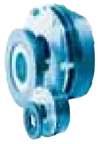


TECHNICAL EXPLANATIONS

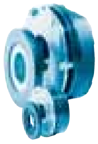
ELECTRICAL DESIGN

SPECIAL DESIGNS

BRAKE SIZE SELECTION

BRAKES - TECHNICAL DATA

BRAKE MOTOR SWITCHING VARIATIONS



NORD brake motors

are equipped with electromagnetic (DC voltage) spring-loaded brakes. The brakes prevent unintended machine rotation (as holding brakes), or stop machine rotation (as work brakes or by emergency-stop).

Environment

The brake pads are asbestos-free.

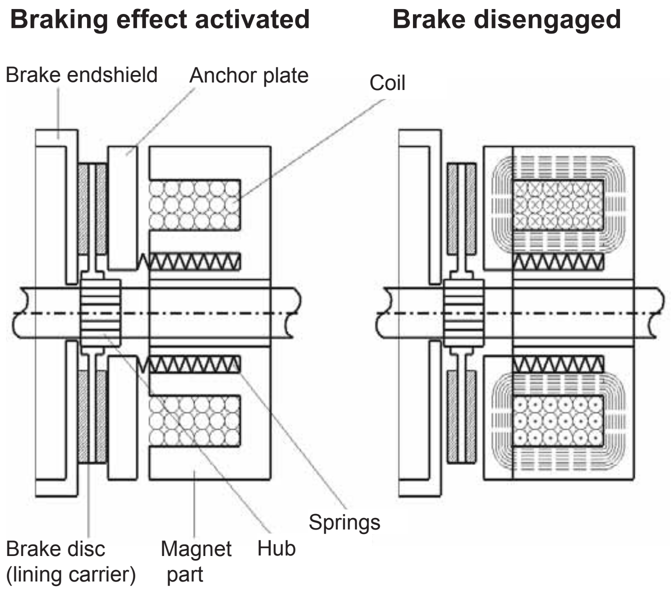
Safety

The braking effect is activated by a current interruption (closed current principle).

Closed current principle (Failsafe)

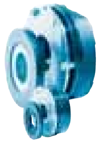
The brake disc is located between the brake endshield and the anchor plate. The brake disc has a brake lining on each side. The brake disc transfers the braking torque via the hub to the motor shaft. The brake disc can be axially moved on the hub. Using spring force, the anchor plate of the brake disc is pressed against the brake endshield. The braking torque is produced by the friction between anchor plate and brake lining, and between brake endshield and brake lining. The brakes are being disengaged by an electromagnet (magnet part).

When the electromagnet is energised, it pulls back the spring loaded anchor plate several tenths of a millimetre from the brake lining, allowing the brake disc to turn freely. Due to current interruption the magnetic retraction force collapses, allowing the spring force to prevail again. The braking effect is therefore inevitably activated.



Power-on brake

Brakes that are activated (engaged) by the electromagnet are called power-on brakes.
(Please enquire!)



Nomenclature - Brakes

BRE 100 RG HL [...]

- [...] – options possible
- HL – release
- RG – Rust-proof design
- 100 – Brake size/Brake torque
- BRE – Brake

Example: **BRE 40 FHL SR**
Brake, 40 Nm with lockable manual hand release, dust- and rust-proof design.

Options

HL **Manual Hand Release**
This option allows the brake to be manually released without applying voltage to the brake coil. To do so, the lever is pulled in direction of the motor end. It is returned to its position by spring force.

FHL **Lockable Manual Hand Release**
Brakes with manual hand release can be locked in the disengaged status.

MIK **Micro switch**
The brakes are available with an integrated micro switch to provide a simple electronic monitoring of the released function.

RG **Rust-Proof Design**
Painted endshield and corrosion-proof friction plate

SR **Dust- and Rust-Proof Design**
As RG option, but with extra dust boot

IR **Current Sensing Relay**

NRB1 **Noise-Reduced Brake**
In order to reduce the switching noises, the brake can be delivered with an O-ring between the anchor plate and the magnetic part.

NRB2 **Noise-Reduced Brake**
Noises due to torque vibrations deriving from inverter operation or single-phase motors can be effectively reduced by O-rings on the brake hub.

DBR **Theater Design**
A combination of 2 brakes, in a noise-reduced design, are also available to meet the safety requirements in the theatre sector.

BRB **Anti condensation**
(Bifilar winding)

Nomenclature - Brake Rectifier

Example G H E 4 0 L

- L – Electronic protection components
- 0 – Power rating
- 4 – Voltage range
- E – Type of DC - switching
- H – Type of rectifier
- G – Rectifier

Explanations

1st pos.: **G**: Rectifier

2nd pos.: Type of rectifier
H: Half wave (One-way rectifier)
V: Full wave (Bridge rectifier)
P: Push (short-time full wave, thereafter half wave) fast-reaction rectifier

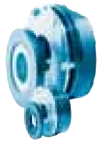
3rd pos.: Type of DC-side switching
E: through external contact (protection)
U: through internal electronic circuit

4th pos.: Voltage range
2: up to 275VAC
4: up to 480VAC
5: up to 575VAC

5th pos.: Max. current rating
0: 0,5A (75°C)
1: 1,5 A (75°C)

6th pos.: Protection of electronic components against jolts and moisture
L - Paint coating
V - Sealed

Switch Variants, see page G15

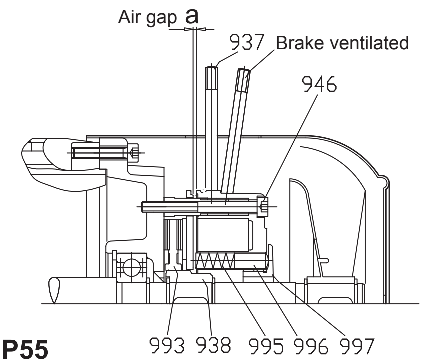


Protection against corrosion, dust, dirt and moisture

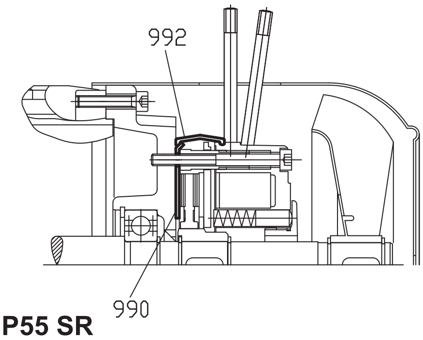
1) Corrosion-proof friction plate (option RG) (only in IP55 available)
2) Dust-boot (Option SR), including corrosion-proof friction plate (only in IP55 available)
3) Enclosure IP66, note motor enclosure, please enquire!
4) Enclosure IP67 (seawater brakes), note motor enclosure, please enquire!
5) Bifilar brakes, option BRB (anti condensation heater), please enquire!

Sectional drawings

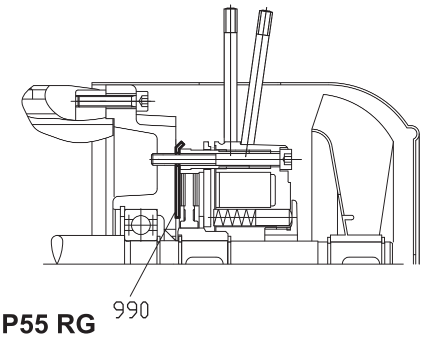
937 Manual hand release
938 Brake hub
946 Screw
971 O-ring
990 Friction plate
992 Dust-boot
993 Brake lining
995 Spring
996 Pressure element
997 Adjusting ring
5 - 40 Nm
998 Bushing / Sealing disc
999 V-ring



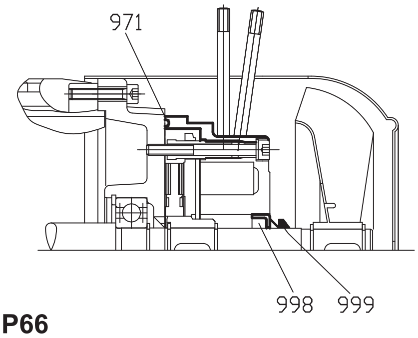
IP55



IP55 SR



IP55 RG



IP66

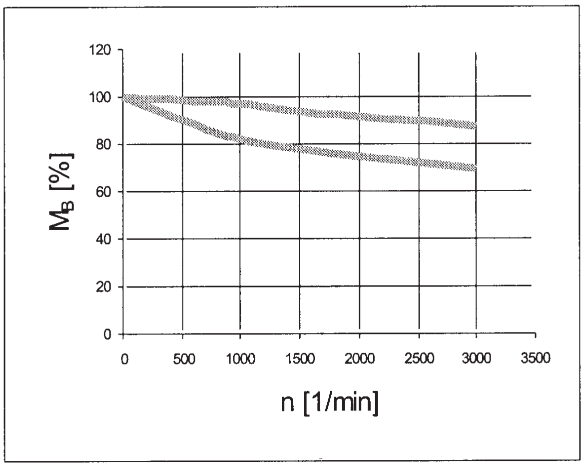
The brake torque (MB)

The switching torque, as a characteristic value of braking torque, is normally defined as the torque generated by an average friction velocity of the friction surfaces of 1 m/s. (DIN VDE 0580/10.94, Low voltage guideline 72/23 EEC). Applies to run-in brake conditions. If the effective braking torque is not exactly identical to the switching torque, it must be considered as a guide value. The magnitude of the actual effective braking torque depends on temperature, speed (friction velocity), environmental conditions (contamination, humidity) and wear conditions. This must be considered during project planning.

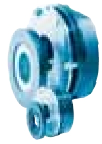
⚠ The full braking torque is only available after a short initial run-in phase.

The friction surfaces of the brakes must be dry. **They must not come in contact with grease or oil! Grease or oil on the friction surfaces will drastically reduce the braking torque.**

Speed dependency of the braking torque



Average values between both characteristic curves,
upper characteristic curve – small brakes (from 5 Nm)
lower characteristic curve – large brakes (400 … 1200Nm)



Brakes - standard combinations for 4-pole motors

	M_B [Nm]										
Motor BG	**BRE 5**	**BRE 10**	**BRE 20**	**BRE 40**	**BRE 60**	**BRE 100**	**BRE 150**	**BRE 250**	**BRE 400**	**BRE 800**	**BRE 1200**
63 S/L**	**5**	10*1)									
71 S/L**	**5**	10*									
80 S**	**5**4)	10	20*								
80 L	5	**10**	20*								
90 S		10	**20**	40*							
90 L		10	**20**	40*							
100 L			**20**4)	40	60*1)						
100 LA			20	**40**	60*1)						
112 M			20	40	**60**						
132 S					**60**	100	150*				
132 M					60	**100**	150*				
132 MA					60	100	**150***				
160 M						100	**150**	250			
160 L						100	150	**250**			
180 MX/LX							150	**250**			
200 L								250	**400**		
225 S/M									**400**	800*2)	
250 M										**800***2)	
280 S/M										**800***2)	1200*3)
Extra-weight [kg]	2	3	5,5	7	10	16	22	32	50	80	100
$J\ [10^{-3}\ kgm^2]$	0,015	0,045	0,153	0,45	0,86	1,22	2,85	6,65	19,5	39	39

Braking torques shown in bold font: Standard design

* IP66 not possible

** Economic, non-adjustable BRH holding brake models with lower torques, please enquire.

1) Manual release not possible!

2) When used as working brake, additional calculation of braking work is essential!

3) Permitted only as holding brake, with EMERGENCY-STOP function!

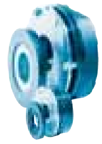
4) When operating as frequently switched working brake, we recommend using a brake of the the next size with torque adjusted to the application.

BRE800 and BRE1200 brakes may only be controlled with a fast reaction rectifier (over-excitation), the maximum permissible nominal currents of the rectifier must be considered!

The selection of a standard combination motor brake as per the above overview must be checked carefully. The braking torque must be determined in line with the demands of the application.
When doing so, it is important to consider that motors of the same type but with a different number of poles generate very different torque levels, especially 4-pole motors compared to 8-2 pole motors. (Nominal, starting and break down torques see table on page F13-F18).
When designing the drives, you have to consider not only the torque requirement of the application but also the torque on the motor side. The braking torque may therefore be reduced considerably (see table on page G6) so that the gear unit is not overloaded when braking large moving masses (see “Selecting brake size” on page G13 below).

Holding brake - working brake - emergency stop brake

The terms “holding brake”, “working brake” and „emergency stop brake“ are defined by the type of application. A holding brake has the task of preventing a machine from moving when at standstill or partial standstill.
As soon as a brake is required to performs any notable level of frictional work, it is regarded as a working brake. The respective frictional work and frequency of switching must be determined and taken into account when selecting the brake (see page G13, see G14).
To qualify as an emergency stop brake, the brake has to be required to brake very large masses at once and be subjected to accordingly large energy loads. In this case the selection of the brake is based on the maximum permitted level of frictional work for each braking procedure (see G14).



Braking torque settings

On request, the brakes can be supplied with reduced braking torque (excluding BRE1200).
The braking torque can be reduced by removing springs.

An even finer adjustment of the braking torque is possible by turning an adjustment ring (BRE5 to BRE40 only).

⚠ The switching times are changed by reducing the braking torque! (faster disengagement - slower engagement)

Number of springs	M_B [Nm]									
	BRE 5	BRE 10	BRE 20	BRE 40	BRE 60	BRE 100	BRE 150	BRE 250	BRE 400	BRE 800
8								250	400	800
7	5	10	20	40	60	100	150			
6								187	300	600
5	3,5	7	14	28	43	70	107			
4	3	6	12	23	34	57	85	125	200	400
3	2	4	8	17	26	42	65			

Reduction of braking torque with a setting ring		BRE 5	BRE 10	BRE 20	BRE 40
• **Per setting ring detent**	[Nm]	0,2	0,2	0,3	1
• **Smallest achievable braking torque**	[Nm]	0,8	1,6	4,4	5

Wear

The brake linings are subject to different wear dependent on the application. The brake disc thickness is reduced by material wear and the air gap increases.

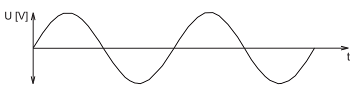
When the maximum air gap is reached, they must be readjusted. If the minimum permissible brake disc thickness is reached the brake disc must be replaced. BRE 800 and BRE 1200 brakes have 2 brake discs each.

⚠ An increasing air gap increases the release time of the brake!

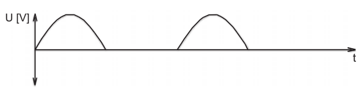
Electrical design

The windings of the brakes are designed for continuous operation. They heat up at nominal voltage in continuous released condition according to the insulation class 130°C (B). (Temperature increase ≤ 80K). The brakes are powered by DC voltage. Power from the AC network is rectified.

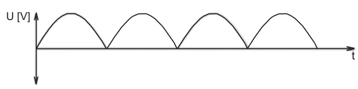
Half-wave and full-wave rectifiers are available, together with fast reaction rectifiers whose function will be explained in the following sections. The rectifier should be selected according to the application requirements. To protect the lining against freezing, the brakes can be heated electrically, see also **„Anticondensation heaters of brakes with bifilar coils“, (option BRB)“.** 📖 **G8/ G9**. **Please enquire.**



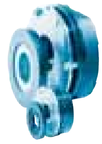
Sinusoidal form of the AC voltage



Voltage form with half-way rectifier
$U_{DC} = U_{AC} \times 0{,}45$



Voltage form with full-wave rectifier
$U_{DC} = U_{AC} \times 0{,}9$



Switching Performance of the Brakes

The building up of a magnet field to release the brakes and its collapse when engaging the brake requires a certain amount of time. This delay is often of wanted but can be effectively reduced through suitable measures.

Activating the Brake Effect (Engagement)

AC-side switching (GVE, GHE, GPE Rectifiers)

- **Slow Activation of the Brake Effect**

If only the AC side of a bridge or one-way rectifier is disconnected from the supply, then DC power flows still through the rectifier until the magnetic field in the brake has been collapsed.

Only when the magnetic field has collapsed to minimum level the brake engages. The time required to collapse the field depends on the inductivity of the brake and the resistance value of its windings. As delivered, the terminals 3 and 4 of the standard rectifier are each connected by a wire bridge.
These may not be removed for AC-side switching.

DC-side switching (GVE, GHE, GPE Rectifiers)

- **Accelerated Activation of the Brake Effect**

The magnetic field of a brake collapses quickly and the brake effect is rapidly deployed if current flow is interrupted “on the DC side”, between the rectifier and the brake. This interruption can be effected through a contact between terminals 3 and 4 of the rectifier (see also switching examples). The contact must be suitable for the DC switching load. As delivered, terminals 3 and 4 of the standard rectifier are each connected by wire bridge.
These must be disconnected for DC-side Switching.

Sub-Excitation Through Fast Reacting Rectifier (GPU20, GPE 20)

- **Quickest Activation of the Brake Effect**

If the reduction of the engagement time through DC switching is insufficient, then sub-excitation of the brake in combination with a fast reacting rectifier is recommended. After disengagement of the brake, the fast reacting rectifier switches from the bridge rectifier the one-way rectifier. This reduces the output voltage (DC) and the current by half (in the disengaged status, the brake voltage can be reduced down to approximately 30% of its rated value without engaging the brake).

At half voltage, the magnetic field energy is reduced to a quarter of the energy compared to full voltage (this is the same for the heating up of the windings).

The current flow will be interrupted on the DC-side. A weakened magnetic field collapses faster than a full field. Hence, a brake with a weaker field engages more quickly than a brake with an unweakened field.
No accelerated brake release through over-excitation is possible in this switching combination!

Brass Foil

Another possibility for activating the brake effect as quickly as possible is the usage of a brake with brass foil. The brass foil is located between the anchor plate and the magnetic part of the brake, and is 0.3 mm thick. With it, a large magnetic resistance is introduced into the brake circuit, whereby only a weakened field can build up. With a weakened magnetic field, the brake engagement as with sub-excitation. The release of a brake with brass foil takes longer than the release without brass foil. Its wear buffer is reduced by the thickness of the brass foil. It is recommended to use brakes with brass foil in combination with a fast reacting rectifier for over-excitation only if full brake torque is required. Brakes with brass foil, in combination with standard rectifiers, should only be used with the brake torque reduced to approximately 50%.
Usage in combination with fast reacting rectifiers for sub-excitation is not recommended!

Brake Release (Disengagement)

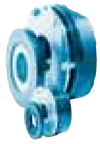
- **Normal Brake Release**

Brake release effect has already been described in the section “Closed Current Principle”. (see page G2).

Over-Excitation Through Fast Reacting Rectifiers (GPU20, GPE 20, GPU40, GPE40)

- **Accelerated Brake Effect**

The fast reacting rectifier works for a short time as bridge rectifier (Push). The double rated voltage is applied to the brake. The force with which the anchor plate is actuated by the magnetic part is subject to an enormous increase due to the double voltage, whereby the anchor plate releases the brake plate significantly faster and the brake release quicker than in the case with normal excitation. After releasing the brake, the fast reacting rectifier switches to a one-way rectifier. The rated brake voltage is then applied.
No accelerated actuation of the brake effect through sub-excitation is possible in this switching combination!



Current Sensing Relays (IR)

(Accelerated Activation of the Brake Effect)

When the rectifiers are wired directly to the motor terminals, the brake is fed directly through the motor supply. This eliminates the need for a separate supply for the brake. Once the motor is shut down, the brake remains electrically connected to the motor via the rectifier. As long as the motor has not yet come to a stand still it acts as a generator and continues to supply the brake via the rectifier, whereby actuation of the brake effect is significantly delayed. Particularly in regard to hoisting devices under load, an inadmissable operating condition can be developped in downward operation.

In order to get short engagement times also with this switching variant, current sensing relays must be used. Current sensing relays analyse the motor's current. If the motor is switched off, then the current sensing relay drops off. DC cut-off of the brake then occurs. Due to internal reaction times, the activation of the brake effect occurs, of course, at a slower rate than with a normal DC cut-off.

The current sensing relay can only be used in combination with the GVE, GHE and GPE rectifiers!

Technical Data Current Sensing Relays (IR)	
Switching voltage	$42...550V_{DC}$
Switching current	$1{,}0A_{DC}$
Primary current	$25A_{DC}$
Max. primary current	75 A (0,2 sec)
Holding current	> $0{,}7\ A_{DC}$
Max. operating temperature	75°C

Bifilar Windings (BRB)

Brakes with a Bifilar winding have 2 independent partial windings of equal value. Both partial windings are switched in series. Both partial windings are provided with identical current flows to release a brake. Both partial windings are provided with opposite current flows to heat a brake. No magnetic field develops. The brake does not disengages, but it's coil is heated by the current.

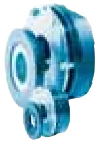
Heat operation at the rated voltage is only permissible at ambient temperatures of max. 0°C! (Only then does it make sense to heat the brakes.)

If a brake should also be heated at normal ambient temperatures of up to 40°C or higher, then this may only be done at a reduced voltage!

Micro Switch (MIK)

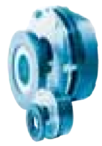
A micro switch can be fitted to the brake to monitor the air-gap in the brake if this is required. Only when the armature plate is in contact with the brake coil housing the micro switch enables the main motor contactor.

The motor can only start up after the brake has been fully released. When the maximum air-gap "a" is reached the brake coil does not the lift armature plate and the brake remains engaged. In this situation the micro switch is not closed and the motor contactor is not activated so the motor cannot start up. The air-gap of the brake needs to be adjusted.



Technical data NORD brake rectifier		
Full-wave rectifier	**GVE20L/V**	
Rated voltage	$230V_{AC}$	
Max. admissible voltage range	110V...275V+10%	
Output voltage	$205V_{DC}$ ($U_{DC} = U_{AC} \times 0{,}9$)	
Rated current up to 40°C	1,5A	
Rated current up to 75°C	1,0A	
DC side disconnection	Possible with external contact	
Half-wave rectifier	**GHE40L/V**	**GHE50L/V**
Rated voltage	$480V_{AC}$	$575V_{AC}$
Max. admissible voltage range	230V...480V+10%	230V...575V+10%
Output voltage	$216V_{DC}$ ($U_{DC} = U_{AC} \times 0{,}45$)	$259V_{DC}$ (U_{DC} = UAC x 0,45)
Rated current up to 40°C	1,0A	1,0A
Rated current up to 75°C *	0,5A	0,5A
DC side disconnection	Possible with external contact	
Short time as full-wave, then half-wave rectifier	**GPU20L/V**	**GPU40L/V**
Rated voltage	230V	480V
Max. admissible voltage range	200V...275V+/-10%	380V...480V+/-10%
Output voltage	$104V_{DC}$ ($U_{DC} = U_{AC} \times 0{,}45$)	$225V_{DC}$ ($U_{DC} = U_{AC} \times 0{,}45$)
Rated current up to 40°C	0,7A	0,7A
Rated current up to 75°C *	0,5A	0,5A
DC side disconnection	Automatically takes place internally! Is deactivated by bridge 3-4!	
Short time as full-wave, then half-wave rectifier	**GPE20L/V**	**GPE40L/V**
Rated voltage	230V	480V
Max. admissible voltage range	200...275V+/-10%	380V...480V+/-10%
Output voltage	$104V_{DC}$ ($U_{DC} = U_{AC} \times 0{,}45$)	$225V_{DC}$ ($U_{DC} = U_{AC} \times 0{,}45$)
Rated current up to 40°C	0,7A	0,7A
Rated current up to 75°C *	0,5A	0,5A
DC side disconnection	Possible with external contact	

* In normal cases, the rectifier can be inserted in the terminal box of the motor. In cases with higher thermal operating conditions, the rectifier must be mounted outside the terminal box, for example, in a separate terminal box on the ventilation cover or in the control cabinet.



Supply Voltages for the Brakes

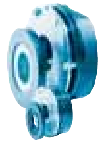
The brakes are deliverable with the following coil voltages:
24 V_{DC}, 105 V_{DC}, **180** V_{DC}, **205** V_{DC}, 225 V_{DC}, 250 V_{DC}
The preferred voltages are printed in boldface.

Supply Voltage [V_{AC}]	**Standard Rectifier**			
110 - 128	GVE20			
180 - 220		GVE20		
205 - 250			GVE20	
210 - 256	GHE40			
225 - 275				GVE20
360 - 440		GHE40		
410 - 480			GHE40	
410 - 500			GHE50	
450 - 550				GHE50
Coil voltage (brake)[V_{DC}]	105	180	205	225

Supply Voltage [V_{AC}]	**Fast Ventilation - Fast Reacting Rectifier**			
200 - 256 **(230)**	GPU20 / GPE20			
380 - 440 **(400)**		GPU40 / GPE40		
380 - 480 **(460)**			GPU40 / GPE40	
450 - 480				GPU40 / GPE40
Coil voltage (brake) [V_{DC}]	105	180	205	225

Supply Voltage [V_{AC}]	**Fast Engagement - Fast Reacting Rectifier**		
200 - 275 **(200)**	GPU20 / GPE20		
200 - 275 **(230)**		GPU20 / GPE20	
200 - 275 **(250)**			GPU20 / GPE20
Coil voltage (brake) [V_{DC}]	180	205	225

The optimum values are printed in boldface



Braking response times (Average values, valid for nominal air gap)																			
Rectifier	V_{AC} Rectifier	V_{DC} Brake	Switch-ing	BRE5		BRE10		BRE20		BRE40		BRE60		BRE100		BRE150		BRE250	
				t_{tr} [ms]	t_{av} [ms]	t_{tr} [ms]	t_{av} [ms]	t_{tr} [ms]	t_{av} [ms]	t_{tr} [ms]	t_{av} [ms]	t_{tr} [ms]	t_{av} [ms]	t_{tr} [ms]	t_{av} [ms]	t_{tr} [ms]	t_{av} [ms]	t_{tr} [ms]	t_{av} [ms]
GHE 4...	230	103	AC	35	130	60	150	85	200	100	180	120	200	150	230	270	300	300	520
GHE 4...	400	180																	
GHE 5...	500	225																	
GVE 2...	230	205																	
GHE 4...	230	103	DC external	35	18	60	20	85	25	100	20	120	22	150	24	270	28	300	38
GHE 4...	400	180																	
GHE 5...	500	225																	
GVE 2...	230	205																	
GPU 2...	230	205	DC internal	35	30	60	34	85	37	100	34	120	35	150	37	270	39	300	46
GPU 2...	230	103		18	35	24	40	38	45	55	40	70	42	85	44	120	48	140	58
GPU 4...	400	180																	
GPU 4...	480	225																	
GPE 2...*	230	103	DC external	18	5	24	5	38	8	55	8	70	12	85	20	120	25	140	34
GPE 4...*	400	180																	
GPE 4...*	480	225																	
GPE 2...*	230	103	DC IR	18	23	24	23	38	24	55	25	70	31	85	34	120	40	140	50
GPE 4...*	400	180																	
GPE 4...*	480	225																	

*** Brake with brass foil**

The switching times are only valid for brakes with nominal air gaps!

Definitions

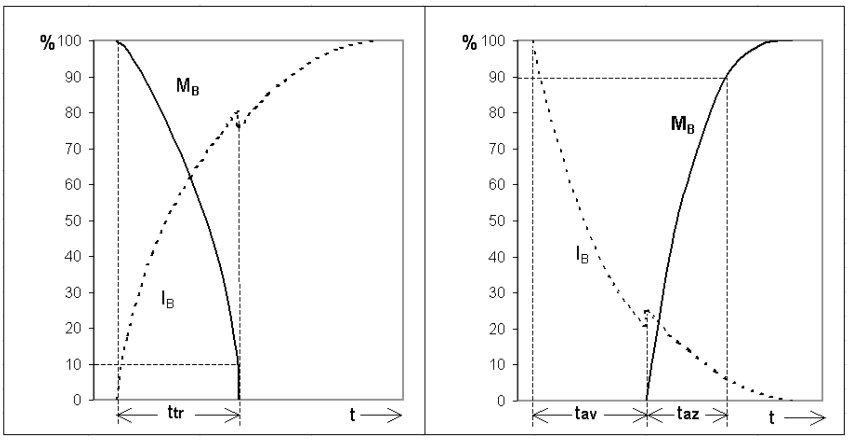
M_B = Brake torques

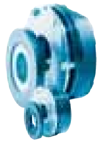
I_B = Coil current

t_{av} = Delay at brake engagement. Time between current is switched off an brake torque rises.

t_{az} = Rising time, time until the brake torque rises until 90% of the rated value. The taz time of the brake torque mainly depends on the rotational speed, therefore it can only be predicted with insufficient precision.

t_{tr} = Disconnection time, time from current is switched on until the brake torque is reduced to 10%





Special design for theatre applications (DBR)

Combinations of 2 brakes for safety requirements in theatre areas are also available. For noise reduction (<50 dB(A) powered from the AC current side), the brakes in the theatre design are with O-rings between the anchor plate and the magnetic element.

As per DIN 56950 the brake discs must be spring-loaded (i.e., released when powered, automatically closed when the voltage is not applied (failsafe)). Redundancy is also required (significance: technical safety systems must excist parallel so that if one component fails, the other is working-guaranteed) for the brakes; these are the double brakes DBR in our product range.

The double brakes are attached to the B-endshield of the motor, which increases the motor lenght (please enquire). The adjustment of a theatre brake generally takes place in accordance with the load torque.

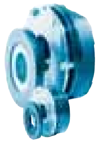
According to DIN 56950, the brake must at least hold 1.25 times the test load. We recommend to adjust the brake for at least approx. 1.6 times to a maximum of 2.0 times the output torque.
Our theatre brakes already reach their full braking torque with the first engagement. Run-in of the brake linings is not required.

The coil voltages correspond to the values named here in the catalogue. Two rectifiers are necessary for the double brake. These are generally built into the switching cabinet and are thus loose parts. The brake cables are placed on free terminals in the brake terminal box.

Note:
We recommend engaging the brakes shortly after each other, as simultaneous engagement results in the adding of braking torque, this could damage the gears and the system. In case of a possible emergency stop or voltage drop, the gear units must be calculated in accordance with the full braking torque of both brakes!

Theatre brakes

Motor size		M_B [Nm]		
		Full braking	Reduced braking torque	Reduced braking torque
63 S/L	DBR6	2 x 6	2 x 4	2 x 3,5
71 S/L	DBR6	2 x 6	2 x 4	2 x 3,5
80 S	DBR6	2 x 6	2 x 4	2 x 3,5
80 L	DBR12	2 x 12,5	2 x 8,5	2 x 7
90 S	DBR12	2 x 12,5	2 x 8,5	2 x 7
90 L	DBR25	2 x 25	2 x 17,5	2 x 14
100 L	DBR25	2 x 25	2 x 17,5	2 x 14
100 LA	DBR50	2 x 50	2 x 35	2 x 28
112 M	DBR50	2 x 50	2 x 35	2 x 28
132 S	DBR75	2 x 75	2 x 52	2 x 42
132 M	DBR125	2 x 125	2 x 89	2 x 70
160 M	DBR187	2 x 187	2 x 132	2 x 107
160 L	DBR187	2 x 187	2 x 132	2 x 107
180 MX/LX	DBR300	2 x 300	2 x 225	2 x 150
200 L	DBR500	2 x 500	2 x 375	2 x 250
225 S/M	DBR500	2 x 500	2 x 375	2 x 250



Brake size selection

Torques and moments of inertia are based on the motor speed.
Output side torques must always be divided by the output ratio. Output side moments of inertia must always be divided by the square of the output ratio.

1. Selection based on static loads (holding brakes)

   $$M_{erf} = M_{stat} = M_{Last} \times K$$

2. Design based on static and dynamic loads (working brakes)

   $$\Sigma J = J_{Motor} + \frac{J_{Last}}{i^2}$$

   Other moments of inertia (brake, gearbox), can generally be neglected.

   $$M_{dyn} = \frac{\Sigma J \times n}{9{,}55 \times tr}$$

   $$M_{erf} = (M_{dyn} \pm M_{Last}) \times K$$

   For driving loads: Use a positive M_{load}!
   For braking loads: Use a negative M_{load}!

3. Checking the maximum permissible friction work

   $$W = \frac{J \times n^2}{182{,}5} \times \frac{M_B}{M_B \pm M_{Last}} \Rightarrow W \leq W_{max}\,!$$

   For driving loads: Use a negative M_{load}!
   For braking loads: Use a positive M_{load}!

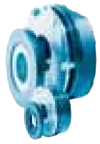
   Permissible values for W_{max} → Grafik „Friction work dependent on the switching frequency" graphic"

For technical and economic reasons, brakes should not be oversized!

Motors from different series, e.g. 8-2-pole travel motors, have considerably less rated torques than the 4-pole standard motors. We urgently recommend proceeding very carefully when selecting brakes for travel drives and similar applications.
It is usually advisable to reduce the torque (Setting braking torque, page G6).

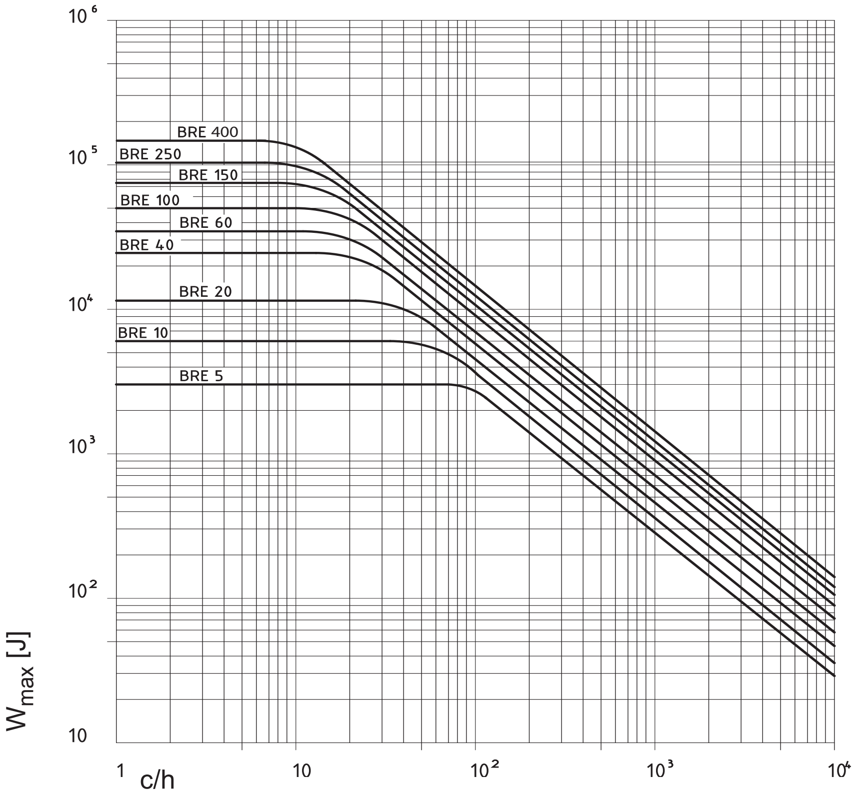
Abbreviations definition

c/h	=	Number of brakings per hour
ΣJ [kgm^2]	=	Sum of all driven moments of inertia, based on the motor speed
i	=	Gear ratio
K	=	Safety factor, application-based, selection according to individual construction rules Reference values: 0.8...3.0 Hoisting devices: >2 Hoisting devices with personnel safety: 2...3 Travel drives: 0.5...1.5
M_B [Nm]	=	Brake torque applied by the brakes
M_{dyn} [Nm]	=	Dynamic torque (delay torque)
M_{erf} [Nm]	=	Required braking torque
M_{Last} [Nm]	=	Load torque, from the resulting
M_{stat} [Nm]	=	static torque (holding torque)
n [min^{-1}]	=	Motor speed
t_r [sec]	=	Slip time, the time in which the drive comes to a standstill
W [J]	=	Friction work per braking
W_{max} [J]	=	Maximum permissible friction work per friction work dependent on the switching frequency (G14)



Friction work dependent on the switching frequency

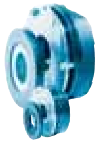
W_{max} is based on **each** braking.



Brakes			BRE 5	BRE 10	BRE 20	BRE 40	BRE 60	BRE 100	BRE 150	BRE 250	BRE 400	BRE 800	BRE 1200
Braking inertia	M_a	[Nm]	5	10	20	40	60	100	150	250	400	800	1200
Rated coil power	P_{Spule}	[W]	22	28	34	42	50	64	76	100	140	140	140
Nominal air gap		[mm]	0,2	0,2	0,3	0,3	0,3	0,4	0,4	0,5	0,5	0,6	0,6
Air gap adjustment		[mm]	0,6	0,8	0,8	0,9	1,0	1,1	1,1	1,2	1,2	1,2	1,2
Max. wear until rotor replacement		[mm]	3,0	3,0	2,8	3,0	3,0	3,5	3,5	5,5	3,5	3,5	3,5
Min. permissible pad thickness		[mm]	4,5	5,5	7,5	9,5	11,5	12,5	14,5	16,5	16,5	16,5	16,5
Max. permissible friction work per braking	W_{max}	[Jx10^3]	3	6	12	25	35	50	75	105	150	225	225
Friction work until adjustment	W_{RN}	[Jx10^7]	5	12	20	35	60	125	200	340	420	420	420
Max. permissible heat load	P_R	[W]	80	100	130	160	200	250	300	350	400	600	600
Current per coil 24V_{DC}*	I_N	A_{DC}	0,92	1,17	1,42	1,69	2,18	3,33	3,20	4,20	6,00	6,00	6,00
Current per coil 105V_{DC}	I_N	A_{DC}	0,21	0,32	0,39	0,46	0,60	**0,88**	**0,90**	**1,10**	**1,40**	**1,40**	**1,40**
Current per coil 180V_{DC}	I_N	A_{DC}	0,12	0,16	0,19	0,25	0,30	0,46	0,40	**0,60**	**0,80**	**0,80**	**0,80**
Current per coil 205V_{DC}	I_N	A_{DC}	0,11	0,13	0,15	0,24	0,28	0,44	0,30	0,50	**0,70**	**0,70**	**0,70**
Current per coil 225V_{DC}	I_N	A_{DC}	0,09	0,13	0,16	0,20	0,22	0,35	0,30	0,40	**0,60**	**0,60**	**0,60**
Current per coil 250V_{DC}	I_N	A_{DC}	0,09	0,11	0,14	0,18	0,19	0,31	0,30	0,40	0,60	0,60	0,60

* 24V_{DC} There must be 24 VDC available on the application side.

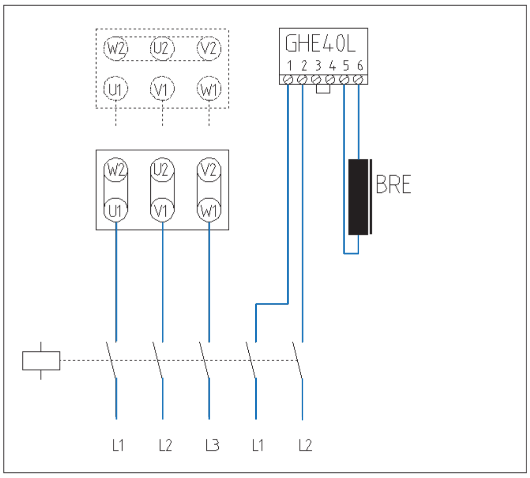
⚠ **Values printed in bold:** Take into account the maximum permissible rated currents of the rectifier.



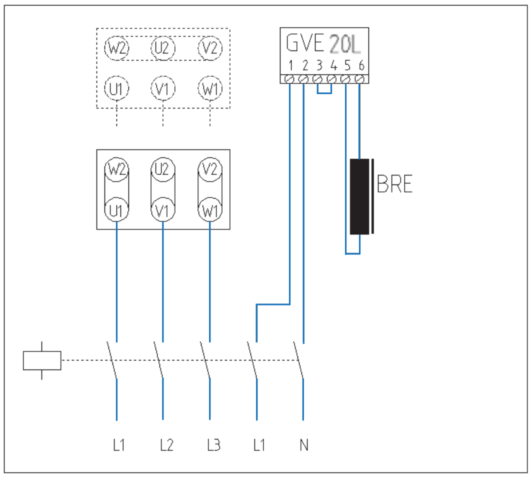
Brake motor switching variations (examples)

The following options show the normal switching variations for single speed brake motors.
The selection of the correct combination of rectifier and coil voltage of the brake must occur about the available supply voltage from the table page G10.

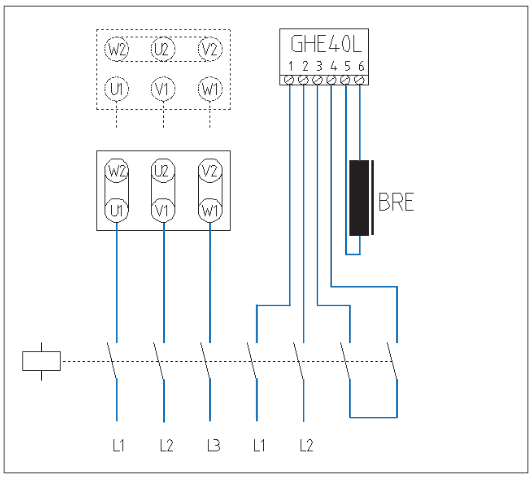
1. Motor Δ-connection: $400V_{AC}$
   Optional Y-conneciton: $400V_{AC}$
   One way rectifier: GHE40L
   Separate power supply: $400V_{AC}$
   Brakes: $180V_{DC}$
   Disconnection: AC side



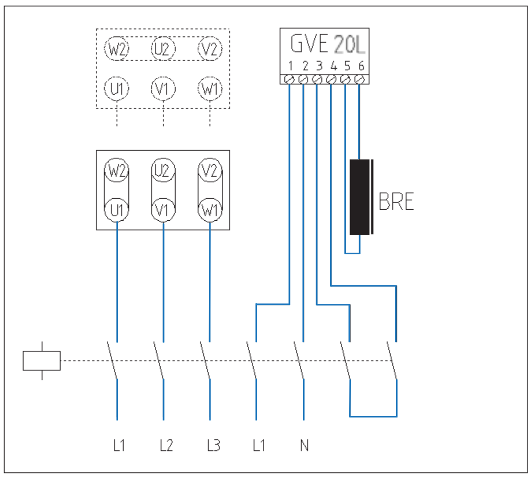
2. Motor Δ-connection: $400V_{AC}$
   Optional Y-connection: $400V_{AC}$
   Bridge rectifier: GVE20L
   Separate power supply: $230V_{AC}$
   Brakes: $205V_{DC}$
   Disconnection: AC side

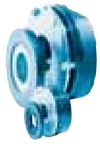


3. Motor Δ-connection: $400V_{AC}$
   Optional Y-connection: $400V_{AC}$
   One way rectifier: GHE40L
   Separate power supply: $400V_{AC}$
   Brakes: $180V_{DC}$
   Disconnection: AC side



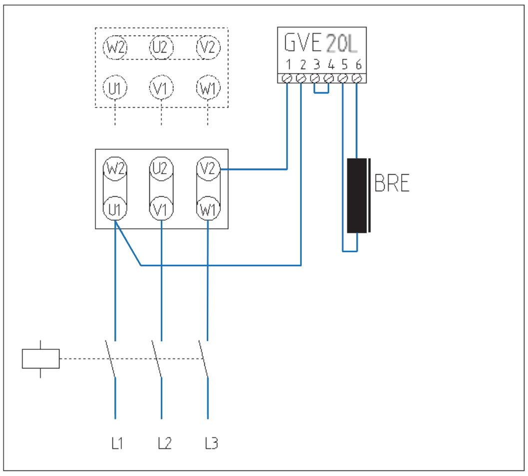
4. Motor Δ-connection: $400V_{AC}$
   Optional Y-connection: $400V_{AC}$
   Bridge rectifier: GVE20L
   Separate power supply: $230V_{AC}$
   Brakes: $205V_{DC}$
   Disconnection: DC side





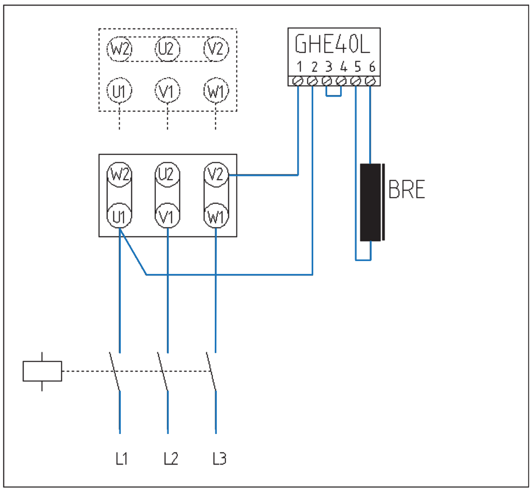
5. Motor Δ-connection, $230V_{AC}$ Δ
   Optional Y-connection: $400V_{AC}$
   Bridge rectifier: GVE20L
   Power supply via
   motor terminals: $230V_{AC}$
   Brakes: $205V_{DC}$
   Disconnection: AC side

   Braking occurs very slowly!



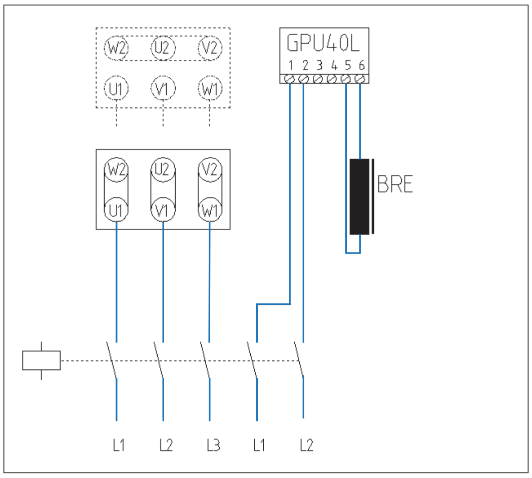
6. Motor Δ-connection: $400V_{AC}$
   Optional Y-connection: $400V_{AC}$
   One way rectifier: GHE40L
   Power supply via
   motor terminals: $400V_{AC}$
   Brakes: $180V_{DC}$
   Disconnection: AC side

   Braking occurs very slowly!



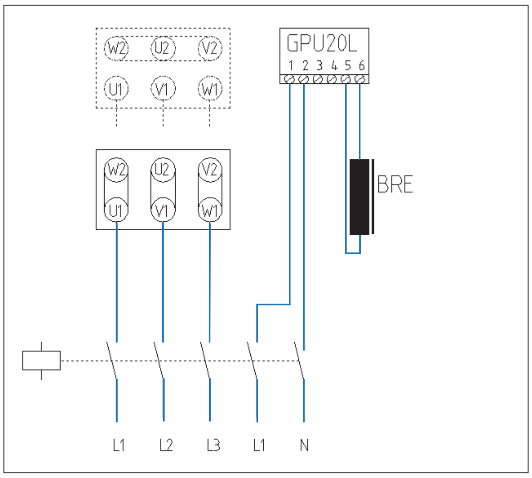
7. Motor Δ-connection: $400V_{AC}$
   Optional Y-connection: $400V_{AC}$
   Fast response rectifier: GPU40L
   Brakes: $180V_{DC}$
   Separate power supply: $400V_{AC}$
   Disconnection: DC side, internal

   Switching variant for fast release.



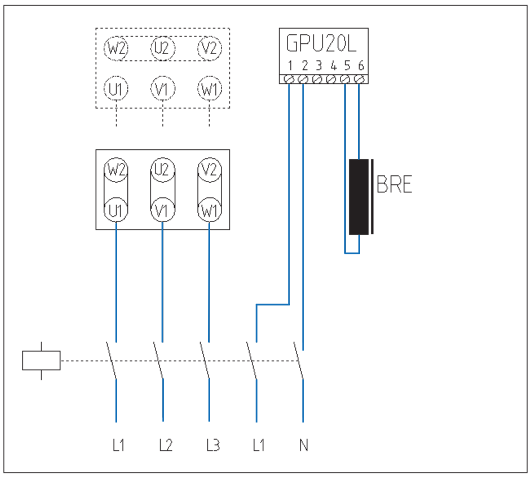
8. Motor Δ-connection: $400V_{AC}$
   Optional Y-connection: $400V_{AC}$
   Fast response rectifier: GPU20L
   Brake: $105V_{DC}$
   Separate power supply: $230V_{AC}$
   Disconnection: DC side, internal

   Switching variant for fast release.

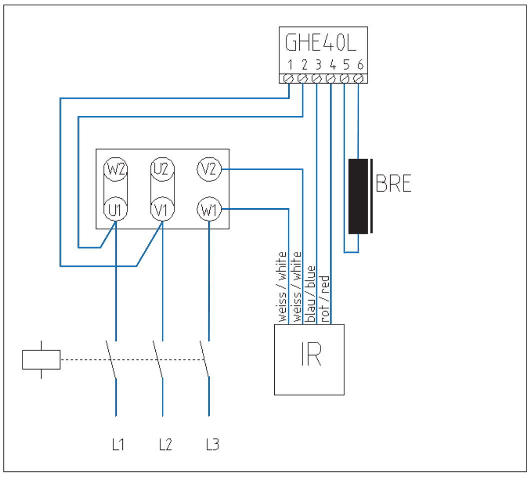


9. Motor Δ-connection: $400V_{AC}$
Optional Y-connection: $400V_{AC}$
Fast response rectifier: GPU20L
Brakes: $205V_{DC}$
Separate power supply: $230V_{AC}$
Disconnection: DC side, internal

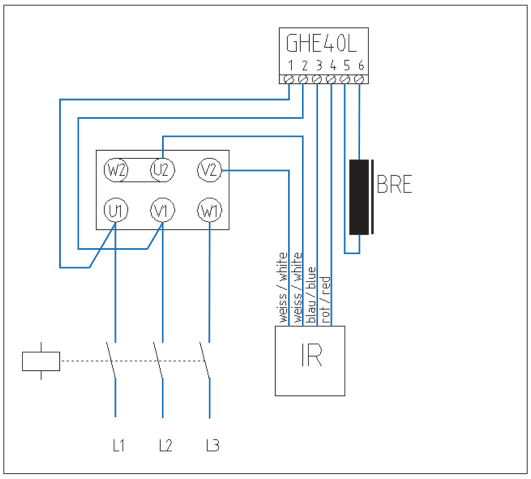
Switching variant for fast engagement.



10. Motor Δ-connection: $400V_{AC}$
One way rectifier: GHE40L
Brakes: $180V_{DC}$
Power supply via motor terminals: $400V_{AC}$
Disconnection: **Current collection relay**

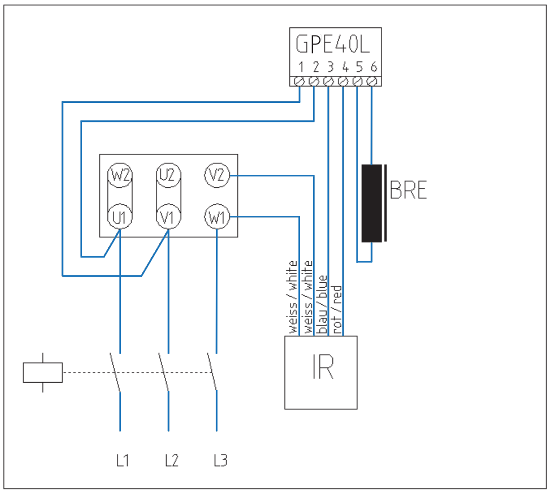


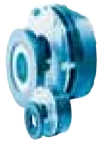
11. Motor Y-connection: $400V_{AC}$
One way rectifier: GHE40L
Brakes: $180V_{DC}$
Power supply via motor terminals: $400V_{AC}$
Disconnection: **Current collection relay**



12. Motor Δ-connection: $400V_{AC}$
High speed rectifiers: GPE40L
Bremse: $180V_{DC}$
Power supply via motor terminals: $400V_{AC}$
Disconnection: **Current collection relay**

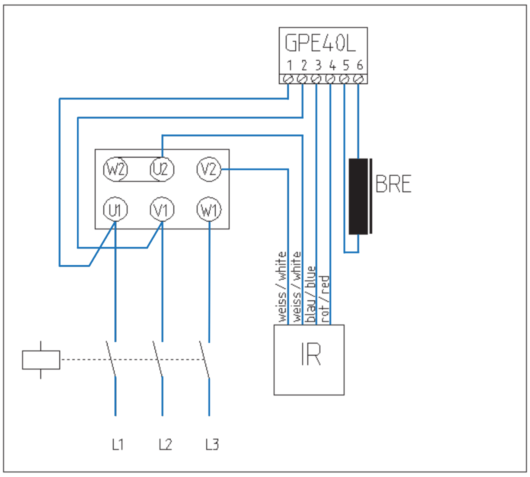
Switching variant for fast release..





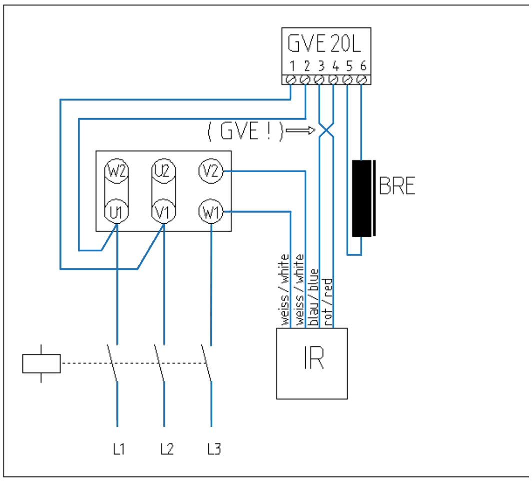
13. Motor Y-connection: $400V_{AC}$
High speed rectifiers: GPE40L
Brakes: $180V_{DC}$
Power supply via motor terminals: $400V_{AC}$
Disconnection: **current collection relay**

Switching variant for fast release.



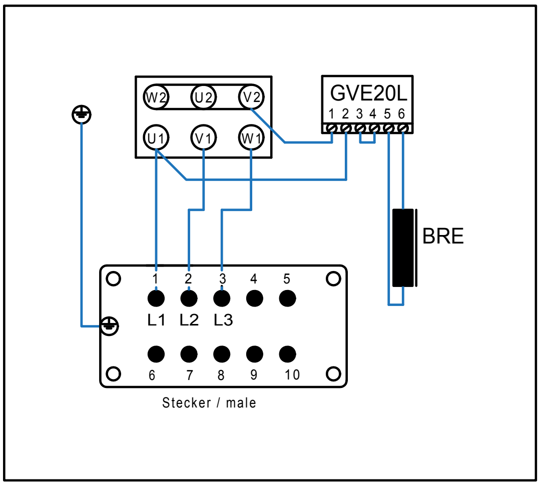
14. Motor Δ-connection: $230V_{AC}$
Bridge rectifier: GVE20L
Brakes: $205V_{DC}$
Power supply via motor terminals: $230V_{AC}$
Disconnection: **current collection relay**

Switching variant for fast release.
Note IR connection to rectifier!



15. Motor Y-connection: $400V_{AC}$
Bridge rectifier: GVE20L
Brake: $205V_{DC}$
Power supply via motor terminals: $230V_{AC}$
Disconnection: **AC side**

Switching variant for connection via motor plug connector (MS)



16. Motor Δ-connection: $400V_{AC}$
One way rectifier: GHE40L
Brake: $180V_{DC}$
Power supply via motor terminals: $400V_{AC}$
Disconnection: **AC side**

Switching variant for connection via motor plug connector (MS)