



Operating Manual

Explosion-Proof F&G Three-Phase Motors (II2G) EEx d(e) IIC(B) T3-6

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© Moeller Antriebstechnik GmbH,
Nordenham

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Warning!

Dangerous electrical voltage!

Observe explosion protection measures!

Before commencing the installation

- Disconnect the power supply of the device
- Ensure that the device cannot be accidentally restarted
- Verify isolation from the supply
- Earth and short-circuit
- Cover or enclose neighbouring units that are live.
- Follow the installation instructions of the device concerned.
- Only suitably qualified personnel in accordance with EN 50110-1/-2 (VDE 0105 Part 100) may work on this device/system.
- The electrical installation must be carried out in accordance with the relevant regulations (e.g. cable cross-sections, fuses, protective conductor connections).
- The opening of the motor without the manufacturer's consent, apart from the opening of terminal boxes, will invalidate the warranty during the warranty period.
- Original spare parts must be used for approved repairs or repairs outside of the warranty period.
- Electrically conducting and rotating parts of electric machines may cause serious and/or fatal injury.
- All transport, installation, commissioning and maintenance activities must only be carried out by qualified personnel. Observe the relevant standards for explosion protection such as EN 60079-14 and EN 50281-1-2, as well as national work safety regulations.
- Where installations are subject to these guidelines, appropriate safety measures must be taken in order to protect personnel from injury.
- Personnel must be instructed in how to proceed with care and observe the regulations in the transport, lifting and installation of the motor, as well as in recommissioning and repair.
- Do not use the lifting eye bolts to lift the motor together with the drive device.
- Do not use the supplied lifting eye bolts at ambient temperatures below -20°C , in accordance with DIN 580. Lower temperatures could lead to the ring screws breaking and consequent injury to personnel and/or damage to the installation.
- The eye bolts should also not be loaded at an angle of more than 45° from the vertical direction and outside the plane of the ring, in accordance with DIN 580. In this case use transverse rods. Dimensions for positioning lifting eyes and minimum dimensions of transverse rods and chain lengths, see our operating manual.
- Suitable safety measures should be taken against possible brake failure on motors fitted with an external brake. This particularly applies to brake motors used in lifting applications.
- Operating the motor only with the supplied shaft end guard is not permitted.
- Avoid contact with the start and operation capacitors in single-phase motors until a secure discharge has occurred.

- If high-voltage tests are required, follow the procedures and precautionary measures laid down in the accident prevention regulations.


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About This Manual

This operating manual is for AC motors in the series CD...; dCD...; BD... and dBD....

The guidelines described in this document are for the installation, commissioning and maintenance of explosion-proof AC motors in flameproof enclosures with the following designation:  (II.), EEx de II. T. and EEx d II. T., in addition to the general installation requirements.

Target group	This manual is designed for specialist personnel responsible for the installation, commissioning and maintenance of the motors. These persons must have a special knowledge of explosion protection in addition to normal technical training.
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Abbreviations and symbols	This manual uses the following abbreviations and symbols:
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► Indicates instructions on what to do



Draws your attention to useful tips and additional information



Attention!

Indicates the possibility of minor material damage.



Caution!

Indicates the possibility of major damage to property or slight injury.



Warning!

Indicates the possibility of major damage to property or serious or fatal injury.

All dimensions are given in millimeters if not specified otherwise.

Except for the first page of chapters and empty pages at the end, the top left of the page shows the chapter title and the top right of the page shows the current section for greater clarity.

1 Explosion-Proof Motors

Intended use

Motors should only be used according to the rating data specified on the rating plate. The motors are suitable for use in hazardous areas according to the designation on the rating plate.

The motors are designed for installation in a machine. Commissioning is not permitted until the conformity of the final product with Directive 89/392/EEC has been ascertained.

Liability and warranty

No liability is accepted for damage and malfunction caused by installation faults, non-observance of these operating instructions or improper repairs.

Original Moeller spares are specially constructed and tested for F&G motors.

We recommend that spare parts and accessories should be obtained exclusively from Moeller.

We wish to point out expressly that spare parts and accessories that were not supplied by Moeller must be approved by Moeller.

In certain circumstances, the installation and use of non-Moeller products may adversely affect the design-based properties of the motor and consequently impair the safety of persons, the motor itself or other property.

Moeller does not accept any liability for damage resulting from the use of spare parts or accessories that were not approved by Moeller.

Any changes or modifications that are made to the motor by the user are not permitted for safety reasons and exclude any liability by Moeller for any resulting damage.

Service information

The Moeller customer service can provide all technical information on F&G motors.

Please contact the relevant manufacturing plant or local offices should any problems arise with our motors. The address of the local branch is available on the Internet.

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Helgoländer Damm 75
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e-mail: fugdrive@fug.com
<http://www.moeller.net>

Spare parts

When ordering spare parts please state the designation of the required part or motor type and the manufacturing number.

Delivery, storage, transport

Delivery

- ▶ Inspect the motor for transport damage.

In the event of transport damage a damage report from the transport manager is required.

- ▶ Report any hidden damage no later than seven days after the motor has been received to the transport manager or manufacturer.

All packaging material can be disposed of without damage to the environment.

Storage

Storage up to 36 months is possible under the following conditions:

- The motor must be stored in a dry and dust-free environment to prevent any reduction in insulation resistance.
- Room temperatures must be between +5 °C and +30 °C with an air humidity of < 70 % and maximum temperature change of 10 °C/day.
- Any vibrations must not exceed $V_{\text{eff}} < 0.2$ mm/s in order to prevent any bearing damage.
- Before storing motors with a lubrication device, apply twice the amount of grease specified on the motor.



Attention!

The special measures of storage regulations AR9 must be adhered to if any different storage conditions apply.

Transport

Do not use the motor transport hooks to lift the motor together with the driven machine, such as pumps, gear units etc.

DIN 580 specifies that eye bolts should not be loaded in ambient temperatures lower than -20 °C.

These eye bolts may break at these temperature and thus cause injury to persons and/or damage to the installation. The eye bolts should also not be loaded at an angle of more than 45° from the vertical direction and outside the plane of the ring, in accordance with DIN 580. In this case use transverse rods. Dimensions for positioning lifting eyes and minimum dimensions of transverse rods and chain lengths (→ Fig. 1).



Attention!

When placing horizontally positioned motors upright, the motor shaft must not touch the ground. This will cause damage to the bearings.

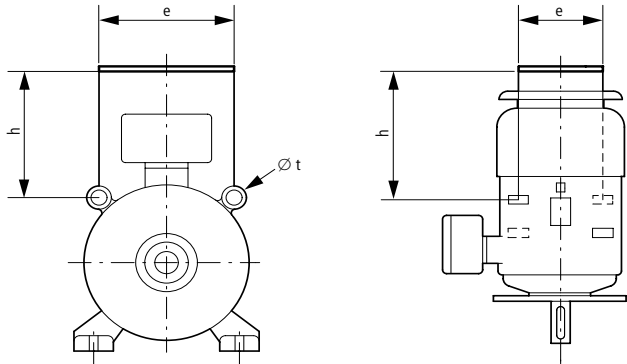


Figure 1: Dimensions for lifting eyes

Table 1: Minimum dimensions for lifting eyes and transverse rods

Frame size	Ø t	horizontal		vertical	
		e	h	e	h
90	20	167	100	220	187
100	20	185	112	242	201
112	20	202	103	262	236
132	25	243	170	307	247
160	30	262	206	314	293
180	30	294	223	402	372
200	35	390	219	451	399
225	40	366	230	510	490
250	40	435	282	546	548
280	40	498	301	600	574
315	50	640	337	700	595
355	60	629	397	816	893
400	60	790	312	890	771
450	60	833	317	980	660

2 Installation

Mechanical inspection

The motor shaft must be able to be moved by hand once the transport locking bolt has been removed (see also designation on motor). The brake unit of brake motors must be released when the motor is at rest (maximum 10 min). This is carried out by applying a voltage as specified in the circuit diagram, from page 28.



Attention!

Use the transport locking bolt for any further transport of the motor, otherwise the bearings may be damaged in transit.

Location

The fully enclosed motors are designed for operating areas in which they are exposed to dirt, humidity and outdoor conditions, as specified by their degree of protection.

The motors must only be installed in locations with ambient temperatures from -20 °C to $+40\text{ °C}$. Any permissible ambient temperatures (T_a) other than this must be specified on the rating plate. Anti-condensation heating must be used when used in lower temperatures without the required designation on the rating plate (by agreement with Moeller).



Attention!

The entry and exit of air through the fan cowls must not be impeded, otherwise this will result in a temperature rise above the permissible temperature, and a reduction in the lifespan of the winding insulation (→ Fig. 2 and → Table 2).

This particularly applies when using noise insulating covers. Furthermore, air passages must be checked and cleaned regularly in severely contaminated operating areas.

Table 2: Minimum distance (LE) of an obstacle in front of the air inlet, see Fig. 2.

Axle height	LE
Up to 160	35
180 to 225	85
Above 250	125

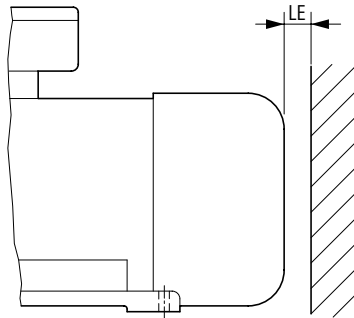


Figure 2: Minimum distance between obstacle and air inlet opening

The motors are designed for use in hazardous areas. The following specifications on the rating plate state the suitability of the motor for use as explosion-proof apparatus:

- Type of explosion protection
- Explosion group
- Temperature class

The specified device category allocates the motor to the appropriate zone division of the operating area.

Mounting

The motors are mounted at the desired location via the motor feet or the flange. The bearing design of motors up to axle height 355 mm allows them to be mounted horizontally or vertically. This also applies to motors with feet that are mounted to ceilings or side walls. For trouble-free functioning of the roller bearings, motors with reinforced bearings must be operated with a minimum load (→ Table 3).

Table 3: Minimum load for motors with reinforced bearings

Axle height	Minimum load	Axle height	Minimum load	Axle height	Minimum load
112	1 100 N	200	3 400 N	315	8 000 N
132	1 600 N	225	3 800 N	355	2 000 N
160	1 900 N	250	4 900 N	400	2 000 N
180	2 700 N	280	5 500 N	450	2 300 N

Loads below the minimum value will cause damage to the bearings. Test runs under no load must not last longer than a few minutes.

Align the motor according to the requirements of the coupling and belt manufacturers. The feet must make full contact with the mounting surface and must be packed if necessary.



Attention!

Ensure that fastening screws are correctly dimensioned.

The foundation load specifications for the motor can be obtained from the manufacturer by stating the motor number. The fastening screws must be tightened and secured according to design specifications in order to prevent loosening during operation and the resulting damage to the drive (→ Table 4, → page 16).

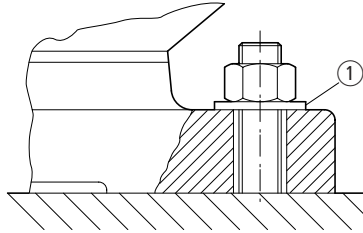


Figure 3: Motor fastening

① Large washer

Use a large washer under every nut or bolt head in order to ensure sufficient contact area (→ Fig. 3).



Flange nuts or bolts can be used as an alternative.

If the motors are mounted vertically, with the shaft end pointing down or up, the driven machine or a suitable shroud must be used to prevent foreign bodies ≤ 8 mm from falling into the air inlet or outlet openings of the fan cowl.



Attention!

The cooling airflow of the motor must not be reduced by the cover, see section "Location", page 9.

The balance of the motors is given on the shaft end face and/or the rating plate (H = half, F = full, N = without featherkey).

The version of coupling or belt pulley must be suitable for the balance of the motor.

**Attention!**

In versions with a half featherkey (H) protruding (visible) key parts must be flush with the diameter of the shaft or covered with rings with key slots in the positions concerned.

If the coupling is longer than the featherkey, you must fill in the key slot in the protruding section of the coupling.

In both cases, if this is not carried out, imbalances leading to impermissible vibrations will be produced.

**Attention!**

Only fit the belt pulleys or couplings using the threaded hole in the shaft end, otherwise the roller bearings may be damaged (→ Fig. 4).

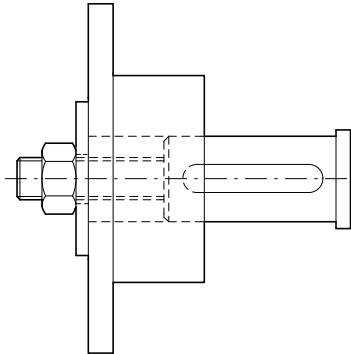


Figure 4: Fastening the belt pulley or coupling

- ▶ Screw in the threaded bolt into the threaded hole.
- ▶ Fit the belt pulley or coupling onto the shaft end: by screwing a nut with a washer onto the threaded bolt. The diameter of the washer must be at least that of the pulley hub or coupling.

Only fit belt pulleys or couplings onto the shaft end that have been carefully dynamically balanced. Machines that are linked by couplings must be installed according to the specifications of the coupling manufacturer.



Only use flexible couplings!

Mains supply and connections

The motors operate with a mains supply fluctuation up to $\pm 10\%$ or a frequency fluctuation of up to -5% to $+3\%$ in accordance with VDE 0530. Mains data must correspond to the voltage and frequency specifications on the rating plate.

Connect the motors as stated in the connection diagram enclosed in the terminal box, see also page 28. To do this only use the original connection parts supplied, see section "Connecting the mains and monitoring circuit", page 19.



Attention!

Connect the motor, the control system, overload protection and earthing according to the relevant national installation regulations.



Attention!

Do not use any automatically restarting motor protective devices where unexpected startups may be a danger to personnel.

Mains connection of explosion-protected motors

EN 60079-14 and EN 50281-1-2 must be observed in addition to general installation regulations. Compliance with these standards requires the provision of overload protection by means of motor-protective circuit-breakers or similar protective devices. This also includes PTC thermistor temperature sensors with a tripping device, see section "Motors with temperature monitoring", page 23. These must be specified on the rating plate together with a tripping time t_A .

Any special requirements prescribed on the test certificate must also be fulfilled. These are identified by an "X" behind the test certificate number on the rating plate.

Terminal box

The terminal box can be rotated by $4 \times 90^\circ$ in order to change the position of the cable entries.

- ▶ For this either undo
 - the four fastening screws (→ Fig. 5) or
 - the anti-rotation locking feature using the threaded pin (→ Fig. 6).

- ▶ Turn the terminal box to the required position.

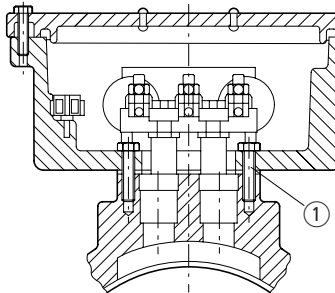


Figure 5: Terminal box with fastening screw ①

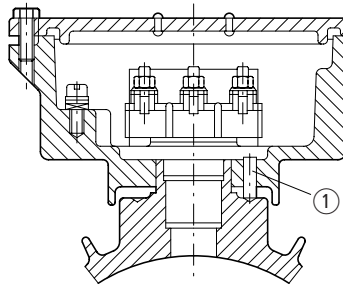


Figure 6: Terminal box with threaded pin ①

- Then re-tighten the fastening elements to the appropriate tightening torque for the thread. For this see the following table.

Table 4: Tightening torques for grade 8.8 screws

Thread size	Tightening torque
M5	6 Nm
M6	10 Nm
M8	25 Nm
M10	49 Nm
M12	85 Nm
M16	210 Nm
M20	425 Nm



Attention!

Terminal boxes that are fastened as per Fig. 6 must not be rotated back through more than one full turn from the fully screwed down position. Covers that are screwed on using a thread should not be rotated back more than the first locating point from the fully screwed down position. Secure them at this point.

Corrosion protection can be achieved using non-curing sealant or sealant grease, especially on the machined sealing

surfaces of the cover of terminal boxes with a flameproof enclosure, designation EEx d IIC(B).

Permissible sealing materials:

- for threads and surfaces:
Hylomar, from Marston-Domsel or
- for surfaces:
Admosit and Fluid-D, from Teroson.



Attention!

The seals used in terminal boxes with protection type "increased safety" are part of the certification. Only original seals must be used.

Cable entries

Connect the motors with cable entries or via ducting systems in accordance with EN 60079-14. These must fulfill the following requirements:

- EN 50019 for terminal boxes with protection type "increased safety", (component designation EEx e II)
- EN 50018 for flameproof enclosures, (component designation EEx d IIC(B))

Test certificates must also be provided for cable entries.



Attention!

Only the original cable entries supplied or those compliant with the new Directive must be fitted with motors complying with Directive 94/9/EEC, (designations such as II 2G ...).

Unused openings must be closed with blanking plugs which must also be provided with suitable test certification and/or the above designations.

The supplied sealing caps for the cable entries are only for protection during transport and are not approved shut-offs. This also applies to outdoor storage. In this case, additional protection from the rain is required.

The standard entries supplied (version 1) are only for the entry of permanently laid cables.

Version 3 entries, that are supplied as a special accessory, with additional strain relief are designed for the entry of cables on motors that can be moved.



Attention!

Cable entries and blanking plugs not meeting these requirements are not permissible. Cable diameters used must comply with the clamp range indicated on the opening.

Directions for motors with terminal boxes where the mains supply is located between the upper and lower sections

Only use the supplied original seals, in order to maintain degree of protection EEx e II. Depending on type (see designation on the plug), the plugs are suitable for the following cable diameters (→ Table 5).

Table 5: Cable diameter

Type	Cable diameter
RS-75	26 to 48 mm
RS-100	48 to 70 mm

Installation:

- ▶ After connecting the mains supply, the terminal box should be closed using the upper section.
- ▶ Remove the small plates of the plugs in order to adapt them as follows:
Adapt the plugs to the cable diameter by removing the small plates so that there is no more than a 1 mm gap between the cable and the fitted plug.

For this, up to one small plate more can be removed from one module half than from the other.

- ▶ Grease the cutting edges and sealing surfaces of the plug with the supplied grease.
- ▶ Push the plug halves over the cable all the way into the passage opening.
- ▶ Tighten them with the screws until there is a considerable resistance (maximum torque: 6 Nm).

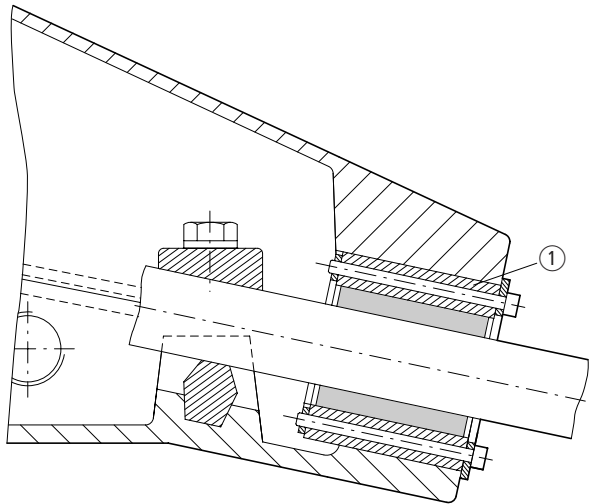


Figure 7: Cable entry

- ① Up to two cable entries, from Roxtec, Rox plugs type RS

Connecting the mains and monitoring circuit

On versions with a terminal board (→ Fig. 8) or with individual bolt clamps (→ Fig. 9) the power cable can be connected with or without a cable lug, see section "Connection diagrams", page 28.

► Connect the power supply to the terminals in accordance with the circuit diagram supplied.

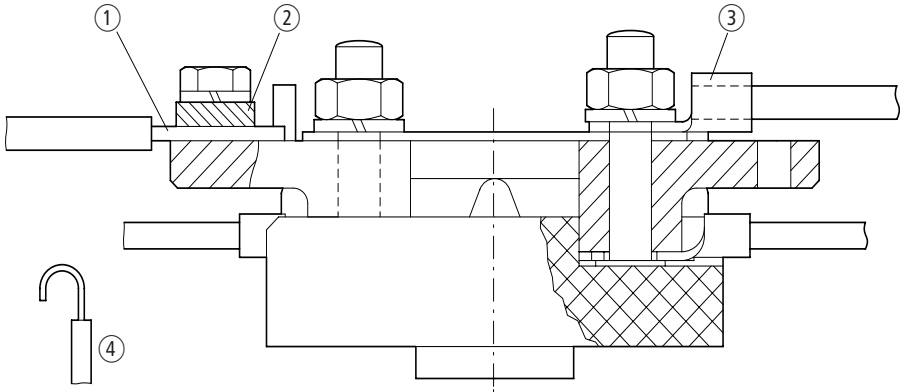


Figure 8: Connecting the cables

- ① Connection without cable lug
- ② Terminal clamp
- ③ Connection with cable lug
- ④ Shape of single core wire without cable lug

► Bend the conductor end in the form shown ④ when connecting single-core wires without a cable lug under a terminal clamp with only one screw.

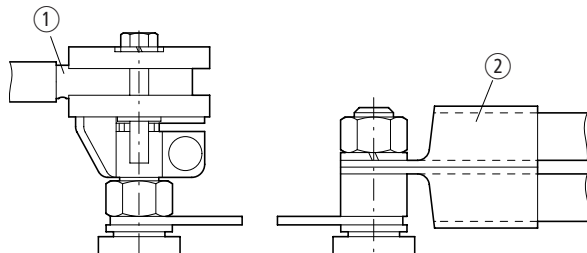


Figure 9: Terminal board with bolt clamp

- ① Connection without cable lug
- ② Connection with cable lug

With terminal boxes with protection type “increased safety” ensure compliance with the required clearances between conductive parts and different potentials as specified in EN 50019 (→ Table 6). Tighten the screws and nuts on conductive parts to the specified tightening torques (→ Table 7).

Table 6: Clearances

Rated voltage, U [V]	Minimum clearance [mm]
$175 < U \leq 275$	5
$275 < U \leq 420$	6
$420 < U \leq 550$	8
$550 < U \leq 750$	10
$750 < U \leq 1100$	14
$2200 < U \leq 3300$	36
$5500 < U \leq 6600$	60
$8300 < U \leq 11000$	100

Table 7: Tightening torques for conductive bolts

Thread size	Torque [Nm]
M4	1,2
M5	2
M6	3
M8	6
M10	10
M12	15,5
M16	30

Depending on the version, additional terminals, such as for anti-condensation heating, are located either in the main terminal box or in additional terminal boxes, see the supplied circuit diagram.



Attention!

Observe the rating data shown on the terminals.



Attention!

The circuit diagram supplied in the terminal box must be kept with the documents belonging to the drive.

Motors with external cooling by means of externally driven fans

The electrical control must ensure that the main motor can only be operated when the motor for external cooling is active.

Motors with temperature monitoring

Terminals 10-11 or 12-13

The motors are fitted with PTC thermistors in accordance with DIN 44081. Observe the temperature specifications and tripping time t_A on the rating plate.

Connect the PTC thermistor to a tripping device with PTB approval 3.53 PTC/A.



Attention!

The tripping device is not explosion-proof. It must therefore be installed outside of the hazardous area.

The PTB approval 3.53-PTC/A confirms observance of the electrical data at the interface between the temperature sensor circuit and the tripping device. The use of the tripping device with PTC thermistor sensors is approved by DIN 44081 for the temperature monitoring of explosion-proof electrical machines.

The temperature sensors described here can only be used in combination with an approved tripping device as the sole method of overload protection, in accordance with EN 60079-14, if the tripping time t_A is specified on the motor rating plate.

Motors with anti-condensation heaters

Terminals 70-71 or U1-V1

The rating data of the anti-condensation heating is specified on the rating plate or on an additional plate. Depending on the version, the heater power supply can either be fed:

- via heating bands connected to terminals 70-71, or
- via the stator coil by means of an AC voltage applied to terminals U1-V1.



Attention!

The electrical control must ensure that motor voltage and heater voltage cannot be applied simultaneously.

Motors for operation on frequency inverters

Only motors with temperature monitoring via PTC thermistors may be used for operation with frequency inverters, see section “Motors with temperature monitoring”, page 23. The ratings permissible with this mode of operation are specified on the rating plate or on an additional plate. If no additional plate is fitted, the specifications provided in the Moeller publication “Explosion-proof three-phase motors, type EEx d(e) IIC(B) T4” apply.

With frequency inverter operation check the EMC compliance of the drive in accordance with the EMC Directive 89/336 EEC.

When operating the motors with frequency inverters using a DC link, ensure that the periodically occurring commutation voltage peaks do not exceed the permissible voltage peak value of 1000 V (limit value for terminals, air gaps and creepage paths).

When using a pulse-width modulated intermediate circuit voltage converter (pulse convertor) for supplying power, high-frequency transients with high voltage peaks must be prevented. These can arise due to the sharp switching ramps of the voltage pulses (especially in long supply lines between converter and motor) and will shorten the lifespan of the coil insulation. The normal version of terminals and glands for 750 V is designed for peak voltages of 1 166 V. Higher voltage peaks require the use of glands and terminals for 1 000 V. The permissible value for periodic peak voltages is then 1 600 V. If periodic voltage peaks over 1 600 V occur, high-voltage insulation systems must be used.

If a converter output is not galvanically isolated from the mains supply with a current limiter, the protective conductor must be provided with overload protection in accordance with DIN EN 50178, VDE 0160 (equipment of heavy current systems electronic equipment).

The size of the protective device for the phase conductors should take into account that, in the event of a fault, the current on the protective conductor can exceed that of the phase conductors. The protective conductor must therefore be designed for this fault current.

Observe all the specifications of the converter manufacturer with regard to this type of fault.

Motors with integrated frequency inverters

Parameters

The parameters of the integrated frequency inverter are set by Moeller for the application concerned.

This setting is not the original factory setting of the frequency inverter manufacturer. A list of parameter settings is provided in the enclosed frequency inverter manual.

Changing certain parameters, such as motor voltage or pulse frequency may cause the drive to operate in a critical range. This may lead to a fault disconnection of the inverter or the tripping of the PTC thermistor monitoring.

The motors can be operated in the frequency range between 2 Hz (restricted torque) and 100 Hz. The pulse frequency of the frequency inverter is 5 kHz.

Explosion protection is ensured, however, since the motor and frequency inverter have to be monitored by the PTC thermistor temperature sensors, see section "Motors for operation on frequency inverters", page 24.

Follow the instructions given in section "Explosion protection", page 35, since, depending on type, the parameter settings must be carried out in a flameproof enclosure on which explosion protection depends.

Insulation measurements:

To measure the insulation resistance of the motor winding, open the connection to the frequency inverter.

An insulation test of the frequency inverter was carried out at the factory so that further tests are may no longer be necessary. If an insulation test was found to be necessary, proceed according to the instructions in the frequency inverter manual.

Observe the standards and instructions given in the enclosed frequency inverter manual.

Brake motors

With motor versions featuring an internal brake, the mains supply is connected inside the terminal box of the motor. Motors with an external brake are connected to the mains supply in a separate terminal box of the brake. Observe the supplied connection diagram and the rated voltage shown on the rating plate. When the AC voltage is connected, the brake coil is energized via a silicon rectifier housed in the flameproof enclosure.

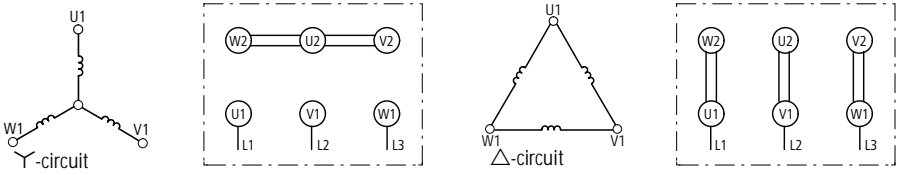


Connect the temperature sensors in the motor and in the brake according to section "Motors with temperature monitoring", page 23.

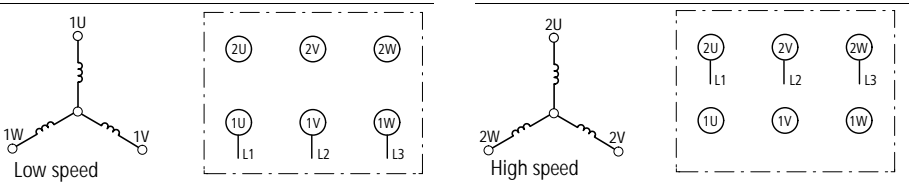
Connection diagrams

The circuit diagram provided with the motor must be observed.

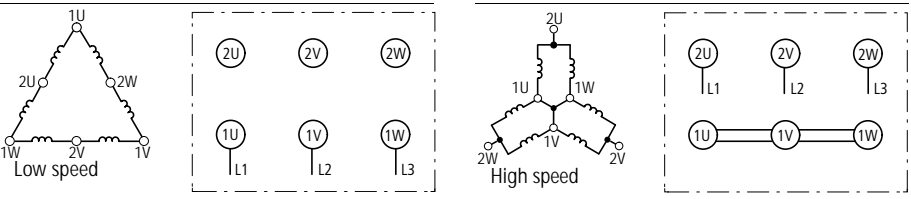
Single-speed – one pole



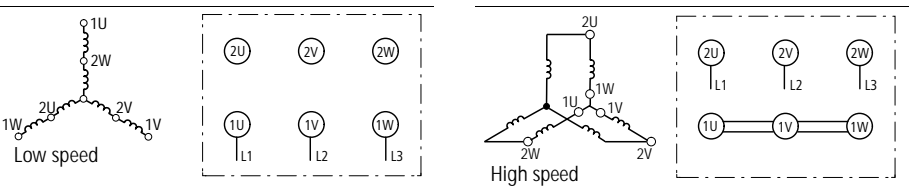
Pole-changing



Dahlander circuit



Dahlander circuit

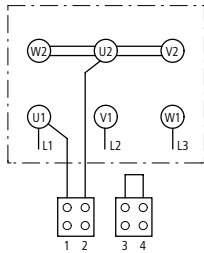


5-6	Tacho-generator		
10-11	PTC thermistor disconnection	PTC thermistor, advance warning	Use tripping device with PTB number
12-13	PTC thermistor disconnection		
20 to 23	PT 100 resistance temperature sensor		
70-71	Anti-condensation heater		

Brake Motors With Integral Brake

Brake Connection Via Motor Winding

Y-circuit

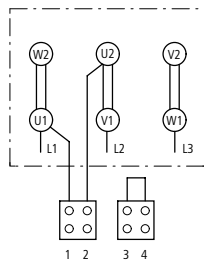


Terminals 1-2 can be connected directly with the motor terminals to supply the brake. Check the voltages of the motor/brake to determine whether terminals U1-U2 or U1-V1 should be used.

Terminals 3 and 4 must be bridged.

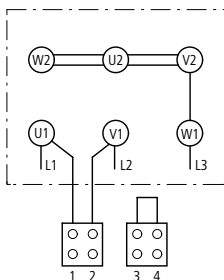
An external voltage can also be applied to terminals 1-2. Observe the voltage on the rating plate. Terminals 3 and 4 must be bridged.

Y-circuit



For a fast brake response (DC-side operation), the bridge between 3 and 4 can be replaced with a contact. The contact must switch at the same time as the brake voltage supply.

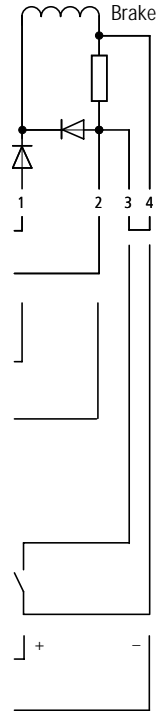
Δ-circuit



For emergency release of the brake, e.g. to turn the motor by hand, a DC voltage can be applied across terminals 1 and 4 (disconnect other wiring first and observe polarity).

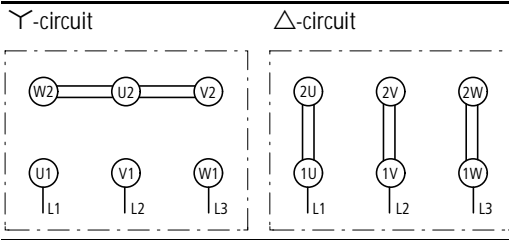
Voltage $U_{DC} = U_{AC} \times 0.45$

Voltage U_{AC} see brake voltage on the rating plate.

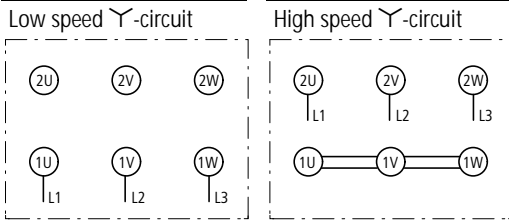


1-4	Brake		
10-11	PTC thermistor disconnection	PTC thermistor, advance warning	Use tripping device with PTB number
12-13		PTC thermistor disconnection	
70-71	Anti-condensation heater		
P1-P2	Temperature monitoring: Microtherm T 10		

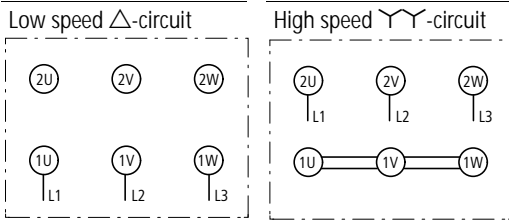
Brake Connection Via External Power Supply



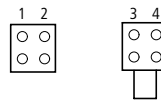
Pole-changing



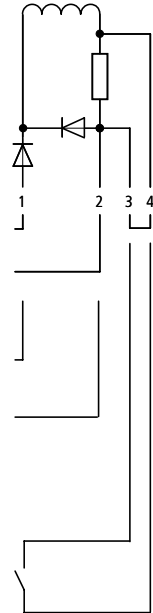
Dahlander pole-changing circuit



Brake connection



Power supply to brake via terminals 1-2. Observe data on rating plate. Terminals 3 and 4 must be bridged.



For a fast brake response (DC-side operation), the bridge between 3 and 4 can be replaced with a contact. The contact must switch at the same time as the brake voltage supply.

1-4	Brake		
10-11	PTC thermistor disconnection	PTC thermistor, advance warning	Use tripping device with PTB number
12-13		PTC thermistor disconnection	
70-71	Anti-condensation heater		
P1-P2	Temperature monitoring: Microtherm T 10		

3 Operation and Repair

Operating modes and temperature protection

- On motors with S1 operation, temperature sensors can also be used in addition to the motor-protective circuit-breakers specified in DIN EN 60079-14, VDE 0165.
- If protection against impermissible temperatures is to be implemented only using temperature sensors in motors with operating mode S1, a tested combination of temperature sensor and tripping device must be used.
- With motors using operating modes S2, S3 or S6 a tested combination of temperature sensor and tripping device must be used. This is an additional protection to the motor-protective circuit-breaker required by DIN EN 60079-14, VDE 0165 Part 1, or as a sole protective temperature sensor.
- With motors with operating modes S4, S5, S7, S8, S9 or S10 protection against impermissible temperatures is to be implemented only using tested combinations of temperature sensor and tripping device.
- A power supply to the motors via the frequency inverter is only permissible if a tested combination of temperature sensor and tripping device is used in the coils and tripping device.

The temperature sensors must be connected according to section “Motors with temperature monitoring”, page 23.

Operation of motors at temperatures below -20 °C is permissible if the temperature of the entire motor can be brought to at least -20 °C using an anti-condensation heater prior to switching on.

Commissioning



Attention!

Insulation resistance must be measured by specialist engineers before installation and commissioning. The resistance should be at least 1 M Ω . A critical value should be reached at 0.5 M Ω . If this value is not reached the motors must be dried.

This is best done in an oven at temperatures of up to 100 °C. Open the motor in order to allow moisture to evaporate. However, consult with Moeller beforehand in order to safeguard any warranty claims.

This work must be carried out by specialist personnel. Moeller will provide directions for maintaining explosion protection during reassembly. Refer to the relevant Moeller instructions for installation and removal.

- Check the direction of rotation and how the motor is running with no load applied. For external fans (axial-flow fans) that depend on the direction of rotation, observe the rotation direction shown on the motor. To change the direction of rotation, exchange the two main cables and the fan.
- If the motor has been stored and the rolling bearings were provided with an additional quantity of grease, the motor must be run without load for at least 30 minutes in order to ensure that the grease is adequately spread and to prevent the bearing from becoming overheated.
- Compare the operational current with the specifications on the rating plate.

The protective devices required by EN 60079-14 must be set to the motor rating data shown on the rating plate. The amperage value shown on the rating plate must not be exceeded under a continuous load.

**Attention!**

Run the motor for at least 1 hour under load and observe whether any unusual noises occur and whether the specified temperature class is exceeded.

Fluctuations $V_{\text{eff}} \leq 3.5 \text{ mm/s}$ ($P_N \leq 15 \text{ kW}$) or 4.5 mm/s ($P_N > 15 \text{ kW}$) in coupled operation are not a problem. In the case of deviations from normal operation (e.g. increased temperatures, noises, fluctuations, vibrations), establish the cause and contact Moeller, if necessary.

**Attention!**

Never decommission protective devices, even during test runs. In case of doubt, deactivate the machine.

Maintenance**Inspection**

- Continuously monitor motors according to the circumstances of their use.
- Keep motors clean and the ventilation openings clear, see section "Location", page 9.

Lubrication**Attention!**

Bearings and grease must be kept free of contamination in order to prevent damage.

The ball bearings of motors up to size 280 are sealed on both sides, and provided with a grease filling by the manufacturer that under normal operating conditions (coupling drive) will be adequate for 40 000 operating hours with 4-pole or multi-pole motors, or for 20 000 operating hours with 2-pole motors.

When the bearings are replaced, the shaft seals must be replaced as well. For this, dismantle the motor (which will also provide an opportunity to clean the coils). Dismantle and assemble in accordance with separate Moeller repair instructions.

Motors from size 315 and motors with reinforced bearings must be fitted with a lubrication device. Lubrication of the bearings should be carried out using a grease gun and via the lubricating nipples installed on the end plate or bearing covers, preferably when the motor is running.

The collection space in the bearing cover for spent grease is so large (given correct lubrication) it can accommodate the old grease for the nominal lifespan of the motor.

The lubrication periods and the grease quantities and grades prescribed for the motor can be derived from the plate fitted on the motor housing. The manufacturer normally uses ESSO-Unirex N3, a lithium-complex soap/mineral oil grease.

Table 8: Normal lubrication periods in hours

Ambient temperature	Speed up to 1800 rpm	Speed up to 3600 rpm
40 °C	5 000 h	2 500 h
50 °C	2 500 h	1 000 h



Attention!

In motors with increased power (motor type ...X), under demanding drive conditions (e.g. belt or gear drives with additional bearing loads and in vertical installations), the lubrication periods should be reduced by 50 %.

Observe stated grease quantities.

Too much lubrication may cause a considerable increase in bearing temperature and therefore cause bearing failure.

**Caution!**

When lubricating a running motor, make sure there is adequate protection against rotating parts!

Use only resin-free and acid-free anti-friction roller bearing grease with a drop point of approx. 200 °C.

Explosion protection

Designations such as Ex (II2G), EEx de IIC T4 indicate where the motor may be used and that it was designed, constructed and approved in accordance with the European standards for operating in hazardous areas.

**Attention!**

The motor therefore may not be modified in any form and the instructions of this operating manual must always be observed.

If the motor is changed or if repairs must be carried out, these should be completed by a workshop or factory that has the necessary knowledge. Before recommissioning the motor, observance of the regulations must be checked by an appointed authority in accordance with the EC Directives and the result must be confirmed by designating such on the motor or by issuing a test report.

If these stipulations are not observed, the motor will no longer be classified as explosion-proof and the designation referred to must be removed.

Directions for maintaining explosion-proof enclosure during operation

- All contact screws or nuts of the electrical connections must be well tightened in order to avoid excessive contact resistance, which can lead to excessive heating of the contact point. For the tightening torques, see table 7, page 22.
- When connecting the mains cable, proceed with extreme care. Observe the creepage paths and air clearances. The sealing parts of the cable openings and the connection spaces, and the entry parts provided as strain relief or rotation protection for the mains cable must be used correctly in order to maintain the protection class of the connection spaces, see section "Connecting the mains and monitoring circuit", page 19.
- Rectify any damage immediately and only use original spare parts. The correct execution of the activities must be verified by an agency appointed under the EC Directives (in Germany, by an ElexV specialist) and be confirmed by designating such on the motor or by issuing a test report.
- The surfaces of flameproof joints must not be sealed with mastic. These surfaces must be maintained as clean metal. As corrosion protection, provide a film of oil or non-curing grease. Permissible sealing materials are Hylomar from Marston-Domsel, or Admosit and Fluid-D from Teroson. This particularly applies to the flameproof joints of the cover for connection space areas of flameproof enclosures, designation EEx d IIC(B).
- All screws must be tightened to the specified torque, see table 4, page 16 and must be sufficient for the number of fastening holes provided.

Repair

Repairs and modifications to explosion-proof machines must be carried out by an appointed agency operating under EC Directives (in Germany, in compliance with ElexV), as well as with the safety instructions and descriptions given in the Moeller repair manual. Activities related to explosion protection must be carried out on Moeller premises, or in a workshop specializing in electric machines. If such activities are not carried out by Moeller, they must be approved by a recognized specialist. In Germany, a written confirmation in accordance with ElexV must be provided. Elsewhere, observe the applicable national regulations.