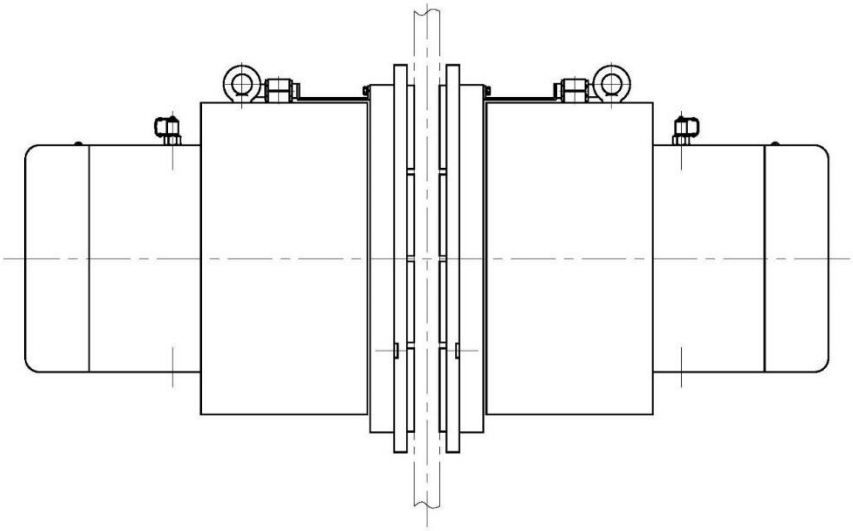
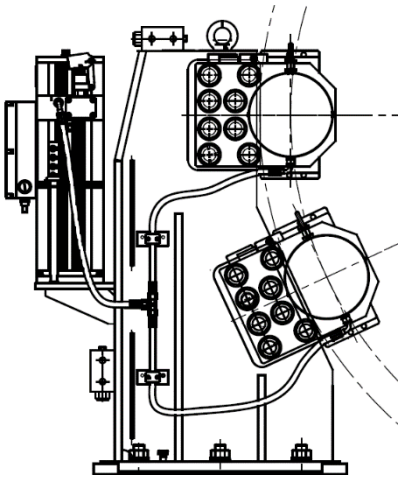
Furka® FDB.H / HSB Series Disc Brake

FDB.H caliper



FDB.H Caliper with thruster and support = HSB



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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 FDB.H / F-HSB 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 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 FDB.H/HSB safety brake is spring applied and hydraulically released. When the brake is actuated (closed), brake linings are pressed against the rotating/stationary disc creating the necessary friction. The friction between the brake linings and the disc causes the disc to stop rotating. Contact pressure is generated by Belleville spring washers that are located in the housing. The brake force is directly transferred to the brake shoes. In case of an emergency stop or a power failure the brake closes automatically. The design is fail-safe. To open the brake the hydraulic power unit or thruster must be energized. It is then compressing the brake springs, generating an air gap that allows the brake disc to spin freely. The FDB.H/HSB brake is used as safety as well as holding brake on heavy duty equipment like cranes, conveyors, steel mill equipment etc. . This version of FDB.H/HSB brake is not certified acc. to ATEX and cannot be used in explosion hazard zones.

Brake torque depends on:

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

Proximity sensors to indicate “brake released” and “lining wear” are included as standard.

2.2 Transportation and storage instructions

The weight of the brake depending on the size is between 90…1200kg. 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:

- Brake disc surfaces
- Brake pads
- Electrical components
- Nameplate

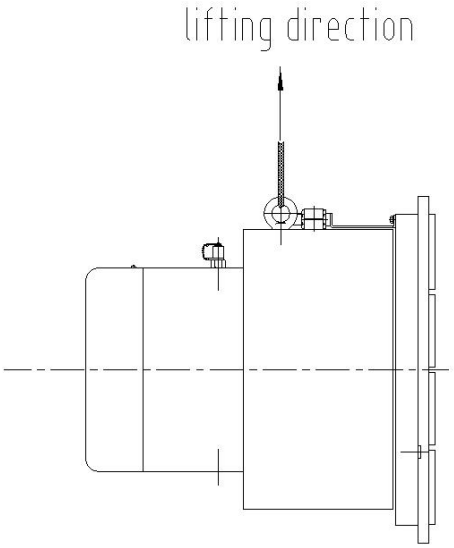


Fig. 1: Transport

2.3 Technical data

Type	*Release pressure*	*Release oil volume*	*Rated contact force*	*Air gap*	*Coefficient of friction*
FDB.H50	110bar	30ml	50kN	1~2mm	0.4
FDB.H100	120bar	50ml	100kN	1~2mm	0.4
FDB.H160	120bar	70ml	160kN	1~2mm	0.4
FDB.H250	130bar	95ml	250kN	1~2mm	0.4
FDB.H315	140bar	115ml	315kN	1~2mm	0.4
FDB.H400	120bar	170ml	400kN	1~2mm	0.4

Table 1

The hydraulic system must never be operated at a pressure higher than the values indicated on the name plate data.

2.4 Mounting dimensions, brake torque calculation

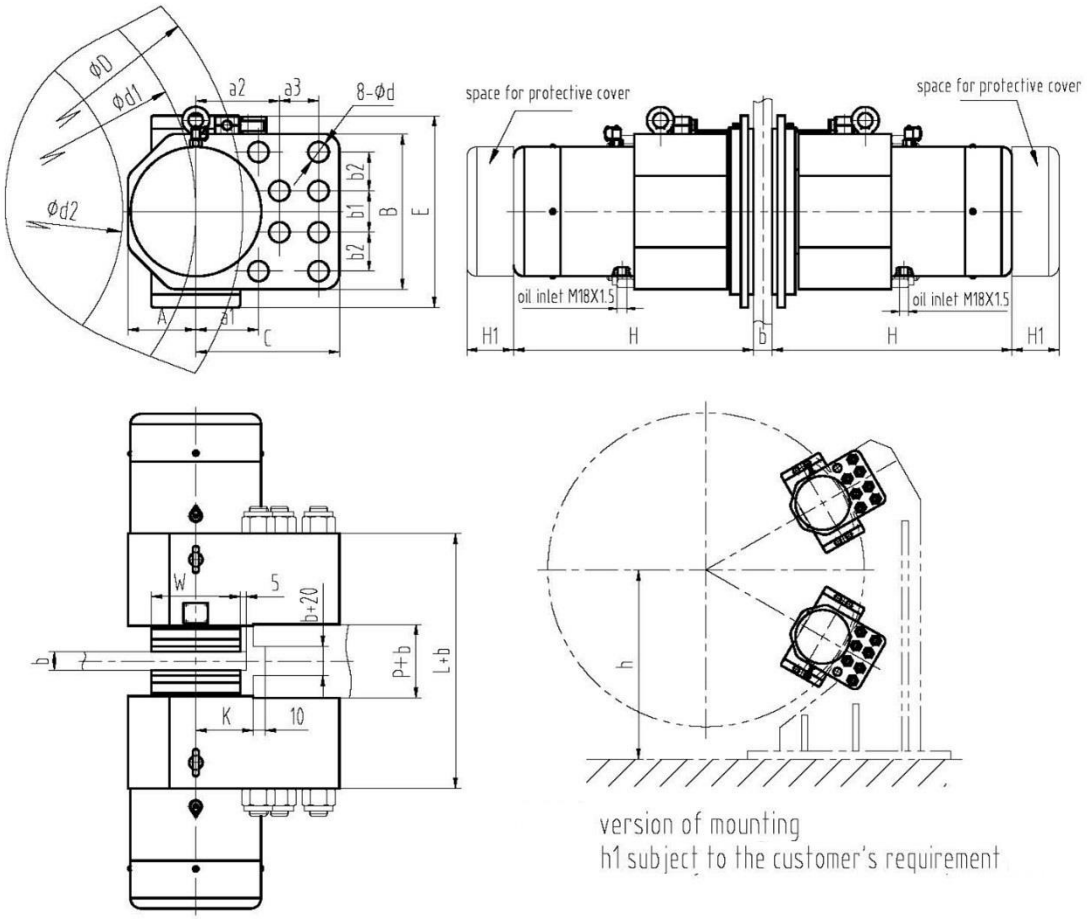


Fig. 2: Dimensions

Brake Type	A	a_1	a_2	a_3	B	b_1	b_2	C	d	k	P	L	E	W	H	H_1
FDB.H50	77	77	90	38	154	38	38	150	20.5	56	102	300	240	110	310	80
FDB.H100	95	95	105	45	190	55	45	180	25	71	102	348	286	140	360	85
FDB.H160	110	120	135	65	260	70	65	235	31	87	106	412	370	170	410	95
FDB.H250	130	120	160	75	300	80	75	275	37	87	106	456	370	170	470	110
FDB.H315	140	175	205	85	335	90	82.5	330	37	137	106	476	410	270	500	110
FDB.H400	170	180	220	120	440	110	110	420	50	137	142	602	546	270	560	115

Mounting dimensions: Table 2 units: mm

Brake Type	b			D	d_1	d_2
FDB.H50	30	36	40	≥500	D-120	D-300
FDB.H100	30	36	40	≥500	D-150	D-380
FDB.H160	30	36	40	≥600	D-180	D-440
FDB.H250	30	36	40	≥600	D-180	D-480
FDB.H315	30	36	40	≥1200	D-280	D-600
FDB.H400	30	36	40	≥1800	D-280	D-660

Brake disc related dimensions: Table 3 units: mm

Brake torque: $M = F \times \mu \times d_1$

Where: **μ** …….coefficient of friction: 0.4

d_1 ……friction diameter:

F ……contact force [kN]:

Note: **d_2** …max. allowable outer diameter of drum/hub:

2.5 Nameplate

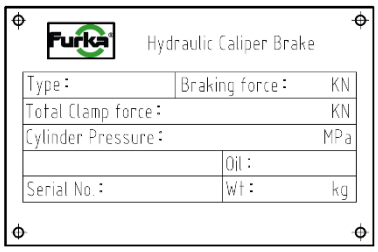


Fig. 3: Brake caliper nameplate

3. Design, installation and brake adjustments

3.1 Structural drawing

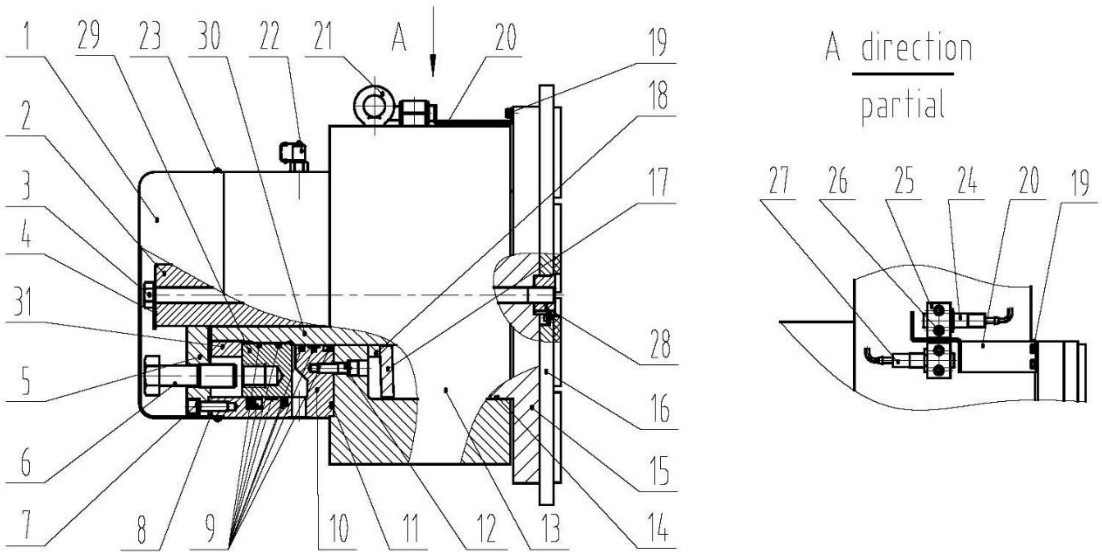


Fig. 4: List of main parts

Pos.	Description	Pos.	Description	Pos.	Description
1	Protective cover	11	Flange base seal	21	Eyebolt
2	Adjusting pin	12	Connection bolt(s)	22	Test point coupling
3	Pad retaining screw	13	Flange	23	Screw (for cover)
4	Lock washer	14	Lining carrier seal	24	Pad wear prox switch
5	Rear end cover	15	Lining carrier	25	Mounting clamp
6	Bolts for transport	16	Brake pad	26	Fastening screw
7	Bolts for rear end cover	17	Disc spring stack	27	Release prox switch
8	Sealing ring	18	Spring washer	28	Socket
9	Seal kit (for cylinder)	19	Bolts	29	(hydraulic) Piston
10	Cylinder body	20	Actuator (target)	30	Piston rod
				31	Locknut

Table 4: List of main parts

3.2 Installation

3.2.1 Basic brake inspection

- Check whether all parts and components of the brake are complete. 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 complies 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 caliper 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 disc with cracks or other defects.

Average roughness depth in the contact area of the brake linings should be 3.2µm. Other tolerances can be taken from Fig. 5.

3.2.3 Design and inspection of the brake support

The brake support is normally not part of Furka® supply. The brake support must be checked for dimensional accuracy. Please check Fig. 5 for detailed information.

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 5) should not exceed the specification in table 5.

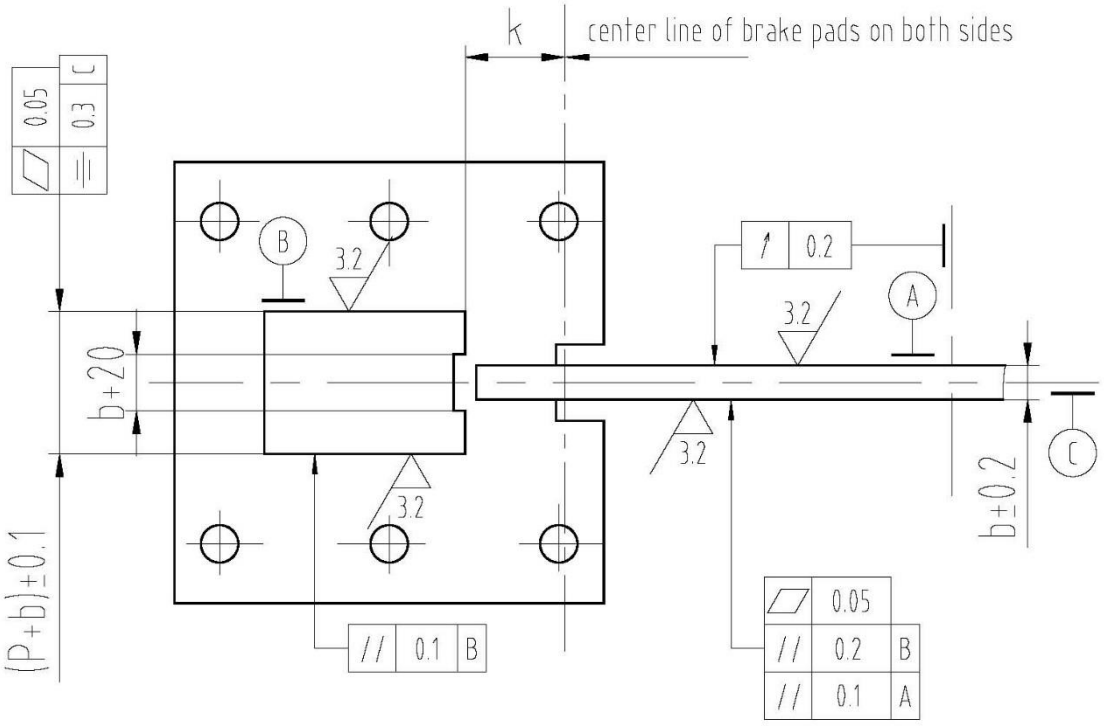


Fig. 5: Mounting dimensions

Brake Type	P	k
FDB.H50	102	56
FDB.H100	102	71
FDB.H160	106	87
FDB.H250	106	87
FDB.H315	106	137
FDB.H400	142	137

Table 5 (unit mm)

3.2.4 Brake installation

⚠	**Please use the O-ring eyelet to lift the brake in order to prevent damage during transport and installation. The brake's minimess test point coupling must face upwards during assembly so that complete bleeding of the brake is possible later.**

Make sure that the right connection bolts (acc. to table 6) are used to mount the calipers to the brake support.

Brake Type	*Bolt size /grade*	*Tightening torque (μ=0.12)*	*Brake Type*	*Bolt size / grade*	*Tightening torque (μ=0.12)*
FDB.H50	8 x M20, 10.9	590Nm	***FDB.H315***	8 x M36, 10.9	3540Nm
FDB.H100	8 x M24, 10.9	1018Nm	***FDB.H400***	8 x M48, 10.9	8200Nm
FDB.H160	8 x M30, 10.9	2040Nm			
FDB.H250	8 x M36, 10.9	3540Nm			

Table 6: Mounting bolts FDB.H brakes

Place the released brake on the installation position. Check whether the installation position is correct on the basis of the Fig.4 .

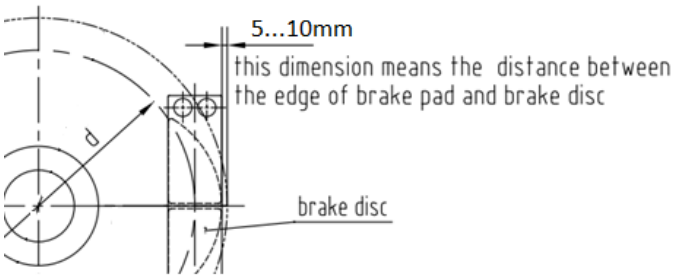


Fig. 6: Installation position

Adjust the correct position of the brake support and check if the linings are in parallel position to the brake disc. The entire surface of the brake pad must be in contact with the brake disc. The brake disc shall therefore protrude approx. 5 to 10mm beyond the outer edge of the brake pad. Pls. see Fig. 6. The brake support can be aligned with shims. The release gap of the brake should be approx.. 1…2 mm each side. Acc. to the selected bolt quality, use torque spanner to tighten the foundation bolts.

Connect the pressure oil line to the pressure connections of the brake. The oil inlet thread is M18x1.5 (see fig. 2) and the diameter of the pipe shall be 12mm (12L).

⚠	**Flush the hydraulic lines before connecting to the brake to prevent particles from intruding the brake. If the lines are not flushed sufficiently, seals may be damaged and the function of the brake is not guaranteed.**

Before the brakes can be put into operation, they must be bled. Make sure that there is sufficient oil in the hydraulic system during and after the bleeding process. Briefly switch on the hydraulic system so that the brake is flushed with hydraulic oil. Repeat this until a clean stream of oil comes out of the test point coupling.

Please see Fig. 7 showing bleeding and non-bleeding position of the monitoring port.

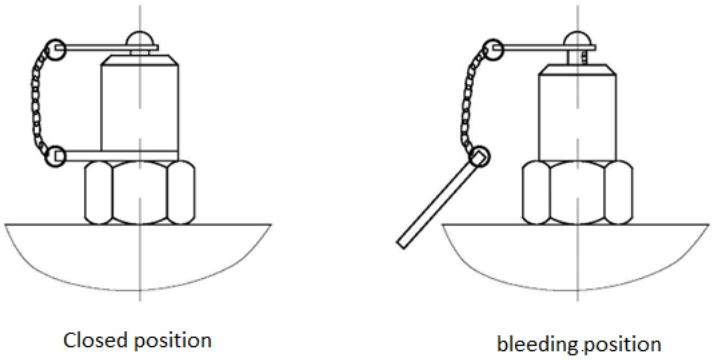


Fig. 7: Bleeding

Please ref. to fig. 4: FDB.H brakes are shipped with transport screws (pos. 6) to hold the brake open. Before operating the brakes these screws must be removed. First, the cover (pos. 1) needs to be removed. Then the brake must be pressurized (opened) by HPU or hand pump. Then, transport screws can be unscrewed. Don't forget to mount the cover again.

3.3 Adjustments

Adjustments include the contact force and air gap settings as well as the setting of the prox switches.

STOP	**Each adjustment should be done during the initial installation and after the linings have been changed**.
⚠	**When the linings are worn out 0.5mm contact pressure needs to be readjusted to guarantee that the nominal contact pressure is achieved.**

3.3.1 Contact force and air gap adjustment

The air gap (distance between brake disc and lining when the brake is released) has a direct influence on the contact pressure of the brake. The brake must be set to the values that are given in table 7.

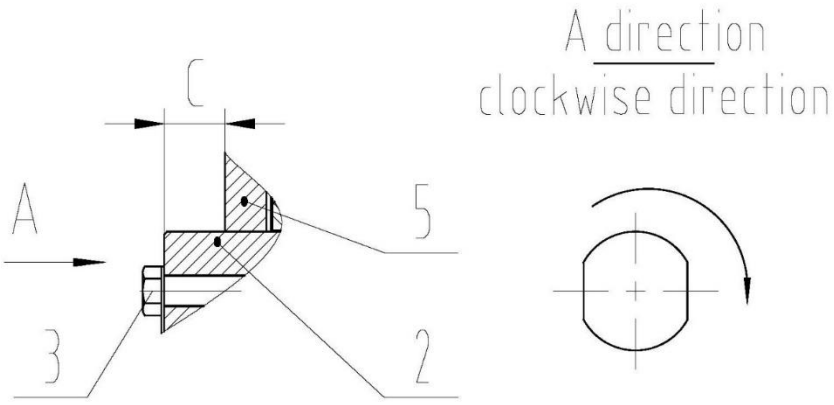


Fig. 8: Air gap setting

2 Adjusting pin 3 Pad holding screw 5 Rear end cover

Brake type	*Release pressure*	*C value*
FDB.H50	110bar	1~2mm
FDB.H100	120bar	
FDB.H160	120bar	
FDB.H250	130bar	
FDB.H315	140bar	
FDB.H400	120bar	

Value C (distance rear end cover to adjusting pin – see fig. 8) has to be set to 1~2mm. Therefore the working pressure of the HPU must be set to the value acc. to table 7. Open and close the brake a few times and check distance C. If value C is over 2mm: Open brake, counter-clockwise (CCW) rotate the pad connecting bold (3) to unscrew. Clockwise (CW) rotate the adjustment pin (2) and open/close the brake until value C is set between 1…2mm. Finally the pad connecting bolt must be tightened again. Don't forget to mount the protection cover (1) when the setting is finished.

3.3.2 Limit switch adjustment

FDB.H brakes are delivered with proximity switches to indicate

1. if the brake is released or not

   Wiring of close and release limit switch is shown as fig. 9 with molded 2m cable, capacity of contactors: 20～250V AC/400mA and 10～300V DC/300mA. (Note: BN is brown, BU is blue)

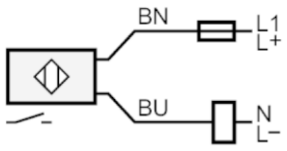


Fig. 9: Release prox switch circuitry

2. pad wear

   Wiring of pad wear 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)

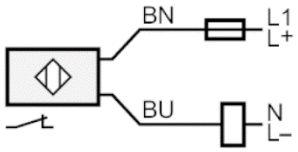


Fig. 10: Pad wear prox switch circuitry

Adjusting methods: Use an Allen key to loosen the fixing bolts of the clamping bracket to position the sensor in the right distance to the target. Please check table 7.

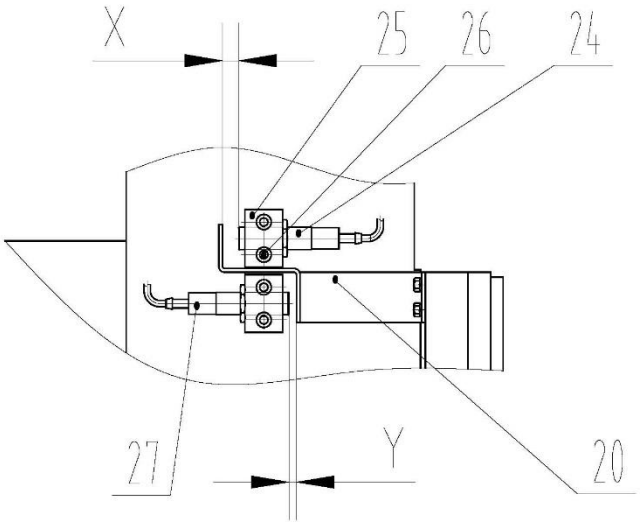


Fig. 11: Sensor settings

Sensor function	***Wear Indicator***		***Brake Release Indicator***	
Air gap	Brake Close	Brake Release	Brake Close	Brake Release
	Gap X		***Gap Y***	
1mm	5.5mm (*)	6.5mm (*)	5.5mm (*)	4.5mm (*)
1.5mm	5.5mm (*)	7mm (*)	6mm (*)	4.5mm (*)
2mm	5.5mm (*)	7.5mm (*)	6.5mm (*)	4.5mm (*)

Table 7 (*) all values are approximate values

Note:

1. Value X corresponds to 0.5mm pad wear. The sensor will send a signal as soon as one single side has been worn out 0.5mm.
2. Value Y stands for the brake release signal. The sensor will send a signal when the brake is opened (…it will not send a signal when the brake is closed).

3.4 Final functions and settings

Open and close the brake several times. Please check for value C (contact force/air gap) table 7. If the value is not between 1…2mm item 3.3.1 needs to be repeated.

Check for equal air gap when the brake is released. If not please repat 3.3.1 .

Check the function of the limit switches. In case of problems repeat 3.3.2 .

4. Operation

4.1 Manual release device (Handpump)

	**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 device 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 normally connected to a hand pump that is mounted on an (external) HPU (**H**ydraulic **P**ower **U**nit) or thruster. Please read the manual of the HPU/thruster for further instructions.

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 brake pads is of decisive importance in order to achieve a sufficient contact surface between brake pads and brake disc.

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 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.

Loosen the brake pad holding screw (turn CCW). Let the motor run on 25% to 50% of nominal speed. Then clockwise (CW) turn the adjusting pin until the brake pad touches the brake disc. Open and close the brake several times until the entire surface of the linings is completely run-in (Max. braking time should not exceed 5s for organic linings and 15s for sintered linings).

Remove the brake pads and check the contact pattern.

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.

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.

Please check during the running-in procedure:

- Contact pattern between linings and brake disc
- Brake disc temperature (should not exceed 200 °C for organic linings, 250 °C for sintered linings)

After the running-in procedure is finished please check the setting of the air gap acc. to chapter 3.3.1.

The brake is now ready for operation.

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 linings
  Check/re-adjust linings (refer to 5.2)

- Contact force
  Check/re-adjust linings (refer to 3.3.1)

- Wear situation and thickness of brake linings
  If the thickness of the friction material is less than 3mm, the brake pad should be replaced by a new one (refer to 5.2).

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

- Limit switches
  Check if the limit switches are working properly (refer to 3.3.2).

Inspect the brake outside normal maintenance intervals if:

- the stopping distance/time is too long
- a limit switch indicates worn out linings
- emergency stops have been performed
- overspeed situations/excessive braking times have occurred
- leakage has occurred
- the machine/system has been at a standstill for a long time
- the brake has not been used for a long time.

	**Especially during commissioning, but also after longer periods of standstill, make sure that the brake disc is free of rust. Likewise, brake discs with rust protection layers can also pollute the brake linings what will cause a low coefficient of friction. Regardless of whether rust or rust protection is present on the disc, care must always be taken to ensure that the brake disc and pads are free of contamination.**

5.2 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, 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!**

- Open the brake by handpump or by HPU.
- Refer to fig. 3. First remove the protective cover (1) by loosening screw (23).
- The pad retaining screw (3) must be completely unscrewed from the socket (28). Please note fig. 12.

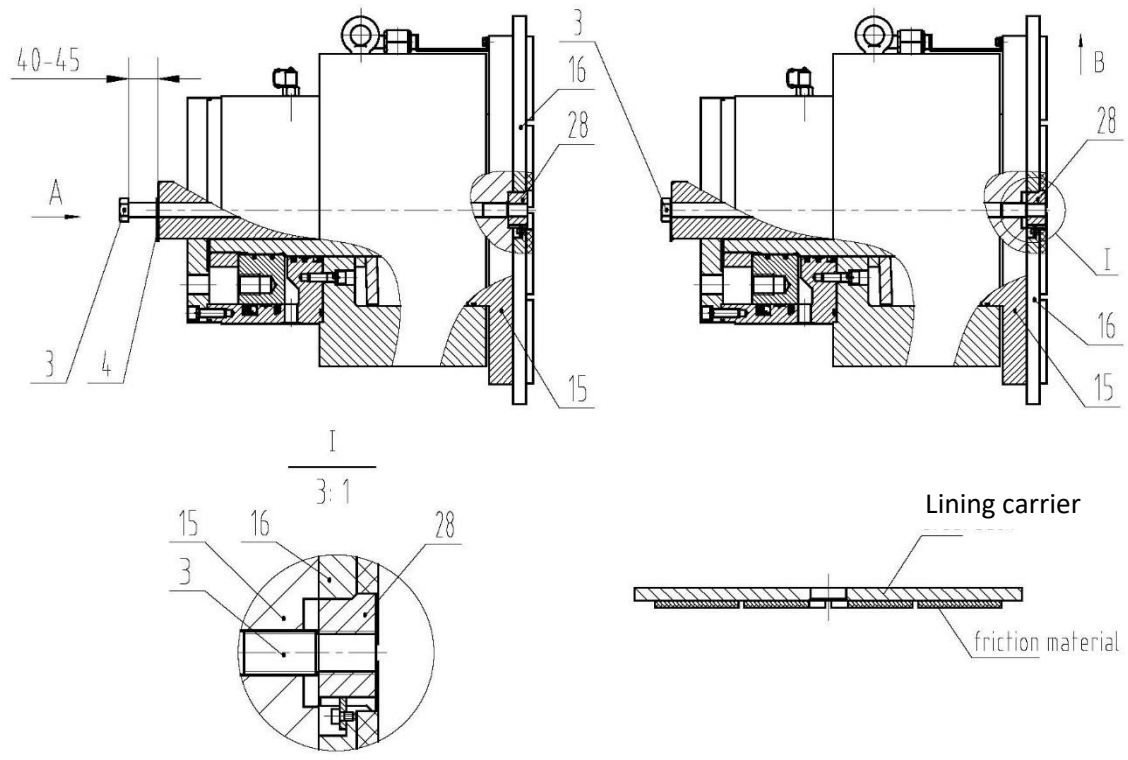


Fig. 12 Lining change

- Detach the socket (28) from the keyway of the lining carrier (15) by tapping the pad retaining screw (3) slightly in the A direction with a rubber mallet. The lining (16) can be removed in “B” direction.

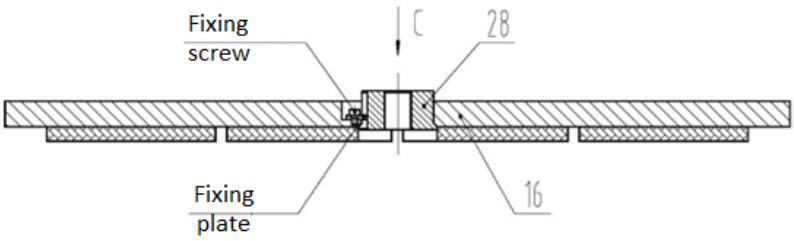


Fig. 13: Lining completion

- Unscrew the fixing screw and remove the fixing plate. Tap out the socket (28) from the lining carrier in “C” direction.
- Install the socket (28) into the new pad and mount it with the fixing plate and screw.
- The new pad can now be installed and fastened with the pad retaining screw (3).
- Mount the protective cover (part 1, fig. 4) again.
- Please check the adjustments as per 3.3. Running-in procedure as per 4.2 is mandatory.

5.3 Replacement of limit switches

- Disconnect the electrical connection of the limit switch.
- Replace the damaged limit switch by a new one.
- Connect the new limit switch electrically.
- Adjust the limit switch as per 3.3.2
- Open and close the brake several times.
- Check if the switch is properly working.

5.4 Replacing the Belleville spring packages and seals

	When working on the hydraulic system, ensure the greatest possible cleanliness. Each part must be cleaned in a solvent, dried and stored in a dust-protected place. Dirt considerably shortens the service life of the seals. Check the surfaces of the brake housing and brake pistons. Damage to the surface can destroy the seals immediately.

5.4.1 Replacing the Belleville spring package

- Open the brake electrically or by hand pump.
- Refer to fig. 4. First remove the protective cover (1) by loosening screw (23).
- Refer to fig. 4. Screw transport bolts (6) into the piston (29).
- Release pressure from the hydraulic system (Check HPU manual).
- Disconnect the oil lines from the brake.
- Remove the limit switches (24,27) together with the mounting bracket (25).
- Loosen the screw connection between flange and support and place the brake half on a workbench.
- Refer to fig. 4. Remove the brake pad, pad retaining bolt (3) and the lock washer (4).
- Refer to fig. 14. Fix end “A” and “B” with a jack in order to release the spring in a controlled manner.

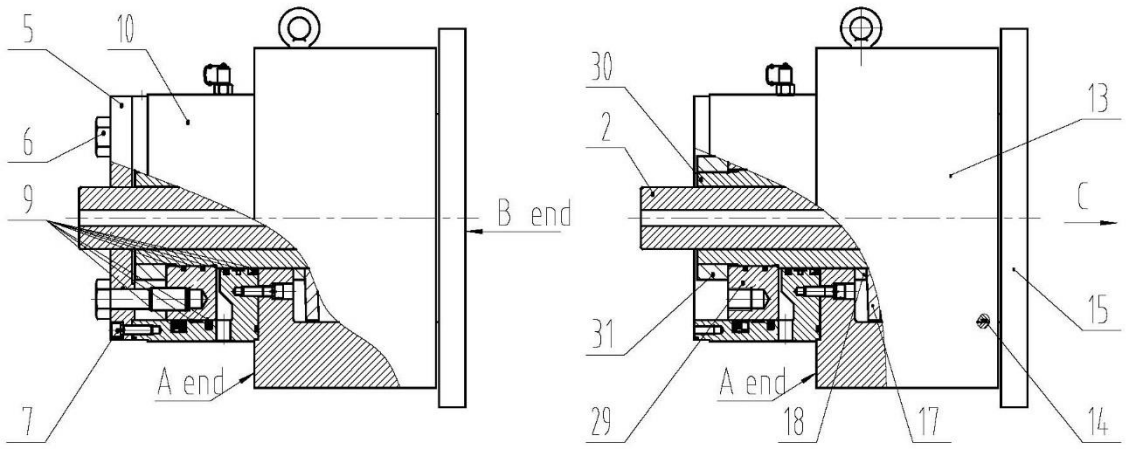


Fig. 14: Belleville spring washer replacement

- Remove the transport screws (6) and the cover screws (7). Now you can remove the rear cover (5) and the lock nut (31).
- Loosen the lock nut (31) slowly and remove the piston (29). Slowly operate the jack to release spring pressure.
- Remove the brake shoe (15) in “C” direction. Take care not to damage the seal (14)
- Rotate the adjusting pin (2) and remove it from the brake flange(13) in “C” direction.
- Remove the piston rod (30), spring assembly (17) and washer (18) one by one from the brake flange (in C direction).
- Clean the parts thoroughly, dry them and then lubricate them.

- The correctly assembled spring pack shall be lubricated with MoS_2. Please note that the disc spring stack must be re-installed in the same configuration as it was delivered. This also applies in case a new disc spring assembly is installed.
- All parts are reassembled in reverse.
- Refer to 3.2 and 3.3

5.4.2 Replacing seals

Seals always have to be replaced as a set. Please pay attention to the correct installation direction of the seals.

- Disassemble the spring unit (Refer to 5.4.1)
- Remove piston (29) and cylinder body (10)
- The parts must be cleaned of dirt, grease and corrosion protection. The parts can be easily cleaned with the help of solvents. Then dry the components.
- Insert new seals and springs into the brake in reverse order. The seals should be lubricated with hydraulic oil.
- Re-assemble the brake (refer to 5.4.1)
- Connect the hydraulic hoses to the brake
- Check the brake for leakages by applying 1.5 rated pressure for half an hour (check table 1)
- Adjust the brake as per 3.3

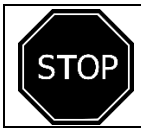
6. Failure analysis and troubleshooting

Failures	*Possible reasons*	*Measures*	*Refer to chapter*
Brake doesn't close	Check valve of HPU/thruster is locked	Open check valve	Operating manual of HPU/thruster
	Belleville spring washers damaged	Replace spring assembly	5.4.1
	Brake pads are worn beyond the permissible level	Replace brake pads	5.2
	Transport screws have not been removed	Remove transport screws	3.2.4
	faulty limit switch adjustment	Check limit switch connection and function	3.3.2
	brake disc worn	Change brake disc	-
Brake applies slowly	air in the hydraulic system	Bleed the system	3.2.4
	low temperature	check oil viscosity	HPU/thruster manual
Brake doesn't open	Pressure too low	Check HPU/thruster	HPU/thruster manual
	Oil level too low	Check HPU/thruster	HPU/thruster manual
	Hydraulic piping damaged	Check hoses, pipes and fittings for damage	
	air in the hydraulic system	Bleed the system	3.2.4
	too high contact pressure	Adjust C value ac. to table 7	3.3.1
	Brake is leaking	Exchange seals	5.4.2
Uneven wear on brake pad	lousy brake alignment	align brake/support	3.2.3, 3.2.4
	no air gap	Adjust air gap	3.3.1

7. Disposal

The disposal of the individual materials must be carried out in accordance with the legal and national regulations of your country or your company's internal specifications. If the brake is to be decommissioned and scrapped, the remaining hydraulic fluid must first be carefully drained from all parts of the unit.

The brake to be scrapped should be dismantled into its individual parts and disposed of separately according to the various materials in accordance with the applicable regulations.
Dismantling should be carried out by competent personnel. There are no special dangers as long as suitable tools and equipment are used.

	**Caution: Risk of injury due to pre-tensioned springs. Do not attempt disassembly unless mechanism is caged.**

8. Technical annex

Tightening torques acc. to VDI 2230-1:2015

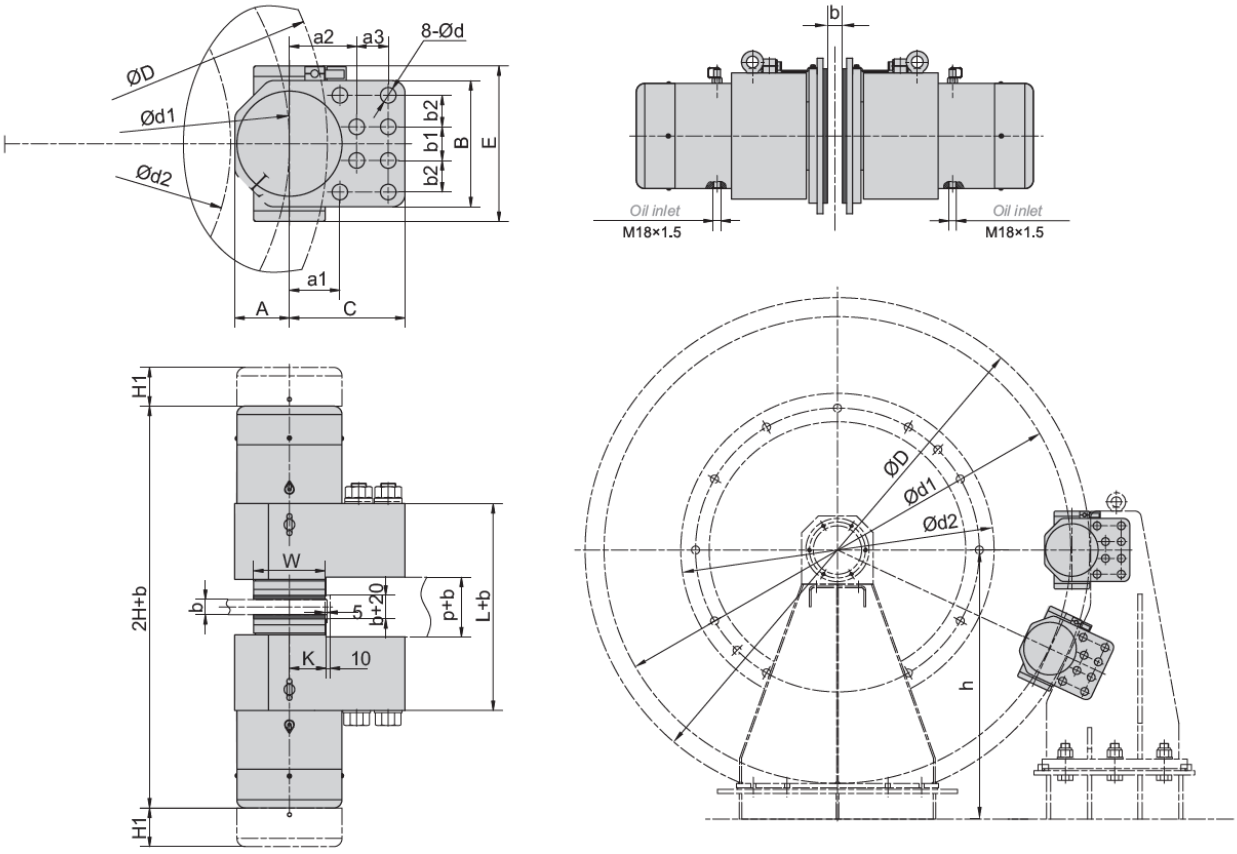
Bolts with metric standard thread:	DIN ISO 68, DIN ISO 724, DIN 13-19
Spanner size of hex bolts	DIN EN ISO 4014 bis DIN EN ISO 4018
Screws with external hexagonal round:	DIN 34800
Socket-head cap screws:	DIN EN ISO 4762
Bore "medium"	DIN EN 20273

μ=0.12 **$\mu=\mu_G=\mu_K$ Friction on the thread / head rest**

	Metric Class						Spanner size	
	8.8		10.9		12.9		acc. to ISO 4014 etc.	acc. to DIN
	Nm	ft·lb	Nm	ft·lb	Nm	ft·lb	mm	mm
M3	1.3	1.0	1.91	1.4	2.24	1.7	5.5	5.5
M3.5	2.01	1.48	2.96	2.18	3.46	2.55	6	6
M4	2.99	2.2	4.39	3.2	5.14	3.8	7	7
M5	5.9	4.35	8.66	6.39	10.1	7.45	8	8
M6	10.2	7.5	15	11.1	17.5	12.9	10	10
M8	24.7	18.2	36.3	26.8	42.4	31.3	13	13
M10	48.6	35.8	71	52.4	84	62.0	16	17
M12	84	62	123	91	144	106	19	19
M14	133	98.1	195	143.8	229	168.9	21	22
M16	205	151	301	222	353	260	24	24
M18	295	217.6	420	309.8	491	362.1	27	27
M20	415	306	591	436	692	510	30	30
M22	567	418.2	808	596.0	946	697.7	34	32
M24	715	527	1018	751	1191	878	36	36
M27	1054	777.4	1501	1107.1	1756	1295.2	41	41
M30	1432	1056	2040	1505	2387	1761	46	46
M33	1934	1426.4	2755	2032.0	3224	2377.9	50	50
M36	2489	1836	3544	2614	4148	3059	55	55
M39	3216	2372	4581	3379	5360	3953	60	60

Fig. 15: Tightening torques

FDB.H data sheet



FDB.H series | FDB.H Baureihe
FDB.H series safety brakes | FDB.H Sicherheitsbremsen

B2.1

Technical data | Technische Daten

Type Typ	Clamp force (kN) Haltekraft (kN)	Release pressure *(MPa)* hydr. Lüftdruck (MPa)	Release oil volume *(ml)* Ölvolumen (ml)	Clearance *(mm)* Lüftspalt (mm)	Friction coefficient Reibwert		Mounting bolts; performance class; installation torque Befestigungsschrauben, Qualität, Auszugsmoment	Weight bracket excluded *(kg)* Gewicht ohne Konsole (kg)
					Static statisch	Dynamic dynamisch		
FDB.H50	50	11	30	1-2	0.4	0.36	8-M20 10.9 550±10	90
FDB.H100	100	12	50	1-2	0.4	0.36	8-M24 10.9 950±10	150
FDB.H160	160	12	70	1-2	0.4	0.36	8-M30 10.9 1900±20	310
FDB.H250	250	16.5	95	1-2	0.4	0.36	8-M36 10.9 3300±40	452
FDB.H315	315	17	115	1-2	0.4	0.36	8-M36 10.9 3300±40	672
FDB.H400	400	16.5	170	1-2	0.4	0.36	8-M48 10.9 7500±100	1100

Brake torque
Bremsmoment
Nm=F×μ×d1

Dimensions (mm)
Abmessungen (mm)

Type Typ	A	a1	a2	a3	b1	b2	B	C	d	k	P	L	E	W	H	H1
FDB.H50	77	77	90	38	38	38	154	150	20.5	56	102	300	240	110	310	80
FDB.H100	95	95	105	45	55	45	190	180	25	71	102	348	286	140	360	85
FDB.H160	110	120	135	65	70	65	260	235	31	87	106	412	370	170	410	95
FDB.H250	130	120	160	75	80	75	300	275	37	87	106	456	370	170	470	110
FDB.H315	140	175	205	85	90	82.5	335	330	37	137	106	476	410	270	500	110
FDB.H400	170	180	220	120	110	110	440	420	50	137	142	602	546	270	560	115

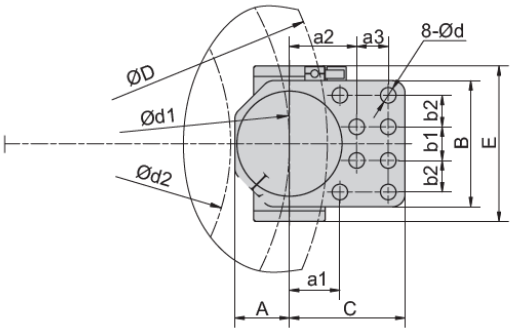
Relativ Dimensions of brake disc (mm)
Abmessungen Bremsscheibe (mm)

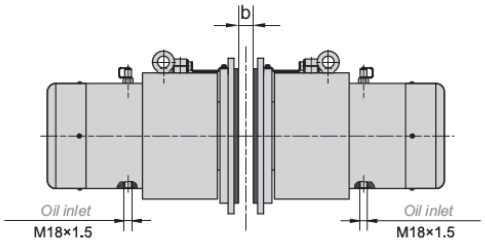
Type Typ	b			D	d1	$d2_{max}$
FDB.H50	30	36	40	≥500	D-120	D-300
FDB.H100	30	36	40	≥500	D-150	D-380
FDB.H160	30	36	40	≥600	D-180	D-440
FDB.H250	30	36	40	≥600	D-180	D-480
FDB.H315	30	36	40	≥1200	D-280	D-600
FDB.H400	30	36	40	≥1800	D-280	D-660

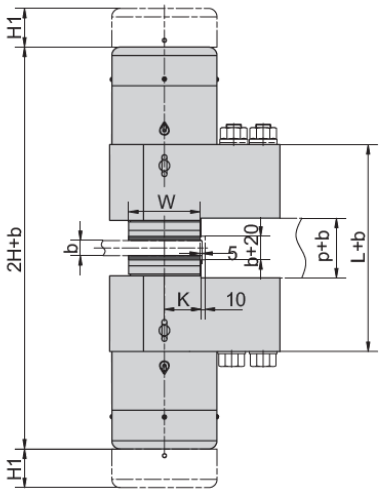
d1 = the theoretical friction diameter
d2 = max. allowable drum or hub diameter

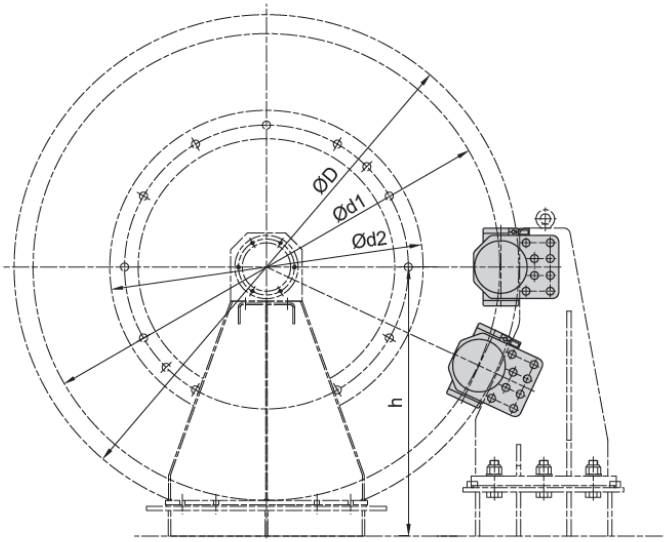
d1 = theoretischer Reibdurchmesser
d2 = max. zulässiger Trommel- oder Nabendurchmesser

Fig. 16: FDB.H data sheet


ØD
Ød1
Ød2
a2
a3
8-Ød
b2
b1
b2
B
E
a1
A
C


b
Oil inlet
M18×1.5
Oil inlet
M18×1.5

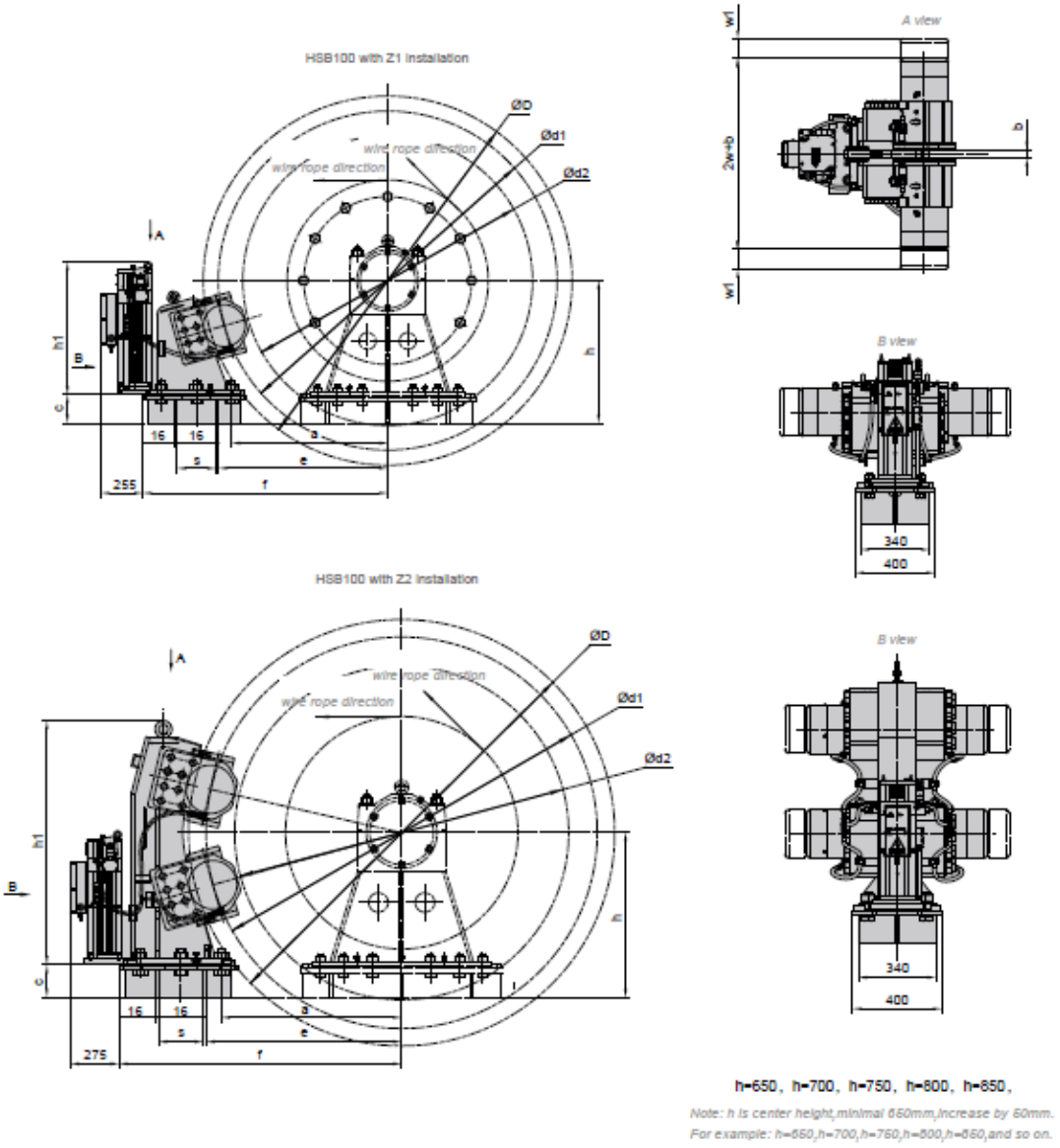

H1
2H+b
W
b
5
b+20
p+b
L+b
K
10
H1


ØD
Ød1
Ød2
h

F-HSB data sheets

F-HSB Series Safety Braking System

Outline and installation dimensions:



h=650, h=700, h=750, h=800, h=850,

Note: h is center height,minimal 650mm,increase by 50mm.
For example: h=650,h=700,h=750,h=800,h=850,and so on.

The following dimensions (HSB100 with Z1 and Z2) only apply to disc diameter: ø2000-ø2300

Type	a	f	s	c	e	h1		w	w1
						Z1	Z2		
F-HSB100	(D+60)Xcos20°/2-55	a+440	190	h-480	a+60	720	950	360	85

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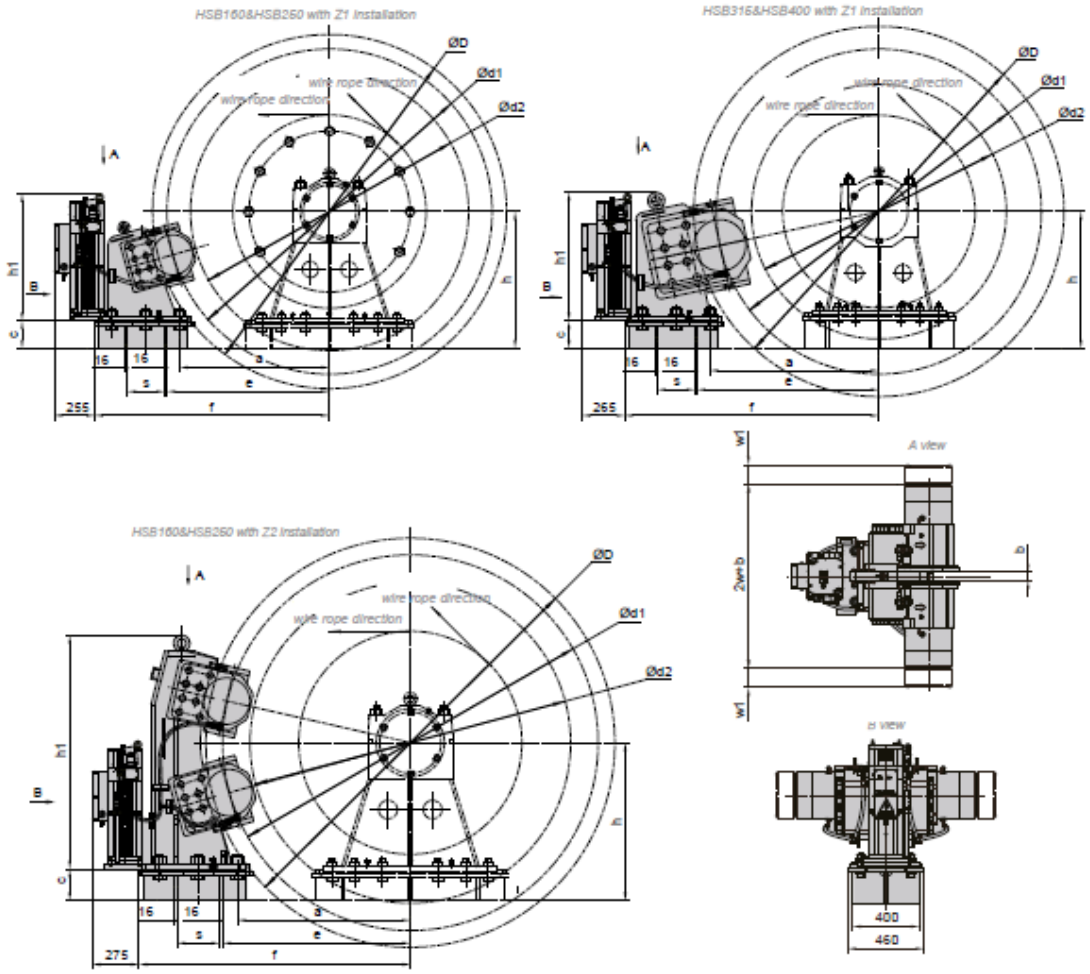
Outline and installation dimensions:



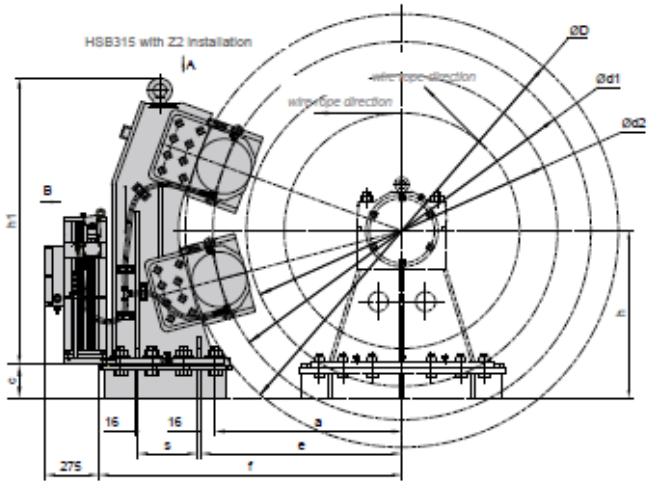
The following dimensions (HSB160-HSB400 with Z1) only apply to disc diameter: ø2000-ø2300

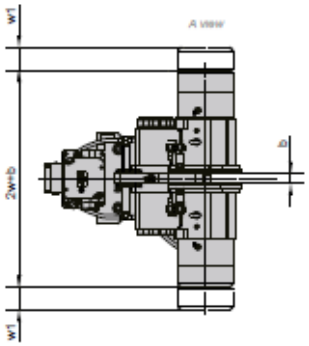
Note: h is center height,minimal 860mm,increase by 50mm.
For example: h=860,h=900,h=950,h=1000,and so on.

Type	a	f	s	c	e	h1		w	w1
						Z1	Z2		
F-HSB160	(D+90)*cos17°/2-175	a+530	230	h-680	a+79	720	1210	410	95
F-HSB250	(D+140)*cos17°/2-195	a+530	230	h-680	a+79	720	1265	470	110
F-HSB315	(D+130)*cos15°/2-175	a+530	230	h-680	a+79	720		500	110
F-HSB400	(D+160)*cos20°/2-200	a+530	230	h-680	a+79	800		560	115

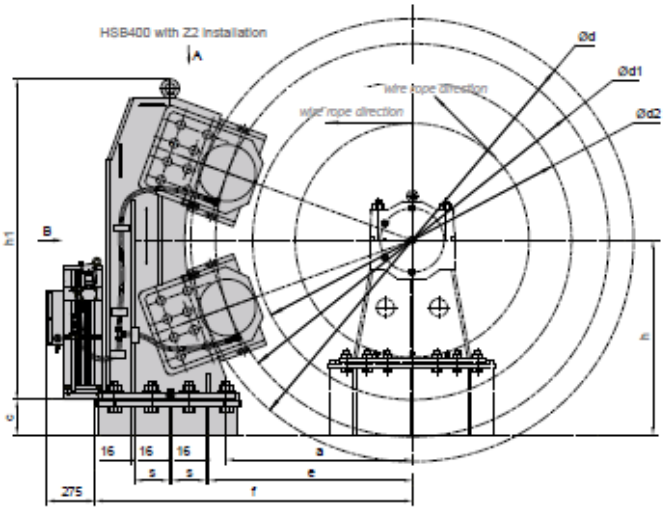
F-HSB Series Safety Braking System

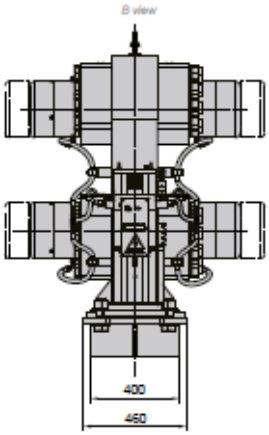
Outline and installation dimensions:





Note: h is center height,minimal 850mm,increase by 50mm.
For example: h=850,h=900,h=950,h=1000,and so on.





Note: h is center height,minimal 1100mm,increase every 50mm.
For example: h=1100,h=1150,h=1200,h=1250,and so on.

The following dimensions (HSB315 with Z2) only apply to disc diameter: ø2000-ø2300

Type	a	f	s	c	e	h1	w	w1
F-HSB315	(D+130)*cos15°/2-175	a+590	304	h-680	a+72	1455	500	110

The following dimensions (HSB400 with Z2) only apply to disc diameter: ø2000-ø2500

Type	a	f	s	c	e	h1	w	w1
F-HSB400	(D+160)*cos20°/2-200	a+740	194	h-900	a+97	1865	560	115

Please contact us if mounting dimensions are different.

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Technical data of F-HSB series safety brakes:

Type	Clamp force (KN)	Release pressure (MPa)	Clearance (mm)	Friction coefficient		Power (KW)	Current (A)	Diameter of power cable (mm)	Diameter of control cable (mm)	Weight bracket excluded (kg)
				Static	Dynamic					
F-HSB100	100	12	1-2	0.4	0.36	3	6.9	13~18	8~14	210
F-HSB160	160	12	1-2	0.4	0.36	3	6.9	13~18	8~14	360
F-HSB250	250	16.5	1-2	0.4	0.36	3	6.9	13~18	8~14	502
F-HSB315	315	17	1-2	0.4	0.36	3	6.9	13~18	8~14	722
F-HSB400	400	16.5	1-2	0.4	0.36	3	6.9	13~18	8~14	1150

Relative Dimensions of brake disc (mm):

Type	b			D	d1	d2 max
F-HSB100	30	36	40	≥500	D-150	D-380
F-HSB160	30	36	40	≥600	D-180	D-440
F-HSB250	30	36	40	≥600	D-180	D-480
F-HSB315	30	36	40	≥1200	D-280	D-600
F-HSB400	30	36	40	≥1800	D-280	D-660

Brake torque: Nm=F×μ×d1

w1= reserved space dimensions for adjusting brake (mm)

b= disc thickness (mm)

d1= theoretical friction diameter (mm)

d2= max.allowable outer diameter for drum and hub (mm)

D= disc diameter (mm)

Please contact us for different disc diameters.

Fig. 17: F-HSB data sheets

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