English translation of German original

TI-P11-EN-01/2017

Technical Information TI-P11

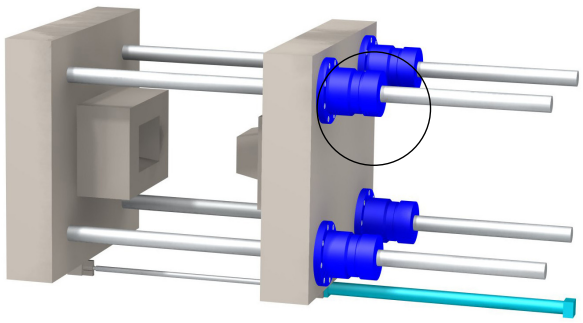
SITEMA PowerStroke

Mould closing devices series FSK

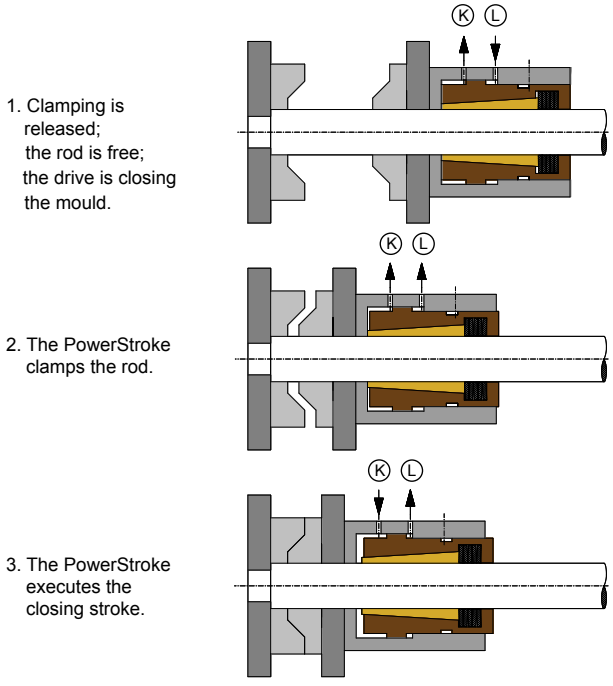
- ☑ drive system for powerful forces on a short stroke
- ☑ hydraulic actuation
- ☑ closing force up to 200 tonnes

Contents

A detailed description regarding control and use of the SITEMA PowerStroke is given in the *"Assembly Instructions MA-P11"*.



Application example:
schematic compression moulding machine with
4 x SITEMA PowerStroke series FSK



computer animation of the operation on www.sitema.com

1 Function

The mould closing device SITEMA PowerStroke clamps and actuates a rod in one direction (closing direction).
A force proportional to the operating pressure is exerted to the rod by friction.

2 Applications

The SITEMA PowerStroke series FSK with its integrated short stroke cylinder is typically used in:

- blow moulding to close and press the mould
- injection die moulding to close and generate the closing force
- other applications requiring powerful forces on a short stroke

3 Function description

The following function description specifies the typical case if the SITEMA PowerStroke is mounted to the moving machine element. Then, the rod acts as a connection to the stationary machine element. The closing direction is shown as it would appear in this case.

Alternatively, it is also possible to mount the SITEMA PowerStroke to the stationary machine element. Then, the rod is moving. In this case, the closing direction is reversed.

3.1 Design

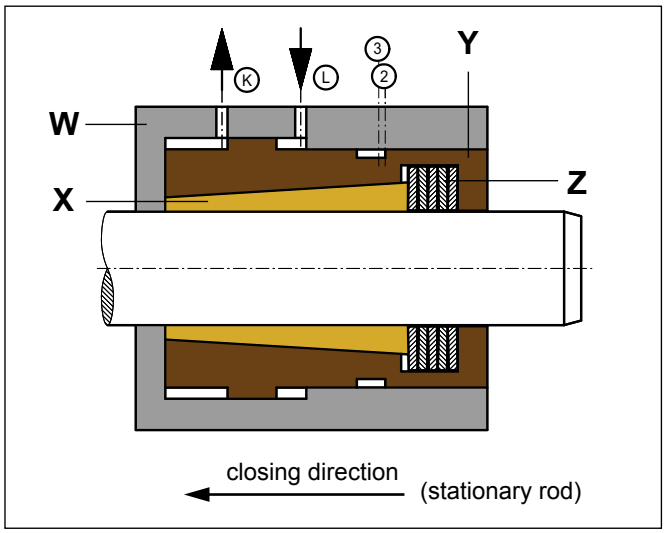


Fig. 1: Design of the SITEMA PowerStroke (clamping released)

The clamping system consists of the clamping sleeve (X) *Fig. 1* and the clamping ring (Y) *Fig. 1* which are braced against each other by springs (Z) *Fig. 1*. The clamping ring is supported in the housing (W) *Fig. 1* so that it can be moved hydraulically via the pressure ports L and K.

Hydraulically initialized types (FSK 140 to FSK 200) are not equipped with springs but with a hydraulic piston which braces the clamping system. The hydraulic piston is actuated at pressure port V.

3.2 Releasing the clamping

If the required minimum pressure is applied to pressure port L (pressure port K pressureless), then the housing (W) moves in opposite direction to the closing direction until it reaches the stop, thereby opening the clamping system (see *Fig. 1*).

Proximity switch 2 signals “clamping released”.

3.3 Clamping the rod

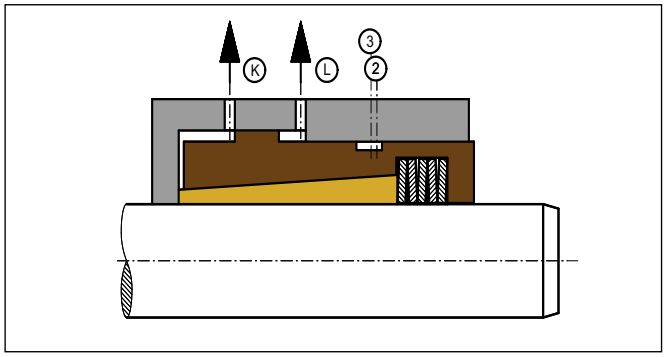


Fig. 2: SITEMA PowerStroke is about to clamp the rod

If pressure port L is switched to pressureless, the SITEMA PowerStroke clamps the rod. The unit is ready to execute the closing stroke.

Proximity switch 2 “clamping released” is no longer active.

3.4 Executing the closing stroke

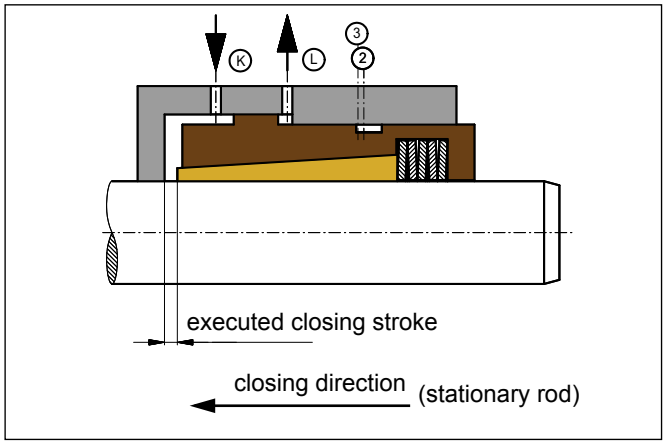


Fig. 3: Design of the SITEMA PowerStroke (after closing stroke)

When the rod is clamped, pressure can be applied to pressure port K. This generates the clamping force and the housing is pushed in the closing direction.

The resulting closing stroke is only limited by the counter force of the tool. An adjusting nut with a mechanical stop can be provided as a special design to limit the closing stroke.

The working force can easily be controlled by the variation of the pressure on pressure port K.

If no counter force from the machine acts on the SITEMA PowerStroke during the closing stroke, the complete stroke will be executed and the internal stop will be reached. Then, depending on design and operating conditions, the clamping system may open and the rod is no longer clamped.

If the complete closing stroke is executed, proximity switch 3 will signal “stroke limit reached”. During normal operation, this signal should never be active (see *Chapter 4.3 „Monitoring by proximity switches“*). With the help of this signal, the correct function of the unit can be constantly controlled.

To release the clamping, hydraulic pressure at pressure port K must be relieved and pressure must be applied to pressure port L. As a result, the housing first moves back a little bit (previously-executed closing stroke) and then the clamping gets released.

4 Installation prerequisites

4.1 Design of the rod

The SITEMA PowerStroke will operate correctly only if the rod has a suitable surface:

- ISO tolerance field f7 or h6
- induction hardened min. HRC 56, surface hardening depth:
  ø up to 30 mm: min. 1 mm
  ø over 30 mm: min. 1.5 mm
- surface roughness: Rz = 1 to 4 µm (Ra 0.15 - 0.3 µm)
- protection against corrosion, e.g. hard chromium plating: 20 ±10 µm, 800 – 1 000 HV
- lead-in chamfer, rounded:
  ø 18 mm up to ø 80 mm: min. 4 x 30 °
  ø over 80 mm up to ø 180 mm: min. 5 x 30 °
  ø over 180 mm up to ø 380 mm: min. 7 x 30 °

Often, the following standard rods fulfill the above mentioned requirements and can then be used:

- piston rods (ISO tolerance field f7), hard chrome plated
- rods for linear ball bearings (ISO tolerance field h6)

The rod may not be lubricated with grease.

Generally, the basic rod material has to have sufficient yield strength. In the case of compression-loaded rods, sufficient buckling resistance must be assured.

4.2 Control

Pressure fluid

Hydraulic oil (HLP) in accordance with DIN 51524-2:2006 must be used as pressure fluid. Please consult SITEMA before using any other fluids.

Pressure port L “release”

Pressure port L must be pressurized continuously as long as the rod is moving or the rod is being inserted. In this way the clamping is released.

Before the closing stroke can be executed, the pressure for pressure port L must be relieved. This prepares the clamping system for the closing stroke.

Pressure port V “supply pressure” (only applies to hydraulically initialized types)

Pressure port V has to be pressurized constantly by the control. Furthermore a pressure-relief valve has to be necessarily added to this line.

Pressure port K “closing stroke”

Pressure corresponding to the desired closing force is applied to port K after insertion of the rod and after port L is pressure-free. Thus a clamping force corresponding to the working pressure is realized and the closing stroke is executed.

⚠ **In no situation may pressure be applied to both pressure ports L and K at the same time.**

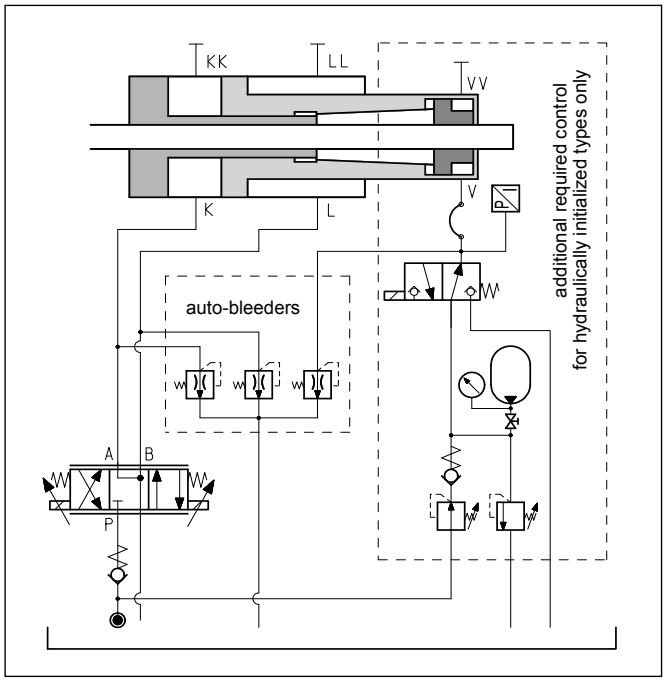


Fig. 4: Principal scheme of control

The hydraulic control has to be provided by the customer on the basis of the diagram above.

In this diagram only logical connections are illustrated. It is the responibilty of the of the manufacturer to ensure the compliance to all relevant legal regulations and to check all functions after the installation.

Clamping the rod with the SITEMA PowerStroke during the fast movement of the primary drive has to be avoided, as this can lead to high dynamic braking forces. If necessary, precautions have to be made to avoid unintended pressure losses at release port L.

If a particular quick response of the SITEMA PowerStroke is required, the following preconditions must be met:

- short piping distances
- large valve and pipe cross-sections
- fast valve response times
- appropriate control

Notes

1. The rod may not leave the clamping unit during operation. However, special designs which allow the rod to be removed and inserted with each stroke are possible.
   In this case, the rod may only be inserted in the released state (proximity switch signal 2 is active) through the centre ring. Before the rod may be clamped, it has to be ensured, that the rod is inserted to at least the “minimum insertion depth” indicated in the special design’s specifications.
2. During the release process, force on the rod is not allowed. This has to be considered in the control of the primary drive.
3. In applications with vertical moves: It may be necessary to induce a counter force with the primary drive, in the range of the load of the rod and the moved tool (counter balance). So the lowering of the machine part can be prevented after releasing the clamping.

4.3 Monitoring by proximity switches

Proximity switch 2 “clamping released” signals that the rod is not clamped by the SITEMA PowerStroke. The signal can be used to activate the primary drive.

Proximity switch 3 “stroke limit reached” signals that the complete stroke has been executed and the internal stop is reached.

In this situation, the closing force is no longer fully active, see also *Chapter 3.4 „Executing the closing stroke“*.

4.4 Operating conditions

The immediate environment of the SITEMA PowerStroke in its standard design must be dry and clean.

Environmental contamination, such as grease, dirt, grinding dust, chips require special protective measures. Liquids such as coolants, conservation agents and other liquids or chemicals inside the housing may reduce the holding force.

It is particularly important not to apply grease to the rod because lubricants influence the clamping force.

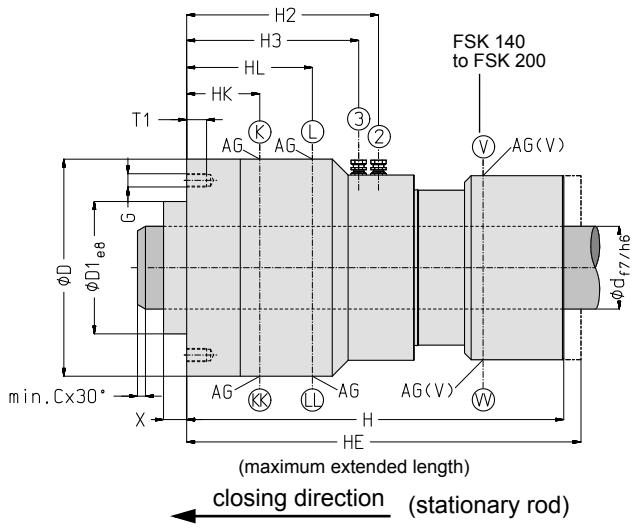
- The machine manufacturer must take measures to ensure that contamination cannot enter the interior of the housing.
- In case of doubt, please contact SITEMA.

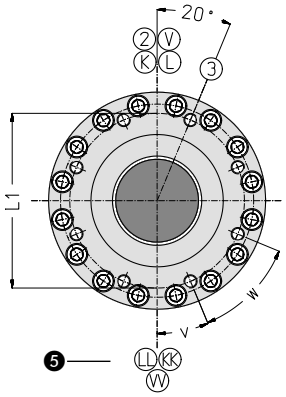
The permitted surface temperature is 0 to +60 °C.

4.5 CE marking

The SITEMA PowerStroke is designed as a component (partly completed machinery) to be integrated into a machine or system and as such can never be CE marking itself. The seller of the machine or system must provide information on the SITEMA PowerStroke with the overall documentation and if applicable ensure that the machine or system is CE certified.

5 Overview FSK types





Ⓚ Pressure port K "closing stroke" see ❶
Ⓛ Pressure port L "release" see ❷
Ⓥ Pressure port V "supply pressure" see ❸
② Holder for proximity switch 2, signal "clamping released" see ❹
③ Holder for proximity switch 3, signal "stroke limit reached" see ❹

Abb. 5: Dimensions SITEMA PowerStroke series FSK

Type		FSK 45	FSK 70	FSK 100	FSK 110	FSK 125	FSK 140	FSK 160	FSK 180	FSK 200
ID no.		FSK 045 01	FSK 070 01	FSK 100 01	FSK 110 01	FSK 125 01	FSK 140 01	FSK 160 01	FSK 180 01	FSK 200 01
Closing force at max. closing pressure	**kN**	**60**	**110**	**300**	**450**	**625**	**800**	**950**	**1375**	**1800**
Technical data										
Rod diameter [d]	mm	**45**	**70**	**100**	**110**	**125**	**140**	**160**	**180**	**200**
Lead-in chamfer [C]	mm	4	4	5	5	5	5	5	5	7
External diameter [D]	mm	160	198	268	298	328	371	398	454	525
Total length [H]	mm	285	334	444	529	570	626	680	765	850
Max. extended length [HE]	mm	311	361	471	557	598	658	713	798	883
Closing stroke	mm	20	20	20	20	20	20	20	20	20
Weight ca.	kg	36	66	150	220	235	310	470	620	870
Hydraulic data										
Max. closing press.❶/ max. release press.❷	bar	100	100	150	200	200	200	200	200	200
Hydraulic volume K at complete stroke ❶	cm³	160	310	580	660	880	1280	1600	2260	3030
Min. release pressure ❷	bar	80	75	100	150	150	150	150	160	150
Hydraulic volume L at complete stroke ❷	cm³	70	130	180	200	270	410	460	550	820
Clamping system initialized by		springs	springs	springs	springs	springs	hydraulic	hydraulic	hydraulic	hydraulic
Supply pressure at V ❸	bar	-	-	-	-	-	150	150	160	150
Connection dimensions										
HK	mm	60.5	77	115	116.5	110.5	118	134	134	134
HL	mm	136.5	149.5	194	196	190	211.5	245	245	245
H2	mm	197	222.5	285	285	279	309	412	414	414
H3	mm	190.5	215	275	277	271	301	404	406	406
AG		G1/4	G3/8	G1/2	G1/2	G1/2	G1/2	G3/4	G3/4	G3/4
AG (V)		-	-	-	-	-	G3/8	G3/8	G1/2	G1/2
D1	mm	105	120	150	185	200	215	230	250	275
X	mm	30	21	30	35	35	38	35	35	35
L1	mm	130	160	200	237	264	260	290	340	390
n		6 x 60°	6 x 60°	6 x 60°	10 x 36°	8 x 45°	8 x 45°	8 x 45°	10 x 36°	10 x 36°
G		M 10	M 12	M 16	M 16	M 20	M 24	M 24	M 24	M 30
T1	mm	20	25	25	25	30	50	50	50	60

Subject to modification without prior notice

❹ Proximity switch holders are provided for standard inductive proximity switches (M 12 x 1, nominal switching distance 2 mm, flush mountable, NOC; except FSK 45 to FSK 100 need M 8 x 1 with a nominal switching distance of 1.5 mm.
For easier service, the proximity switch holders have a depth stop and are pre-adjusted when delivered from the factory. The switches only The proximity switches are not included in the standard scope of delivery but are available as accessories.

❺ As supplied, pressure ports LL, KK, VV are plugged by a plug screw. They may be used alternatively to L, K, V and are useful for filling / air-bleeding the pressure chambers.