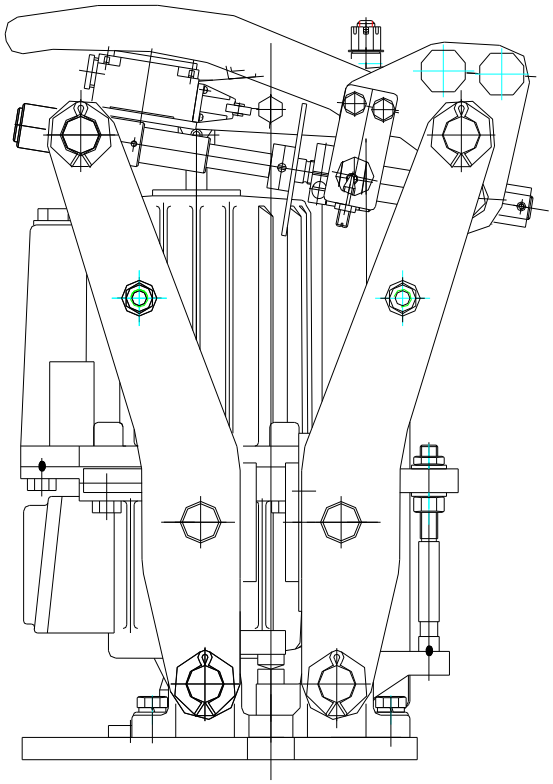
Furka® SFB11 and SFB21 Series Disc Brake



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1. Safety regulations

The safety of your brake / brake-system depends on proper and regular inspection and maintenance. Study thoroughly the entire manual before installing and operating the brake. If in doubt, please don't hesitate to contact our service-department or your local retailer.

Safety and advice symbols:

	Warning of personal injury	This signal indicates a threat of danger. If this danger is not avoided, this will result in death or serious injuries.
	Warning of product damages	This symbol indicates a warning which may contribute to prevent material or machine damage.
	General advice	This symbol indicates information that helps to avoid adverse results and conditions.

Important:

➔ Installation, adjustment, operation and maintenance must be carried out by qualified, skilled personnel, and must comply with safety procedures.

	**Important!** **The Furka® brake type SFB is an essential safety device. Any misuse or insufficient handling or maintenance endangers life!**

Also study the following manuals and regulations:

- Operating manual of the installation
- Safety precautions of the installation
- Valid Safety regulations

➔ The safety of this brake and brake system depends on correct and periodic inspection and maintenance.

	**Warning! A sudden start-up of the installation endangers the life of the maintenance personnel! Secure the drive and the installation against any accidental movement before starting any work!**

1.1 Safety precautions

	Secure the drive and the installation against any accidental movement before starting any work! **Reading the operating instructions is indispensable.**

- The following applies to all work and operations with the brake: Safety first.
- Don't use any mechanical devices to block the brake.
- Ensure, that the drive is disconnected from the electrical power supply.
- Ensure, that the brake (thruster) is disconnected from the electrical power supply.
- Any electrical work is only to be done by a trained electrician.
- Only use original Furka® spare parts.
- The brake must not be disassembled further than described in the manual.

1.2 Warranty

The warranty and its duration depends on the contract. For details on the supplier's warranty please refer to the terms of the contract. Any warranty- or liability claims are excluded in case they occur because of one or more of the following conditions:

- Non-designated use of the brake.
- Improper handling, setup, operation and maintenance of the brake by the operating company.
- Neglection of the regulations and notes in this manual concerning transport, setting up, operation and maintenance of the brake.
- Improper maintenance and repairs of the brake.
- Improper monitoring of components, which are prone to wear.
- Catastrophes, external objects and forces and force majeure.
- Changes of the brake without the approval of Furka®.
- The information in this manual has been checked thoroughly. Nevertheless we can't accept liability for errors.
- Use of non-original spare parts

2. Brake

2.1 Description and designated use of brake

The SFB type disc brake is spring applied and electro-hydraulically released. When the brake is actuated, the brake linings are pressed against the rotating/stationary brake disc creating the necessary friction. The friction between the brake linings and the disc causes the disc to stop rotating. Brake torque is generated by the brake spring that is located in the spring tube. The brake force is transferred to the brake shoes via the brake leverage (brake arms). The design is fail-safe. To open the brake the thruster must be energized. It is then compressing the brake spring, generating an air gap that allows the brake disc to spin freely. The SFB disc brake is used as service brake on heavy duty equipment like cranes, conveyors, steel mill equipment etc. . This version of SFB brake is not certified acc. to ATEX and cannot be used in explosion hazard zones.

The brake torque is adjustable (pl. see data sheet…). Brake torque depends on:

- Contact force of the linings
- Coefficient of friction
- Brake disc diameter

It can be released by a manual release lever. Lining wear is compensated by an automatic wear compensator. Proximity sensors to indicate “brake released”, “brake released by hand release lever” and “lining wear” are included as standard. A synchronization linkage (automatic self-centering device) to provide an equal air gap is standard on all brakes of this class.

2.2 Transportation and storage instructions

The weight of the brake depending on the size is between 63…282kg. Please use suitable cranes or jacks to handle the brake (refer to Fig.1);

The brakes are delivered reliably protected against corrosion. They should be stored in a clean, enclosed and dry place. If not directly installed, the brake must be protected against damages and environmental influences.

In case of additional painting, do not contaminate:

- Bolts and hinged joints
- Brake disc surfaces
- Brake pad
- Connecting shaft
- Self-compensating device
- Piston rod of thruster
- Contact surface of equalizing lever
- Electrical component
- Nameplate

3. Design, installation and brake adjustments

3.1 Structural drawing

refer to Fig 1

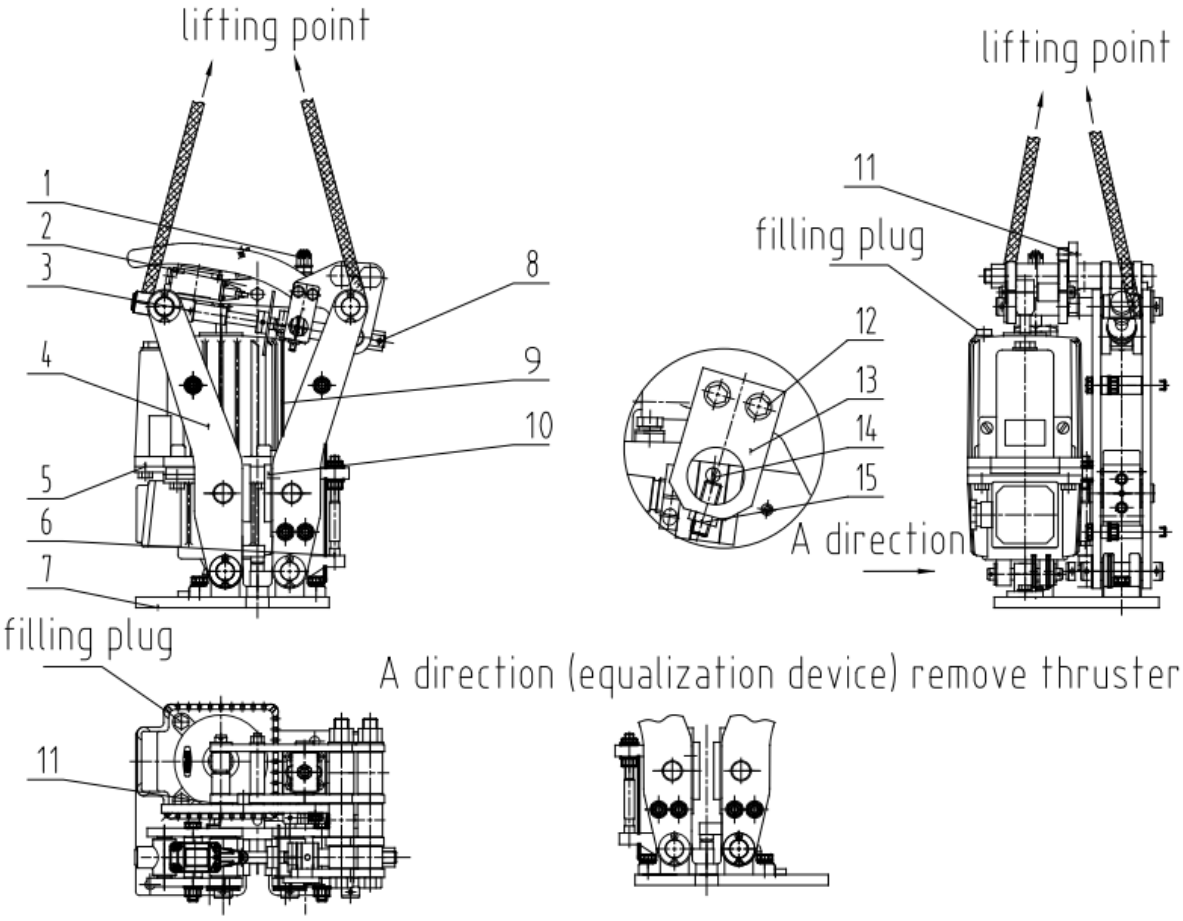

Fig. 1

1Torque-adjustment nut **2**Top lever **3**Brake spindle with automatic wear compensator (AWC) **4**Brake arm **5**Thruster **6**Synchronization linkage **7**Base plate **8**AWC-adjusting nut **9**Spring tube **10**Brake lining **11**hand release jack **12**Fastening screw **13**Catch **14**Catch pin **15**Catch adjusting screw

3.2 Installation

3.2.1 Basic brake inspection

- Check whether all parts and components of the brake are complete.
- Check whether brake mechanism and hinged joints are operable.
- Check whether there is any oil (grease), paint or other contaminants sticking on the brake lining, which may affect the coefficient of friction.
- Check whether the content of nameplate comply with type selection.

The installation of the brakes should be started only when all the points listed above apply.

	**Never put your fingers between the brake disc and the brake when closing the brake to avoid serious hand injuries. Make sure, that the brake is fully secured against closing before starting any maintenance work.**
	**Caution: Risk of injury due to pre-tensioned springs. When working on the released brake, make sure that the brake is secured against unintentional closing**.

3.2.2 Brake disc inspection

The surface of the brake disc must have no defects such as corrosion, oil (grease) contamination, unevenness, damage due to welding etc.. It is strictly forbidden to use brake discs with cracks or other defects.

The radial runout for the brake discs with respect of the axis of rotation must not exceed:

0.15mm - for brake discs ≤500mm

0.2mm - for brake discs >500mm

Average roughness depth in the contact area of the brake linings should be 3.2µm.

3.2.3 Design and inspection of the brake support

The brake support must be checked for dimensional accuracy. Please check in particular if bore pattern of brake support and baseplate do match.

If the brake support is installed together with the brake, they must be secured (by bolts) after they have been aligned accurately. If the mounting bores of the brake support have not been machined, they shall be drilled after the brake has primarily been aligned, then fix the brake.

The relative tolerance between the brake support and the brake disc (refer to fig 2) should not exceed the specification in table 1.

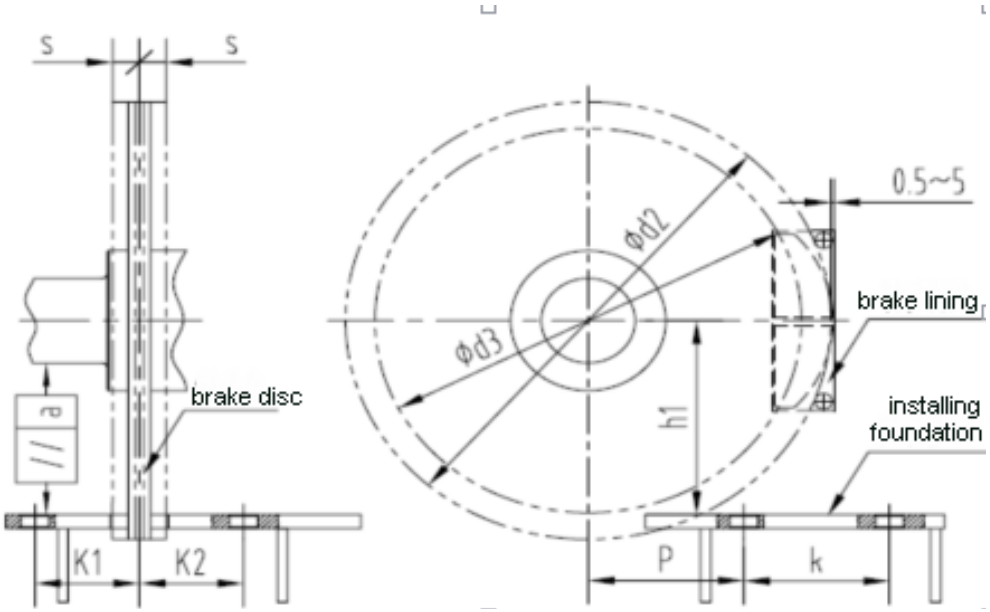

Fig. 2

Brake specification	*Center height*	*Installing dimension*				*Center deviation*	*Parallelism*
	h1	*K1*	*K2*	*K*	*P*	*S*	*a*
SFB11-220～800	160±1	80±0.5	150±0.5	200±0.5	d2/2-65±0.5	1	0.5
SFB21-500～800	230±1.5	145±1	145±0.5	260±0.5	d2/2-105±0.5	1.2	0.8

Table 1 (all units in mm)

3.2.4 Brake installation

Counter-clockwise (CCW) rotate the torque-adjusting nut (Pos. 1) before installation, then adjust the braking torque (spring working length) to the minimum value, dismantle mounting bolts (Pos. 12) of catch and remove catch (Pos. 13).(refer to fig.1).

Rotate the AWC-adjusting nut to open the brake, and assure the air gap between brake pads is 3-5mm bigger than the thickness of brake disc.

Counter-clockwise (CCW) turn clearance adjusting nut (Pos. 8), air gap will increase;

⚠	**The catch must be removed before rotating the AWC-adjusting nut. Make sure that the brake spindle is not unscrewed from the cross piece.**

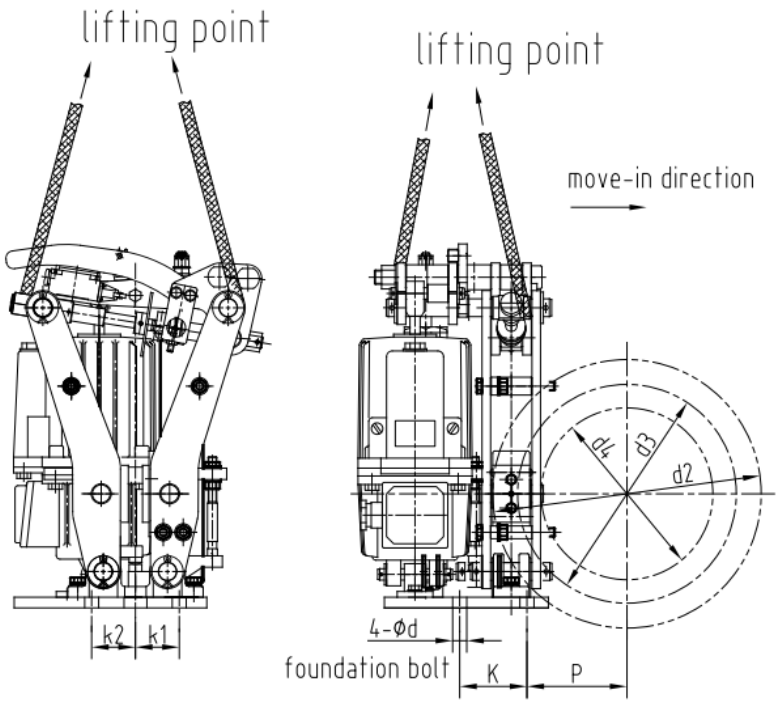

Fig. 3

Place the released brake on the installation position. Check whether the installation position is correct on the basis of the sketch. The theoretical friction diameter d3 of the brake disc shall overlap with the centerline of the lining. (refer to fig 3);

d_2		250	280	315	355	400	450	500	560	630	710
d_3	SFB11	195	225	260	300	345	395	445			
	SFB21				275	320	370	420	480	550	
d_4	SFB11	95	125	160	200	245	295	345			
	SFB21				145	190	240	290	350	420	

Table 2: Mounting dimensions (all units in mm)

The entire surface of the brake pad must be in contact with the brake disc. The brake disc shall therefore protrude approx. 0.5 to 5mm beyond the outer edge of the brake pad.

After the brake has been roughly aligned, the screw of the self-centering device must be loosen, so that the centering mechanism can move freely. Then the fastening screws can be inserted loosely into the base plate (bolt specification see table 3) Note: Do not yet fully tighten at this time (fastening material is not Furka® scope of supply).

For type I brake, Close the brake by clockwise (CW) rotating the AWC-adjusting nut (Pos. 8), until the lifting rod of the thruster is moving upward for approx. 5mm. The brake aligns itself to the disc.

Install and tighten the catch. Note: The catch pin has to be within the catch. Now the bolts of the base plate shall be tightened.

Brake type	Type of bolt	Qty	Tightening torque [Nm]
SFB11	M12-8.8 grade	4	82
SFB21	M16-8.8 grade	4	197

Table 3: Tightening torques for base plate bolts (μ=0.1)

3.2.5 Electrical connection

STOP	**The applied electrical voltages are dangerous to life. Any electrical work has to be done by a qualified electrician. The earthing conductor must always be connected before all other cables.**

Before connecting please check if main supply voltage and frequency correspond to the data on the name plate. Please check the manual of the thruster supplier. Connections have to be flexible and the brake must move freely. Check all cable connections for being proper tightened.

The brake shall be energized intermittently for 20~30 times to realize self-centering and aligning adjustment during brake operation. Check the brake for equal air gaps, reserve stroke settings, and for proper alignment of the linings.

3.3 Adjustments

Adjustments include brake torque adjustment, air gap adjustment, thruster reserve stroke adjustment and the setting of the automatic wear compensator.

STOP	**Each adjustment should be done during the initial installation and after the linings have been changed**.

3.3.1 Brake torque setting

The brake must be closed. Clockwise (CW) rotate torque-adjusting nut (Pos. 1) with a spanner, brake torque will increase, on the contrary, the brake torque will decrease.(refer to fig 4). The upper edge of the spring force indicator shows the brake torque.

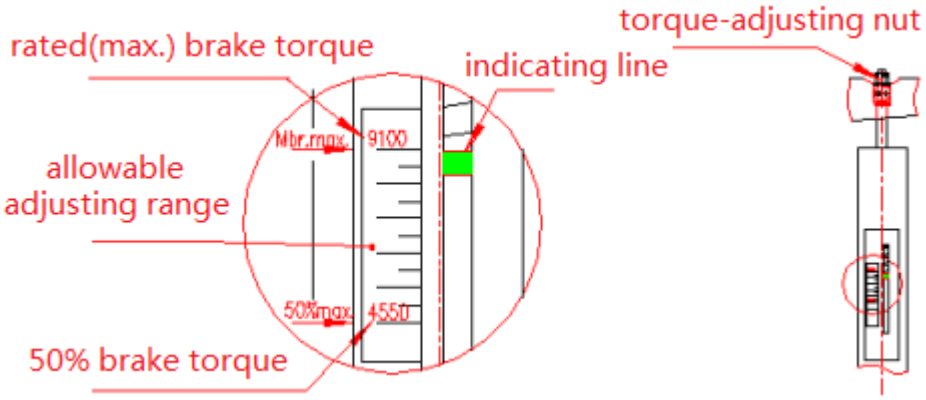

Fig. 4: Brake torque adjustment

3.3.2 Thruster reserve stroke setting

STOP	**The catch must be always removed in case of changing the air gap of the brake. Please check table 4 for reserve stroke settings. Don't forget to install it again after settings have been made.**

Adjusting methods as follows: Energize the thruster separately to open the brake, rotate the AWC-adjusting nut (Pos. 8) until the thruster piston is moving upwards or downwards. Close the brake; Measure the reserve stroke (hb) of the thruster. (data for reserve stroke of thruster please refer to fig.5 and table 4)

Increase reserve stroke:

For I type brake, clockwise (CW) rotate the AWC-adjusting nut (Pos. 8) until measurement hb is set.

Reduce reserve stroke:

For I type brake, counter-clockwise (CCW) rotate the AWC adjusting nut (Pos. 8) until measurement hb is set.

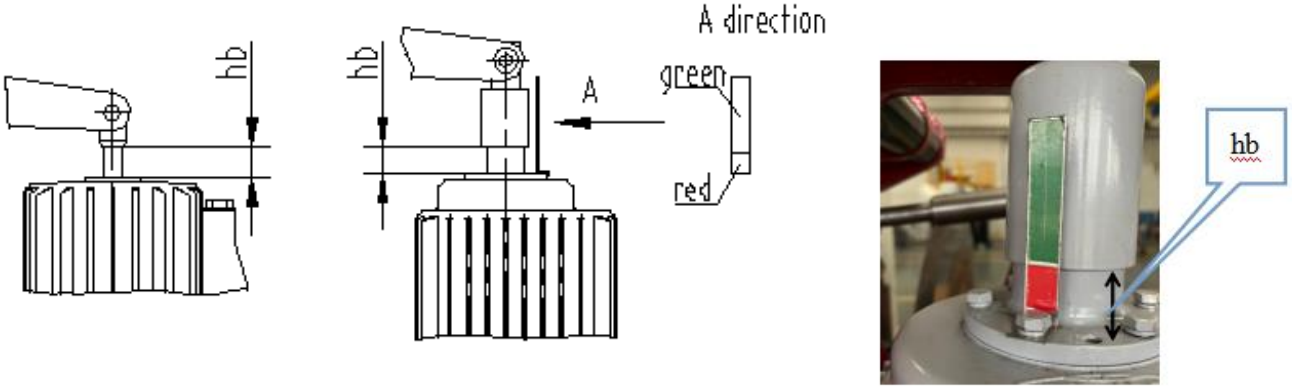

Fig. 5: Reserve stroke adjustment

Brake type	*Rated stroke H*	*Air gap C*	*Working stroke h*	*Reserve stroke hb*
SFB11-220~300	50	0.8±0.1	30-32	18~20
SFB21-500~800	60	0.9±0.2	50-52	8~10

Table 4: Reserve stroke and air gap settings

After the reserve stroke is set, please re-install catch (Pos. 1) correctly and make sure that the catch pin (Pos. 2) is running within the bore of the catch (Pos. 1). If the catch bin does not protrude far enough in the catch it must be turned out counter clockwise (CCW). When the brake is opened, the distance between the catch pin (Pos. 2) and set screw (Pos. 3) is about 0.5-1 mm; when the brake is closed, the distance between the catch pin (Pos. 2) and inner bore diameter of the catch (Pos. 3) is about 0.5-1 mm (refer to fig. 6).

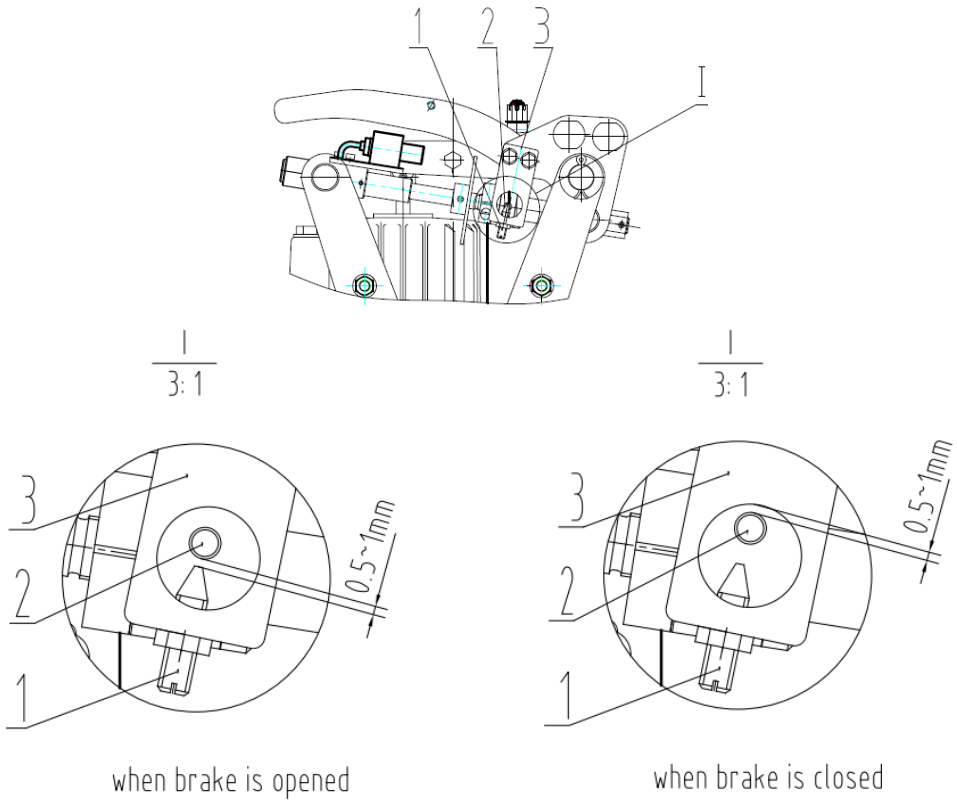

Fig. 6: Catch installation

3.3.3 Brake shoe alignment (…parallel to the brake disc)

Energize thruster to open the brake and check if brake linings are in parallel to the brake disc. If not bring the brake shoe in parallel position with the help of a rubber hammer. Open and close the brake 2-3 times, brake lining is automatically parallel to brake disc under the action of self-aligning device (see to fig 7).

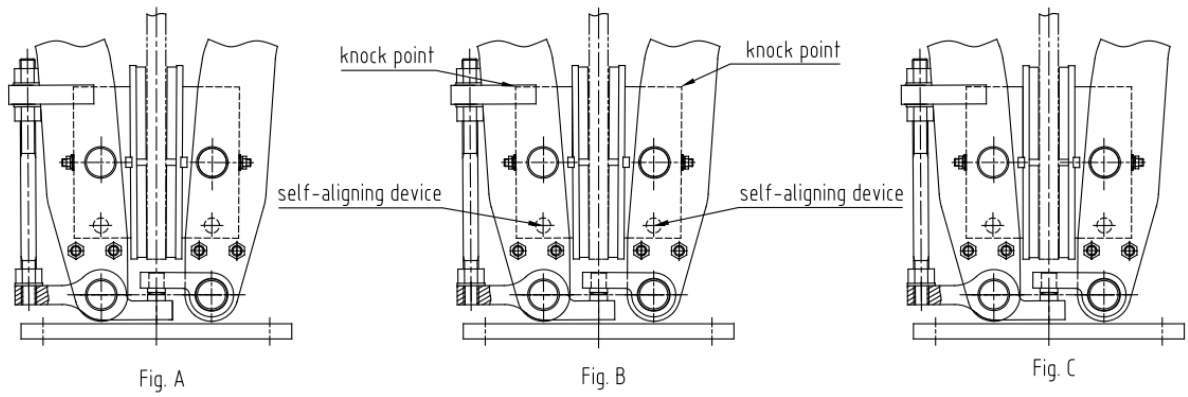

Fig. 7: Brake shoe alignment

3.3.4 Adjustment of synchronization linkage

STOP	**The levers of the synchronization linkage must be horizontally aligned. The distance between the lower edge of the (centering) lever and the base plate should be not less than 5mm. This measurement must be continuously checked in order to avoid contact of the lever mechanism with the base plate (….e.g. due to lining wear). A synchronization lever touching the base plate can lead to brake force loss and can cause malfunction of the brake.**

Refer to fig 9: Open the brake by thruster and check the air gap between the brake lining and brake disc. If the air gap is not equal, loose locknut (Pos. 3) and turn the adjusting nut(Pos. 2) until the air gap on both sides is equal. Tighten the lock-nut (2) when the air gap is fine.

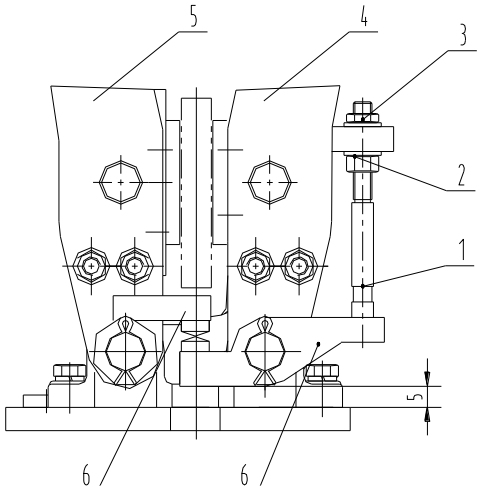

Fig. 8: Air gap setting

1adjusting bolt **2**adjusting nut **3**locknut **4**brake arm B **5**brake arm **6,7**equalizing lever

⚠	**The air gap varies depending on how the brake is released, whether with thruster or with hand release lever. For basic adjustments the brake should be always released by thruster.**

3.3.5 Limit switch adjustments

The brake is normally equipped with following limit switches:

1. Hand release limit-switch: Indicates when the brake has been released by manual release lever.
2. Release limit switch: Indicates when the brake has been released electrically (by thruster).
3. Close limit switch: indicates when the brake is closed.
4. Pad wear limit switch: Indicates when the linings are worn out.

⚠	**If the wear sensor feedbacks the signal "brake pads worn", brake pads must be replaced immediately.**

3.3.5.1 Connect limit switches

Mechanical limit switches: Inner contactors of the mechanical limit switch are shown in fig.9. Thread of cable entry is M20X1.5, operating current at utilization category AC-15: 2A/250V, at utilization category DC-12: 2A/48V. Section area of soft cable should be at least 2×0.75mm^2.

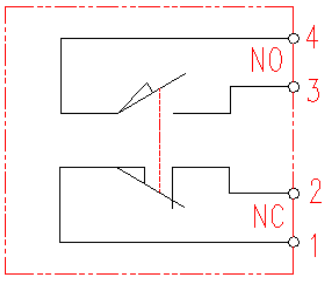

Fig. 9: Wiring mechanical limit switch

Proximity switches:

Wiring of close and release limit switch is shown as fig. 10 with molded 2m cable, capacity of contactors: 20～250V AC/400mA and 10～300V DC/300mA. (Note: BN is brown, BU is blue)

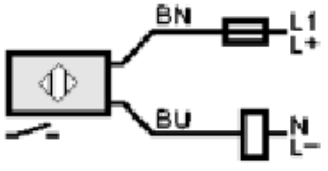

Fig. 10: Wiring proximity switch: OPEN/CLOSE

Wiring of hand release and pad wear limit switch is shown as fig.11, with molded 2m cable, capacity of contactors: 20～250V AC/400mA and 10～300V DC/300mA. (Note: BN is brown, BU is blue)

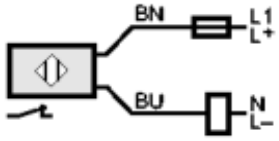

Fig. 11: Wiring proximity switch: WEAR/HAND RELEASE

3.3.5.2 Limit switch adjustments

Adjustment of stroke switch(refer to fig. 12);

a. Adjustment of release limit switch (roller lever);

Loosen the set screw on the lever arm of the release limit switch (Pos.1) with inner hexagonal spanner (M5), adjust the lever arm in direction of the operating point, that the contacts snap when the brake is opened. The lever arm should move back to the initial position when the brake is closed (no external force is applied to the actuator). Finally tighten the screw.

b. Adjustment of close limit switch;

Loosen the set screw on the lever arm of close limit switch (Pos.2) with inner hexagonal spanner (M5), adjust the lever arm in direction of the operating point, that the contacts snap when the brake is closed. The lever arm should move back to the initial position when the brake is opened (no external force is applied to the actuator). Finally tighten the screw.

c. Adjustment of hand release limit switch;

Loosen the set screw on the lever arm of hand release limit switch (Pos.5) with inner hexagonal spanner (M5), adjust the lever arm in direction of the operating point, that the contacts snap when the brake is opened. The lever arm should move back to the initial position when the brake is closed (no force is applied to the actuator). Finally tighten the screw.

d. Adjustment of pad wear limit switch;

The NC contact interrupts the contact in case the brake pads are worn. Distance “A” from plunger head of limit switch to actuator disc (7) should meet the value in table 8. The correct value can be adjusted by turning the actuator disc on the brake spindle. After setting has been done, tighten the set screw.

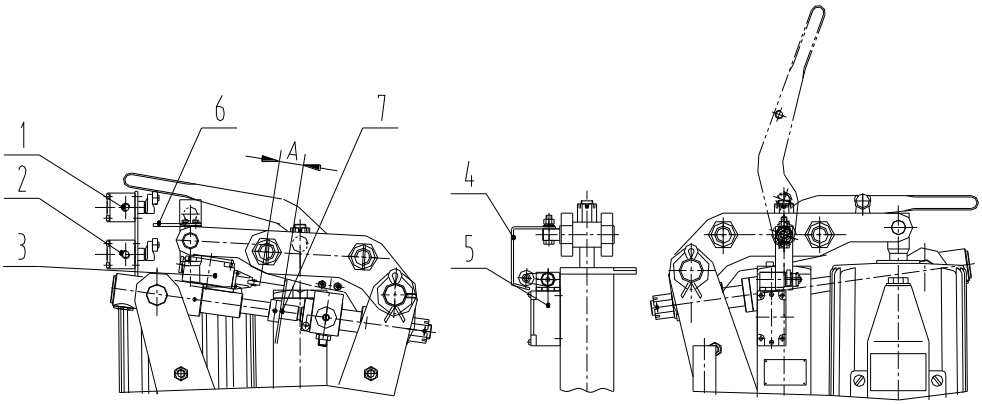

Fig. 12: Mechanical limit switch installation

1Release limit switch (roller lever) **2**Close limit switch (roller lever) **3**Pad wear limit switch (plunger) **4**Actuator of hand release switch **5**Hand release switch (roller lever) **6**Actuator of release switch **7**Actuator disc for pad wear switch

Brake type	*A value （mm）*
SFB11-220-300	32
SFB21-500-800	51

Table 5: Wear limit switch setting

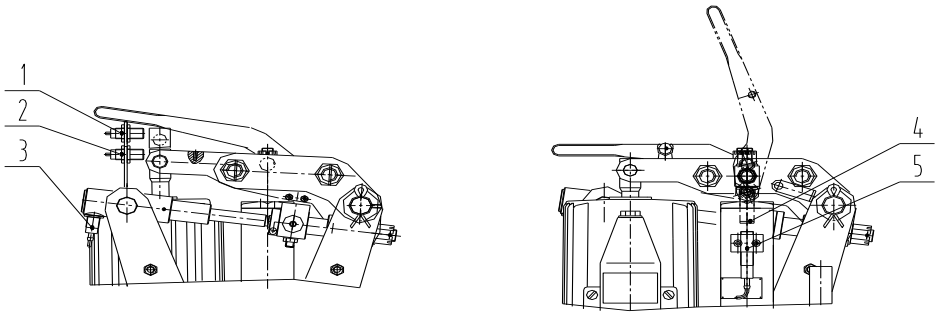

Fig. 13: Proximity switch installation

Adjustment of proximity switches (refer to fig. 13)

1Release control proximity switch **2**Close control proximity switch **3**Pad wear control proximity switch **4**Actuator for hand release proximity switch **5**hand release control proximity switch

Adjustment of release limit switch:

Loosen the two locknuts of the release limit switch (Pos.1). Move the switch in direction of the sensing range when the brake is opened. Finally tighten the locknut.

Adjustment of close limit switch:

Loosen the two locknuts of the close limit switch (Pos.2). Move the switch in direction of the sensing range when the brake is closed. Finally tighten the locknut.

Adjustment of hand release limit switch:

Loosen the two locknuts of the hand release limit switch (Pos.5). Move the switch in direction of the sensing range when the brake is opened. Finally tighten the locknut.

Adjustment of pad wear limit switch;

The pad wear limit switch (Pos. 3) has been adjusted in the factory and does not require any settings.

	**Proper functioning of the limit switches increases the safety of the brake and the drive. The limit switches should not be put out of operation.**

3.4 Functional test

Open and close the brake several times and check following items:

Whether the required brake torque has been set?

If not, repeat 3.3.1.

Check the reserve stroke of the thruster when the brake is closed.

If not correct, repeat 3.3.2.

Whether the position of the catch pin for AWC is correct?

If not, adjust according to 3.3.2.

Equal air gap when the brake is opened

If not, repeat 3.3.4.

4. Operation

4.1 Manual release device

	**There is no other safety device when the brake is manually released. The drive needs to be secured against any accidental movement.**
	**Before actuating the manual release lever make sure that the load is secured. In case of lowering suspended loads the brake must be <u>slowly</u> opened to avoid slipping of the load. Direct communication between operator and spotter required.**

The brake is equipped with a manual release device as standard to enable to be opened manually. The hand release device is primarily required in emergency situations, e.g. the load must be lowered when the crane is in a de-energized state. When the hand release is no longer

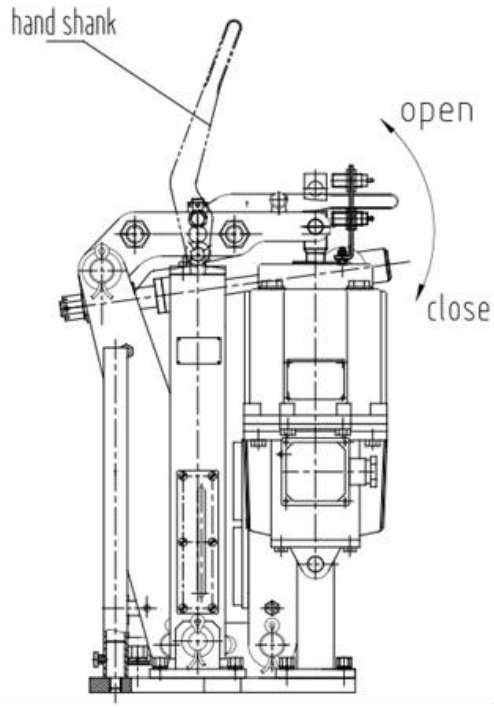

Figure 14: Manual release lever

required, it is essential to ensure that the brake is closed. A brake opened by manual brake release during normal operation can prevent the brake from closing, which can lead to fatal accidents.

Specific operating methods as follows:

If the brake shall be opened by manual release lever, turn the lowering valve clockwise (CW) to the “Open” position. Start pumping to open the brake.

To close the brake counter-clockwise (CCW) turn the lowering valve to the “Closed” position.

4.2 Running-in procedure (Bedding in and pad conditioning)

	**The running-in procedure must be performed after the initial installation of the brake as well as after a brake pad or a brake disc change.**

The running-in procedure of the linings is of decisive importance in order to achieve a sufficient contact surface between linings and brake disc.

- Check whether the installation the brake is in accordance with the manual
- Check brake adjustments
- Check if there is any oil (grease) contaminating the surface of the brake disc or the brake linings. Brake disc and brake pad should be clean and dry.

Before starting the running-in procedure:

- Dismount catch

Run the motor at half nominal speed. Close the brake by CW turning the AWC adjustment nut until the brake pads touch the brake disc. While the motor is running, open and close the brake several times until the entire surface of the linings is completely run-in.

Remove the brake linings and check the contact pattern. Ideally, there is an overlap of 80% or more between the brake pad and the brake disc otherwise the brake torques, shown in the catalogue, cannot be achieved.

A typical test to measure brake torque is to drag the brake disc through the closed brake measuring the current consumption of the electric motor.

Don’t forget to mount the catch again and to set the thruster reserve stroke properly.

Please check during the running-in procedure:

- Contact pattern between linings and brake disc
- Brake disc temperature (should not exceed 350 °C)

4.2.1 Basic check

The following points should be checked for correct installation:

- Check whether the installation the brake is in accordance with the manual
- Check brake adjustments
- Check if thruster type, voltage and frequency (check the nameplate) and the wiring of thruster comply to the specification
- Check if there is any oil (grease) contaminating the surface of the brake disc or the brake linings.

5. Maintenance

	**Warning! A sudden start-up of the installation endangers the life of the maintenance personnel! Secure the drive and the installation against any accidental movement before starting any work!**

Please only use genuine Furka® spare parts.

5.1 *Regular maintenance*

5.1.1 Check intervals

- Perform daily maintenance and self-inspection at least once a month.
- Perform a complete inspection once a year.

5.1.2 Performance of the brake and condition of brake disc

- Brake shoe
  Check/re-adjust brake shoe (refer to fig 3.3.4)

- Wear situation and thickness of brake linings
  If the thickness of the friction material is less than the value in Table 6, the brake pad should be replaced by a new one.

- Status of brake disc
  Replace the brake disc when the following condition occurs:
  When the brake disc has a crack or wear of 1 mm on both sides
  The brake disc has grooves whose depth exceeds 1.5 mm

- Reserve stroke of thruster
  Check/re-adjust the reserve stroke of thruster(refer to 3.3.2)

- Whether the connecting bolts are not seized.
  If there is jamming phenomenon, then remove or replace the bushings;

- Spring force (brake torque)
  Check/re-adjust brake torque(refer to 3.3.1);

- Limit switches
  Check if the limit switches are working properly.

- Please do not remove the automatic wear compensator, otherwise lining wear must be compensated manually.
- Cotter pins must be opened, ensure that they will not be loosen.

5.1.3 Additional maintenance

Inspect the brake outside normal maintenance intervals if:

- the stopping distance/time is too long
- limit switches indicate worn out linings or not enough reserve stroke
- emergency stops have been performed
- overspeed situations/excessive braking times have occurred
- thruster leakage has occurred
- the machine/system has been at a standstill for a long time
- The brake has been not in use for a long time

5.2 Lubrication

SFB brakes are using maintenance free bushings. There is no need for greasing! If the (connecting) bolts move unyieldingly, please remove the blockage or replace the bushings.

5.3 Lining change

⚠	**Warning! A sudden start-up of the installation endangers the life of the maintenance personnel! Secure the drive and the installation against any accidental movement before starting any work!**
⚠	**If brake pad thickness falls below 3mm (SFB11) or 4mm (SFB21), brake pads must be replaced. Replacing worn brake linings is not a one sided matter. They are always replaced in pairs. So if the brake pad on the right side is completely worn out, but not yet completely on the left side, both still need to be replaced!**

Brake lining change (pls. see fig. 16):
Release brake spring: Turn torque adjusting nut CCW to reduce the contact pressure. Turn the AWC spindle CCW and the linings will be easy to access. Open the retaining bolts (Pos. 6) to loosen the linings. Linings can be replaced easily now.

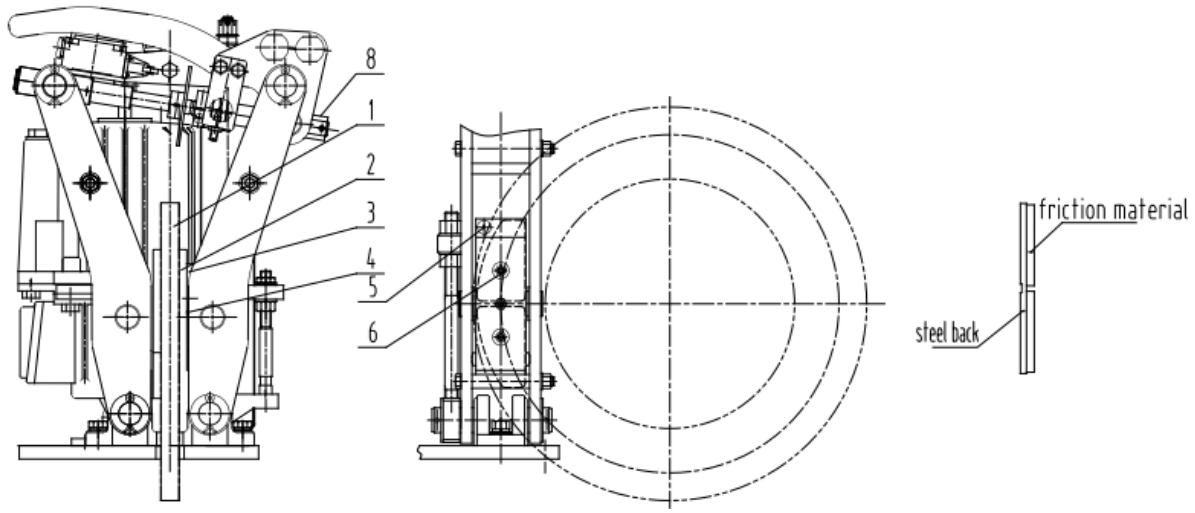

Fig. 16: Brake lining change

1brake disc **2**brake lining **3**brake shoe **4**connecting key **5**eyelets **6**retaining bolt

- Check if the friction surface of the new brake pad is clean, if not, please clean it (with sandpaper or alcohol);
- Insert the new brake pad in the installation position from top to bottom;
- Align the keyway of the brake pad with the connecting wedge and insert it;
- Connect the brake pad to the brake shoe by the retaining bolts, and then tighten it. Please adjust the brake according to 3.3, check if the linings have been run-in and make a test run according to 4.2, then the brake can be put back into operation.

6. Failure analyses and troubleshooting

Fault	*Possible cause*	*Remedy*
Brake does not open	Thruster motor not running	Check for wiring errors and cable connections
	Thruster motor not running (switched off by trigger, e.g. motor protection switch)	Check fuse elements and motor protection switch
	Thruster motor not running Rotor is blocked (bearing problems etc.)	Replace thruster
	Missing/Not enough thruster oil	Top up oil
	Spring tension too high	Adjust spring tension
	Limit switch problem	Check connection, change limit switch
	Too big reserve stroke	Adjust reserve stroke
Braking distance too long	Spring tension too low	Adjust spring tension
	Brake pads have uneven wear pattern	Align brake
	Missing running-in procedure	Perform running-in procedure
	Too small reserve stroke	Adjust reserve stroke
	AWC does not work correctly	Adjust AWC and catch
	Brake disc worn	Change brake disc
	Linings worn	Change linings
Brake doesn’t close	Manual release lever actuated	Manually close
	Spring tension too low	Increase contact force/brake torque
	Reserve stroke too small	Adjust reserve stroke

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