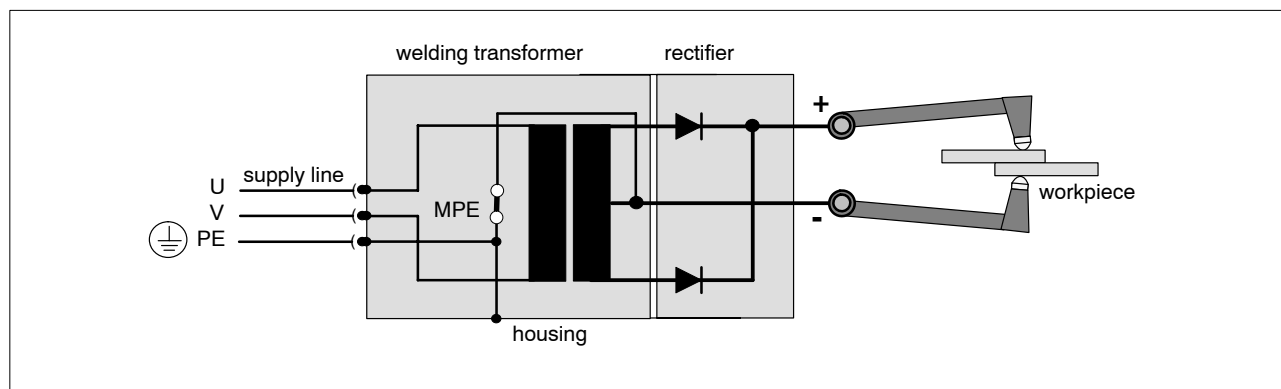
 **Note:** The measurement described above may be performed analogously to check the protective conductor connection to the transformer housing.

### 3.1.1 What are circulating currents?

Circulating currents are defined as currents which do not flow as desired from the positive pole of the welding equipment through the workpiece and to the negative pole of the welding equipment during the welding process, but rather through the workpiece and then through external "ground connections" and the protective conductor jumper (MPE) to the negative pole.

### 3.1.2 When do circulating currents occur?

#### Case 1

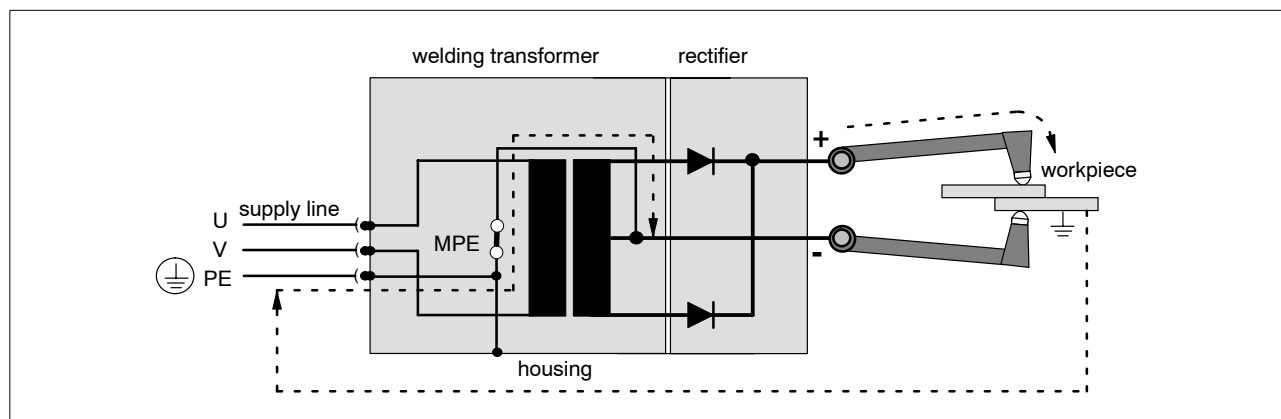


*No circulating currents*

Negative pole grounded through protective conductor jumper (MPE), workpiece not grounded (ideal arrangement).

**No circulating currents can occur.**

#### Case 2



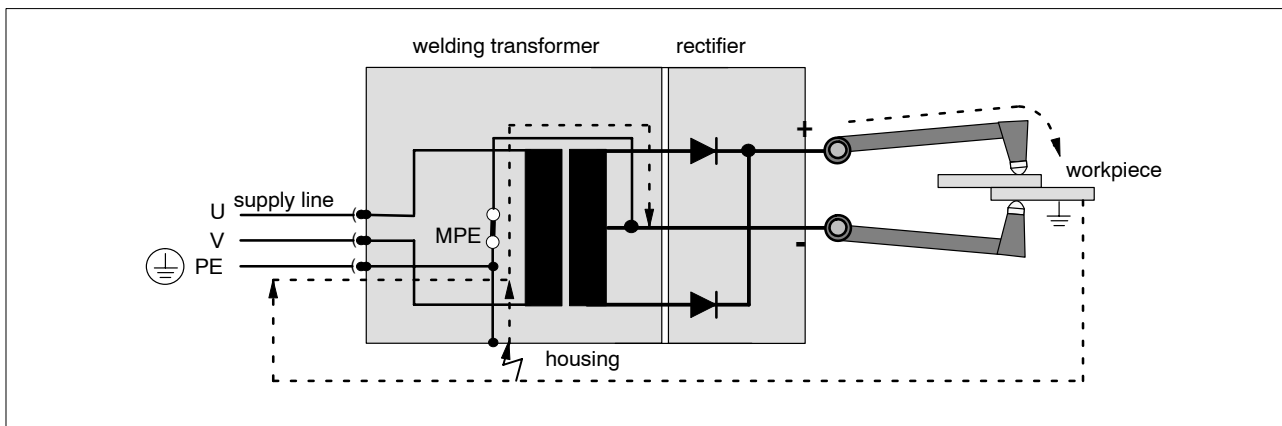
*Circulating currents occur*

Negative pole grounded via protective conductor jumper (MPE), workpiece grounded, welding transformer housing insulated from  $\perp$ .

**There will be circulating currents through the mains supply line.**



## Case 3

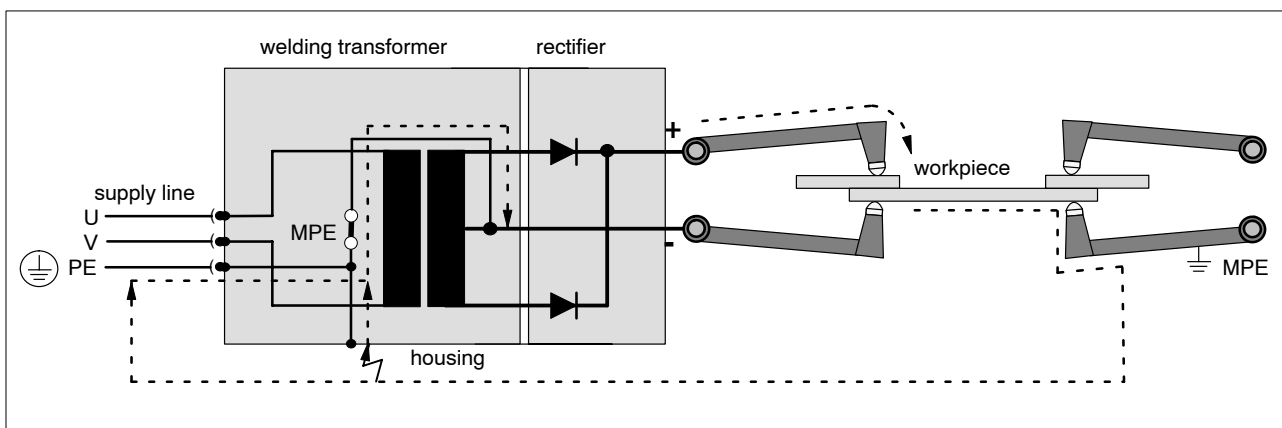


*Circulating currents occur*

Negative pole grounded via protective conductor jumper (MPE), workpiece grounded, welding transformer housing has a low-resistance connection to  $\perp$  through the welding equipment (practical case).

**There will be circulating currents through the mains supply line and furthermore through the welding equipment.**

## Case 4



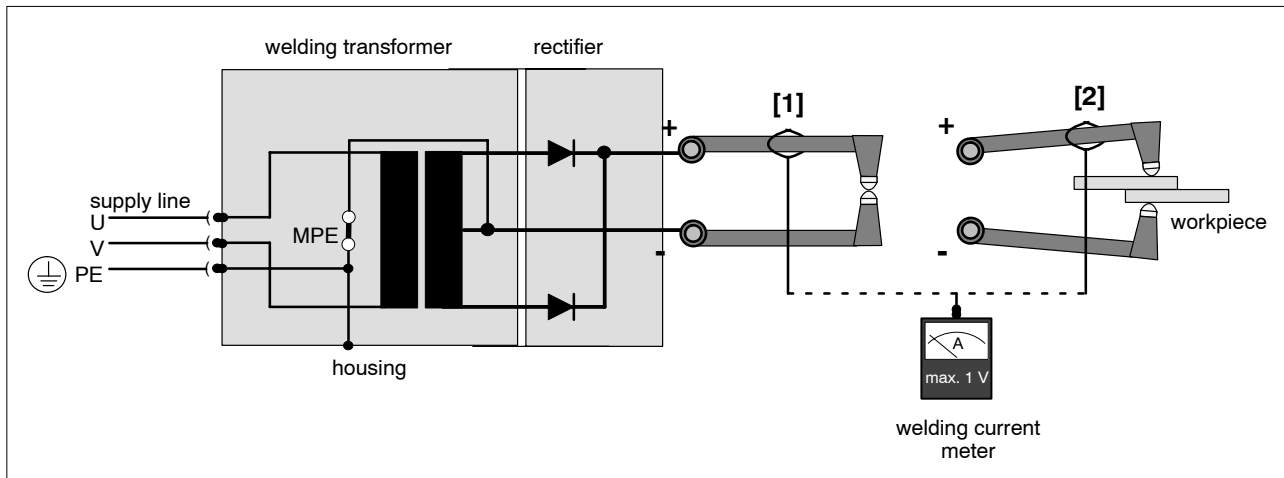
*Circulating currents occur*

Negative pole grounded via protective conductor jumper (MPE), workpiece not grounded, several electrode guns (with their negative poles also grounded) are employed simultaneously.

**There will be circulating currents through the "neighboring" electrode guns.**

**Additional circulating currents will occur if also the workpiece is grounded (cf. Case 3).**

### 3.1.3 How to measure circulating currents



#### Circulating currents

A DC welding current meter is required for measuring circulating currents.

- [1] Apply belted measuring cable to the positive pole of the weld gun and fix it in position. Close the weld gun without a workpiece being used, apply welding current (with MF inverter in closed-loop current control mode). Measure and record welding current  $I_{[1]}$ .
- [2] Close the weld gun on a workpiece, close "neighboring gun", if any, (Case 4), apply welding current with current conditions as under [1] above. Measure and record welding current  $I_{[2]}$ .

If the current values are different, the presence of circulating currents has to be assumed. The amount of the circulating current is calculated as

$$I_{[2]} - I_{[1]} \sim \text{circulating current.}$$

### 3.1.4 Remediating circulating currents

If circulating currents cannot be avoided by the protective measure of a "direct protective conductor connection", other protective measures to EN 50063 must be installed by the machine/plant manufacturer/operator.

For example, protective measures such as current-operated e.l.c.b. systems or voltage-operated e.l.c.b. systems (cf. EN 50063, Sections 5.1.4.3 and 5.1.4.4) may be installed for medium-frequency systems.

However, please read the manufacturer's specifications carefully and check whether devices to be used for the measures described above are suitable for MF system operation with a DC link circuit and at a frequency of 1000 Hz. The manufacturer's specifications must be verified accordingly. The applicable standards are to be observed.

## 3.2 Residual-current protective resistor



### DANGEROUS ELECTRICAL VOLTAGE

A residual-current protective resistor may be used only as prescribed in combination with a residual-current protective device with a rated residual current of  $\leq 30$  mA (as per EN 60947-2) in TN or TT systems of up to 690 V for installation on a welding transformer (cf. EN 50063).

No warranty: Supplier excludes any and all liability for any other than the permitted use, including, without being limited to any use in combination with any residual current protective device unfit for the intended purpose. Visual and electrical inspections must be conducted periodically on residual-current protective resistors installed.

**Recommended inspection intervals: no more than 6 months.**

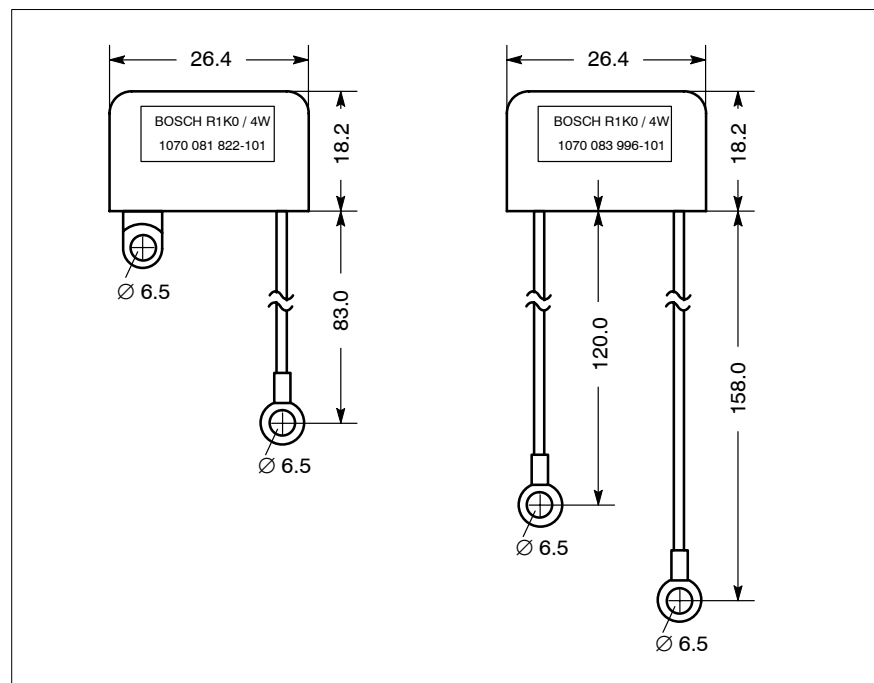


### CAUTION

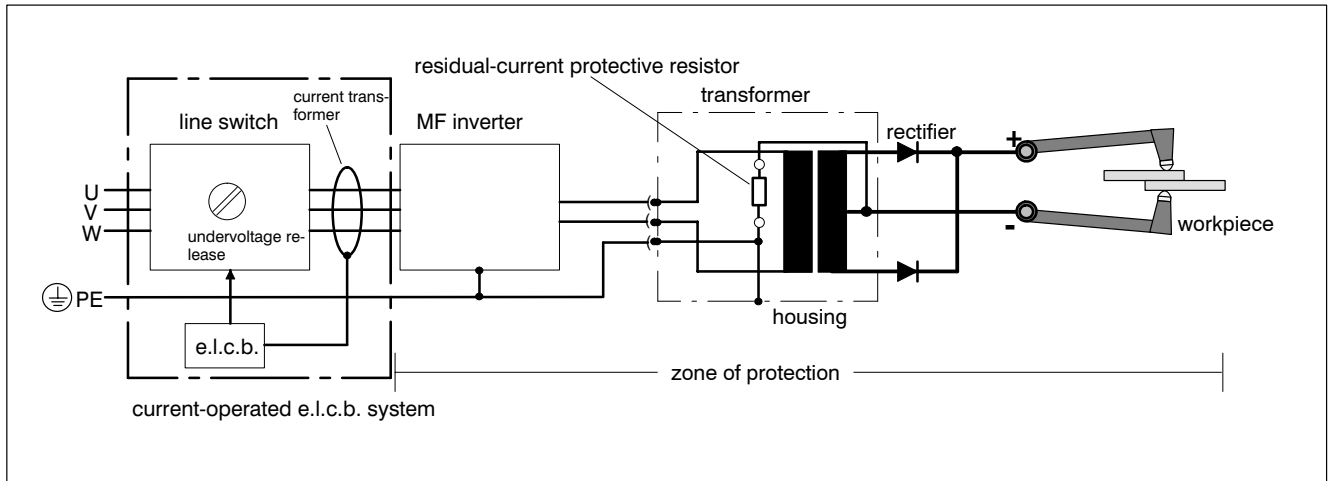
In order to comply with EN 50063, MF welding systems equipped with residual-current protective devices (for personnel protection) require a residual-current protective resistor to be installed on the welding transformer with the protective conductor jumper (MPE jumper) removed (cf. Section 5.1.4.3, EN 50063).

#### Technical data

Resistance	: 1 k $\Omega$ $\pm$ 10%
Pulse power	: tuned to use in combination with residual-current protective device, see above
Degree of protection	: electrical connections IP00, resistor IP65
Dimensions	: see diagram



*Residual-current protective resistor*

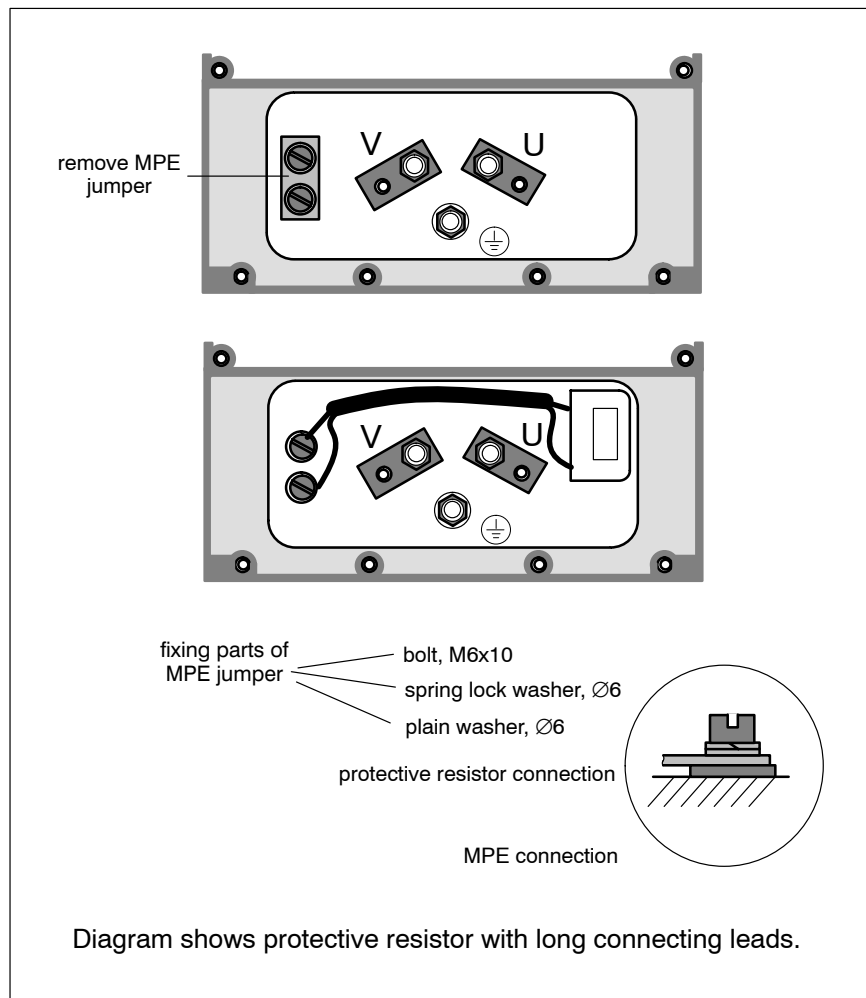


Current-operated e.l.c.b. system to Section 5.1.4.3, EN 50063

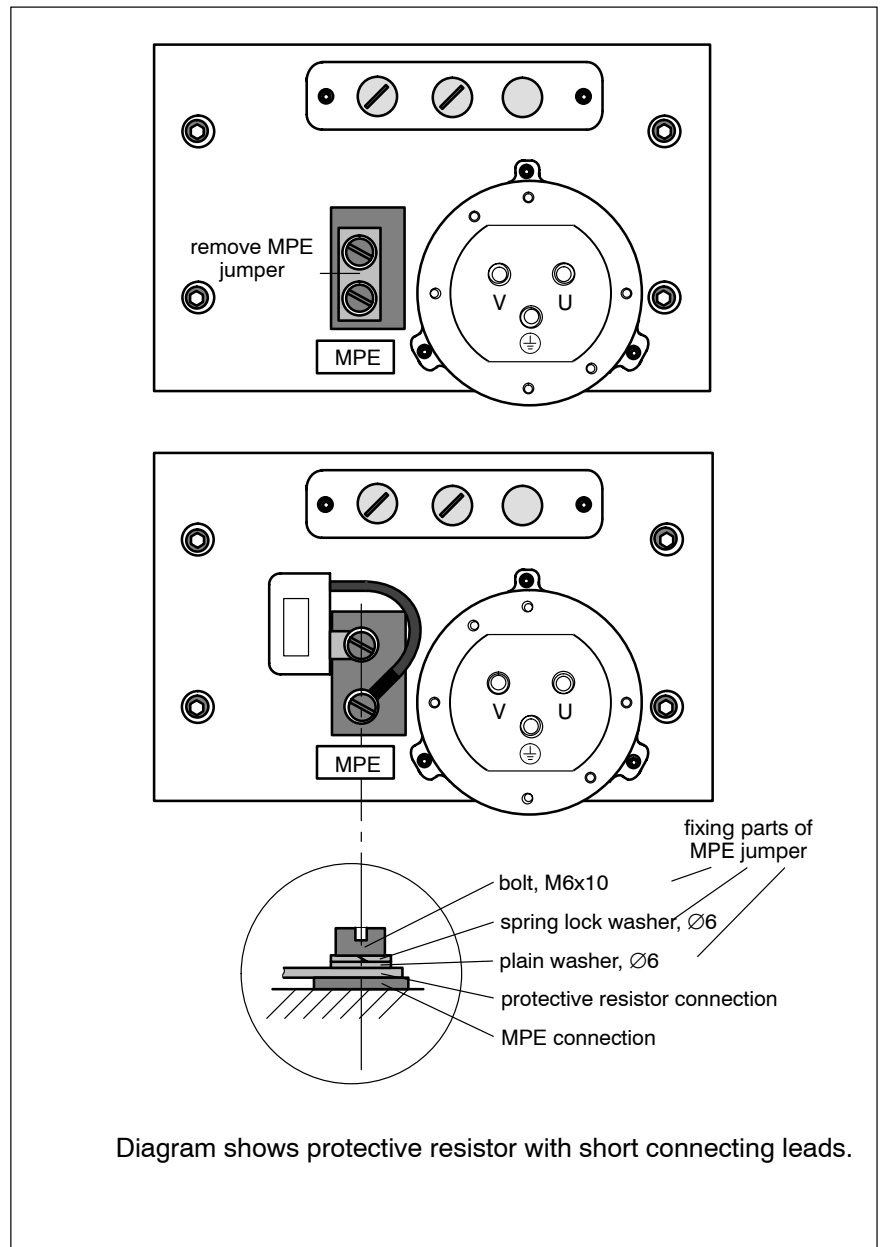
The zone of protection against indirect contact includes all components installed after the current transformer. Indirect contact with live parts will release the line switch.

However, please read the manufacturer's specifications carefully and check whether the current-operated e.l.c.b. system to be used for are suitable for MF system operation with a DC link circuit and at a frequency of 1000 Hz (cf. EN 50178, EN 60947-2, etc.). The applicable standards are to be observed.

### 3.2.1 Installation of a residual-current protective resistor



*Installation of a residual-current protective resistor with long connecting leads.*



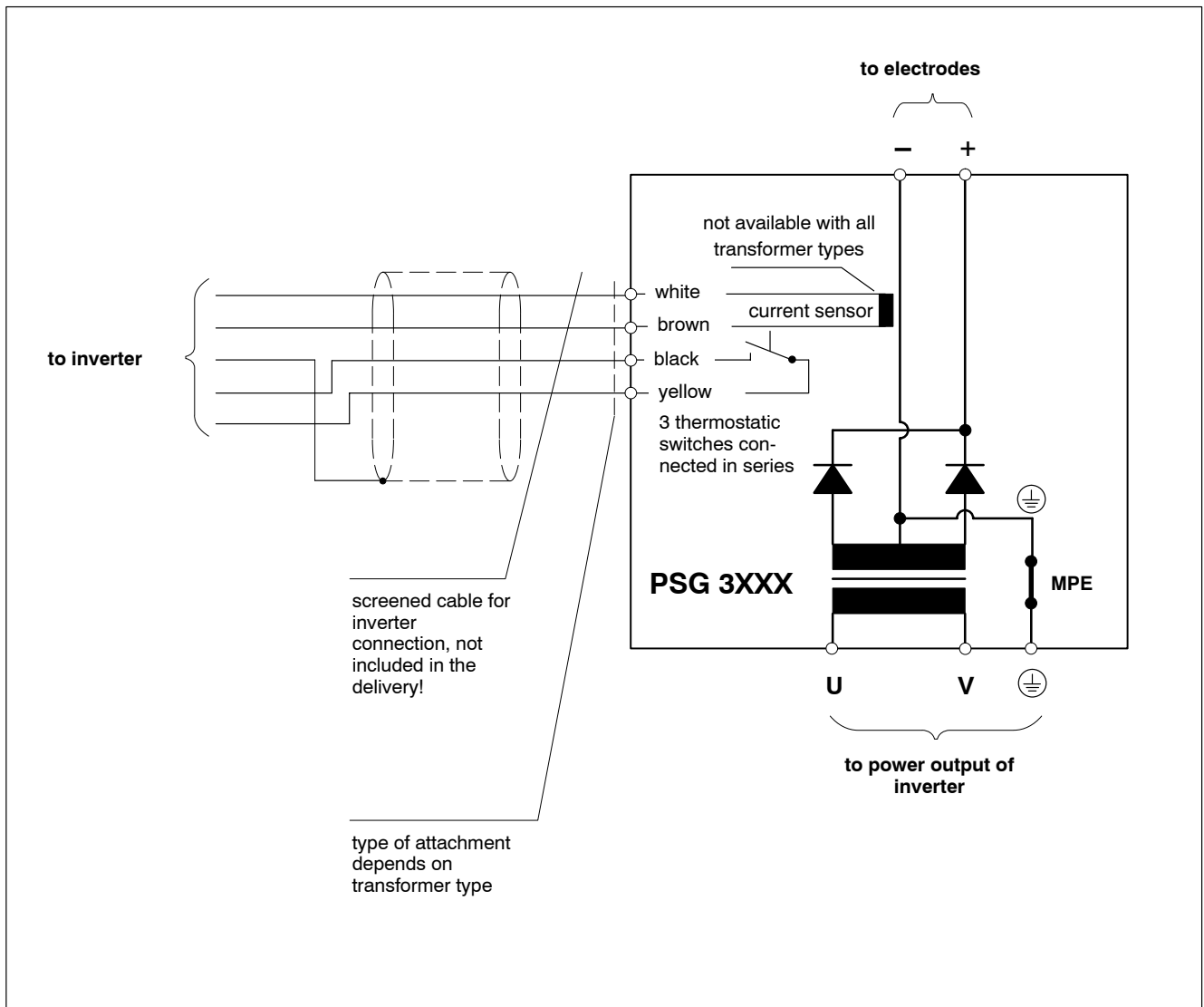
*Installation of a residual-current protective resistor with short connecting leads.*

### 3.3 Ordering protective resistors

Designation	Part No.
Protective resistor (short connecting leads)	1070 081 822
Protective resistor (long connecting leads)	1070 083 996

# 4 Connection

## 4.1 PSG 3XXX.XX X to inverter

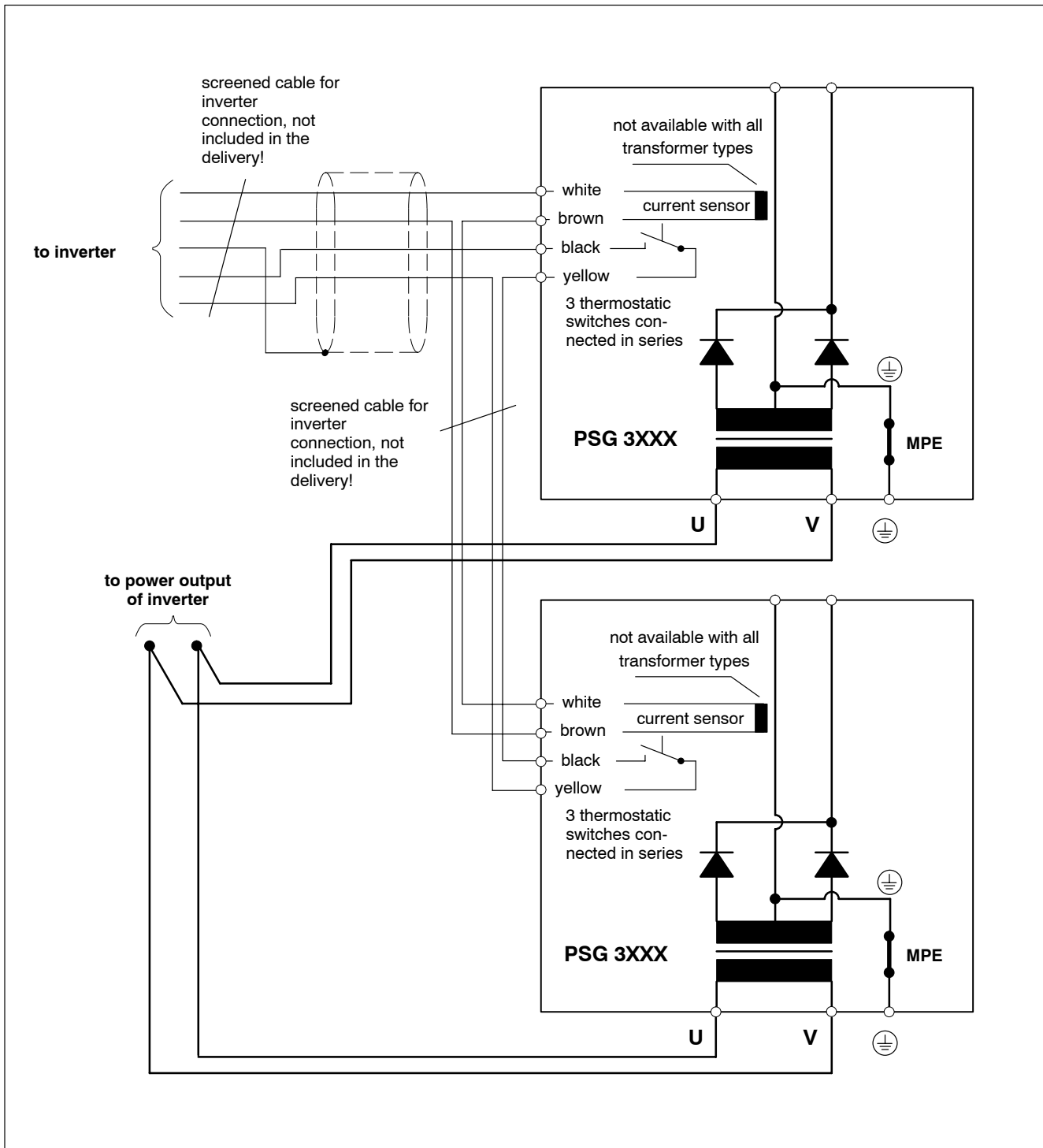


PSG 3XXX.XX X connection to inverter



## 4.2 Parallel connection of PSG 3XXX.XX X

- two PSG 3100.XX X connected to PSI 6200.XXX
- two PSG 3200.XX X connected to PSI 6500.XXX
- four PSG 3100.XX X connected to PSI 6500.XXX (connected accordingly as shown for 2 transformers in the diagram below)



PSG 3XXX.XX X parallel connection to inverters

## 5 Maintenance

---



### **DANGEROUS ELECTRICAL VOLTAGE**

Maintenance work must always be carried out by an electrical expert in compliance with the valid safety regulations, the mains voltage and the maximum current consumption of the individual units of the equipment.

Prior to connecting an MF inverter, the following must be strictly observed:

- Power OFF.
  - Provide a safeguard to prevent unintentional reclosing.
  - Verify that the system is safely isolated from supply and de-energized.
  - Connect to earth and short circuit.
  - Cover up or safeguard all live parts.
- 



### **DANGEROUS ELECTRICAL VOLTAGE**

Prior to any maintenance work - unless described otherwise - the system must always be switched off!

If the system was active shortly before, wait until the system is totally de-energized before starting the maintenance work (e.g. because of charged capacitors, etc.). The system must always be safeguarded against unintentional reclosing while maintenance work is performed!

In the event of necessary measurement or test procedures at the active system, the applicable safety and accident prevention regulations must be strictly observed. In any case, suitable insulated tools must be used!

If you need to open the MF inverter housing, disconnect the system from supply and wait at least 5 minutes before you open the housing so as to ensure that the MF inverter is de-energized.

**Danger of life through inappropriate EMERGENCY-STOP facilities! EMERGENCY-STOP facilities must be operative in all modes of the system. Releasing the EMERGENCY-STOP facility must by no means result in an uncontrolled restart of the system!**

---



### **DANGEROUS ELECTRICAL VOLTAGE**

The right to perform repair/maintenance work on the components is reserved to the BOSCH service department or to repair/maintenance units authorized by BOSCH!

**Only use spare parts/replacement parts approved by BOSCH!**

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- Check the cooling water circuit for leaks at regular intervals.
- Add an algicide to the cooling water.
- Check connections and terminals of all connecting cables for tight fit at regular intervals. Check all cables for damage.

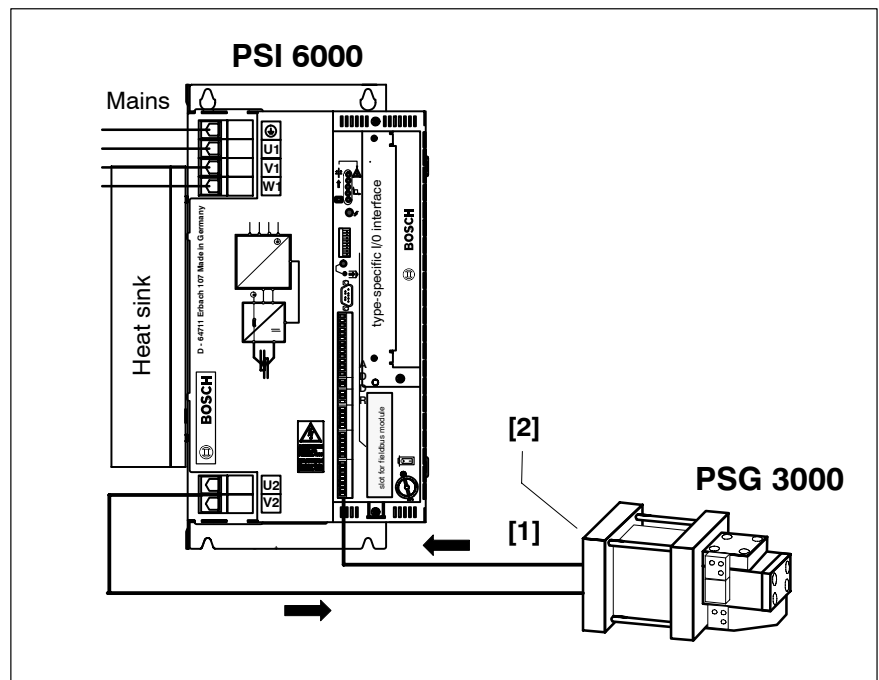
**DANGEROUS ELECTRICAL VOLTAGE**

**Check whether the current-operated e.l.c.b. system / the residual-current protective resistor is in proper service condition at least every 6 months.**

---

## 6 Accessories

### 6.1 Electrical connection



*Electrical connection*

- [1] screened sensor cable LIYCY2 x 2 x 0,75 mm<sup>2</sup>, available as an accessory
- [2] terminal box, flange connectors and connecting sockets available as accessories

## 6.2 Primary connection of welding transformer

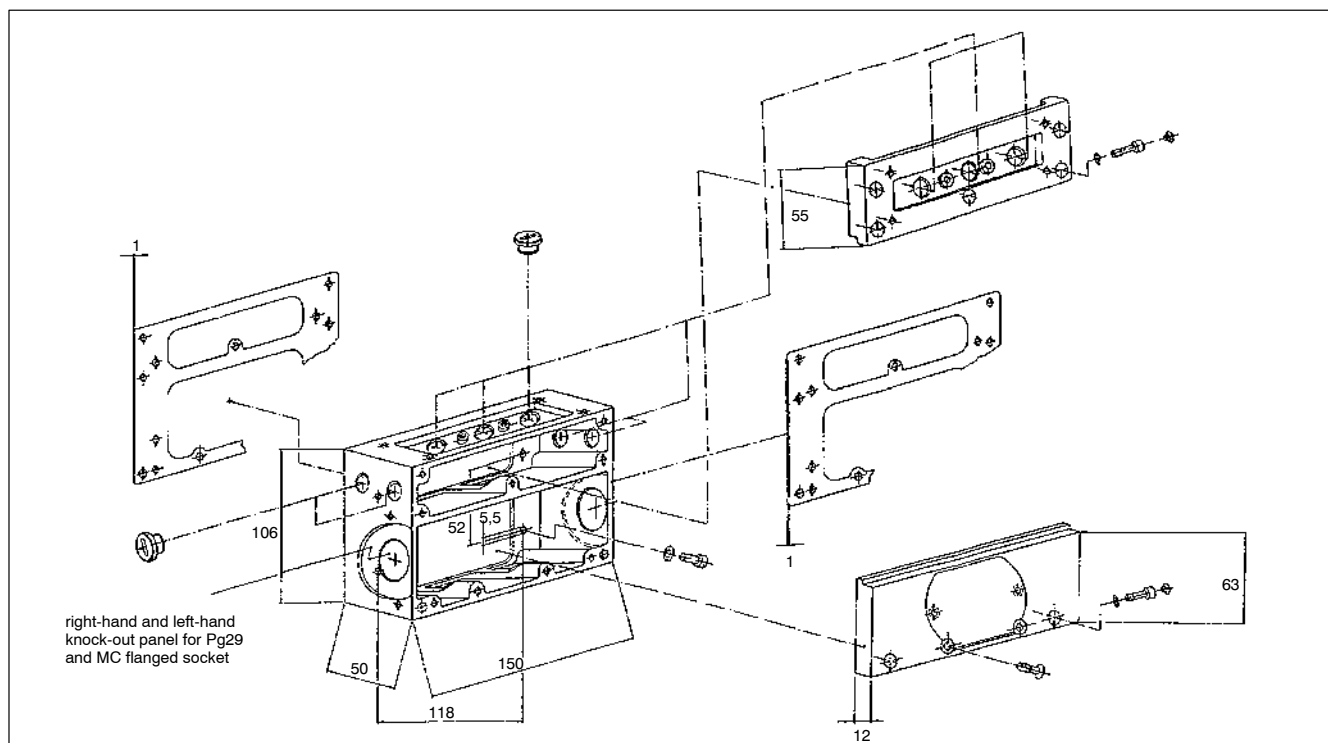
There are two options for the primary connection of the MF welding transformer:

- Provide terminals V, U and the ground terminal with cable clamps and screw them onto the respective contact pieces. A suitable transformer terminal box is the TH 3000 terminal box with cable-gland Pg connection (heavy-gauge screwed conduit connection), see diagram below.
- Welding transformers are delivered with three plug contacts, ea., which can be screwed into the contact tubes. They provide plug-in connection for the welding transformer primary.

For information on the matching female connectors and suitable transformer terminal boxes, please see the following descriptions.

### 6.2.1 Terminal box TH 3000/Pg

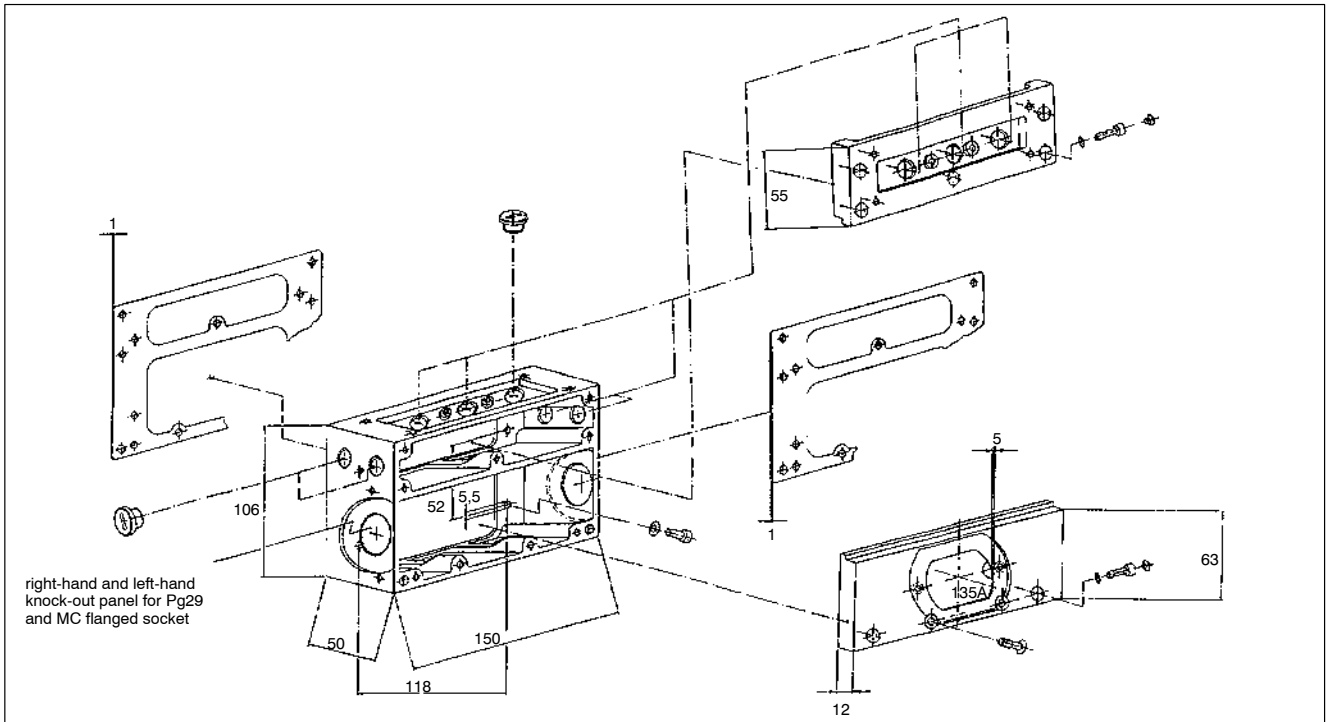
Suitable for all PSG 3000 transformer types (except for PSG 3025.00 A and PSG 3XXX.XX P variants) with primary connection through cable-gland Pg connection.



Terminal box TH 3000/Pg

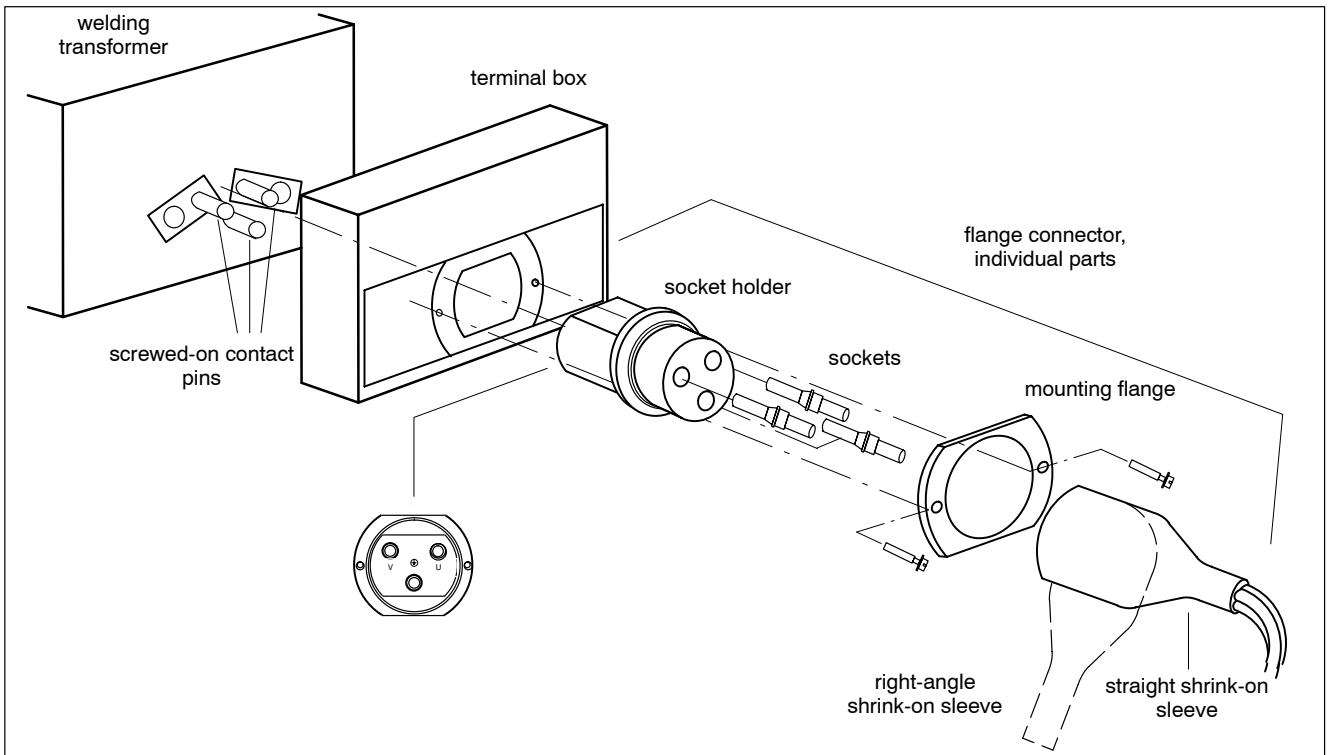
**6.2.2 Terminal box TH 3050/MC**

Suitable for PSG 3050.XX X or PSG 3075.XX X (except for PSG 3XXX.XX P variants) for MC 135 multi-contact connection.



*Terminal box TH 3050/MC*

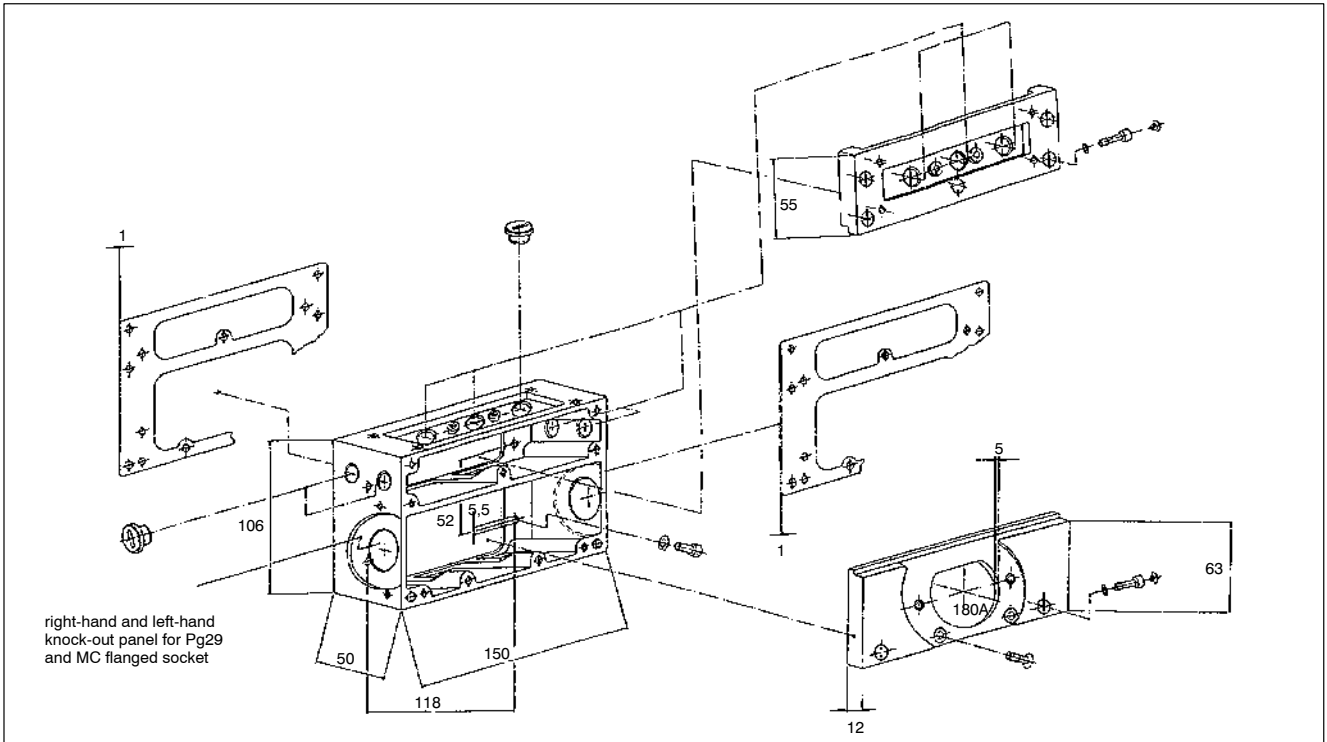
Flange connector suitable for PSG 3050.XX X or PSG 3075.XX X for MC 135 multi-contact connection (contact pins) on welding transformer.



*Flange connector*

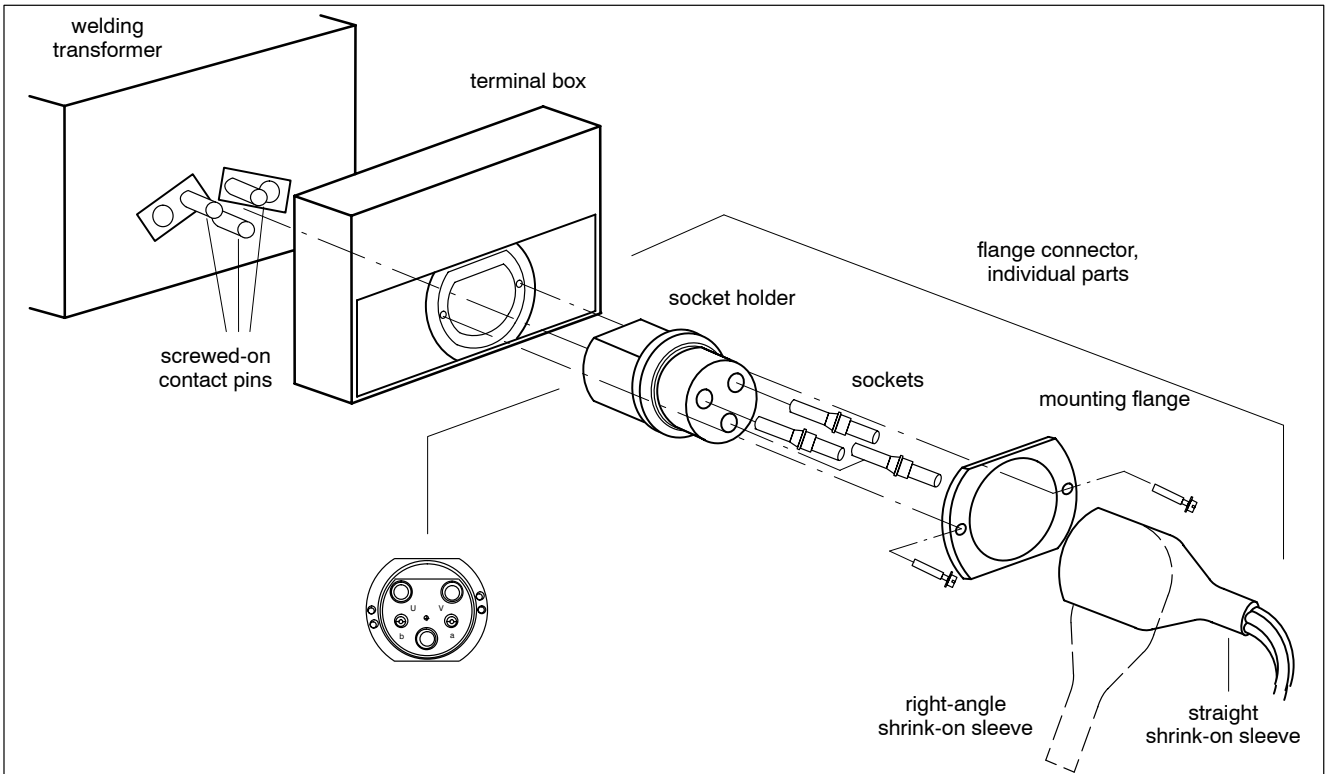
### 6.2.3 Terminal box TH 3100/MC

Suitable for PSG 3100.00 X (except for PSG 3XXX.XX P variants) for MC 180 multi-contact connection.



Terminal box TH 3100/MC

Flange connector suitable for PSG 3100.00 X for MC 180 multi-contact connection (contact pins) on welding transformer.



Flange connector

### 6.3 Ordering PSG accessories

**Not included in the delivery of MF welding transformers:**

Designation	Part no.
Terminal box TH 3000/PG suitable for all PSG 3000 welding transformers (except for PSG 3025.00 A and PSG 3XXX.XX P variants)	1070 917 826
Terminal box TH 3050/MC suitable for PSG 3050.XX X or PSG 3075.XX X for multi-contact connection MC 135/25 (except for PSG 3XXX.XX P variants)	1070 917 828
Flange connector MC 135/25 for multi-contact connection on PSG 3000, suitable for PSG 3050.XX X or PSG 3075.XX X	on request
Terminal box TH 3100/MC suitable for PSG 3100 for multi-contact connection MC 180/50 (except for PSG 3XXX.XX P variants)	1070 917 827
Flange connector MC 180/50 for multi-contact connection on PSG 3000, suitable for PSG 3100	on request
Cable for PSG sensors 2 x 2 x 0,75 mm <sup>2</sup> , screened LiYCY	1070 913 494



Notes:

## 7 Load diagrams

**DANGER**

**Danger of damage to property through inadmissibly high welding current!**

**Therefore, read the load diagrams to see whether the maximum welding current of your application is within the permitted range. The modules should only be operated with appropriate cooling!**

---

The load diagrams define the maximum admissible welding current of the PSG unit depending on the duty cycle (ED).

The maximum admissible welding current depends not only on the duty cycle of the rectifier diodes, but also on the duty cycle of the PSG 3000 (transformer) used.

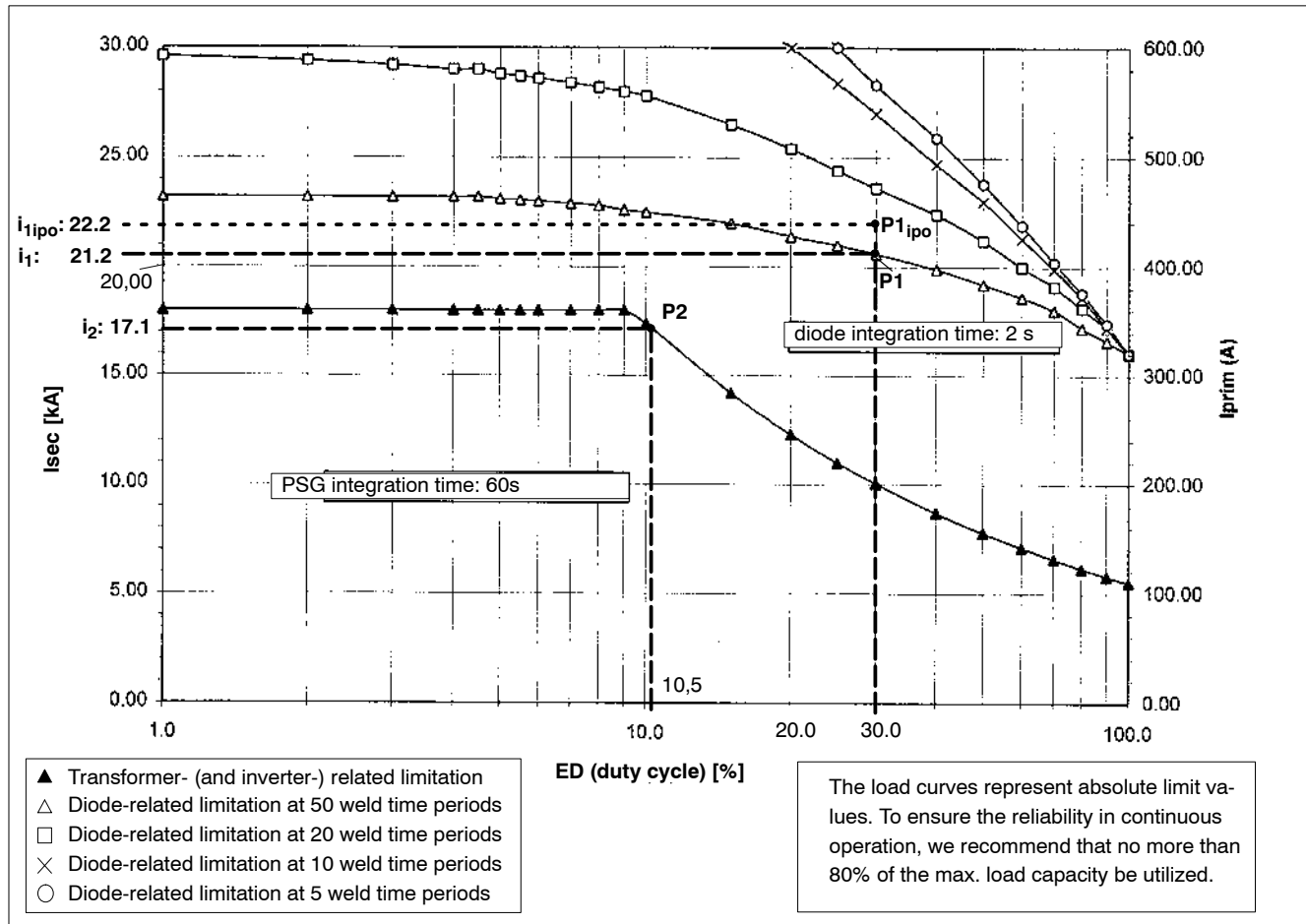
All load diagrams are based on the thermal transient recovery times (integration time) of the rectifier diodes (2 seconds) and the transformers (60 seconds). These data together with some application-specific data (number of spot welds per minute; number of weld time periods, number of overall weld cycles) are used to determine

- 1. the maximum admissible welding current depending on the diode load **and**
- 2. the maximum admissible welding current depending on the transformer load.

**To ensure proper execution of weld schedules, the lowermost of these two values must not be exceeded!**

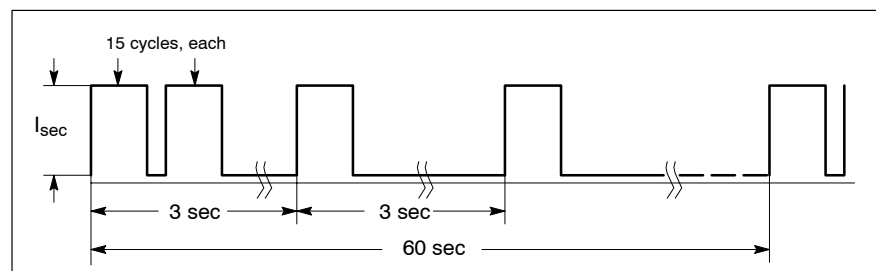
## 7.1 Rating example

- 1. Look for the related load diagram of the PSG 3000 you want to use.  
Example:



Example of load diagram

- 2. Write down your welding parameters.  
Sample data:  
20 sequences per minute (♦ 1 sequence = 60s/20=3s).  
150 overall weld cycles (incl. all non-weld times, i.e. SQZ, OFF, CT, WLD, HOLD and all idle times) ♦ 150 overall weld cycles = 1 sequence ♦ 1 overall weld cycle = 3s/150=0.02s.  
1<sup>st</sup> sequence: 2 x 15 weld time periods:  
subsequent sequences: 15 weld time periods, each (♦  $t_s=15 \times 0.02s=0.3s$ )



Sample data

- 3. Calculate the duty cycle (ED) [2s] of the diodes on the basis of the sequence with the highest number of weld time periods:

$$ED [2s] = \frac{\text{number of weld time periods}}{2 \text{ seconds}} \times 100 \% = \frac{30 \text{ periods} \times 0.02}{2 \text{ seconds}} \times 100 \% = 30 \%$$

- 4. Use the load diagram to determine the maximum welding current permitted for the diodes.

First, draw a vertical line through the duty cycle value of the diodes which you have just calculated (ED=30%).

Next, take the characteristic of the diodes with the next higher number of weld time periods than the required one (with 30 weld time periods given in the example, this would be the  $\triangle$  characteristic) and mark its intersection with the vertical line you have drawn.

Now, you can find the max. welding current  $i_1$  permitted for the diodes at the level of intersection P1 on the left axis (approx. 21 kA in this example). Optionally, you can determine the point of intersection by interpolation between two characteristics, taking the actual number of weld time periods as a basis of calculation (characteristics  $\triangle$  and  $\square$  in this example; see intersection P1<sub>ipo</sub>). This way you can determine the max. welding current in our example more precisely at approx. 22.2 kA ( $i_{1ipo}$ ).

- 5. Calculate the duty cycle ED[60s] of the PSG 3000:

$$ED [60s] = \frac{t_s \times \text{number of spots per min.} + 1}{60s} \times 100 \% = \frac{0.3s \times 21}{60s} \times 100 \% = 10.5 \%$$

(Note : For the calculation of  $t_s$ , see step 2 above)

- 6. Use the load diagram to determine the max. welding current permitted for the PSG 3000 transformer.

First, draw a vertical line through the duty cycle value of the PSG transformer which you have calculated previously (ED = 10.5%).

Next, mark the intersection of the  $\blacktriangle$  characteristic with the vertical line. Now, you can find the max. welding current  $i_2$  permitted for the PSG 3000 transformer at the level of intersection P2 on the left axis (approx. 17 kA in this example).

- 7. The maximum welding current for any welding operation should always be defined by the **lower of the two welding currents**  $i_1$  and  $i_2$  thus determined (17 kA in this example).

Notes:

## 8 Type overview

### **PSG 3025.00 A**

- Medium-frequency welding transformer, 12 kVA
- Welding current range: 0.25 to 6 kA
- Integrated temperature monitoring

### **PSG 3050.00 A**

- Medium-frequency welding transformer, 56 kVA
- Welding current range: 3 to 20 kA
- Integrated current sensor and temperature monitoring

### **PSG 3050.10 A**

- Medium-frequency welding transformer, 56 kVA
- Welding current range: 3 to 20 kA
- Integrated current sensor and temperature monitoring
- Higher diode rating than PSG 3050.00 A

### **PSG 3050.10 S**

- Medium-frequency welding transformer, 56 kVA
- Welding current range: 3 to 20 kA
- Integrated current sensor and temperature monitoring
- Connection for secondary voltage monitoring
- Higher diode rating than PSG 3050.00 A

### **PSG 3075.10 A**

- Medium-frequency welding transformer, 75 kVA
- Welding current range: 3 to 20 kA
- Integrated current sensor and temperature monitoring
- Higher diode rating than PSG 3075.00 A

### **PSG 3075.10 P**

- Medium-frequency welding transformer, 75 kVA
- Welding current range: 3 to 20 kA
- Integrated temperature monitoring
- For primary current regulation, without current sensor
- Higher diode rating than PSG 3075.00 A

**PSG 3100.00 A**

- Medium-frequency welding transformer, 100 kVA
- Welding current range: 3 to 36 kA
- Integrated current sensor and temperature monitoring

**PSG 3100.00 P**

- Medium-frequency welding transformer, 100 kVA
- Welding current range: 3 to 36 kA
- Integrated temperature monitoring
- For primary current regulation, without current sensor

**PSG 3100.00 S**

- Medium-frequency welding transformer, 100 kVA
- Welding current range: 3 to 36 kA
- Integrated temperature monitoring
- Integrated current sensor and temperature monitoring
- Connection for secondary voltage monitoring

**PSG 3100.00 C**

- Medium-frequency welding transformer, 100 kVA
- Welding current range: 3 to 36 kA
- Integrated current sensor and temperature monitoring
- For multi-contact connector MC 135

**PSG 3200.00 A**

- Medium-frequency welding transformer, 200 kVA
- Welding current range: 6 to 40 kA
- Integrated current sensor and temperature monitoring

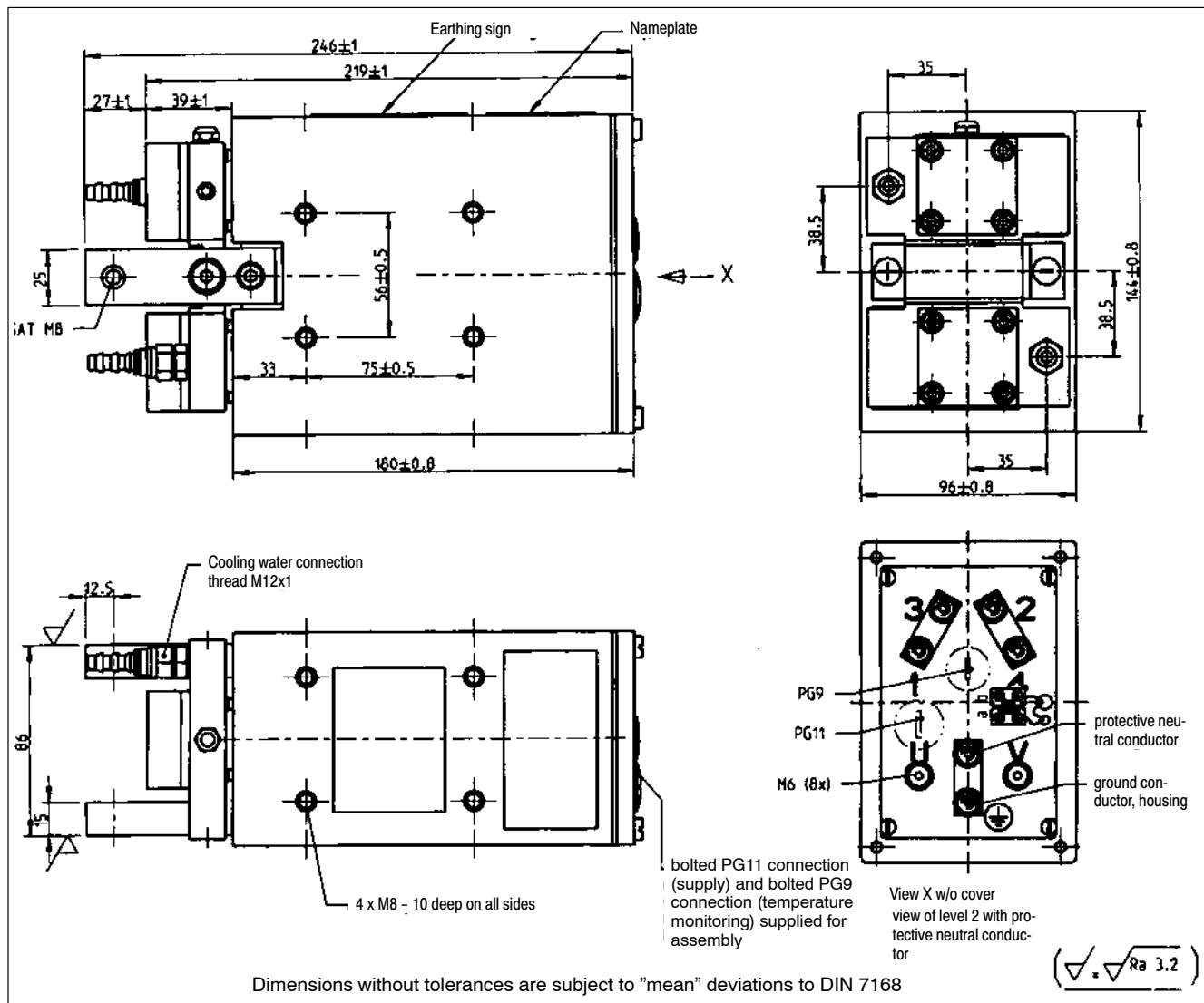
## 9 PSG 3025.00 A

### 9.1 Technical data, PSG 3025.00 A

Medium-frequency transformer-rectifier unit $S_N$	12 kVA; at X = 50%
Primary voltage $U_{1N}$	500 V
Max. primary continuous current $I_{1P}$	14 A
Secondary current range $I_{2N}$	0.25 to 6 kA
Rated direct current $I_d$	1.4 kA 50% duty cycle (ED); level 1
Continuous direct current $I_d$	1.0 kA 100% duty cycle (ED); level 1
Cable cross-section $U_2/V_2 \rightarrow U/V$	$\geq 4\text{mm}^2$
Frequency f	1000 Hz
Transformer ratio $\ddot{U}$	144 : 1; level 1 72 : 1; level 2
No-load direct voltage $U_{dIO}$	2.8 V; level 1 6.2 V; level 2
Continuous d.c. forward current rating $P_{dIO}$	6.2 kW 100% duty cycle (ED); level 1
Max. direct current $I_{d \max.}$	cf. load diagram
Transformer degree of protection	IP65
Primary connection zone degree of protection	IP54
Welding transformer insulation class	F
Weight	9.3 kg
Color	RAL 5015; blue
Cooling water volume	min. 1 l / min
Cooling water temperature	max. 30° C
Cooling water pressure drop	max. 0.6 bar
Primary circuit monitoring	max. 140° C
Rectifier block monitoring	max. 80° C



## 9.2 Dimensioned drawing, PSG 3025.00 A



Dimensioned drawing, PSG 3025.00 A

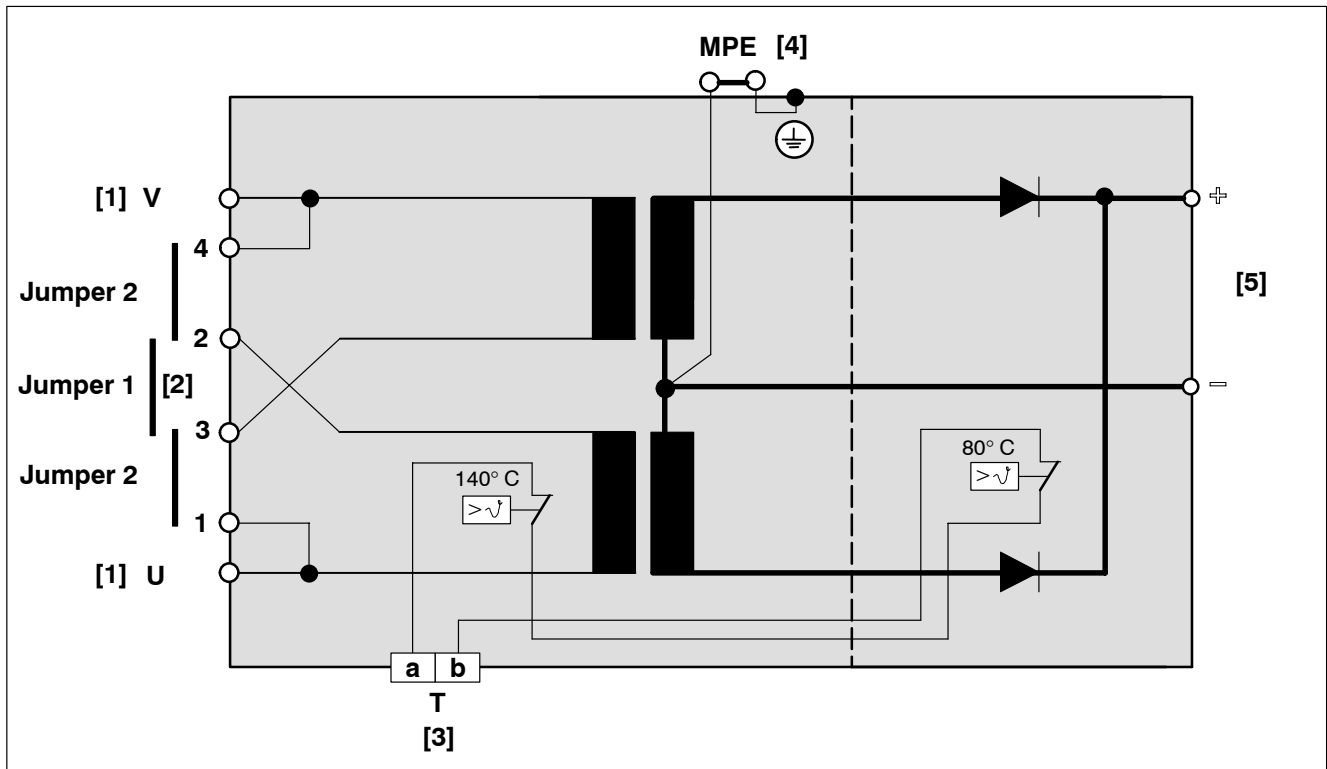
## 9.3 Cooling water connection, PSG 3025.00 A

Maximum supply water temperature:  $30^{\circ}\text{C}$

WE = water inlet, WA = water outlet

Water connection: hose with 6.3 mm internal diameter,  
Type: Parker Push-lock 831-4 WP2.4

## 9.4 Block diagram, PSG 3025.00 A



Block diagram, PSG 3025.00 A

### [1] Primary side:

- U welding transformer → U2 medium-frequency inverter
- V welding transformer → V2 medium-frequency inverter

### [2] Jumpers on primary side:

- Optional connection, jumper 1:  
Primary winding connected in parallel,  
2.8 V no-load output voltage
- Optional connection, jumper 2  
Primary winding connected in series  
6.2 V no-load output voltage

### [3] Primary winding and rectifier block temperature monitoring T:

Connecting cable 2 x 2 x 0,75 mm<sup>2</sup>, screened LiYCY.

### [4] MPE neutral earth conductor:



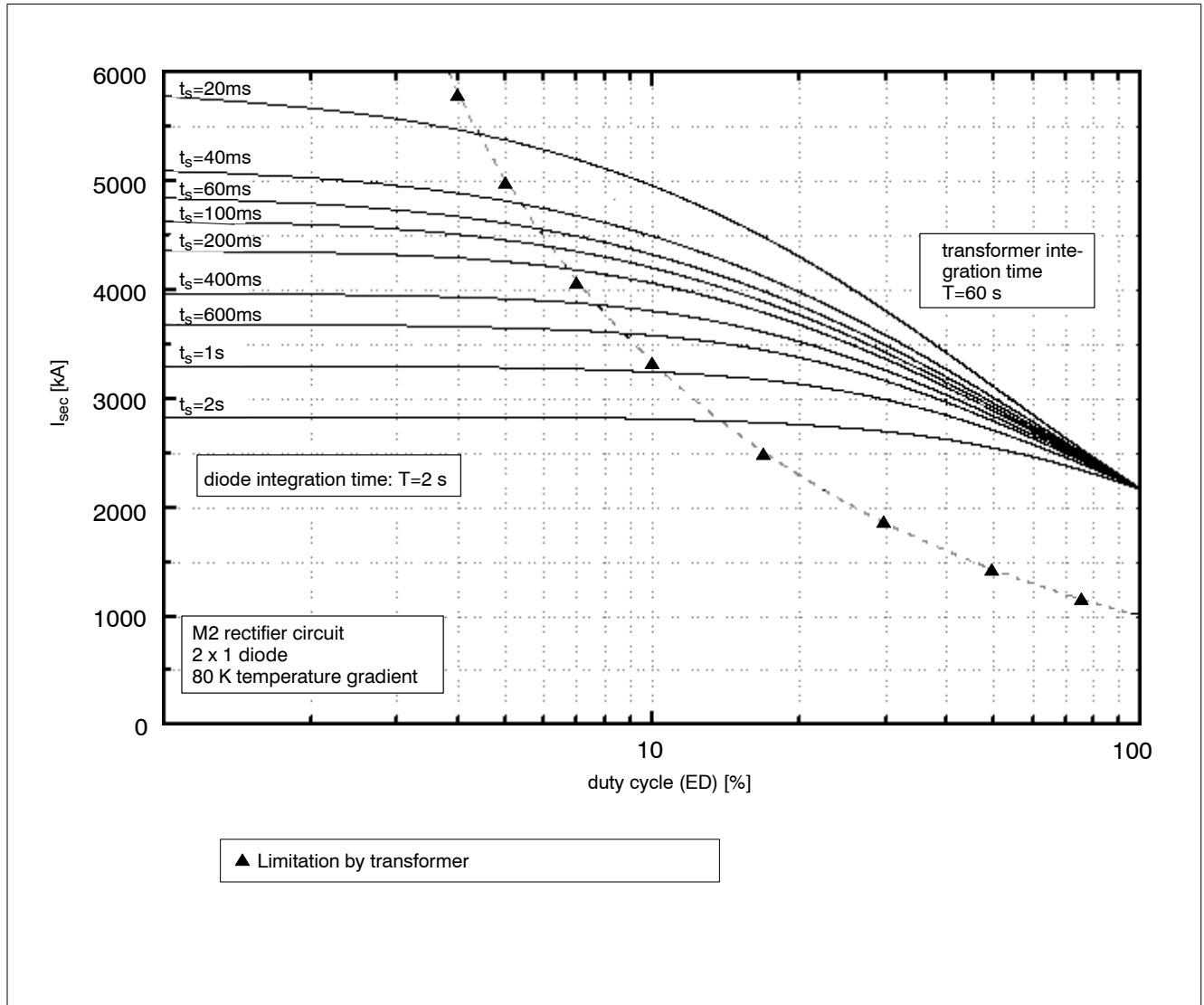
### DANGEROUS ELECTRICAL VOLTAGE

If the MPE protective conductor jumper is to be removed, another protective measure to EN 50063 must be installed.

In this case, the ground connection between the transformer neutral and the earthing bolt must be crossed out in an indelible manner.

### [5] Secondary side, connection of electrodes

9.5 Load diagram, PSG 3025.00 A



Load diagram, PSG 3025.00 A

## 9.6 Ordering, PSG 3025.00 A

Designation	Part no.
PSG 3025.00 A welding transformer	1070 079 345

Notes:

# 10 PSG 3050.00 A/PSG 3050.10 A/PSG 3050.10 S

## 10.1 Technical data, PSG 3050.00 A

- with current transformer in secondary circuit

Medium-frequency transformer-rectifier unit $S_N$	56 kVA; at X = 50%
Primary voltage $U_{1N}$	500 V
Max. primary continuous current $I_{1P}$	60 A
Secondary current range $I_{2N}$	3.0 to 20 kA
Continuous direct current $I_d$	4.2 kA 100% duty cycle (ED)
Cable cross-section $U_2/V_2 \rightarrow U/V$	$\geq 16\text{mm}^2$
Frequency f	1000 Hz
Transformer ratio $\ddot{U}$	70 : 1
No-load direct voltage $U_{dIO}$	6.3 V
Continuous d.c. forward current rating $P_{dIO}$	26.2 kW 100% duty cycle (ED)
Max. rated surge forward current $I_{FSM}$	50 kA; (10 ms; $T_{vj\text{ max.}} 180^\circ\text{C}$ )
Max. direct current $I_{d\text{ max.}}$	cf. load diagram
Transformer degree of protection	IP65
Primary connection zone degree of protection	IP00
Welding transformer insulation class	F
Weight	14.5 kg
Color	RAL 5015; blue
Cooling water volume	min. 6 l / min
Cooling water temperature	max. 30° C
Cooling water pressure drop	max. 0.6 bar
Primary circuit monitoring	max. 150° C
Rectifier block monitoring	max. 80° C

## 10.2 Technical data, PSG 3050.10 A

- **with** current transformer in secondary circuit
- **with** higher diode rating

Medium-frequency transformer-rectifier unit $S_N$	56 kVA; at X = 50%
Primary voltage $U_{1N}$	500 V
Max. primary continuous current $I_{1P}$	60 A
Secondary current range $I_{2N}$	3.0 to 20 kA
Continuous direct current $I_d$	4.2 kA 100% duty cycle (ED)
Cable cross-section $U_2/V_2 \rightarrow U/V$	$\geq 16\text{mm}^2$
Frequency f	1000 Hz
Transformer ratio $\ddot{U}$	70 : 1
No-load direct voltage $U_{diO}$	6.3 V
Continuous d.c. forward current rating $P_{diO}$	26.2 kW 100% duty cycle (ED)
Max. rated surge forward current $I_{FSM}$	50 kA; (10 ms; $T_{vj \text{ max. } 180^\circ \text{ C}}$ )
Max. direct current $I_{d \text{ max.}}$	cf. load diagram
Transformer degree of protection	IP65
Primary connection zone degree of protection	IP00
Welding transformer insulation class	F
Weight	14.5 kg
Color	RAL 5015; blue
Cooling water volume	min. 6 l / min
Cooling water temperature	max. 30° C
Cooling water pressure drop	max. 0.6 bar
Primary circuit monitoring	max. 150° C
Rectifier block monitoring	max. 80° C

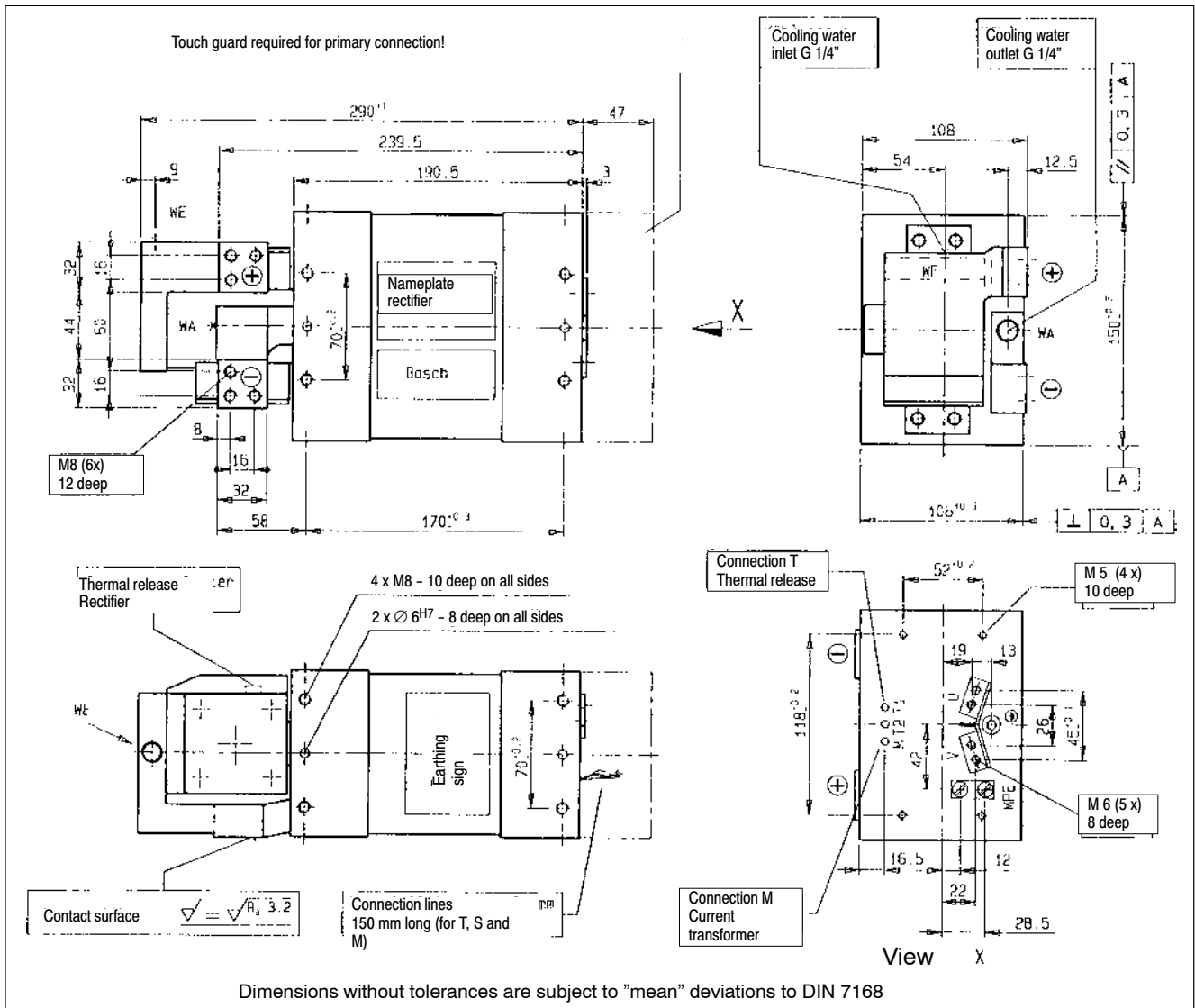
### 10.3 Technical data, PSG 3050.10 S

- **with** current transformer in secondary circuit
- **with** higher diode rating
- **with** connection for secondary voltage monitoring

Medium-frequency transformer-rectifier unit $S_N$	56 kVA; at X = 50%
Primary voltage $U_{1N}$	500 V
Max. primary continuous current $I_{1P}$	60 A
Secondary current range $I_{2N}$	3.0 to 20 kA
Continuous direct current $I_d$	4.2 kA 100% duty cycle (ED)
Cable cross-section $U_2/V_2 \rightarrow U/V$	$\geq 16\text{mm}^2$
Frequency f	1000 Hz
Transformer ratio $\ddot{U}$	70 : 1
No-load direct voltage $U_{diO}$	6.3 V
Continuous d.c. forward current rating $P_{diO}$	26.2 kW 100% duty cycle (ED)
Max. rated surge forward current $I_{FSM}$	50 kA; (10 ms; $T_{vj\text{max.}} 180^\circ\text{C}$ )
Max. direct current $I_{d\text{max.}}$	cf. load diagram
Transformer degree of protection	IP65
Primary connection zone degree of protection	IP54
Secondary connection zone degree of protection	IP00
Welding transformer insulation class	F
Weight	14.5 kg
Color	RAL 5015; blue
Cooling water volume	min. 6 l / min
Cooling water temperature	max. 30° C
Cooling water pressure drop	max. 0.6 bar
Primary circuit monitoring	max. 150° C
Rectifier block monitoring	max. 80° C



**10.4 Dimensioned drawing, PSG 3050.00 A and PSG 3050.10 A**

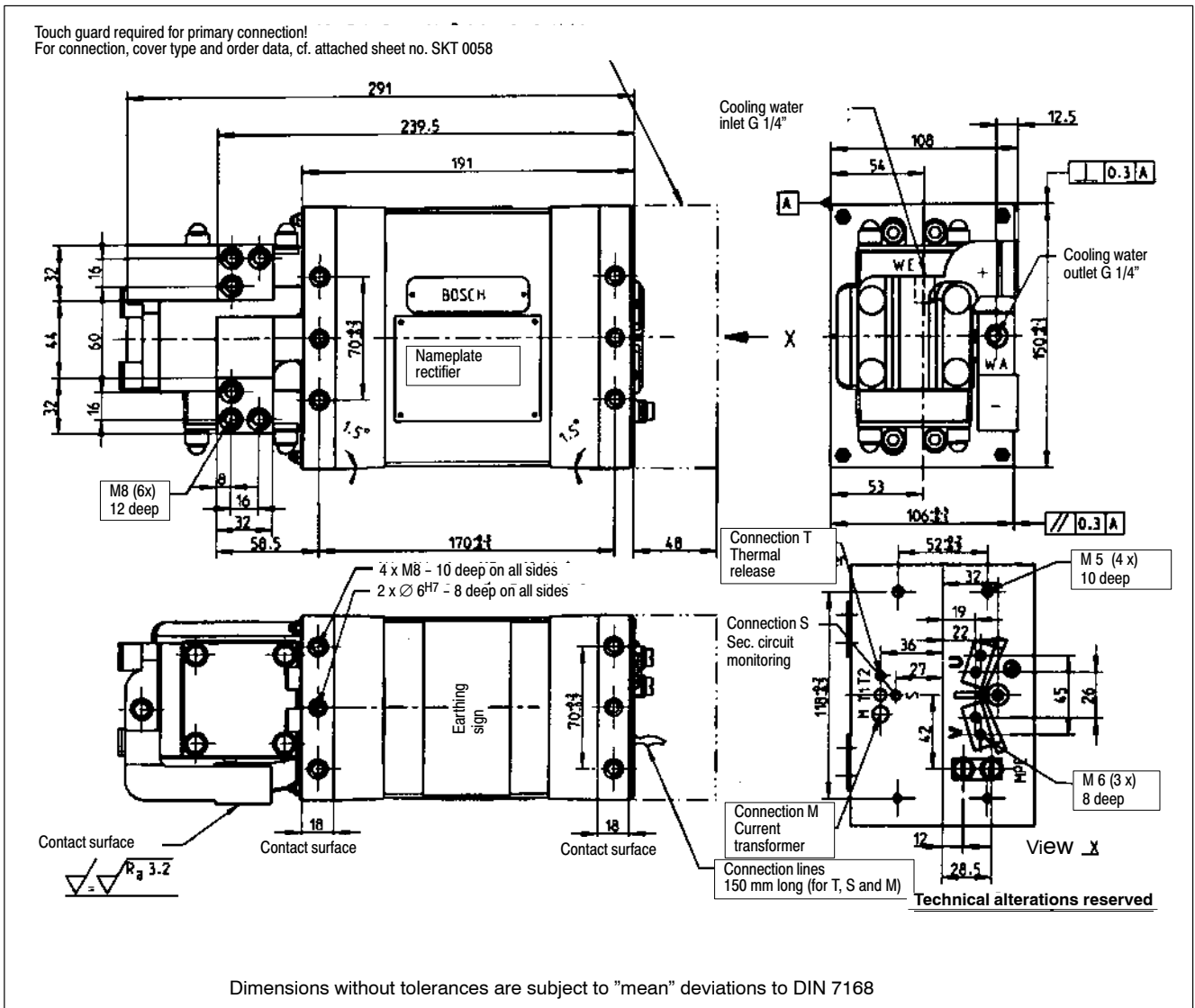


Dimensioned drawing, PSG 3050.00 A and PSG 3050.10 A

**Note:** Connecting pins for primary side supplied loosely.

Designation	
4 straight pins ISO 8735 Ø 06 x 12	supplied loosely
3 contact pins MC135 Ø 06	supplied loosely

**10.5 Dimensioned drawing, PSG 3050.10 S**



Dimensioned drawing, PSG 3050.10 S

**Note:** Connecting pins for primary side supplied loosely.

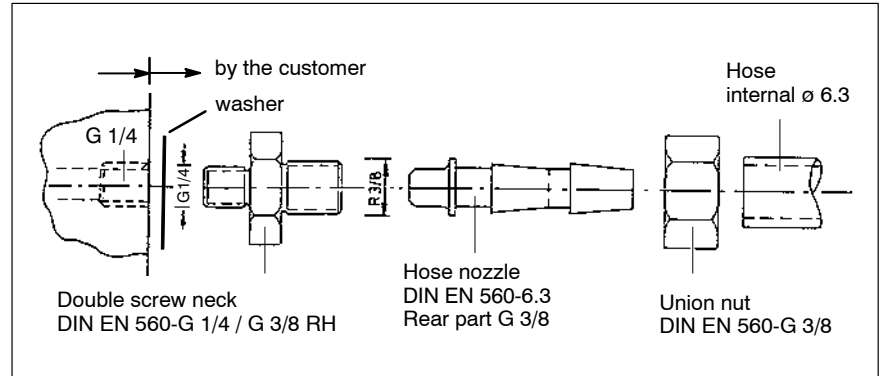
Designation	
4 straight pins ISO 8735 Ø 06 x 12	supplied loosely
3 contact pins MC135 Ø 06	supplied loosely

## 10.6 Cooling water connection, PSG 3050.XX X

Maximum supply water temperature: 30° C

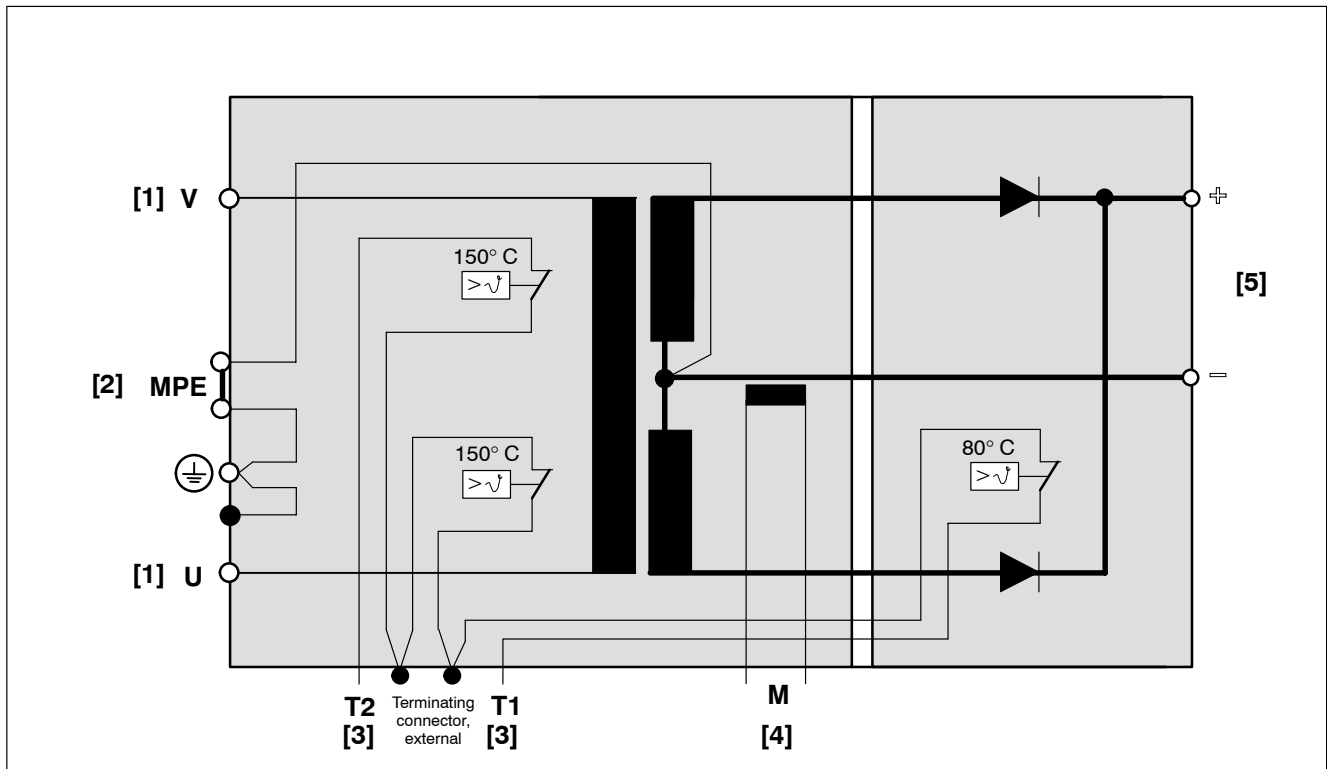
WE = water inlet, WA = water outlet

Water connection: internal thread G 1/4" (for example, see sketch)



Cooling water connection, PSG 3050.00 A/PSG 3050.10 A/PSG 3050.10 S

## 10.7 Block diagram, PSG 3050.00 A and PSG 3050.10 A



Block diagram, PSG 3050.00 A and PSG 3050.10 A

### [1] Primary side:

- U welding transformer → U2 medium-frequency inverter
- V welding transformer → V2 medium-frequency inverter

### [2] MPE neutral earth conductor:



### DANGEROUS ELECTRICAL VOLTAGE

If the MPE protective conductor jumper is to be removed, another protective measure to EN 50063 must be installed.

In this case, the ground connection between the transformer neutral and the earthing bolt must be crossed out in an indelible manner.

### [3] Primary winding and rectifier block temperature monitoring T1/T2:

Connecting cable 2 x 2 x 0,75 mm<sup>2</sup>, screened LiYCY.

- T1; thermal release, rectifier block 80° C
- T2; thermal release, welding transformer primary side 150° C

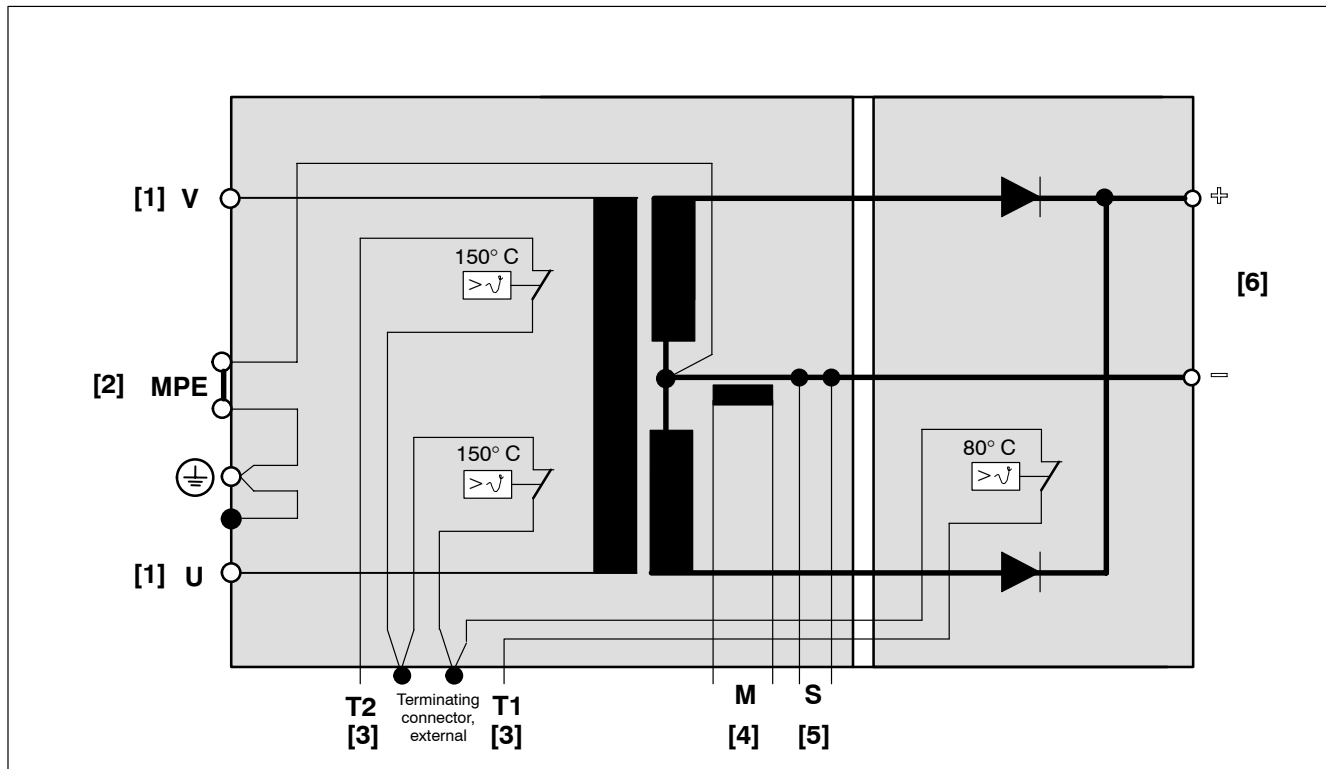
### [4] Connection M - current transformer, secondary side:

Connecting cable 2 x 2 x 0,75 mm<sup>2</sup>, screened LiYCY.

- white; brown
- measuring voltage  $U_m = 150 \text{ mV/kA} \pm 2.5 \%$  at ohmic resistance of 1k $\Omega$

### [5] Secondary side, connection of electrodes

## 10.8 Block diagram, PSG 3050.10 S



Block diagram, PSG 3050.10 S

**[1] Primary side:**

- U welding transformer → U2 medium-frequency inverter
- V welding transformer → V2 medium-frequency inverter

**[2] MPE neutral earth conductor:****DANGEROUS ELECTRICAL VOLTAGE**

If the MPE protective conductor jumper is to be removed, another protective measure to EN 50063 must be installed.

In this case, the ground connection between the transformer neutral and the earthing bolt must be crossed out in an indelible manner.

**[3] Primary winding and rectifier block temperature monitoring T1/T2:**

Connecting cable 2 x 2 x 0,75 mm<sup>2</sup>, screened LiYCY.

- T1; thermal release, rectifier block 80° C
- T2; thermal release, welding transformer primary side 150° C

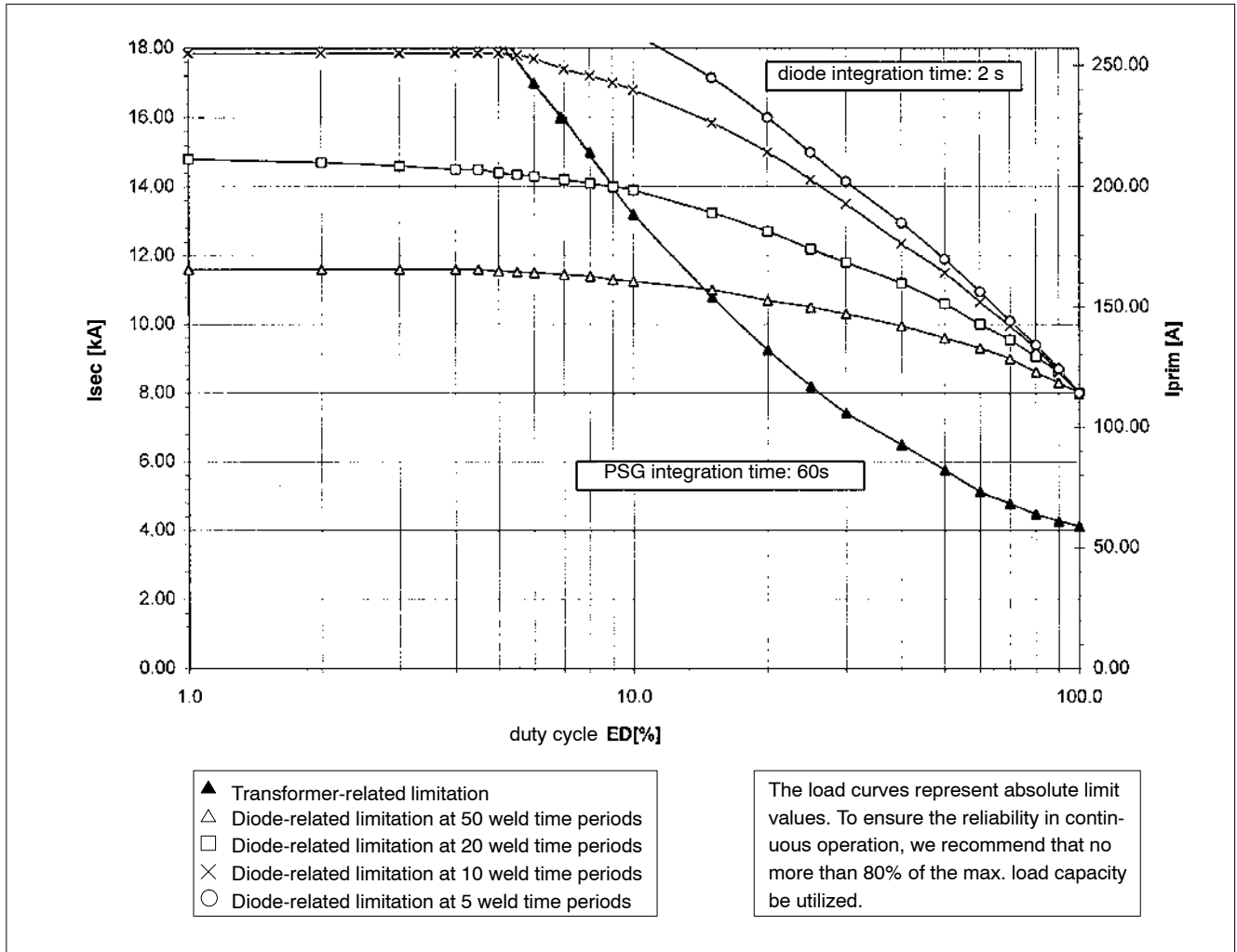
**[4] Connection M - current transformer, secondary side:**

Connecting cable 2 x 2 x 0,75 mm<sup>2</sup>, screened LiYCY.

- white; brown
- measuring voltage  $U_m = 150 \text{ mV/kA} \pm 2.5 \%$  at ohmic resistance of 1k $\Omega$

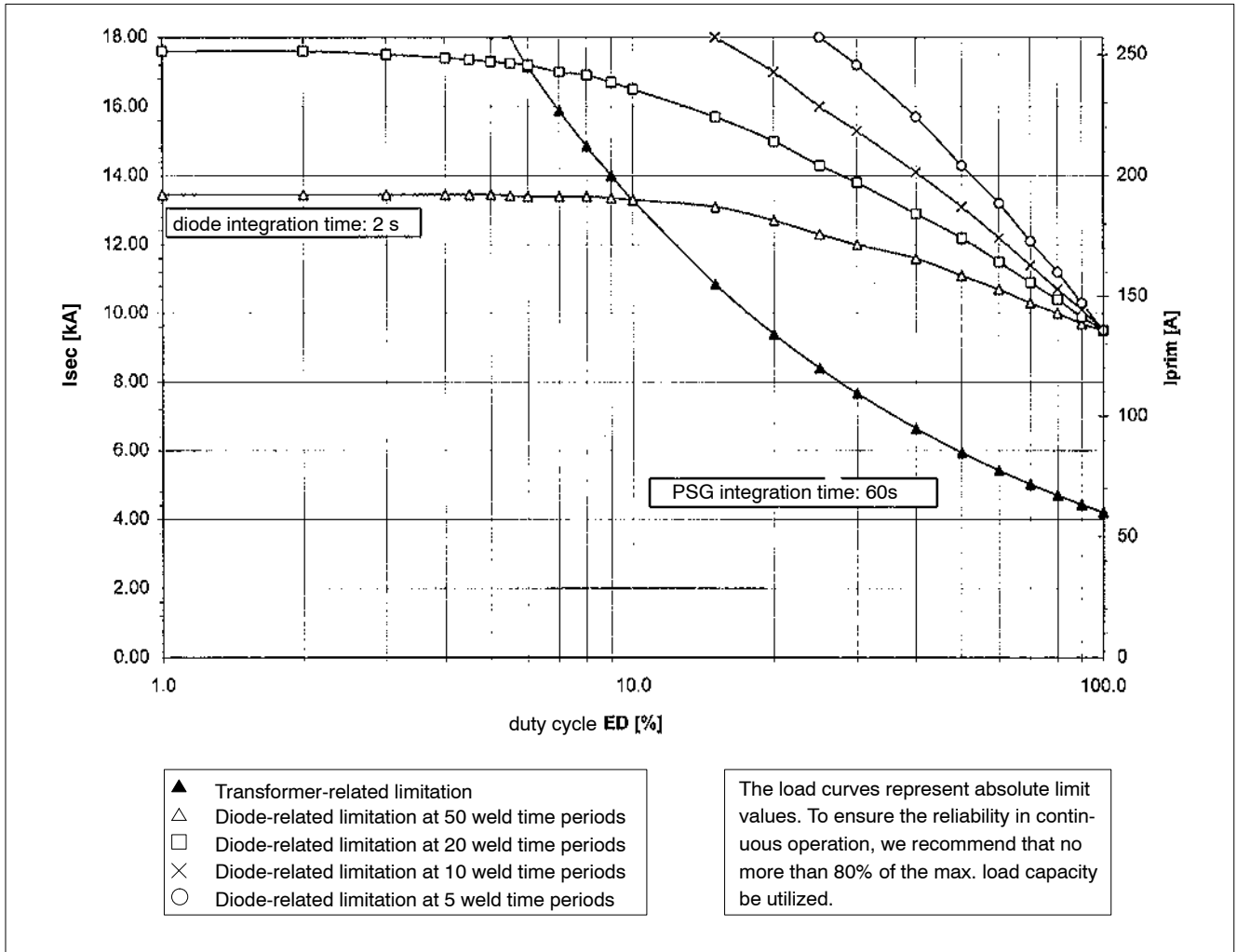
**[5] Connection S - connection of secondary voltage monitoring****[6] Secondary side, connection of electrodes**

10.9 Load diagram, PSG 3050.00 A



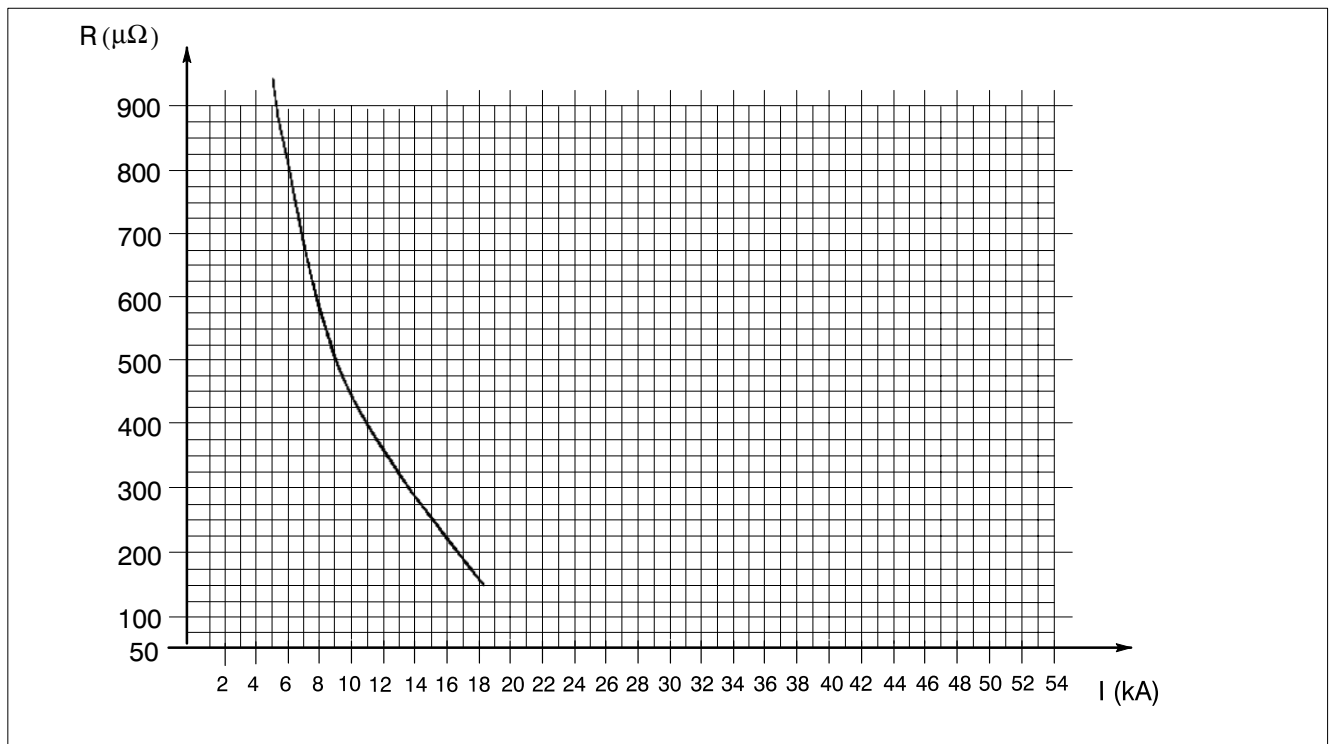
Load diagram, PSG 3050.00 A

10.10 Load diagram, PSG 3050.10 A/PSG 3050.10 S



Load diagram, PSG 3050.10 A/PSG 3050.10 S

**10.11 Current resistance characteristic, PSG 3050.XX X**



*Current resistance characteristic, PSG 3050.XX X*



**10.12 Ordering, PSG 3050.00 A**

<b>Designation</b>	<b>Part no.</b>
PSG 3050.00 A welding transformer with current sensor in secondary circuit	1070 063 560

**10.13 Ordering, PSG 3050.10 A**

<b>Designation</b>	<b>Part no.</b>
PSG 3050.10 A welding transformer with current sensor in secondary circuit with higher diode rating	1070 073 063

**10.14 Ordering, PSG PSG 3050.10 S**

<b>Designation</b>	<b>Part no.</b>
PSG 3050.10 S welding transformer with current sensor in secondary circuit with higher diode rating with connection for secondary voltage monitoring	1070 084 152

# 11 PSG 3075.10 A/PSG 3075.10 P

## 11.1 Technical data, PSG 3075.10 A

- **with** current transformer in secondary circuit
- **with** higher diode rating

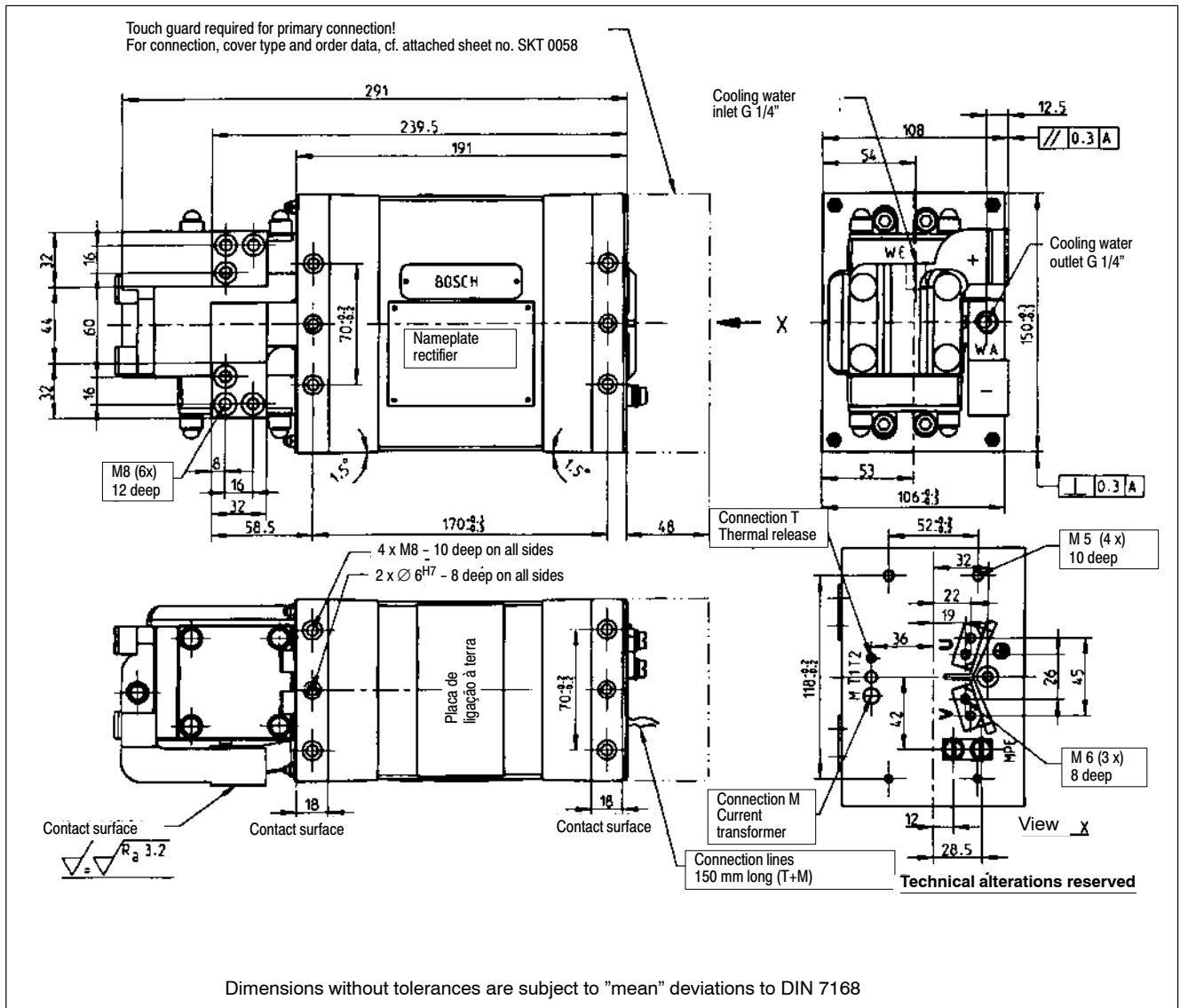
Medium-frequency transformer-rectifier unit $S_N$	75 kVA; at X = 50%
Primary voltage $U_{1N}$	500 V
Max. primary continuous current $I_{1P}$	76 A
Secondary current range $I_{2N}$	3.0 to 20 kA
Continuous direct current $I_d$	4.2 kA 100% duty cycle (ED)
Cable cross-section $U_2/V_2 \rightarrow U/V$	$\geq 16\text{mm}^2$
Frequency $f$	1000 Hz
Transformer ratio $\ddot{U}$	55 : 1
No-load direct voltage $U_{dIO}$	8.4 V
Continuous d.c. forward current rating $P_{dIO}$	35.0 kW 100% duty cycle (ED)
Max. rated surge forward current $I_{FSM}$	50 kA; (10 ms; $T_{vj \text{ max. } 180^\circ \text{ C}}$ )
Max. direct current $I_{d \text{ max.}}$	cf. load diagram
Transformer degree of protection	IP65
Primary connection zone degree of protection	IP54
Welding transformer insulation class	F
Weight	14.5 kg
Color	RAL 7005; grey
Cooling water volume	min. 6 l / min
Cooling water temperature	max. 30° C
Cooling water pressure drop	max. 0.6 bar
Primary circuit monitoring	max. 150° C
Rectifier block monitoring	max. 80° C

## 11.2 Technical data, PSG 3075.10 P

- **without** current transformer in secondary circuit
- **with** higher diode rating
- **with** MC 135 plug receptacle

Medium-frequency transformer-rectifier unit $S_N$	75 kVA; at $X = 50\%$
Primary voltage $U_{1N}$	500 V
Max. primary continuous current $I_{1P}$	76 A
Secondary current range $I_{2N}$	3.0 to 20 kA
Continuous direct current $I_d$	4.2 kA 100% duty cycle (ED)
Cable cross-section $U_2/V_2 \rightarrow U/V$	$\geq 16\text{mm}^2$
Frequency $f$	1000 Hz
Transformer ratio $\ddot{U}$	55 : 1
No-load direct voltage $U_{diO}$	8.4 V
Continuous d.c. forward current rating $P_{diO}$	35.0 kW 100% duty cycle (ED)
Max. rated surge forward current $I_{FSM}$	50 kA; (10 ms; $T_{vj \text{ max. } 180^\circ \text{ C}}$ )
Max. direct current $I_{d \text{ max.}}$	cf. load diagram
Transformer degree of protection	IP65
Primary connection zone degree of protection	IP54
Secondary connection zone degree of protection	IP00
Welding transformer insulation class	F
Weight	14.5 kg
Color	RAL 7005; grey
Cooling water volume	min. 6 l / min
Cooling water temperature	max. 30° C
Cooling water pressure drop	max. 0.6 bar
Primary circuit monitoring	max. 150° C
Rectifier block monitoring	max. 80° C

11.3 Dimensioned drawing, PSG 3075.10 A

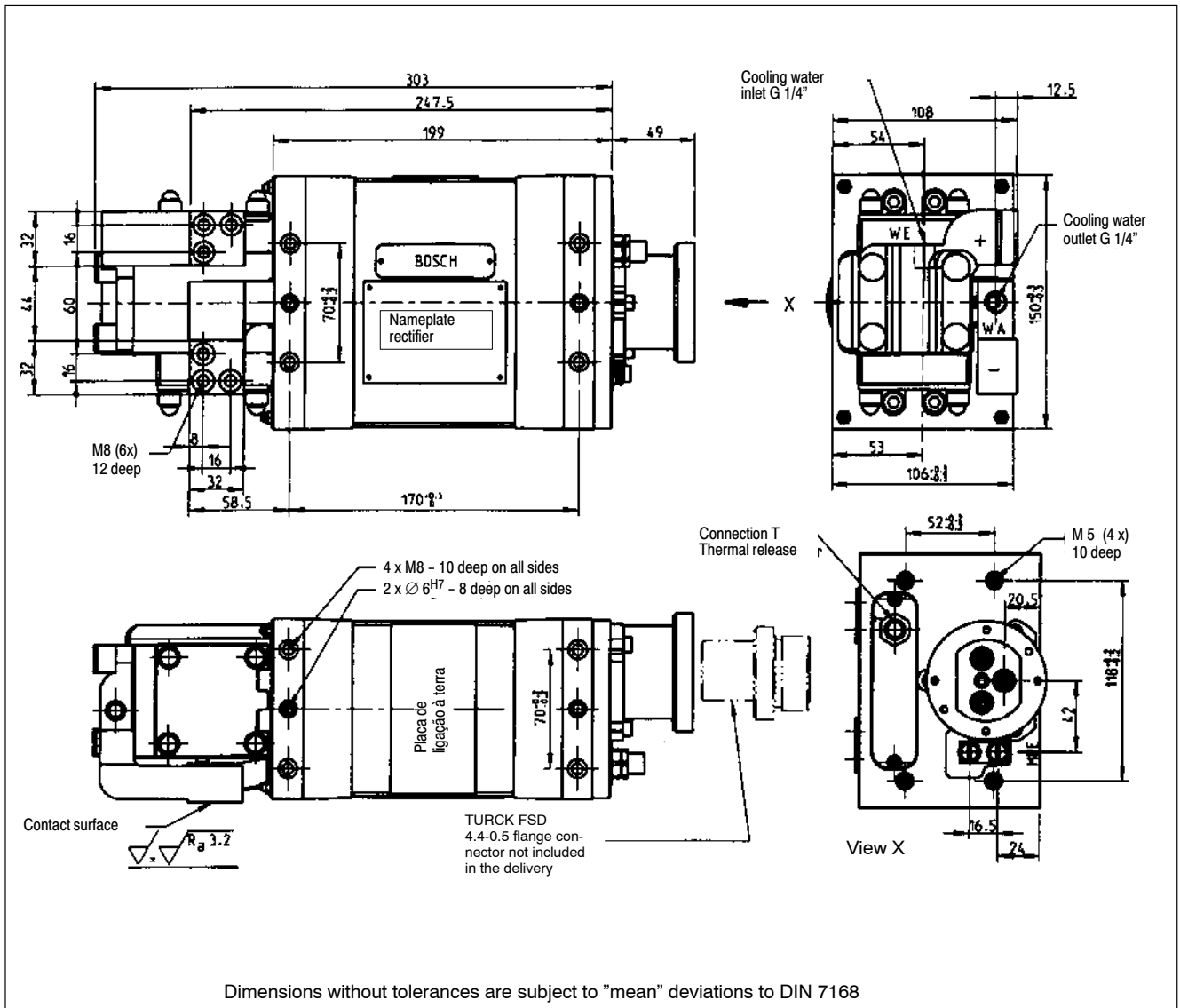


Dimensioned drawing, PSG 3075.10 A

**Note:** Connecting pins for primary side supplied loosely.

Designation	
4 straight pins ISO 8735 Ø 06 x 12	supplied loosely
3 contact pins MC135 Ø 06	supplied loosely

11.4 Dimensioned drawing, PSG 3075.10 P



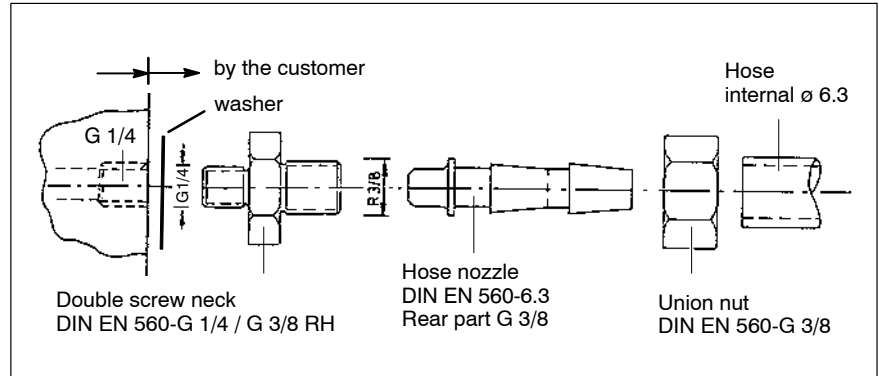
Dimensioned drawing, PSG 3075.10 P

## 11.5 Cooling water connection, PSG 3075.10 A/PSG 3075.10 P

Maximum supply water temperature: 30° C

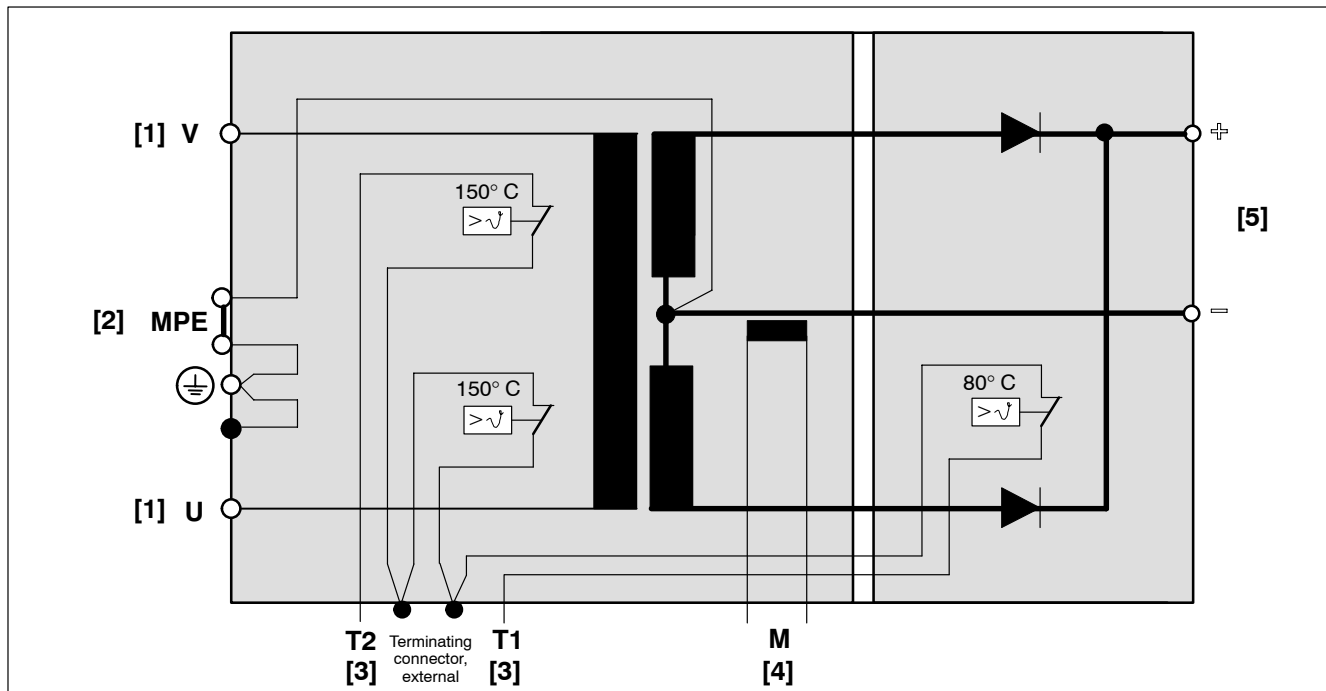
WE = water inlet, WA = water outlet

Water connection: internal thread G 1/4" (for example, see sketch)



*Cooling water connection, PSG 3075.10 A/PSG 3075.10 P*

## 11.6 Block diagram, PSG 3075.10 A



Block diagram, PSG 3075.10 A

**[1] Primary side:**

- U welding transformer → U2 medium-frequency inverter
- V welding transformer → V2 medium-frequency inverter

**[2] MPE neutral earth conductor:****DANGEROUS ELECTRICAL VOLTAGE**

If the MPE protective conductor jumper is to be removed, another protective measure to EN 50063 must be installed.

In this case, the ground connection between the transformer neutral and the earthing bolt must be crossed out in an indelible manner.

**[3] Primary winding and rectifier block temperature monitoring T1/T2:**

Connecting cable 2 x 2 x 0,75 mm<sup>2</sup>, screened LiYCY.

- T1; thermal release, rectifier block 80° C
- T2; thermal release, welding transformer primary side 150° C

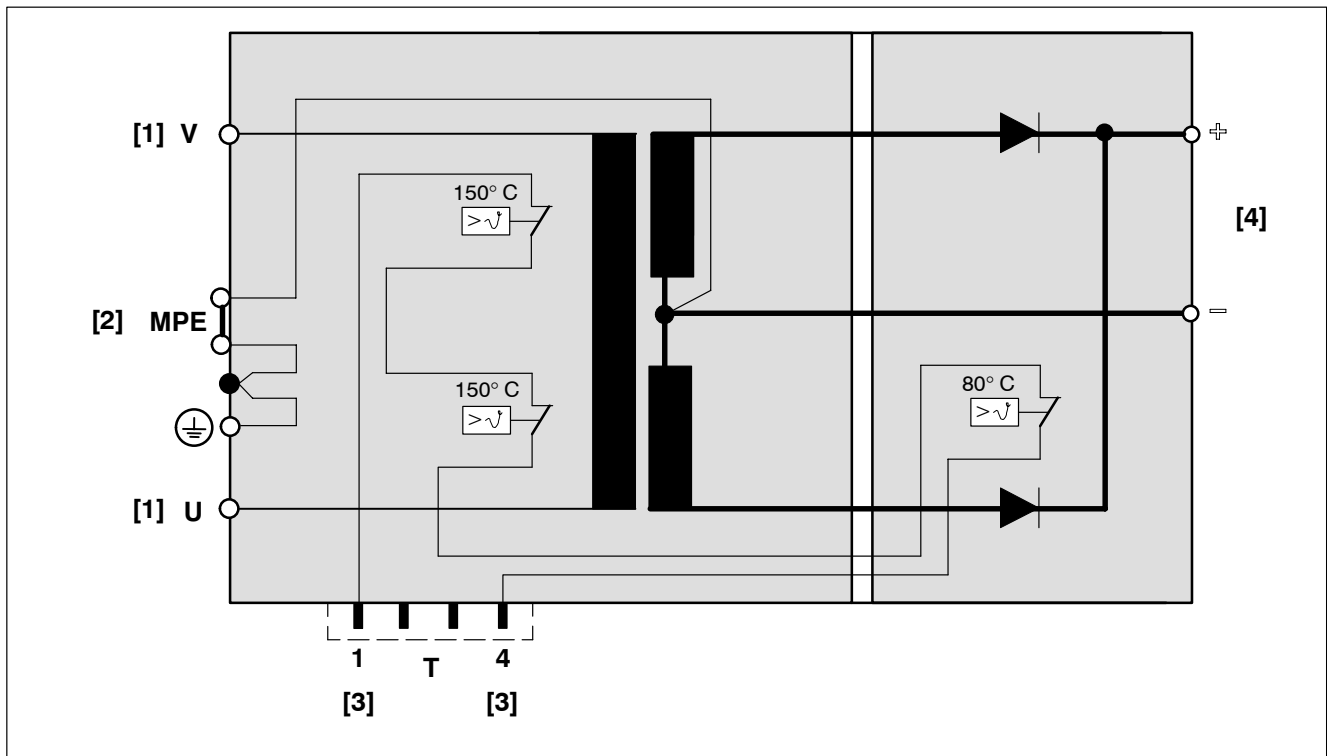
**[4] Connection M - current transformer, secondary side:**

Connecting cable 2 x 2 x 0,75 mm<sup>2</sup>, screened LiYCY.

- white; brown
- measuring voltage  $U_m = 150 \text{ mV/kA} \pm 2.5 \%$  at ohmic resistance of 1k $\Omega$

**[5] Secondary side, connection of electrodes**

## 11.7 Block diagram, PSG 3075.10 P



Block diagram, PSG 3075.10 P

**[1] Primary side:**

- U welding transformer → U2 medium-frequency inverter
- V welding transformer → V2 medium-frequency inverter

**[2] MPE neutral earth conductor:****DANGEROUS ELECTRICAL VOLTAGE**

If the MPE protective conductor jumper is to be removed, another protective measure to EN 50063 must be installed.

In this case, the ground connection between the transformer neutral and the earthing bolt must be crossed out in an indelible manner.

**[3] Primary winding and rectifier block temperature monitoring T1/T4 (Turck FSD 4.4-0.5):**

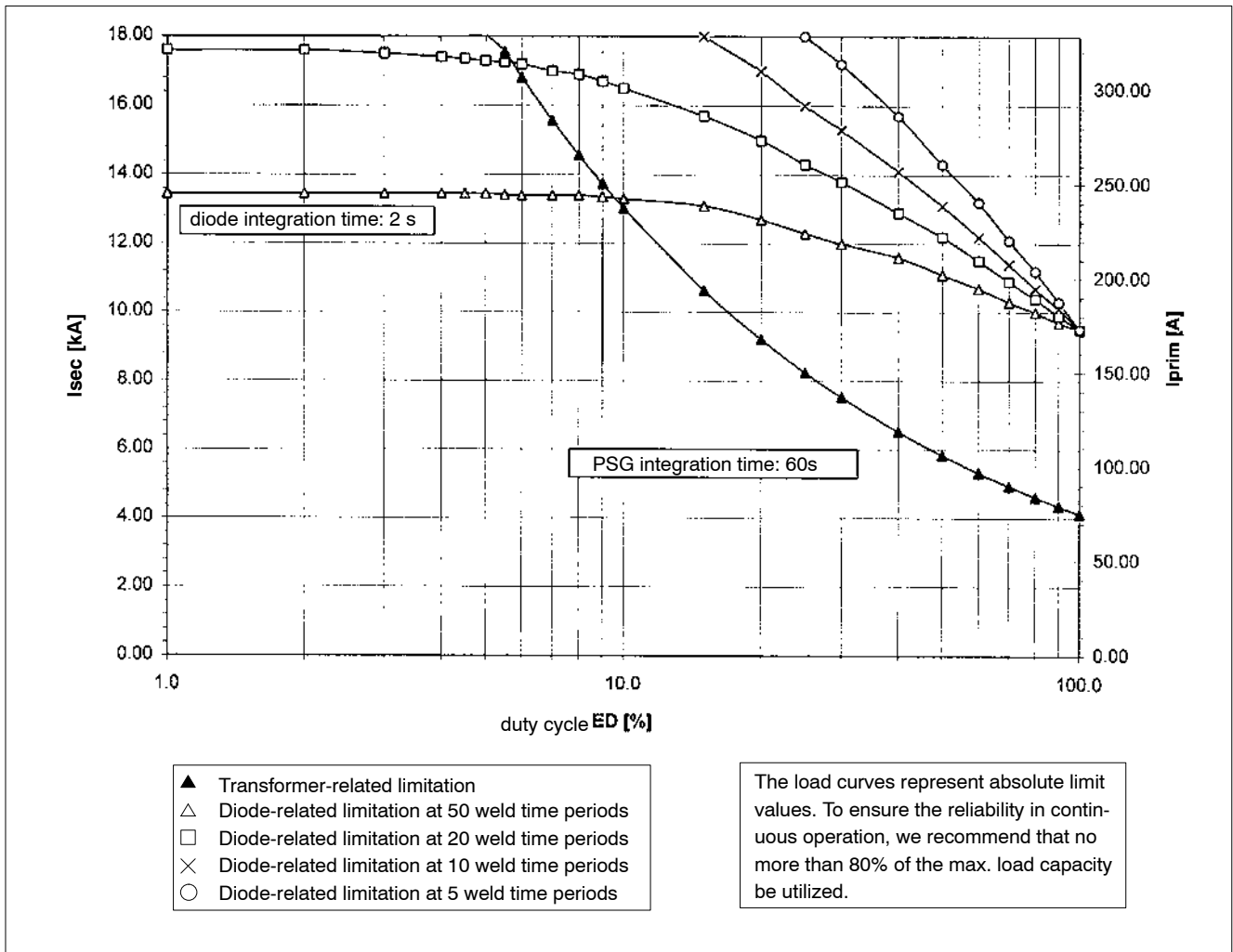
Connecting cable 2 x 2 x 0,75 mm<sup>2</sup>, screened LiYCY.

- T1; thermal release, rectifier block 80° C
- T4; thermal release, welding transformer primary side 150° C

**[4] Secondary side, connection of electrodes**

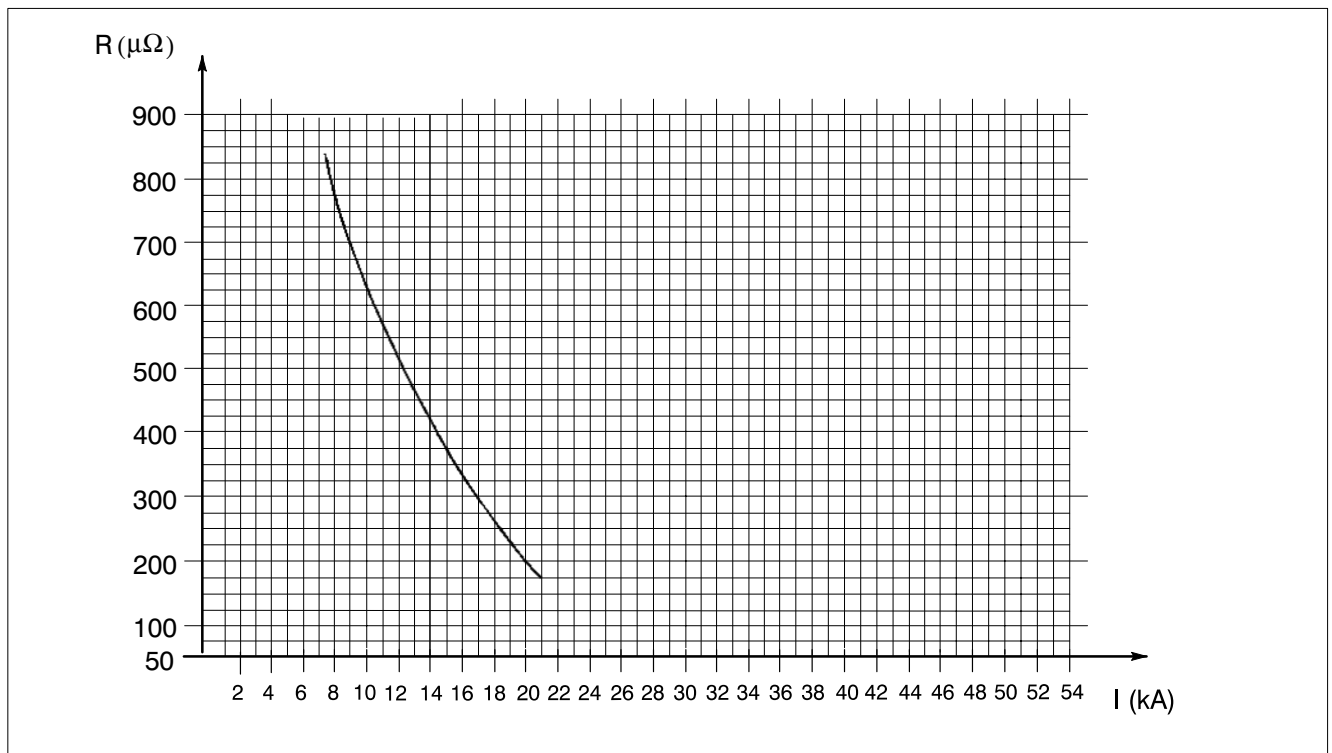


11.8 Load diagram, PSG 3075.10 A/PSG 3075.10 P



Load diagram, PSG 3075.10 A/PSG 3075.10 P

**11.9 Current resistance characteristic, PSG 3075.10 X**



*Current resistance characteristic, PSG 3075.10 X*

**11.10 Ordering, PSG 3075.10 A**

<b>Designation</b>	<b>Part no.</b>
PSG 3075.10 A welding transformer with current sensor in secondary circuit with higher diode rating	1070 079 152

**11.11 Ordering, PSG 3075.10 P**

<b>Designation</b>	<b>Part no.</b>
PSG 3075.10 P welding transformer without current sensor in secondary circuit with higher diode rating with MC 135 plug receptacle	1070 079 346

## 12 PSG 3100.00 X

### 12.1 Technical data, PSG 3100.00 A

- **with** current transformer in secondary circuit

Medium-frequency transformer-rectifier unit $S_N$	100 kVA; at X = 50%
Primary voltage $U_{1N}$	500 V
Max. primary continuous current $I_{1P}$	116 A
Secondary current range $I_{2N}$	3 to 36 kA
Continuous direct current $I_d$	5.8 kA 100% duty cycle (ED)
Cable cross-section $U_2/V_2 \rightarrow U/V$	$\geq 35\text{mm}^2$
Frequency f	1000 Hz
Transformer ratio $\ddot{U}$	50 : 1
No-load direct voltage $U_{dIO}$	9.3 V
Continuous d.c. forward current rating $P_{dIO}$	53.9 kW 100% duty cycle (ED)
Max. rated surge forward current $I_{FSM}$	120 kA; (10 ms; $T_{vj \text{ max. } 180^\circ \text{ C}}$ )
Max. direct current $I_{d \text{ max.}}$	cf. load diagram
Transformer degree of protection	IP65
Primary connection zone degree of protection	IP00
Welding transformer insulation class	F
Weight	24.4 kg
Color	RAL 1004; yellow
Cooling water volume	min. 10 l / min
Cooling water temperature	max. 30° C
Cooling water pressure drop	max. 2.5 bar
Primary circuit monitoring	max. 150° C
Rectifier block monitoring	max. 80° C

## 12.2 Technical data, PSG 3100.00 P

- **without** current transformer in secondary circuit
- **with** MC 135 plug receptacle

Medium-frequency transformer-rectifier unit $S_N$	100 kVA; at X = 50%
Primary voltage $U_{1N}$	500 V
Max. primary continuous current $I_{1P}$	116 A
Secondary current range $I_{2N}$	3 to 36 kA
Continuous direct current $I_d$	5.8 kA 100% duty cycle (ED)
Cable cross-section $U_2/V_2 \rightarrow U/V$	$\geq 35\text{mm}^2$
Frequency f	1000 Hz
Transformer ratio $\ddot{U}$	50 : 1
No-load direct voltage $U_{diO}$	9.0 V
Continuous d.c. forward current rating $P_{diO}$	52.2 kW 100% duty cycle (ED)
Max. rated surge forward current $I_{FSM}$	120 kA; (10 ms; $T_{vj\ max.}\ 180^\circ\ \text{C}$ )
Max. direct current $I_{d\ max.}$	cf. load diagram
Transformer degree of protection	IP65
Primary connection zone degree of protection	IP54
Welding transformer insulation class	F
Weight	24.4 kg
Color	RAL 1004; yellow
Cooling water volume	min. 10 l / min
Cooling water temperature	max. 30° C
Cooling water pressure drop	max. 2.5 bar
Primary circuit monitoring	max. 150° C
Rectifier block monitoring	max. 80° C

### 12.3 Technical data, PSG 3100.00 S

- **with** current transformer in secondary circuit
- **with** connection for secondary voltage monitoring

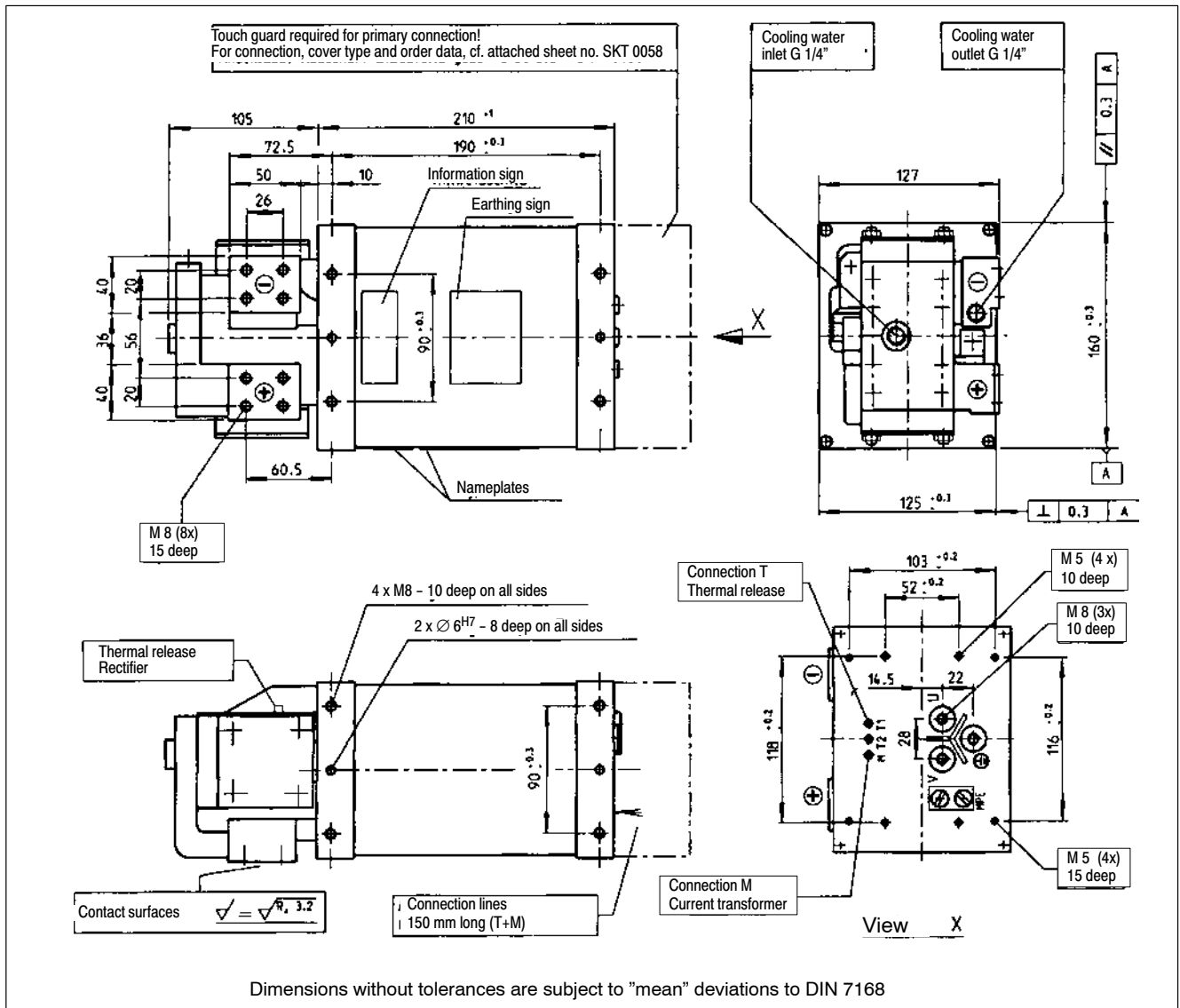
Medium-frequency transformer-rectifier unit $S_N$	100 kVA; at X = 50%
Primary voltage $U_{1N}$	500 V
Max. primary continuous current $I_{1P}$	116 A
Secondary current range $I_{2N}$	3 to 36 kA
Continuous direct current $I_d$	5.8 kA 100% duty cycle (ED)
Cable cross-section $U_2/V_2 \rightarrow U/V$	$\geq 35\text{mm}^2$
Frequency $f$	1000 Hz
Transformer ratio $\ddot{U}$	50 : 1
No-load direct voltage $U_{diO}$	9.0 V
Continuous d.c. forward current rating $P_{diO}$	52.2 kW 100% duty cycle (ED)
Max. rated surge forward current $I_{FSM}$	120 kA; (10 ms; $T_{vj\text{max.}} 180^\circ\text{C}$ )
Max. direct current $I_{d\text{max.}}$	cf. load diagram
Transformer degree of protection	IP65
Primary connection zone degree of protection	IP00
Welding transformer insulation class	F
Weight	24.4 kg
Color	RAL 1004; yellow
Cooling water volume	min. 10 l / min
Cooling water temperature	max. 30° C
Cooling water pressure drop	max. 2.5 bar
Primary circuit monitoring	max. 150° C
Rectifier block monitoring	max. 80° C

## 12.4 Technical data, PSG 3100.00 C

- with current transformer in secondary circuit
- designed for MC 135 plug

Medium-frequency transformer-rectifier unit $S_N$	100 kVA; at X = 50%
Primary voltage $U_{1N}$	500 V
Max. primary continuous current $I_{1P}$	116 A
Secondary current range $I_{2N}$	3 to 36 kA
Continuous direct current $I_d$	5.8 kA 100% duty cycle (ED)
Cable cross-section $U_2/V_2 \rightarrow U/V$	$\geq 35\text{mm}^2$
Frequency f	1000 Hz
Transformer ratio $\ddot{U}$	50 : 1
No-load direct voltage $U_{diO}$	9.3 V
Continuous d.c. forward current rating $P_{diO}$	53.9 kW 100% duty cycle (ED)
Max. rated surge forward current $I_{FSM}$	120 kA; (10 ms; $T_{vj\ max.}\ 180^\circ\ \text{C}$ )
Max. direct current $I_{d\ max.}$	cf. load diagram
Transformer degree of protection	IP65
Primary connection zone degree of protection	IP00
Welding transformer insulation class	F
Weight	24.4 kg
Color	RAL 1004; yellow
Cooling water volume	min. 10 l / min
Cooling water temperature	max. 30° C
Cooling water pressure drop	max. 2.5 bar
Primary circuit monitoring	max. 150° C
Rectifier block monitoring	max. 80° C

**12.5 Dimensioned drawing, PSG 3100.00 A/PSG 3100.00 S**



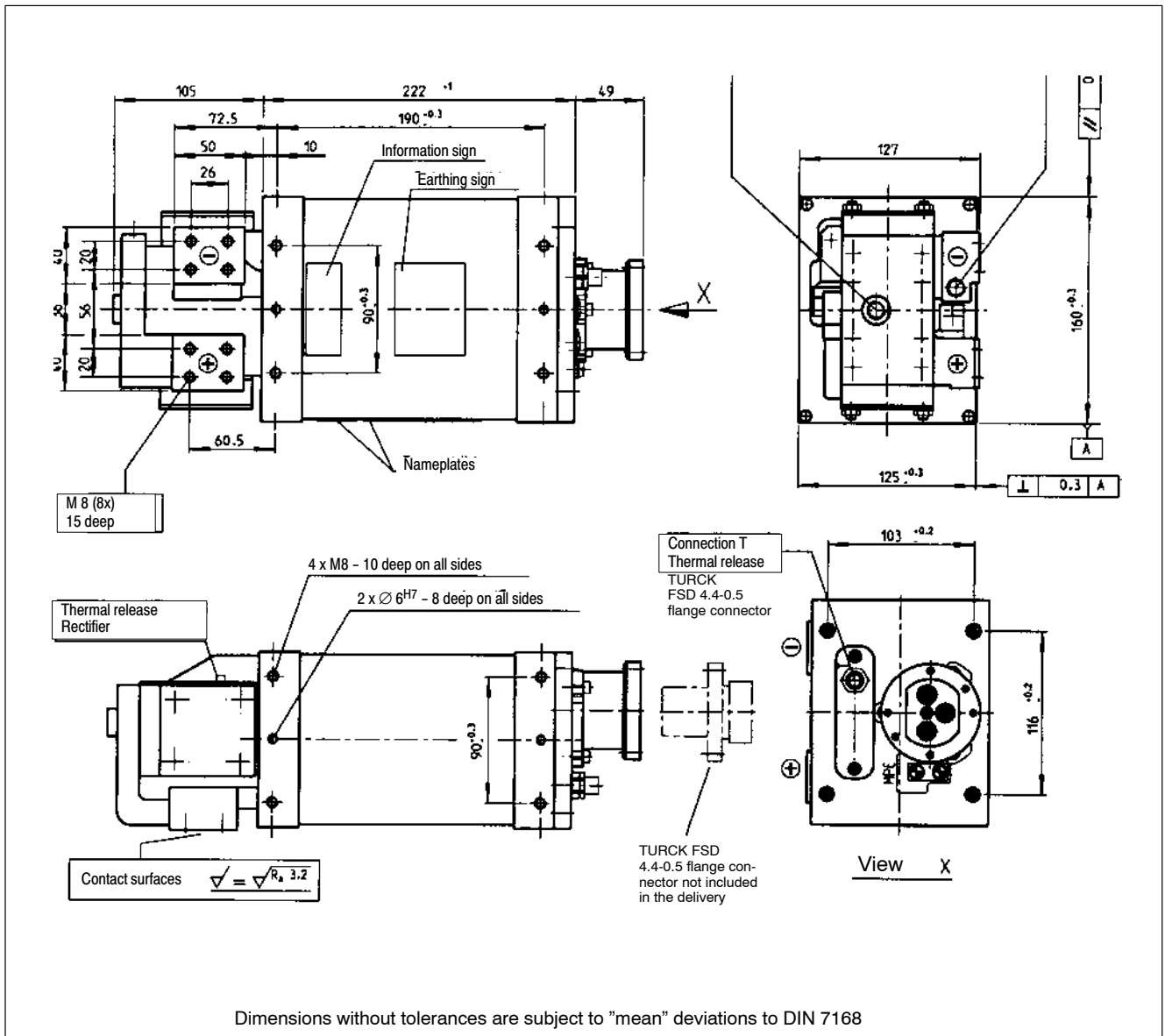
Dimensioned drawing, PSG 3100.00 A/PSG 3100.00 S

**Note:** Connecting pins for primary side supplied loosely.

Designation	
4 straight pins ISO 8735 $\varnothing 06 \times 12$	supplied loosely
3 contact pins MC180 $\varnothing 08$	supplied loosely



12.6 Dimensioned drawing, PSG 3100.00 P

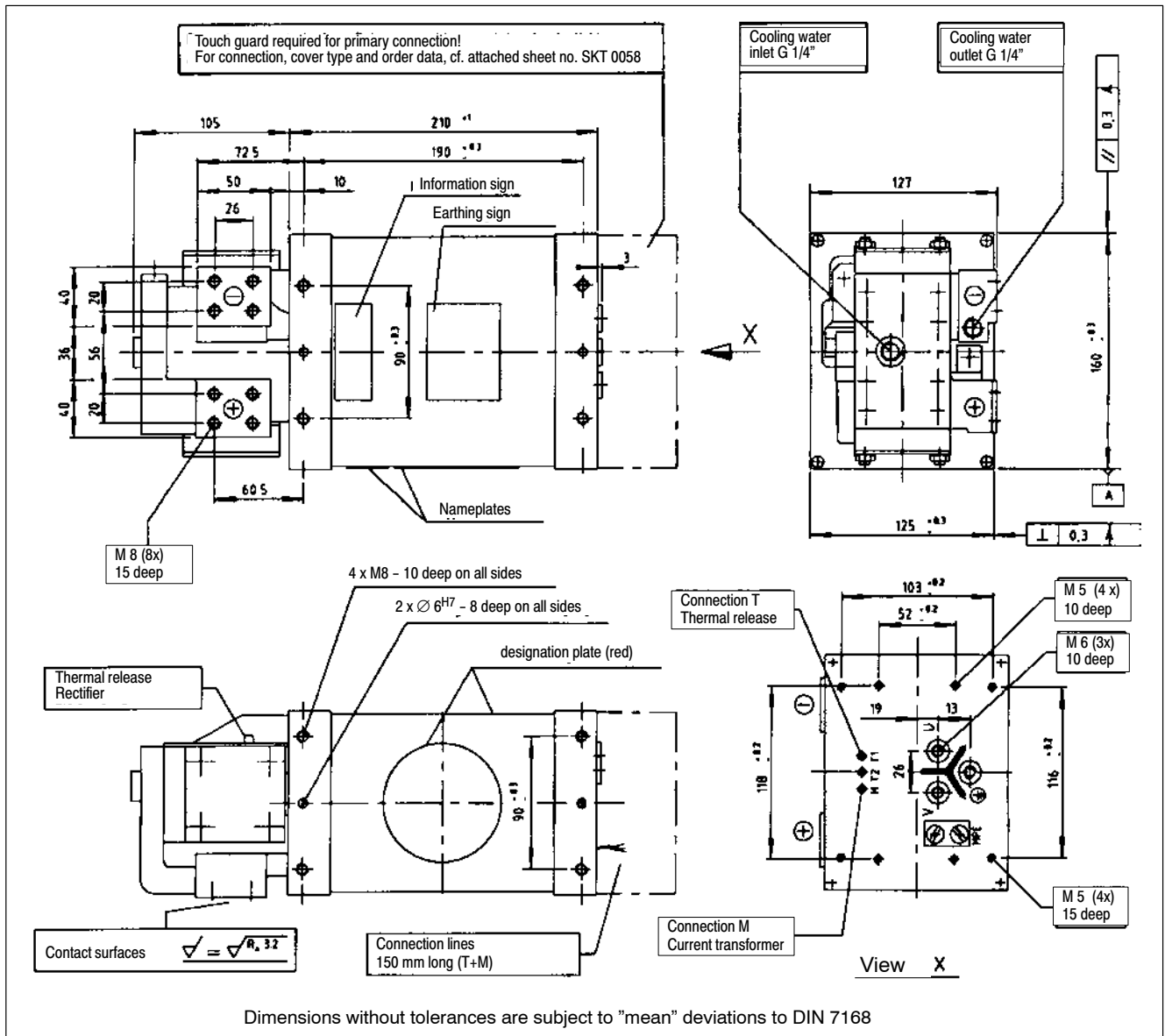


Dimensioned drawing, PSG 3100.00 P


**Note:** Connecting pins for primary side supplied loosely.

Designation	
4 straight pins ISO 8735 Ø 06 x 12	supplied loosely

12.7 Dimensioned drawing, PSG 3100.00 C



Dimensioned drawing, PSG 3100.00 C

 **Note:** Connecting pins for primary side supplied loosely.

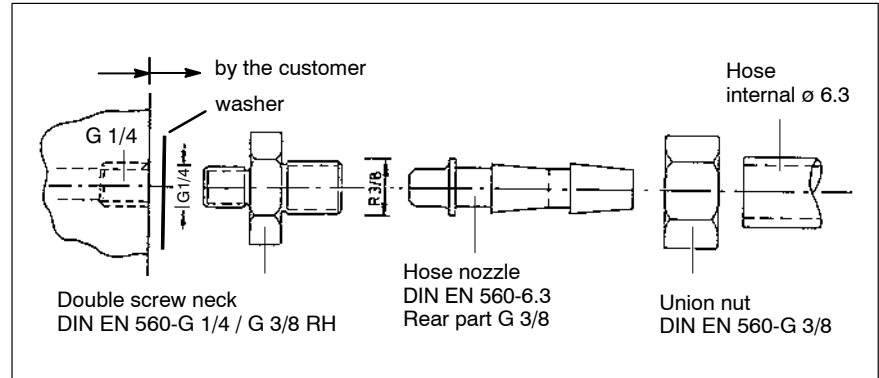
Designation	
4 straight pins ISO 8735 $\varnothing 06 \times 12$	supplied loosely
3 contact pins MC135 $\varnothing 06$	supplied loosely

## 12.8 Cooling water connection, PSG 3100.00 X

Maximum supply water temperature: 30° C

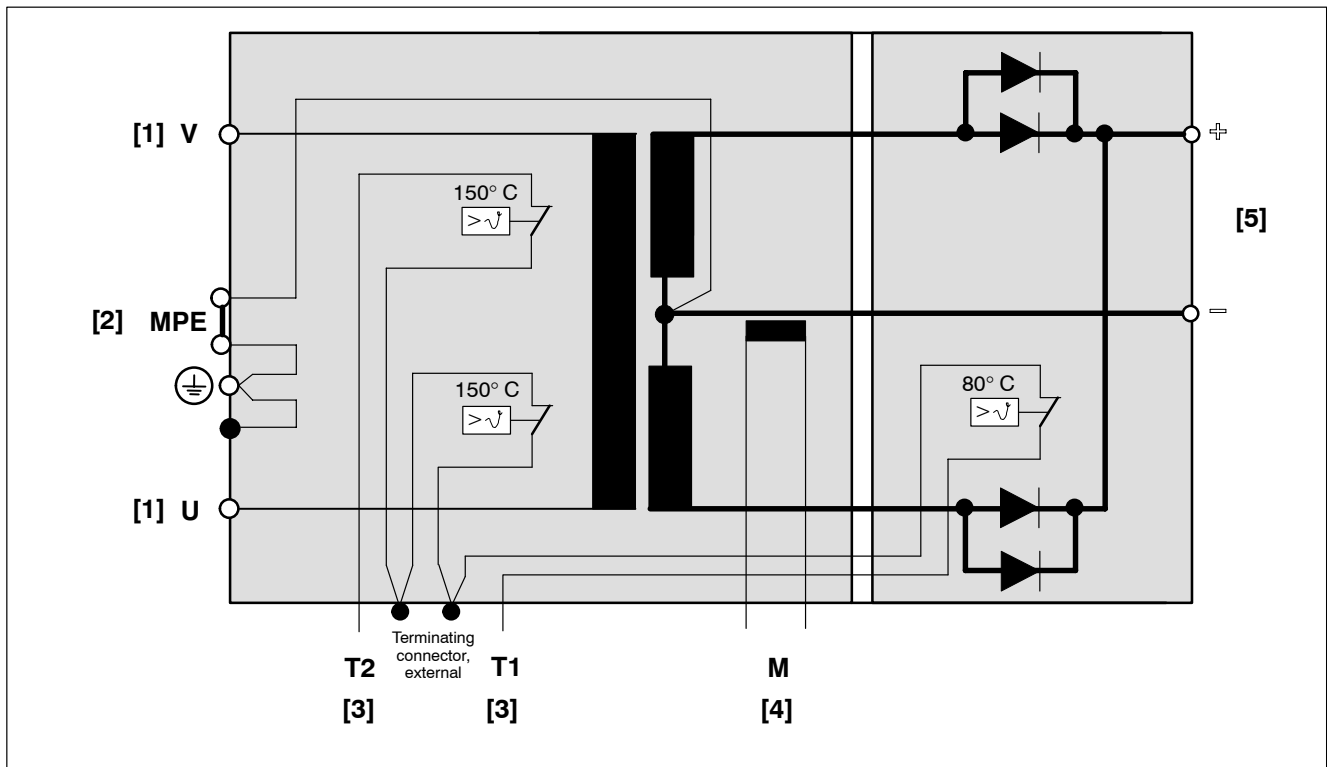
WE = water inlet, WA = water outlet

Water connection: internal thread G 1/4" (for example, see sketch)



Cooling water connection, PSG 3100.00 X

## 12.9 Block diagram, PSG 3100.00 A/PSG 3100.00 C



Block diagram, PSG 3100.00 A/PSG 3100.00 C

### [1] Primary side:

- U welding transformer → U2 medium-frequency inverter
- V welding transformer → V2 medium-frequency inverter

### [2] MPE neutral earth conductor:



### DANGEROUS ELECTRICAL VOLTAGE

If the MPE protective conductor jumper is to be removed, another protective measure to EN 50063 must be installed.

In this case, the ground connection between the transformer neutral and the earthing bolt must be crossed out in an indelible manner.

### [3] Primary winding and rectifier block temperature monitoring T1/T2:

Connecting cable 2 x 2 x 0,75 mm<sup>2</sup>, screened LiYCY.

- T1; thermal release, rectifier block 80° C
- T2; thermal release, welding transformer primary side 150° C

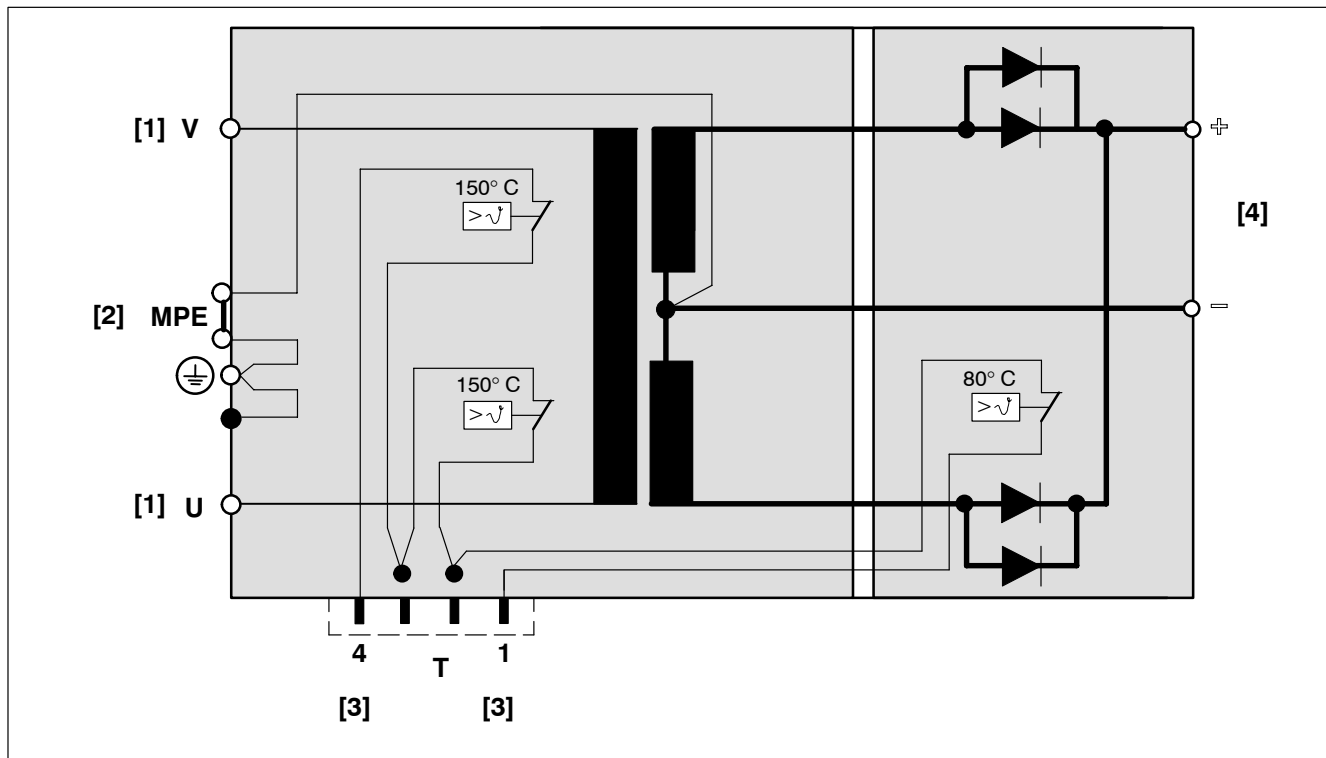
### [4] Connection M - current transformer, secondary side:

Connecting cable 2 x 2 x 0,75 mm<sup>2</sup>, screened LiYCY.

- white; brown
- measuring voltage  $U_m = 150 \text{ mV/kA} \pm 2.5 \%$  at ohmic resistance of 1k $\Omega$

### [5] Secondary side, connection of electrodes

## 12.10 Block diagram, PSG 3100.00 P



Block diagram, PSG 3100.00 P

**[1] Primary side:**

- U welding transformer → U2 medium-frequency inverter
- V welding transformer → V2 medium-frequency inverter

**[2] MPE neutral earth conductor:****DANGEROUS ELECTRICAL VOLTAGE**

If the MPE protective conductor jumper is to be removed, another protective measure to EN 50063 must be installed.

In this case, the ground connection between the transformer neutral and the earthing bolt must be crossed out in an indelible manner.

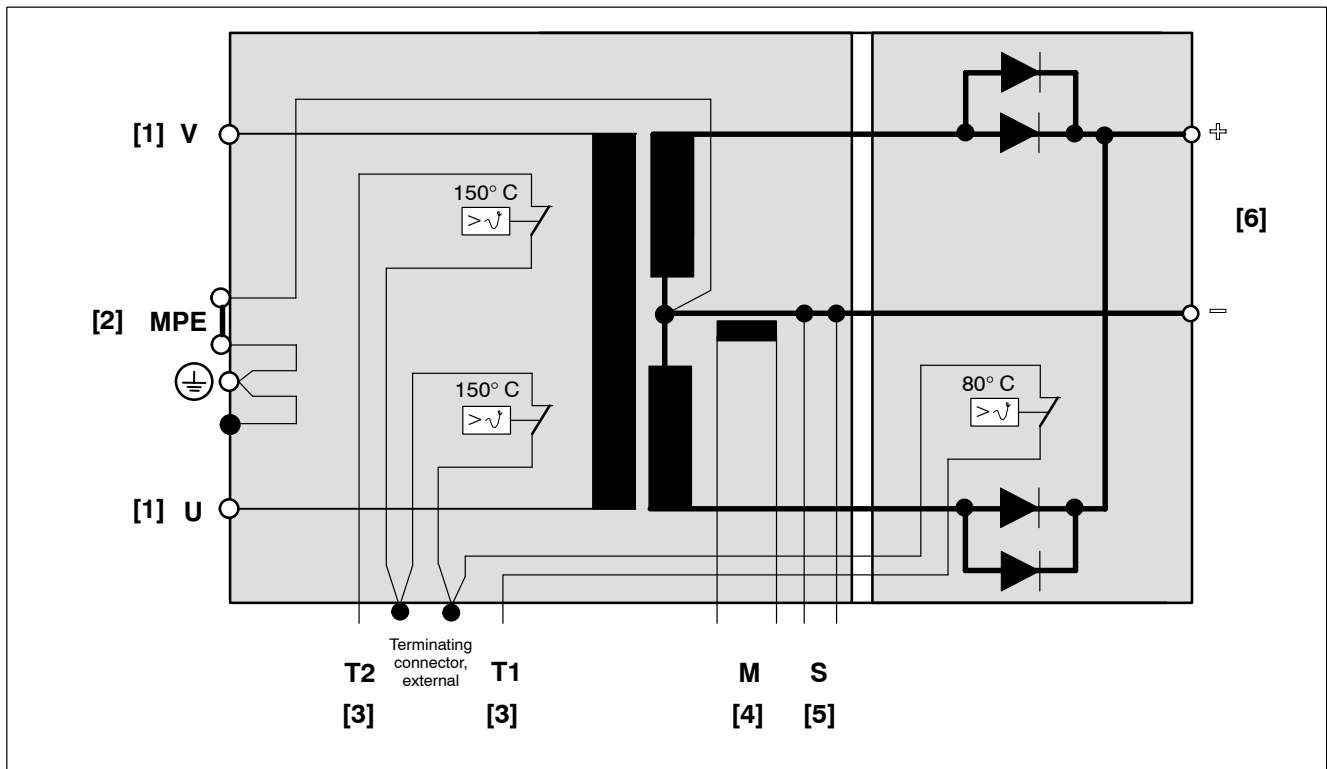
**[3] Primary winding and rectifier block temperature monitoring T1/T4 (Turck FSD 4.4-0.5):**

Connecting cable 2 x 2 x 0,75 mm<sup>2</sup>, screened LiYCY.

- T1; thermal release, rectifier block 80° C
- T4; thermal release, welding transformer primary side 150° C

**[4] Secondary side, connection of electrodes**

## 12.11 Block diagram, PSG 3100.00 S



Block diagram, PSG 3100.00 S

**[1] Primary side:**

- U welding transformer → U2 medium-frequency inverter
- V welding transformer → V2 medium-frequency inverter

**[2] MPE neutral earth conductor:****DANGEROUS ELECTRICAL VOLTAGE**

If the MPE protective conductor jumper is to be removed, another protective measure to EN 50063 must be installed.

In this case, the ground connection between the transformer neutral and the earthing bolt must be crossed out in an indelible manner.

**[3] Primary winding and rectifier block temperature monitoring****T1/T2:**

Connecting cable 2 x 2 x 0,75 mm<sup>2</sup>, screened LiYCY.

- T1; thermal release, rectifier block 80° C
- T2; thermal release, welding transformer primary side 150° C

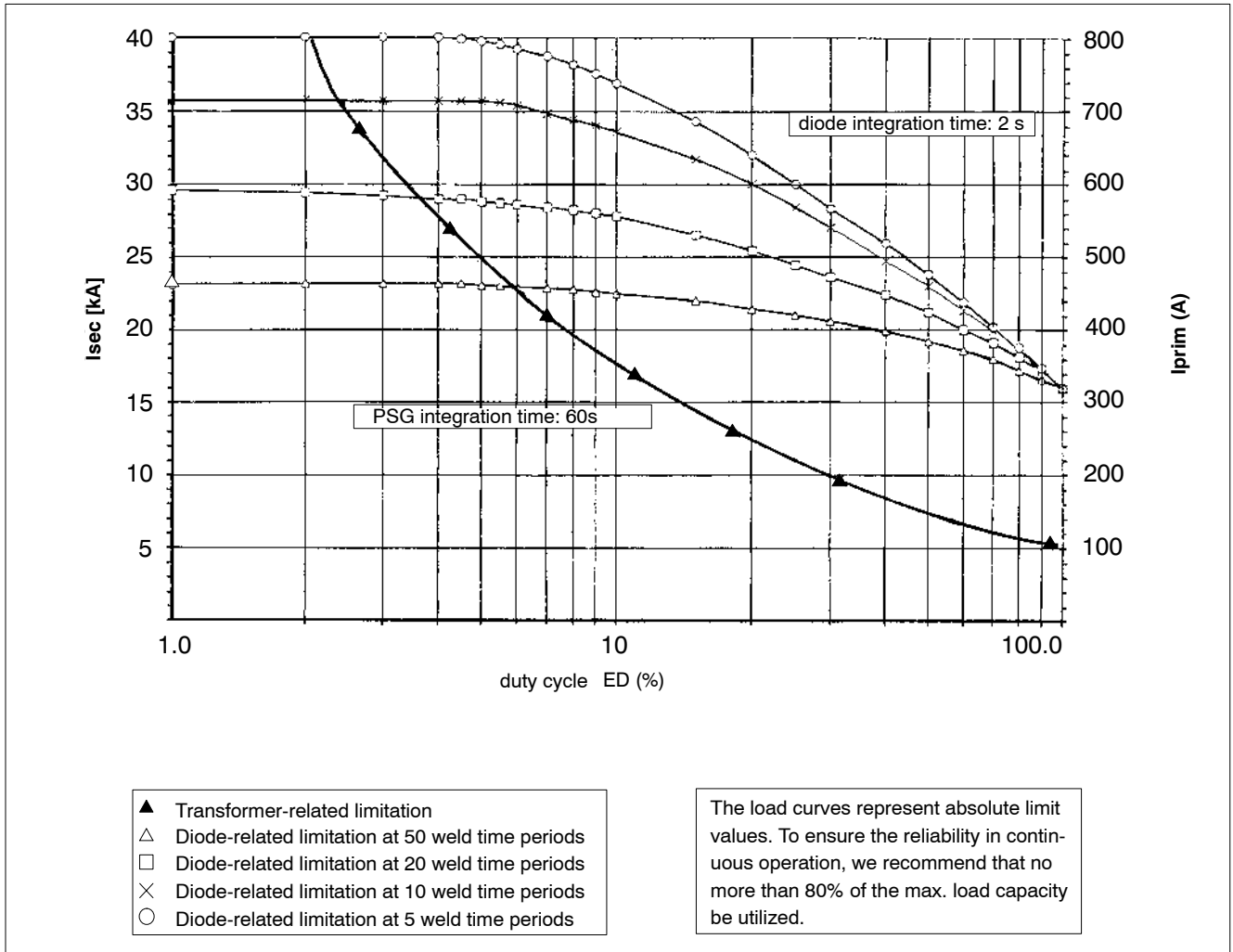
**[4] Connection M - current transformer, secondary side:**

Connecting cable 2 x 2 x 0,75 mm<sup>2</sup>, screened LiYCY.

- white; brown
- measuring voltage  $U_m = 150 \text{ mV/kA} \pm 2.5 \%$  at ohmic resistance of 1k $\Omega$

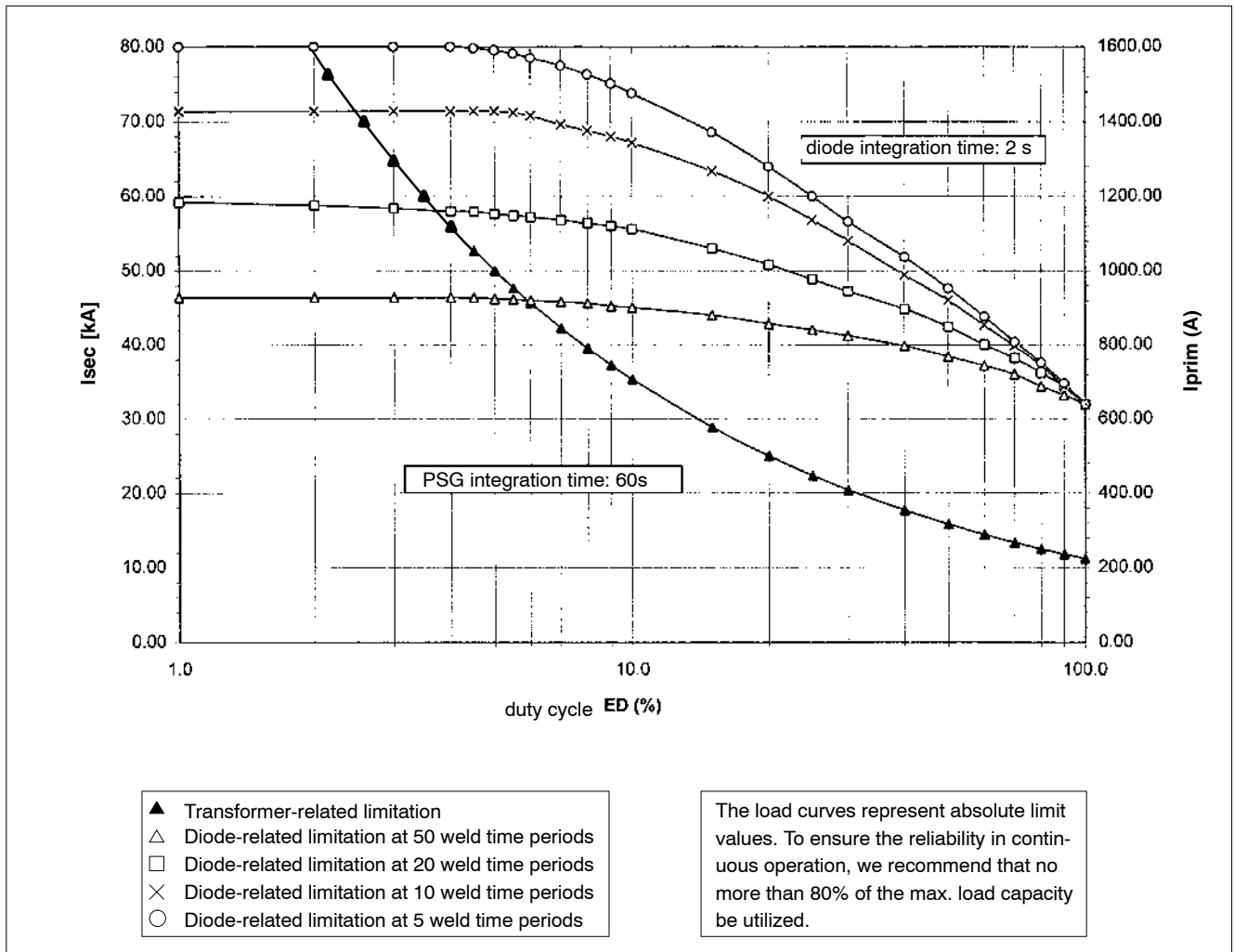
**[5] Connection S - connection of secondary voltage monitoring****[6] Secondary side, connection of electrodes**

12.12 Load diagram, 1 x PSG 3100.00 X



Load diagram, 1 x PSG 3100.00 X

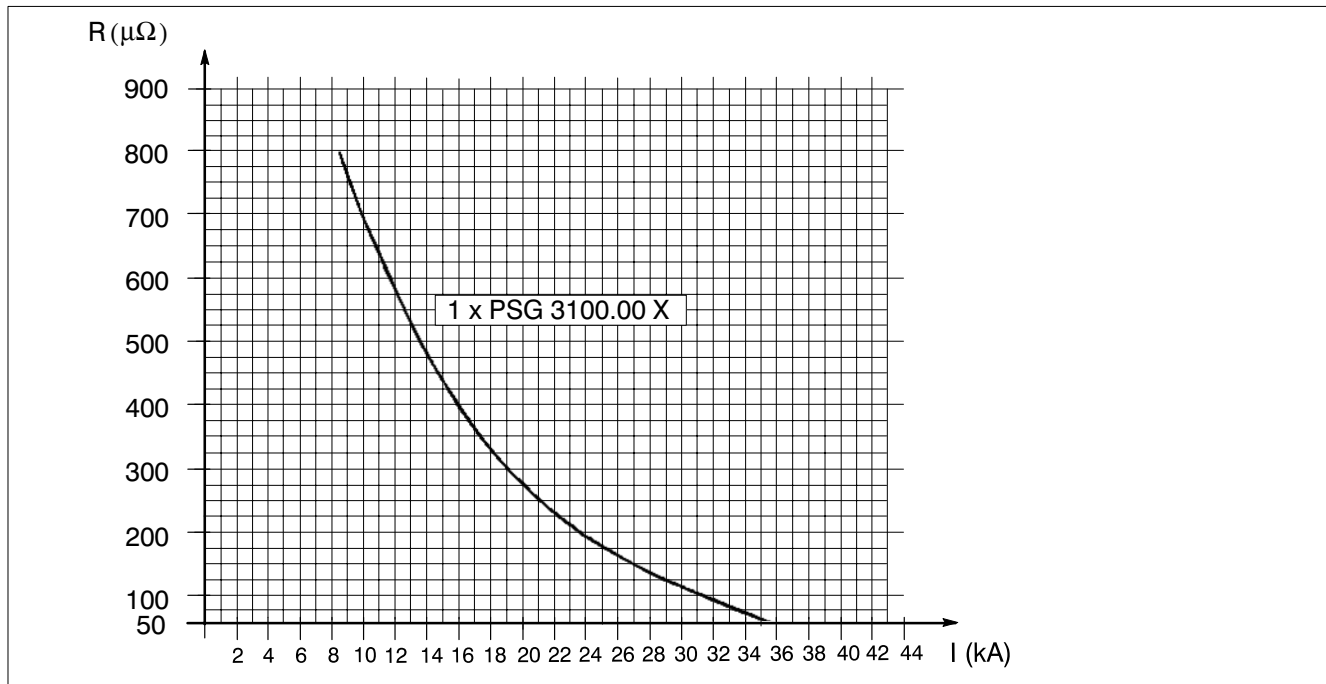
12.13 Load diagram, 2 x PSG 3100.00 X connected in parallel



Load diagram, 2 x PSG 3100.00 X connected in parallel

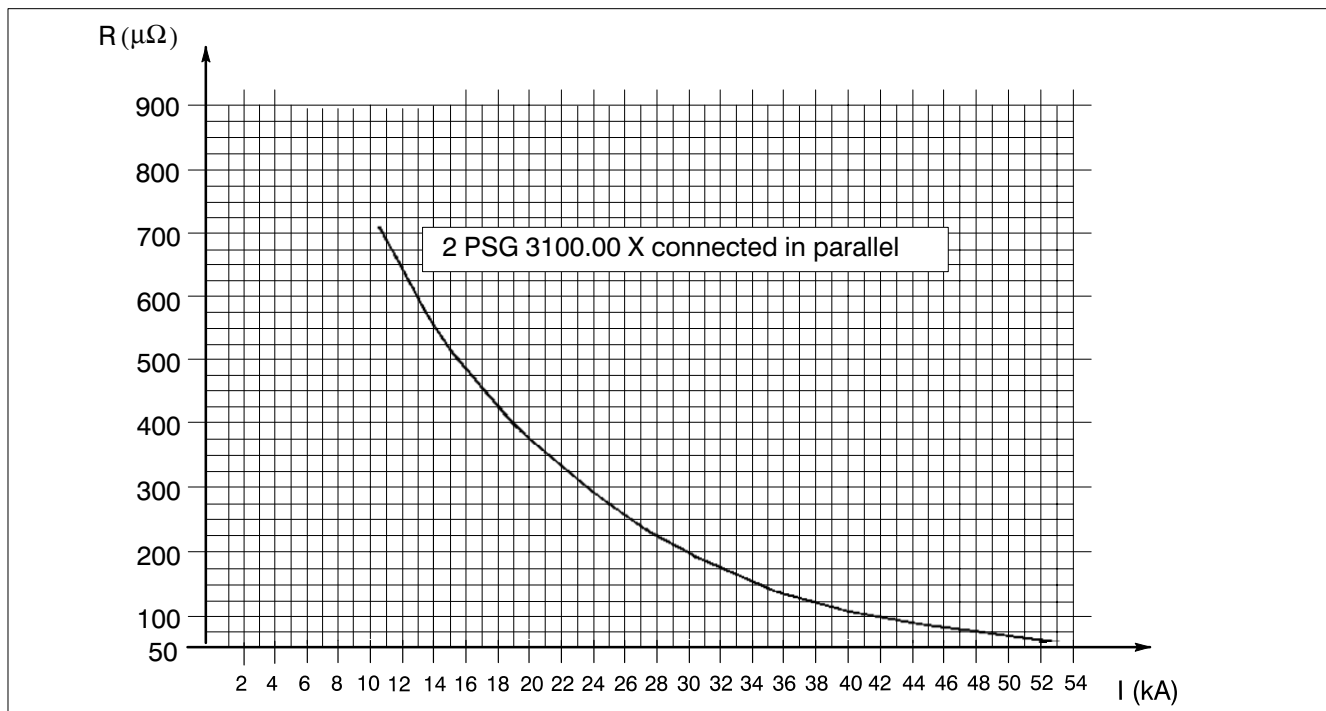


### 12.14 Current resistance characteristic, 1 x PSG 3100.00 X



Current resistance characteristic, 1 x PSG 3100.00 X

### 12.15 Current resistance characteristic, 2 x PSG 3100.00 X connected in parallel



Current resistance characteristic, 2 x PSG 3100.00 X connected in parallel

**12.16 Ordering, PSG 3100.00 A**

<b>Designation</b>	<b>Part no.</b>
PSG 3100.00 A welding transformer with current sensor in secondary circuit	1070 063 764

**12.17 Ordering, PSG 3100.00 P**

<b>Designation</b>	<b>Part no.</b>
PSG 3100.00 P welding transformer without current sensor in secondary circuit complete MC assembly for primary current measuring	1070 079 347

**12.18 Ordering, PSG 3100.00 S**

<b>Designation</b>	<b>Part no.</b>
PSG 3100.00 S welding transformer with current sensor in secondary circuit with secondary voltage monitoring	1070 084 153

**12.19 Ordering, PSG 3100.00 C**

<b>Designation</b>	<b>Part no.</b>
PSG 3100.00 C welding transformer with current sensor in secondary circuit designed for MC 135 plug	1070 084 427

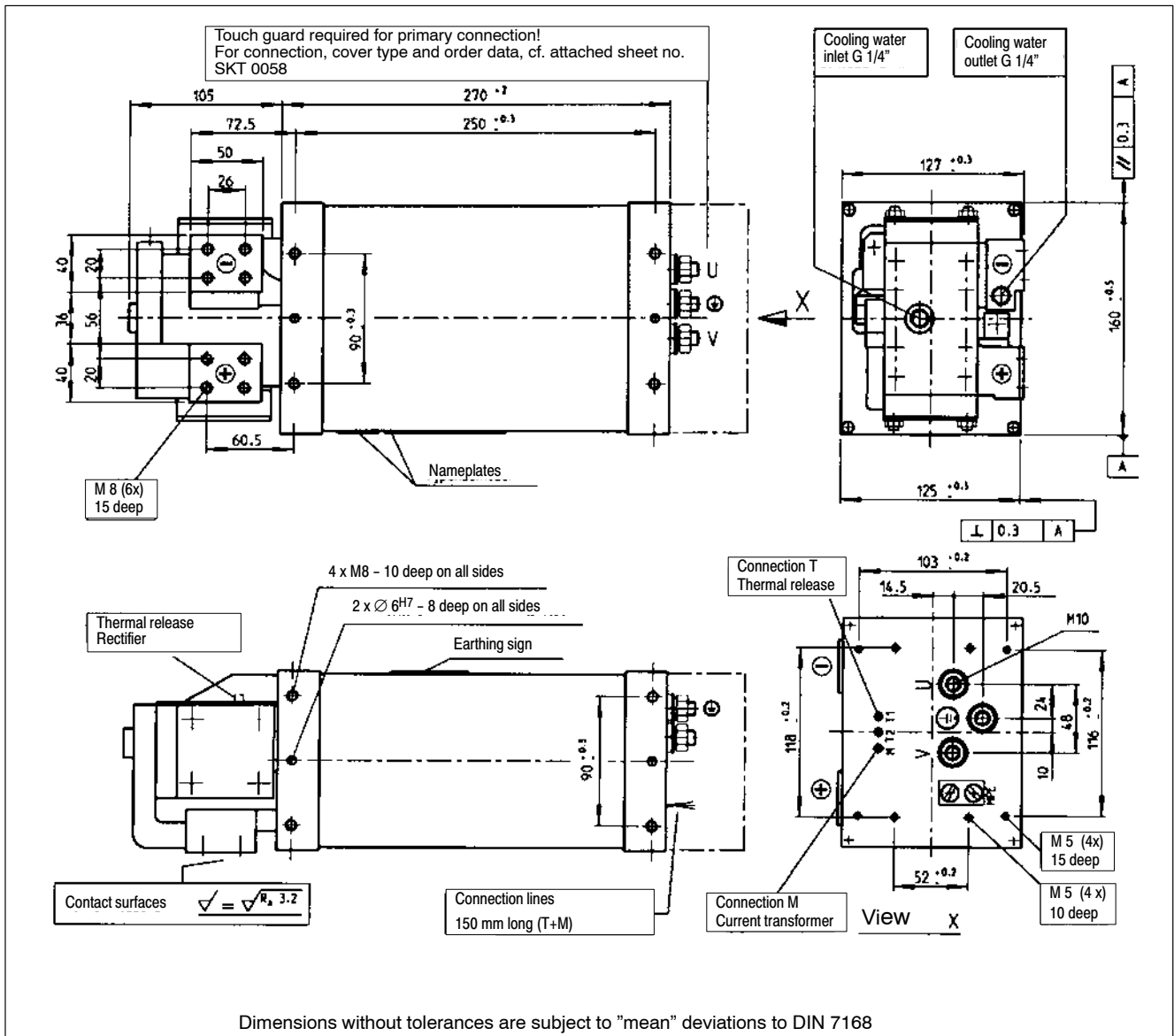
Notes:

## 13 PSG 3200.00 A

### 13.1 Technical data, PSG 3200.00 A

Medium-frequency transformer-rectifier unit $S_N$	200 kVA; at X = 50%
Primary voltage $U_{1N}$	500 V
Max. primary continuous current $I_{1P}$	171 A
Secondary current range $I_{2N}$	6.0 to 40 kA
Continuous direct current $I_d$	6.5 kA 100% duty cycle (ED)
Cable cross-section $U_2/V_2 \rightarrow U/V$	$\geq 95\text{mm}^2$
Frequency $f$	1000 Hz
Transformer ratio $\ddot{U}$	38 : 1
No-load direct voltage $U_{dIO}$	13.0 V
Continuous d.c. forward current rating $P_{dIO}$	85.0 kW 100% duty cycle (ED)
Max. rated surge forward current $I_{FSM}$	120 kA; (10 ms; $T_{vj \text{ max. } 180^\circ \text{ C}}$ )
Max. direct current $I_{d \text{ max.}}$	cf. load diagram
Transformer degree of protection	IP65
Primary connection zone degree of protection	IP00
Welding transformer insulation class	F
Weight	39.5 kg
Color	RAL 8001; brown
Cooling water volume	min. 10 l / min
Cooling water temperature	max. 30° C
Cooling water pressure drop	max. 2.0 bar
Primary circuit monitoring	max. 150° C
Rectifier block monitoring	max. 80° C

**13.2 Dimensioned drawing, PSG 3200.00 A**



Dimensioned drawing, PSG 3200.00 A

**Note:** Connecting pins for primary side supplied loosely.

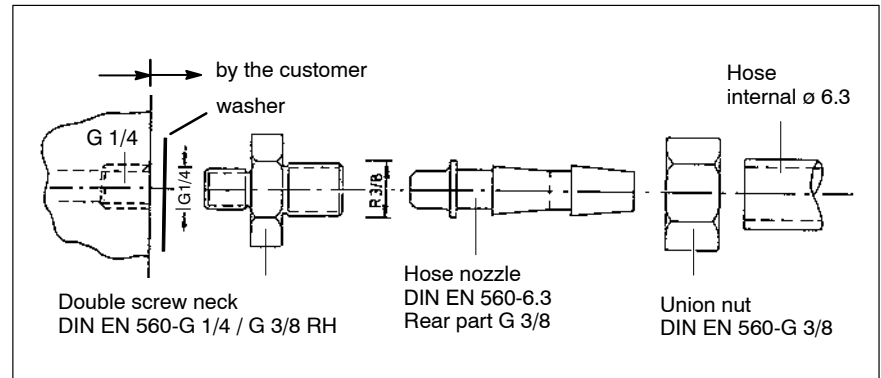
Designation	
4 straight pins ISO 8735 Ø 06 x 12	supplied loosely

### 13.3 Cooling water connection, PSG 3200.00 A

Maximum supply water temperature: 30° C

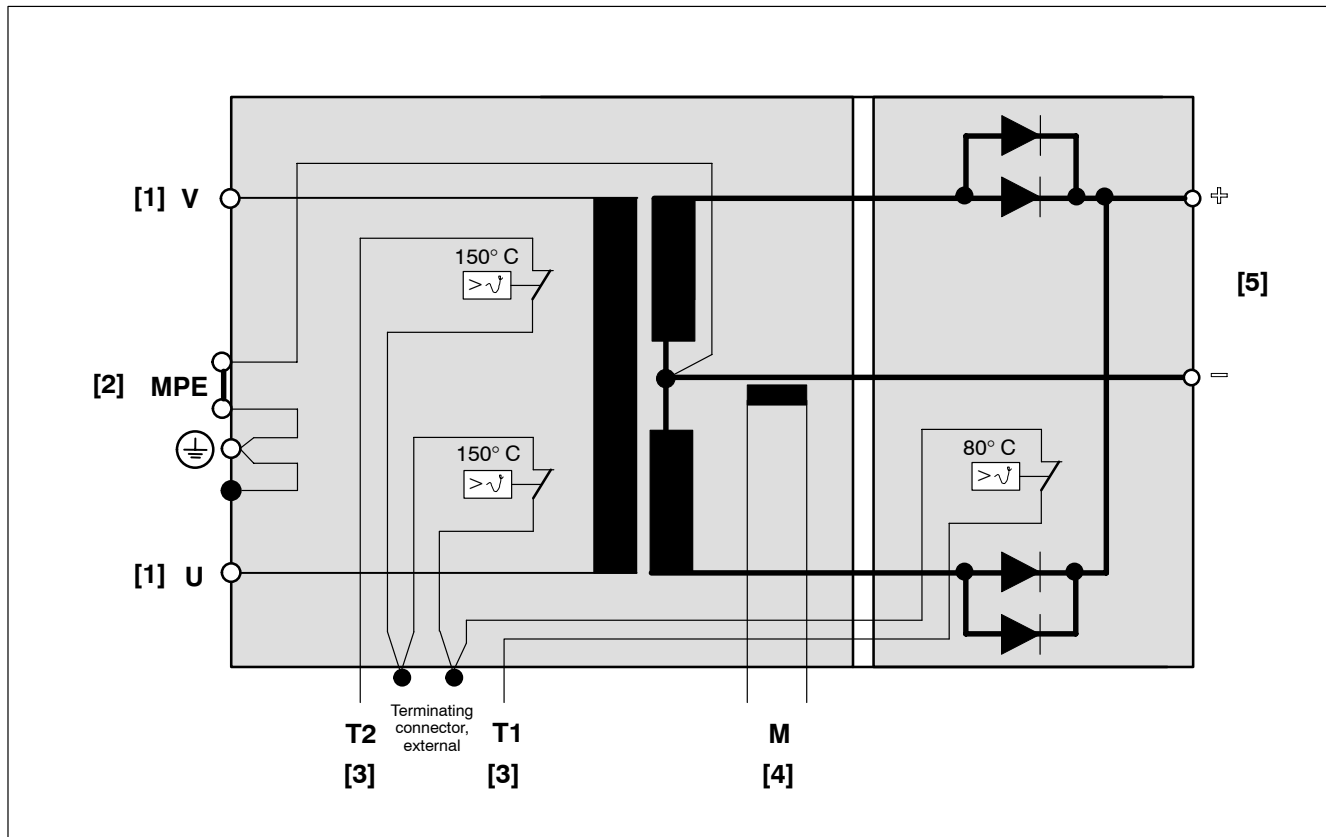
WE = water inlet, WA = water outlet

Water connection: internal thread G 1/4" (for example, see sketch)



Cooling water connection, PSG 3200.00 A

## 13.4 Block diagram, PSG 3200.00 A



Block diagram, PSG 3200.00 A

**[1] Primary side:**

- U welding transformer → U2 medium-frequency inverter
- V welding transformer → V2 medium-frequency inverter

**[2] MPE neutral earth conductor:****DANGEROUS ELECTRICAL VOLTAGE**

If the MPE protective conductor jumper is to be removed, another protective measure to EN 50063 must be installed.

In this case, the ground connection between the transformer neutral and the earthing bolt must be crossed out in an indelible manner.

**[3] Primary winding and rectifier block temperature monitoring T1/T2:**

Connecting cable 2 x 2 x 0,75 mm<sup>2</sup>, screened LiYCY.

- T1; thermal release, rectifier block 80° C
- T2; thermal release, welding transformer primary side 150° C

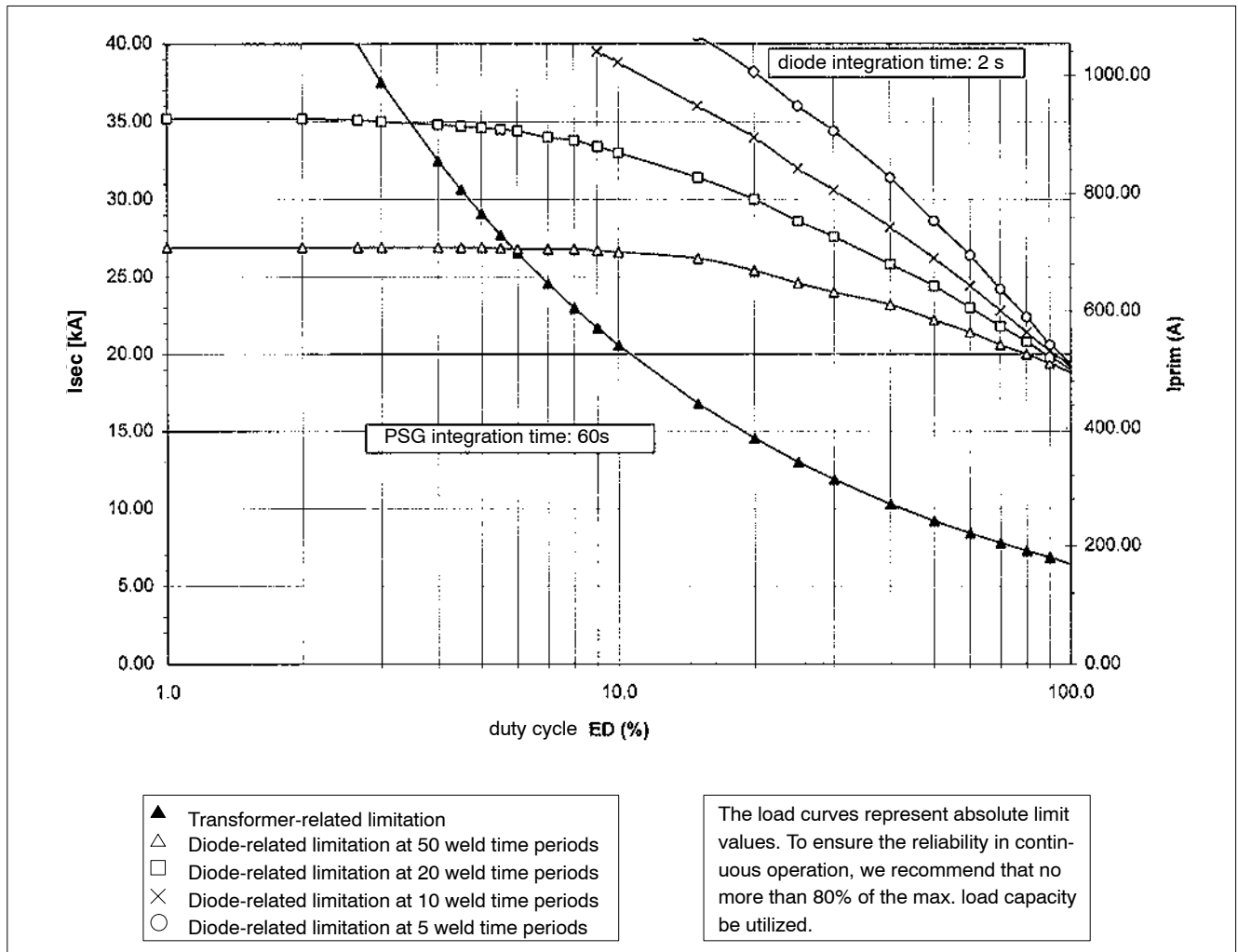
**[4] Connection M - current transformer, secondary side:**

Connecting cable 2 x 2 x 0,75 mm<sup>2</sup>, screened LiYCY.

- white; brown
- measuring voltage  $U_m = 150 \text{ mV/kA} \pm 2.5 \%$  at ohmic resistance of 1k $\Omega$

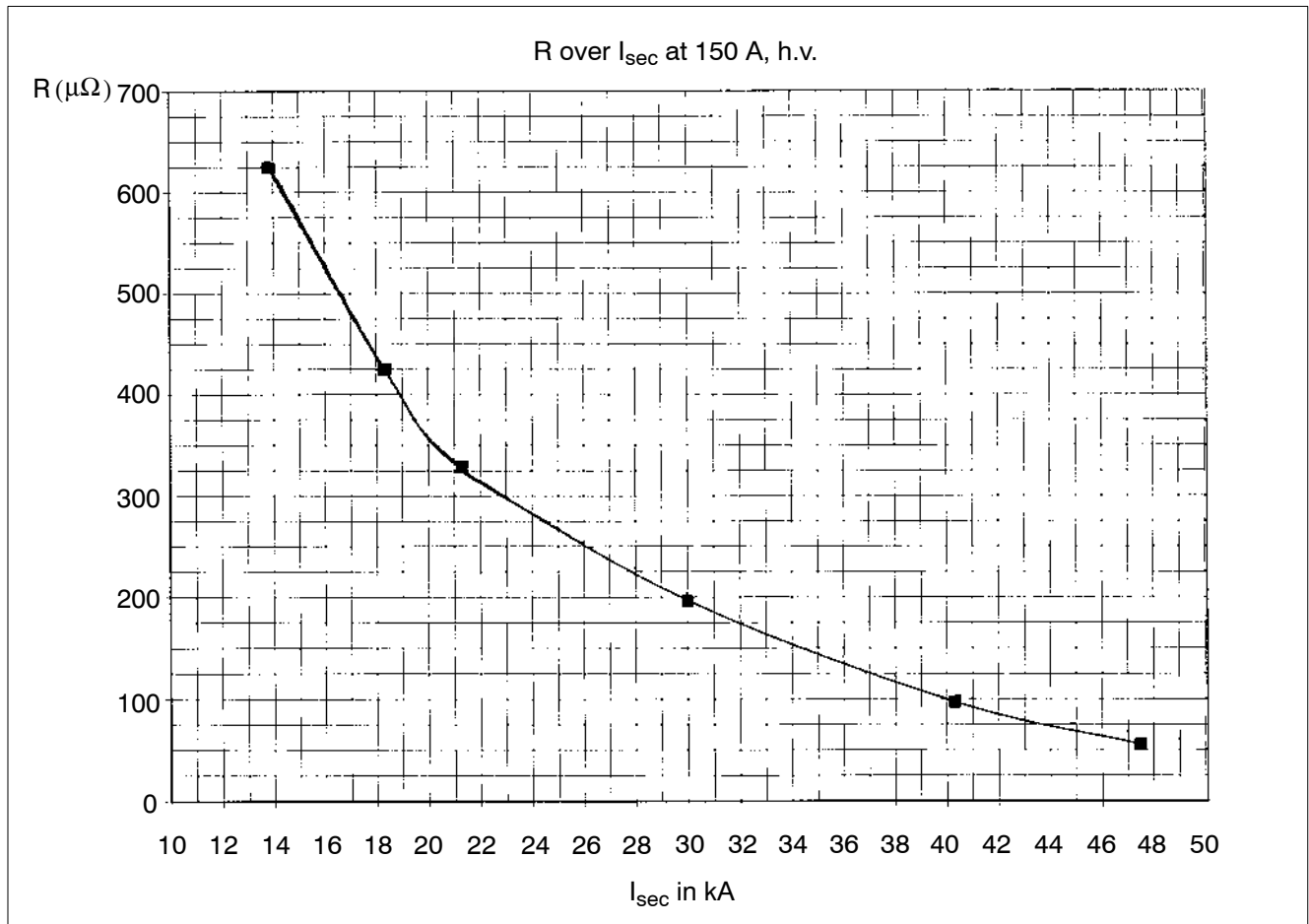
**[5] Secondary side, connection of electrodes**

### 13.5 Load diagram, PSG 3200.00 A



Load diagram, PSG 3200.00 A



**13.6 Current resistance characteristic, PSG 3200.00 A**

Current resistance characteristic, PSG 3200.00 A

### 13.7 Ordering, PSG 3200.00 A

Designation	Part no.
PSG 3200.00 A welding transformer with current sensor in secondary circuit	1070 070 123

Notes:

# 14 Declaration of Conformity

## Hersteller-Erklärung

EXPERT MASCHINENBAU GMBH  
D-64653 Lorsch  
Seehofstraße 56-58

### Stromquelle für die Widerstandsschweißtechnik und Prozeßtechnik

Beschreibung

### Transformator; Transformator-Gleichrichter-Einheit; Zubehör

Produktbezeichnung

Die bezeichneten Produkte sind ausschließlich zum Einbau in andere Maschinen bestimmt. Die Inbetriebnahme ist solange untersagt, bis die Konformität des Endproduktes mit der EG-Maschinenrichtlinie 89/392/EWG Anhang IIB, 91/EWG, 93/44/EWG festgestellt ist.

Hiermit bestätigen wir die Konformität der oben aufgeführten Produkte mit den nachfolgenden Richtlinien/Normen:

#### Richtlinien:

- 73/23/EWG                      Niederspannungs-Richtlinie

#### Normen:

- EN 60204 Teil 1              Elektrische Ausrüstung von Maschinen

- EN 50063                      Sicherheitsanforderungen für den Bau und die Errichtung von Einrichtungen zum Widerstandsschweißen und für verwandte Verfahren

#### Weitere technische Normen wurden berücksichtigt:

- ISO 7284                      Resistance welding equipment - Particular specifications applicable to transformers with two separate secondary windings for multi-spot welding, as used in the automobile industry

- ISO 5826                      Transformatoren für Widerstandsschweißmaschinen

- ISO 10656                     Electric resistance welding - Integrated transformers for welding guns

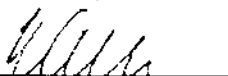
- ISO/DIS 1266                Resistance welding equipment - Particular specifications applicable to transformers with one secondary winding for multi-spot welding, as used in the automobile industry

- ISO 669                        Kenngrößen für Widerstandsschweißeinrichtungen

- DIN 44766 Teil 1,2,3      Widerstands-Schweißtransformatoren

- NFA 82-040 ff                Transformateurs pour machines a souder par resistance spécifications générales applicables a tous les transformateurs

Lorsch, 24.06.1997

  
Köhler (Geschäftsführer)

Notes:

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