

Technical Information TI-B10 Safety Brakes type KSP

- ☑ High holding force by self-intensifying clamping
- ☑ Pneumatic actuation
- ☑ Secure against overloading



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A detailed description of the control, assembly and operational test of the SITEMA Safety Brakes can be found in the „Operating Manual BA-B10“.

1 Purpose

The KSP Safety Brake is designed and built to hold raised loads on a piston rod or on a separate clamping rod. The following purposes are possible and permitted:

1. Static holding
 Static holding of a weight against gravity on a round rod and securing load to prevent it falling in one direction. The size of the KSP Safety Brake must be selected in such a way that the static forces do not exceed the admissible load (nominal load M) of the KSP Safety Brake as given in the „Technical Data Sheet TI-B11“
2. Emergency brakes
 Emergency brakes for a mass moving downwards in the specified direction. In this direction the brake force is high (higher than the nominal load) but limited to ensure well-defined energy dissipation.

The national and international regulations regarding safety as far as applicable to the particular case must be observed.

The KSP Safety Brake is typically used as a **clamping mechanism** or **emergency brake** in the following applications:

- Vertical drives of loaders
- Vertical or diagonal machine tool axes

2 Function

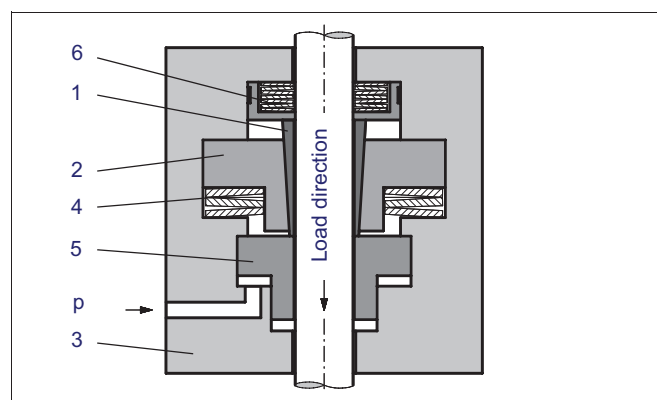


Fig. 1: Structure, clamping released

As shown in Fig. 1, the clamping system consists of a conical clamping sleeve (1) with an outer cone moving within a clamping ring (2). This whole clamping system is movable inside the housing (3) against the force of the disc springs (4). In released condition, the annular piston (5) keeps the clamping sleeve pushed against the set of disc springs (6) by pneumatic pressure, so that the shaft can move freely in both directions.

Static holding of the load

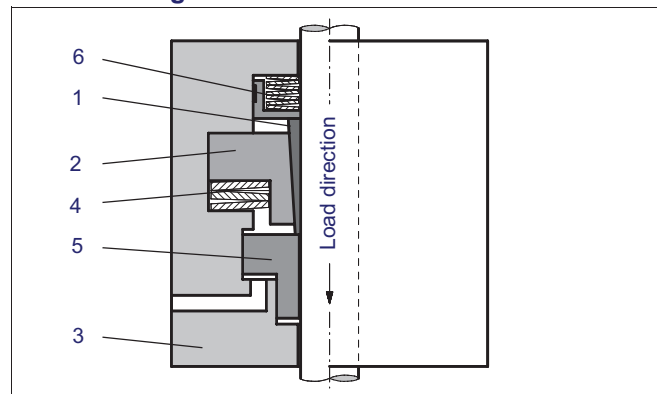


Fig. 2: Clamped, maximum load equals nominal load

At zero pressure the clamping sleeve (1) is pushed into the cone of the housing by a set of disc springs (6), whereby an initial friction contact between rod and clamping sleeve is achieved. If a load is now acting on the rod, the clamping process becomes self-intensifying.

Acting force does not exceed the nominal load M , the movement of the rod is very small, typically under 0.5 mm. The position of the clamping ring remains in its original position, because the spring force V (4) is somewhat larger than M (see Fig. 1).

Dynamic braking of a falling mass

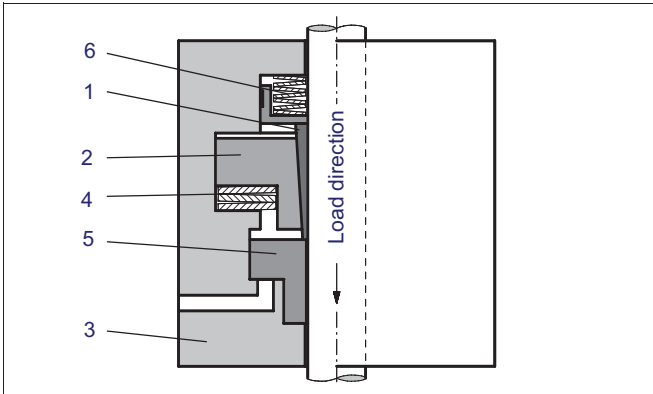


Fig. 3: Clamped and overloaded, i.e. dynamic braking force substantially larger than nominal load

If a moving mass has to be stopped, the kinetic energy has to be dissipated by friction.

For the clamping system, this means that the dynamic forces become much higher than the static forces. If the load exceeds the spring force V (4) Fig. 4, than the whole package (clamping ring (2) + clamping sleeve (1) + annular piston (5)) moves together with the rod until it gets to the mechanical stop after approx. 2 mm. The spring (4) then bounces slightly, without reaching the block storage area. The clamping force cannot increase after this point.

The slipping force for the rod is thus limited and predictable, lying between 2 and 3.5 times M . The resulting deceleration (if load is equivalent to M) is thus between g (gravity) and $2.5g$. The shaded area under the force-deflection curve represents the dissipated energy.

After stopping, the spring (4) will again raise the mass by a small amount.

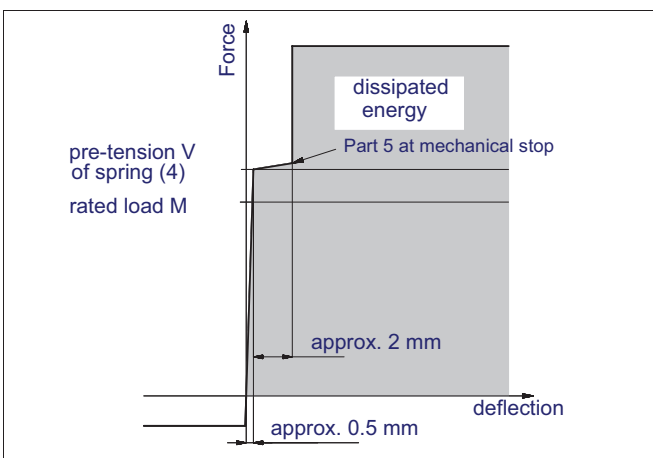


Fig. 4: Force-deflection diagram

Releasing the clamping

If the rod did not move after clamping and therefore no load is transferred to the safety brake, the clamp may be opened by simply applying the operating pressure.

However, if the clamp is to be released while the KSP Safety Brake is holding a load, an upward movement of the rod is normally necessary additionally to the release pressure at port L. Thus providing the safety advantage that the clamp can generally only be released as far as the hoist drive is intact and controlled.

However this advantage does not necessarily apply to small loads with a simultaneously high release pressure (for details see minimal loads F6 in „Technical Data Sheet TI-B11“).

A standard proximity switch has to be used to indicate signal 2 "Clamping released".

Upward movement

The release pressure should normally be enabled for all upward movement, as the rod can then move freely.

Upward movement while clamped (without release pressure) is possible. The friction force then achieves approx. 15-20% of M , which effect can principally be used for an emergency-stop in upward movement. In normal conditions, the safety brake should always be released during upward movement.

Downward movement

Downward movements are only possible when and as long as signal 2 „released“ is activated,, it is therefore imperative that this signal be processed accordingly in the control unit.

3 Control

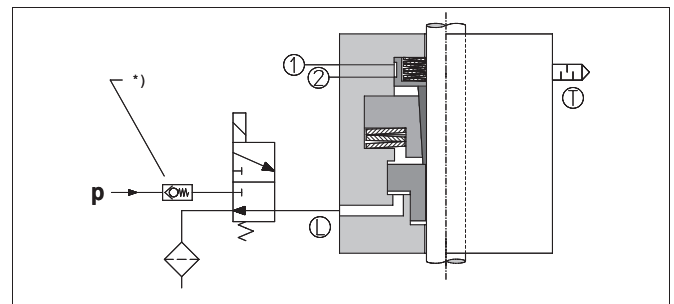


Fig. 5: Schematic diagramm of pneumatic circuit

* If the pressure (p) is not sufficiently constant (e.g. pressure drop at the beginning of lowering movements) we recommend a check valve in the p connection of the valve.

Under no circumstances may the outflow of the medium from connection L be hindered by any additional components.

⚠ All connection lines must be laid out without kinks. If there is any danger of kinking appropriate precautions must be taken (protective tube, thicker hose etc.)

Pressure medium

The compressed air must be dried and filtered.

Activation using 3/2-way valve

In most cases, the activation indicated in Fig. 5 will be used.

During every operational cycle, the 3/2-way valve is actuated electrically and releases the KSP Safety Brake.

In all other operational conditions, as well as in cases of power failure, emergency stop, etc. the Safety Brake becomes effective, secures the shaft and/or stops the load. In case the pressure line should fail, the load is secured in the same way. If necessary the valve can also be switched by another safety signal, e.g. speeding, contouring error, etc. In these circumstances, the KSP Safety Brake operates as a generic emergency brake.

Monitoring by proximity switches

The proximity switch 1 'Load secured' signals the secure state and is used to authorise entrance to the danger area. Switch 2 'released' is used to activate the downward movement of the drive.

For automatic detection of failures both signals are compared. In case both switches indicate the same state - apart from minor overlapping periods - there is a defect present.

4 Choosing the right size

The admissible load M is stated for all types in the „*Technical Data Sheet TI-B11*“ During normal conditions (vertical movement), the criteria load is to be maintained.

$$M \geq \frac{\text{Moving weight}}{\text{Number of safety brakes}}$$

The holding (braking) force for dry running or mineral-oil wetted shafts is not less than 2 x M, but will not exceed 3,5 x M. The fixing elements which accept the load (e.g. linking the rod to the travelling tool etc.) must therefore be dimensioned for a 3.5 x M force. This maximum force can occur with emergency braking and also if, in case of control errors, the full driving force is exerted against the KSP Safety Brake. However circumstances of this kind should remain accidental exceptions, as otherwise possible damage could occur to the KSP Safety Brake.

5 Rod requirements

The KSP Safety Brake is designed for operation on smooth round rods.



Fig. 6: Rod end with lead-in chamfer

Rod design requirements:

- The rod end is fitted with a lead-in chamfer (min. 3x20°, rounded) as a mounting aid.
- The rod surface is hardened (at least HRC 56), burnished and within ISO tolerance f7 or h6 and a surface finish Rz= 1 to 4 µm or R_a 0.15 - 0.25 µm
- The material has a yield strength sufficient to withstand the maximum possible load (up to 3.5 x M, see § "Dynamic braking of a falling mass"). In the case of compression-loaded rods buckling resistance must be assured.

Most recommended are:

Piston rods, hard chrome-plated (ISO-tolerance f7 or h6)
 basic material: yield strength min 580 N/mm²
 induction-hardened HRC 56 - 64 / min. 1 mm deep
 hard chrome plating: 800-1100 HV min 13 µm thickness
 surface finish: R_a 0.15 - 0.25 µm

6 Operating conditions

The KSP Safety Brake is designed to operate in usual clean and dry shop atmosphere. In case of other environments at least the port T for breathing purposes is to be connected to a clean and dry volume (tank).

Should heavy soiling conditions (grinding dust, chips, other liquids, etc.) exist, please contact SITEMA.

Grease on the rod may reduce the holding force. The permissible surface temperature is 0 - 60°C.

7 Required risk assessment

If SITEMA - Safety Brakes are used in safety-relevant applications the following has to be carefully attended:

It must be ensured that the size, the dimensions and arrangement of SITEMA - Safety meet the requirements of the risk evaluation EN ISO 14121-1 for the complete machine and also comply with any further standards and regulations applying to the intended use. This is generally the duty of the system manufacturer/user.

8 Overall documentation and CE mark

The KSP Safety Brake is designed as a component for integration into a machine or system. The seller of the machine or system must provide information on the KSP Safety Brake with the overall documentation and - if applicable - ensure that the machine or system carries the CE mark.

9 Regular functional checks

The KSP Safety Brake must be functionally checked at regular intervals. Regular checking is the only way to ensure that the unit will operate safely in the long run.

Please see „*Operating Manual BA-B10*“ for further details.

10 Maintenance

The maintenance of the SITEMA Safety Brakes is limited to the prescribed regular functional check.

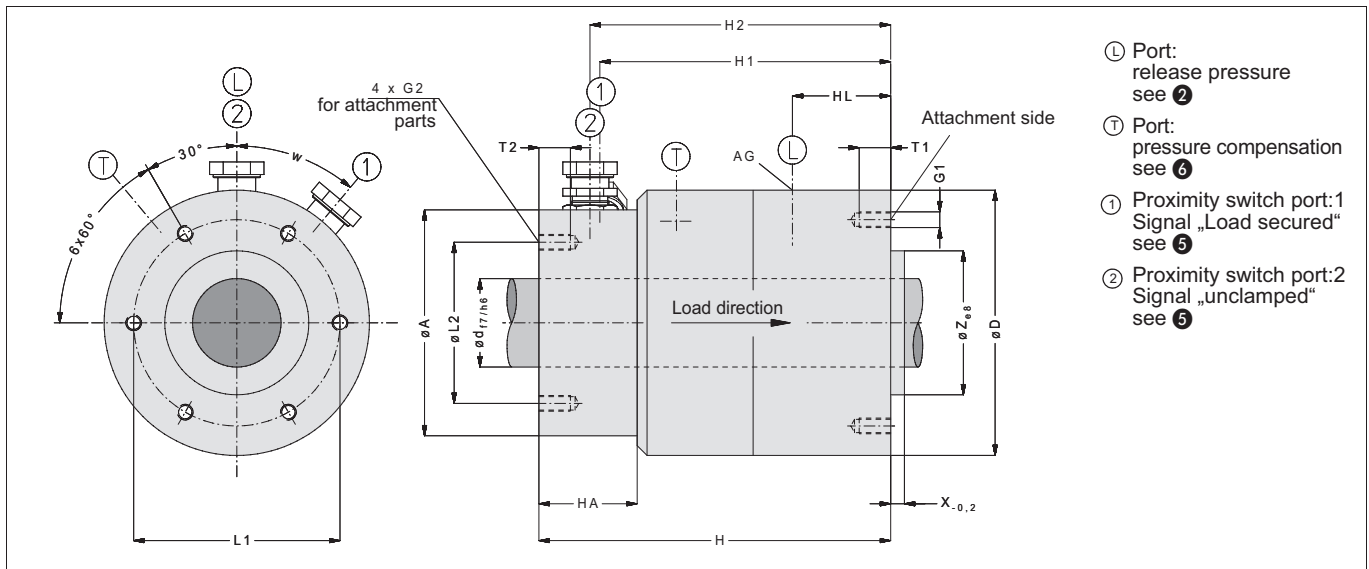
Should the KSP Safety Brake cease to comply with the required characteristics, the aforementioned safety of working with the machine or system is no longer given. In this case the KSP Safety Brake must be removed immediately and professionally repaired by SITEMA.

Any repair or refurbishing must be carried out by SITEMA. SITEMA cannot take any responsibility for repairs by another party.

English translation of German original

Technical Data Sheet TI-B11 Safety Brake KSP

General information, particularly regarding purpose, function, choosing right type and control is provided in „Technical Information TI-B10“. Furthermore important practical advices are given in the „Operating Manual BA-B10“.



- Ⓛ Port: release pressure see ②
- Ⓣ Port: pressure compensation see ⑥
- ① Proximity switch port:1 Signal „Load secured“ see ⑤
- ② Proximity switch port:2 Signal „unclamped“ see ⑤

Fig. 1: Dimensions Safety Brake KSP (CAD-Files download at www.sitema.com)

Type	Ident.-No.	① ② ③			④																				
		d	M	p	F6	H	D	Z	X	A	HA	w	L1	G1	T1	L2	G2	T2	AG	VL	HL	H1	H2	G	
		mm	kN	bar	kN	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	cm ³	mm	mm	mm	mm	kg
KSP 16	KSP 016 01	16	2,5	3,5	2	114	96	35	5	78	36	50°	55	M6	15	65	M6	10	G¼	10	17	91	88	3	
KSP 22	KSP 022 01	22	5	3,5	3	137	120	40	6	104	37	40°	60	M6	15	80	M6	10	G¼	15	25	115	120	5	
KSP 22	KSP 022 02	22	10	3,5	3	137	120	40	6	104	37	40°	60	M6	15	80	M6	10	G¼	15	25	115	120	5	
KSP 25	KSP 025 01	25	15	3,5	4	142	140	45	6	114	37	40°	70	M8	20	90	M6	10	G¼	30	24	120,5	125,5	8	
KSP 28	KSP 028 02	28	20	3,5	7	173	184	50	6	118	40	30°	80	M8	20	90	M6	10	G¼	40	43	148	153	12	

Subject to modification without prior notice

① M is the admissible force the mass to be secured exerts on the clamping device. The minimum holding capacity (braking force) for dry-running or mineral-oil wetted shafts is at least 2 x M but does not exceed 3,5 x M.

② p is the pressure required for releasing. The permissible working pressure is 10 bar.

③ Regarding safety it is an advantageous feature of the Safety Brake KSP, that it normally will not release unless not only pressure is applied but also the load is supported by the lifting drive, thus automatically unintended releasing is prevented.

However, this is only true, if the load exceeds a minimum limit which depends on the working air pressure. With for example 6 bar pressure the critical minimum load is equal to F6. Values for other pressure level will be given on request.

④ Pneumatic operating volume.

⑤ Proximity switch holders are provided for standard proximity switches M12x1 shielded and with a nominal switching distance of 2 mm. For easier service, the proximity switch holders have a positive stop and are preset when delivered from the factory.

⑥ Port T is used for pressure compensation (breathing). It is plugged with an air filter element. If, however, moisture or aggressive media are present, a hose instead of the filter must be installed to connect the device with clean and dry atmosphere.

English translation of German original

Technical Data Sheet TI-B20

Spring-base for SITEMA - Safety Brakes KSP

General Information

Purpose

SITEMA Safety Brake KSP can in normal cases only be unlocked if their clamping system is not under load. This is a matter of principle and complies with the relevant safety regulations.

However this advantage does not necessarily apply to small loads with a simultaneously high release pressure (for details see minimal loads F6 in „*Technical Data Sheet TI-B11*“).

If, however, the slide or any other load carrying device overshoots after reaching its top cut-off position, or moves slightly downward for any particular reason, the Safety Brake KSP is subjected to a partial load. In practice this means that the slide must first be raised before a closing movement of the press is possible. This effect, often found to be disturbing and time-wasting, can be avoided by not bolting the Safety Brake KSP directly to the machine frame, but rather on a spring-base.

Solution

The housing (1) is securely fixed to the machine frame. Inside this housing the flange plate (2) which bears the Safety Brake KSP, is free to move vertically (stroke "h") as well as transversely (by the permitted eccentricity of "x"), and is allowed to tilt. The Safety Brake KSP when released (i.e. not under load) is pressed upward by the spring (3), against the stop. If the slide should settle slightly (due to leakage, for example) while the Safety Brake KSP is engaged, only the spring force — which is very low in comparison to the holding force — is exerted on the Safety Brake KSP. In this case, the Safety Brake KSP can be released without an upward movement. Only when the lowering movement exceeds stroke length "h", the full weight of the slide will be borne by the Safety Brake KSP. Now it is possible to release the Safety Brake KSP after only a short upward movement.

Note:

The overall lowering path, after which the slide will be secured mechanically, is increased by the distance h (for h see picture at page 2). This amount is to be taken into consideration when making safety analyses for engineering purposes. Special note must be made of this in the operating instructions for the machine.

Advantages

Raising the slide before the lowering movement is no longer required, even if a leakage should occur at the cylinder seals.

The **spring-base also compensates for certain misalignment** between the slide guide and the clamping rod. Other methods are not necessary in this case.

There are two alternatives for **attaching** the Safety Brake KSP to the **machine frame**. Either using threaded holes arranged identical to the ones on the clamping device or the externally attached shoulder which engages with the coupling flange.

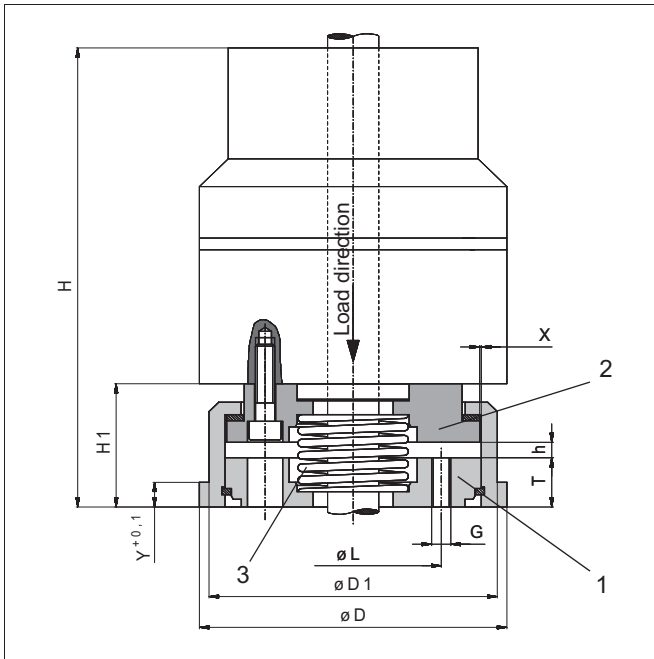
Mounting

Normally the the spring-base is factory-mounted to the Safety Brake KSP, ready for use. For retrofitting, the spring base is supplied fully assembled and just has to be attached on the attachment side of the Safety Brake.

The electric control of the Safety Brake KSP unit is described in „*Technical Informationen TI-B10*“. The required release pressure is 4,5 bar. Pressure must be supplied via a flexible line.

Dimensionen

For these pneumatic version the connecting hoses often rather small and flexible. In order to prevent kinking or squeezing, the suiting spring bases internally have an anti-twist protection.



Dessin 1: Spring base for Safety Brake KSP

Safety Brake	Spring-base	H	H1	D	D1	Y	L	G	T	h	X
	Ident.-No.	mm	mm	mm	mm	mm	mm		mm	mm	mm
KSP 16	FS 016 30	149	40	90	96	8	55	6xM6	16	5	0,5
KSP 22	FS 022 30	184	47	114	120	10	60	6xM6	22	5	1
KSP 25	FS 025 30	192	50	134	140	10	70	6xM8	21	5	1
KSP 28	FS 028 30	233	60	178	184	12	80	6xM8	29	6	1

Subject to modification without prior notice