Flex Cam

Hydraulic cylinders and tool slides
for tool and mould-making and
machinery construction

FIBRO

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Contents

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General

System safety, reliability and functionality can be ensured by supplying FIBRO with the application data and drawings of the installation arrangements for checking.

Please note that the number of the threaded connections and the hose lengths for installation in the system must be determined.

Assembly, commissioning, maintenance and servicing of the Flex Cam system require special knowledge and may only be carried out by FIBRO trained, specialist personnel.

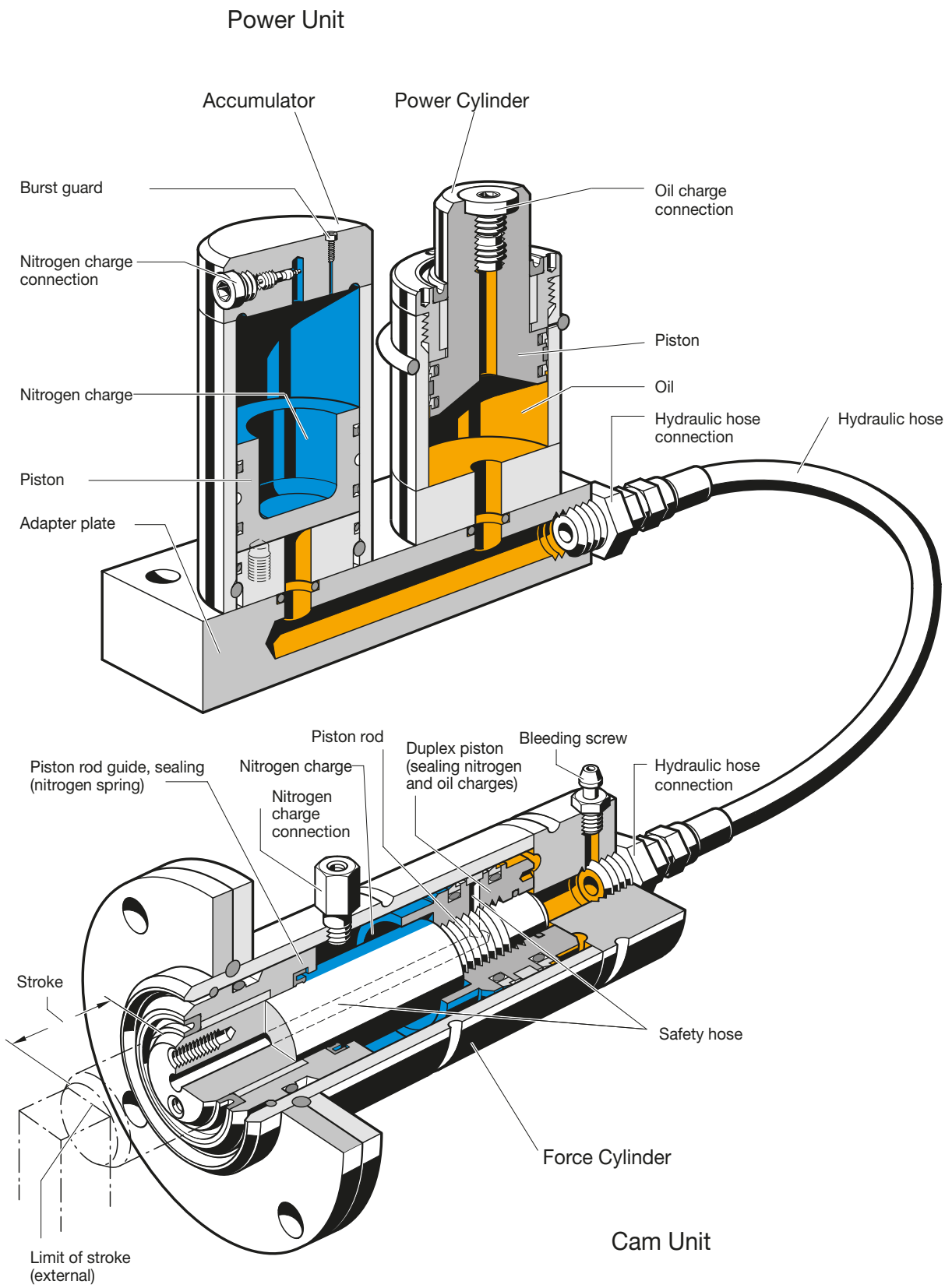
You can order the work to be carried out by a FIBRO customer service engineer, to be invoiced in accordance with our installation tariff.

Just contact us to schedule it for you.

We shall be pleased to answer any technical queries you may have, now or at any time in the future.

As the Flex Cam system which are specially made, we recommend that you keep reserve systems in stock to avoid the risk of delay when the need arises.

Flex Cam


Power Unit
Accumulator
Power Cylinder
Burst guard
Oil charge connection
Nitrogen charge connection
Piston
Nitrogen charge
Oil
Hydraulic hose connection
Hydraulic hose
Piston
Adapter plate
Piston rod
Bleeding screw
Duplex piston (sealing nitrogen and oil charges)
Piston rod guide, sealing (nitrogen spring)
Nitrogen charge
Hydraulic hose connection
Nitrogen charge connection
Stroke
Safety hose
Force Cylinder
Limit of stroke (external)
Cam Unit

Flex Cam

Introduction

The hydraulic cam system is the ideal com-ponent for executing linear motions at any point in the available space.

The system is increasingly atng used in tool making, in particular, to drive drawing, moulding, cutting and drilling operations where conventional slides cannot be used due to lack of space or inconvenient position.

The working motion is generated by the cam unit (e.g. the working cylinder), which can be installed in any position in the available space.

The cam unit is controlled by a driving cylinder which, in turn, is activated by the stroke motion of a press, for example.

The link between the two is provided by a hydraulic hose in which the volume of oil in the power unit is displaced to the cam unit.

Description

Power Unit

The Power Unit consists of the following components:
- Power Cylinder
- Accumulator
- Adapter plate

The Power Cylinder is filled with oil at one end, while the machine that executes the stroke is at the opposite end.

The accumulator is charged with nitrogen gas at one end. In the idle state, the base of the piston rests on the Accumulator, relieving the pressure on the system.

The adapter plate connects the Power Cylinder to the Accumulator and Force Cylinder.

In the standard version, the capacity of the accumulator is matched to the total displacement volume of the Power Cylinder. It is thus of the same height as the piston rod. The integral rupture protection device opens at 517 bar.

The Power Unit is also available with a separate Power Cylinder and Accumulator.

Cam Units

There are 3 types of Cam Units:
- Force Cylinder 2018.30./40./50./60.
- Compact Cam 2018.11.
- Flange Cam 2018.12.

Force Cylinder 2018.30./40./50./60.

Design

The accumulator is charged with nitrogen gas at one end (20 – 40 bar). The volume of oil displaced from the Power Unit acts on the other end when the Power Unit is pressurised. The Force Cylinder then extends. The retraction motion is generated by the nitrogen gas when the pressure is relieved on the stroke side of the Power Cylinder.

The displacement length of the Force Cylinder is twice as long as the permissible nominal displacement length. The unused displacement capacity is needed as a compartment for the pressurised nitrogen gas in order to return the stroke.

Applications

The Force Cylinder is designed to drive an individual tool component (e.g. a slide).

The nominal stroke of the Force Cylinder may be limited by external stops. As a standard the stroke's end position is limited by an internal stop according to stroke length. The Force Cylinder is not guided and therefore cannot absorb any side loads. The tool compo nents themselves must be guided.

⚠ **Side loads acting on the Force Cylinder lead to system failure.**

When attaching accessories, be careful to ensure that the axes are lined up correctly to avoid transverse forces during the stroke. Coupling pins or similar accessories must be used for the connection as there must be no rigid connection between the piston of the Force Cylinder and the tool components.

Flex Cam

Compact Cam 2018.11.

Design

The Power Cylinder starts the piston rod of the Compact Cam moving when pressurised.

The slide is returned by external gas springs. Two pillars with guideways prevent the tool holder plate rotating. The clearance in the guides is 0.01 - 0.03 mm.

Applications

The Compact Cam is suitable for hole punching operations involving no transverse forces. The Compact Cam is guided and has an internal stop. Punches can be mounted directly on the tool holder plate.

Side loads on the Compact Cam will lead to system failure.

In cutting operations with a small cutting clearance and asymmetrical cutting forces a guide bolster should be provi-ded, with an external guide to absorb the lateral forces. As with the Force Cylinder, coupling pins must be used for the connection between the slide and the external guide (uncoupling). The Compact Cam is attached by 4 fixing screws. A feather key groove absorbs the cutting forces. It is positioned by means of two pilot holes.

Flange Cam 2018.12.

Design

The Flange Cam construction is the same as the construction of the Compact Cam. The Power Cylinder starts the piston rod of the Flange Cam moving when pressurised. The slide is returned by external gas springs. Two pillars with guideways prevent the tool holder plate rotating. The clearance in the guides is 0.01 – 0.03 mm. The tool holder plate is supported by a roller and a support plate to absorb lateral forces.

Applications

The Flange Cam is suitable for work operations with lateral forces (e.g. bend up, sliding). The Compact Cam is guided with an integrated stop. Punches can be mounted directly on the tool holder plate.

A guide bolster with external guide should be provided for bending operations with asymmetrical forces.

The Flange Cam is attached by 4 fixing screws. A feather key groove absorbs the bending forces. It is positioned by means of two pilot holes.

Alternative drive

For operating the Cam Unit electrically powered Hydraulic pump units can be used (see page 50). The max. working pressure must not exceed 150 bar. The max. speeds listed on page 8 must not be exceeded.

Charging fittings

Nitrogen gas: The Accumulator and Cam Unit can be charged with the gas spring filling charge 2480.00.32.21.

Hydraulic system: The system is filled and vented using the oil filling unit 2018.00.30.

Filling and venting of the system is described in detail in the user manual supplied with the system.

Hydraulic connection

See also pages 51-58

User-friendly, flexible high-pressure hoses are ideal for the hydraulic connections (see page 50).

A space-saving alternative is to use system hydraulic pipes.

The same screwed couplings are used for both hoses and pipes.

The hose length should not exceed 2000 mm. This is important to ensure a constant build-up of pressure and – even more importantly – to minimise impact during cutting without a significant pressure build-up.

The couplings should be designed for at least 300 bar nominal pressure and 1000 bar rupture pressure.

This is essential if the connection is to be sufficiently rigid and for the rupture protection device to operate at 517 bar.

Quick-release couplings for hydraulic hoses

We recommend that you use quick-release couplings to join the hydraulic hoses.

Benefits:

- The system can be filled and vented under optimum con-ditions when off the tool, either at FIBRO or on site.
- If the tool has to be assembled or dismantled, the hydraulic hose connecting the Power Unit and the Cam Unit is disconnected using the quick-release coupling. It is thus not necessary to dismantle the hoses, drain and refill the oil and vent the system, which keeps costs down.

For layout purposes, the dimensions of the commonly used threaded couplings and hoses are shown on pages 51, 54-58

Leaks and oil level display

The experience we have gained in manufacturing gas springs enables us to select the most suitable seals. The result is an effective and long-lasting seal.

The connecting line can be assembled with no leaks, using available materials and with careful installation.

If an oil leak does occur, it will be compensated short term by the overtravel volume in the Accumulator.

The Accumulator and Power Cylinder are of the same height, so any loss of oil from the system will be manifested by a difference in height.

Stroke rate

The stroke rate is dependent on the minimum flow opening, the volume of oil and the working and return pressures. The connecting openings allow a working stroke rate of up to 0.8 m/s. Although this is limited by the extent to which the system heats up due to the high stroke rates. The system temperature should not exceed 60 °C.

As the volume of the hydraulic oil increases when the system temperature rises, the cam unit no longer returns completely to its stroke starting position due to the oil expansion. For this reason, a stroke reserve must be complied with at the start of the stroke (idle stroke).

⚠ **The minimum idle stroke should be between 3 mm and 6 mm, depending on the number of strokes.**

Safety instructions

If the layout of the system gives the Force Cylinder an excessive displacement volume due to excess overtravel and/or seizing of the cylinder, the pressure in the system can exceed the admissible value of 280 bar. In critical situations, this effect will be counteracted by the opening of a rupture valve at 517 bar.

The couplings are designed for a nominal pressure of 300 bar and 1000 bar rupture pressure.

On the gas side, the Accumulator is pressurised at 150 bar and is subject to Pressure Equipment Directive 97/23/EC.

To monitor safety during the process, we recommend installing a control fitting as an additional check on the gas side – see range of accessories.

Capacity and output

The forces listed in table 1 below are applicable for the following nitrogen gas pressures:

Accumulator 150 bar

Force Cylinder 20 bar

Compact Cam

2018.11.01500. ☐☐☐ and 2018.11.04000. ☐☐☐
Gas spring 2480.21. and .23.00000. ☐☐☐ 180 bar

2018.11.06000. ☐☐☐
Gas spring 2487.12.00350. ☐☐☐ 180 bar

Compact Cam

2018.11.09000. ☐☐☐
Gas spring 2480.12.00500. ☐☐☐ 150 bar

2018.11.15000. ☐☐☐
Gas spring 2487.12.00750. ☐☐☐ 150 bar

Flange Cam

2018.12.04000.049
Gas spring 2480.21. bzw. .23.00000. ☐☐☐ 180 bar

Comments

The Accumulator and the Force Cylinder are pressure vessels and as such are subject to the Pressure Equipment Directive 97/23/EC.

During cutting and hole punching operations the nominal force of the Compact Cam should only be utilised up to 75% to minimise impact during cutting which is reinforced by the Accumulator. Impact during cutting can be reduced by polished tool edges (e.g. roof shape) and so downtime can be reduced.

Description		Force Cylinders 2018.30.					Compact Cams 2018.11					Flange Cams 2018.12.	Power Unit 2018.20				
Force (magnitude)	kN	15	40	60	90	150	15	40	60	90	150	40	15	40	60	90	150
Initial restoring force	kN	2	5	8	13	21	2	4	7	10	15	4	-	-	-	-	-
Minimum gas pressure	bar	10					125			105		125	50				
Maximum gas pressure	bar	40					180			150		180	180				
Stroke length	mm	25, 50, 100					24, 49, 99*					49	35**, 60**, 110**, 160**(1)				
Maximum speed	m/s	0,8					0,8					0,8	0,8				
Maximum restoring speed	m/s	0,8					0,8					0,8	0,8				
Maximum frequency	Strokes/min	30					60			30		60	60		60	30	30
Ambient temperature	°C	10-40					10-40					10-40	10-40				

* not for 2018.11.01500.

** including +10 mm overtravel

(1) not for 2018.20.01500. and 2018.20.15000.

Table 1: Technical data

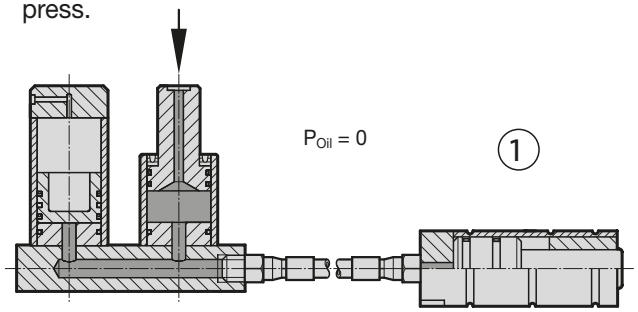
Values other than those specified in the above table may be accepted under certain circumstances or if different stroke lengths, speeds and frequencies are combined.

Flex Cam

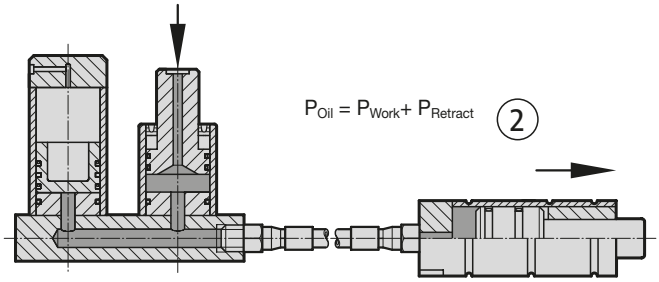
Function

The individual components of the Flex Cam System described above interact as follows:

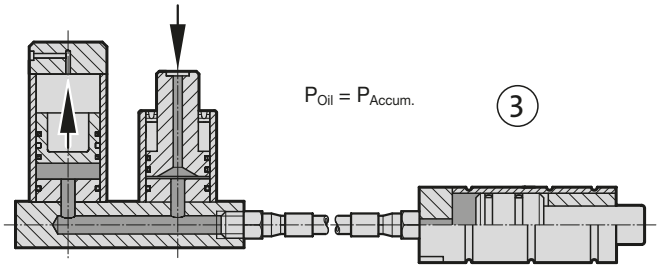
① The Power Cylinder is actuated by the stroke of the press.



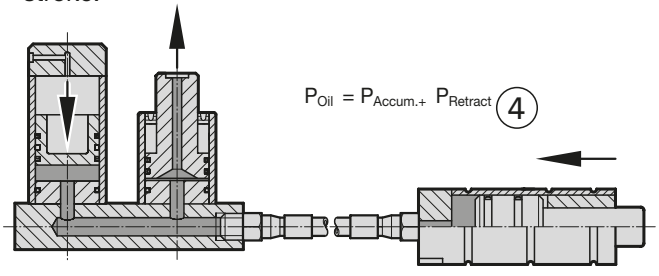
② Once the pressure build-up in the Flex Cam exceeds the preset pressure in the Force Cylinder, the Force Cylinder extends.



③ When the Force Cylinder reaches its working position, the pressure in the system rises to match the pressure in the Accumulator. The rest of the displaced volume of oil is then held in the Accumulator (Power Cylinder overtravels by approx. 3 - 10 mm).

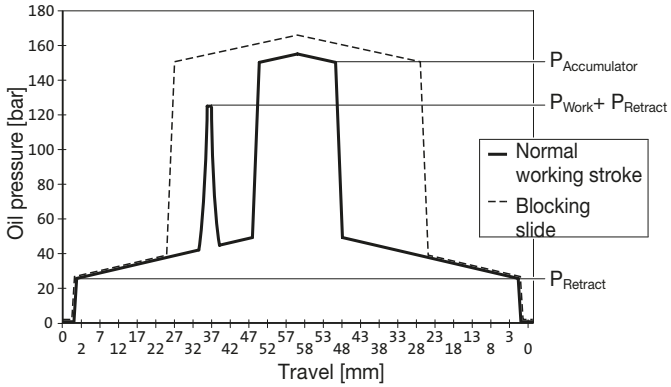


④ This overtravel is essential since it ensures that a constant contact pressure is built up during each stroke.



At the same time the pressure on the Power Cylinder is relieved (return travel of the press), the Force Cylinder is reset by the nitrogen gas.

Pressure ratios in the system



The above diagram shows the oil pressure build-up during the work cycle. Before the working motion, the oil-system is pressureless. When the Power Cylinder is actuated, the oil pressure rises to the preset gas pressure in the Cam Unit. As the Force Cylinder continues to travel, the volume of gas is further compressed until the work operation is executed. At the same time, the back-pressure in the system rises due to the punching operation, for example. Once the operation has ended, the Power Cylinder continues as far as the end position of the Force Cylinder. This ensures that the excess volume of oil is fully absorbed by the Accumulator. At the same time, the oil pressure rises to match the charging pressure in the Accumulator.

If a malfunction occurs in the tool part during system travel and blocks the travel of the Cam Unit, all the displaced oil is held in the Accumulator. The oil pressure increases until it equals that of the compressed nitrogen in the Accumulator.

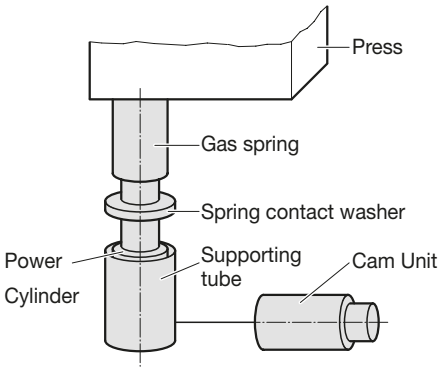
The system is protected by an integral rupture protection device in the Accumulator which opens at 517 bar to vent the nitrogen. The resulting system security protects the tool from damage by the Flex Cam.

Possible combinations Power Unit with Cam Unit

Cam Unit leading

If a stroke of the Cam Unit is required before the tool actually reaches its working position, this can be achieved by incorporating a gas spring. The press stroke actuates a gas spring which, in turn, actuates the Power Unit, since its prestressing force is higher than the nominal force of the Power Unit.

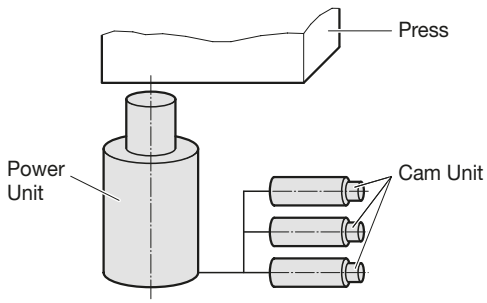
When the Cam Unit reaches its end position, the drive (press) overtravel is compensated by the retracting piston rod of the gas spring. A spring contact washer transmits the pressure of the gas spring to the supporting tube when the Power Unit reaches its end position.



"leading"

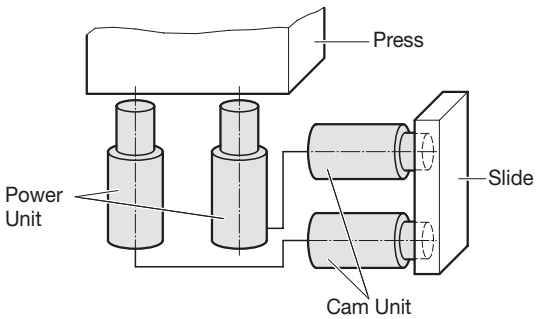
Several Cam Units driven asynchronously

Several Cam Units can be driven by a common Power Unit. The individual Cam Units should not, however, be mechanically connected to one another since the feedrates cannot be totally synchronised due to the different connection lengths (system losses) and restoring forces.



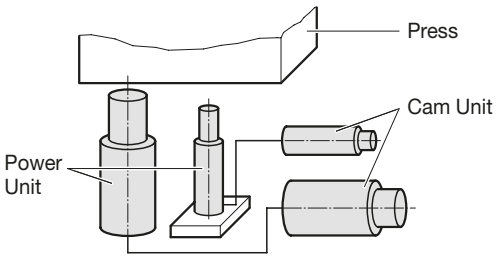
Several Cam Units driven synchronously

Synchronous operation can be achieved by using two systems of the same dimensions, although this application requires the restoring force of the individual Cam Units to be equal, as well.



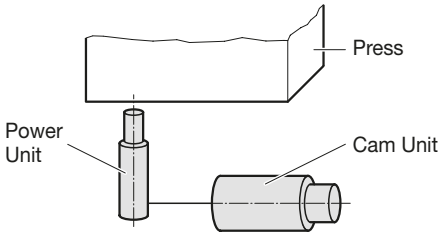
One or more Cam Units driven with delay

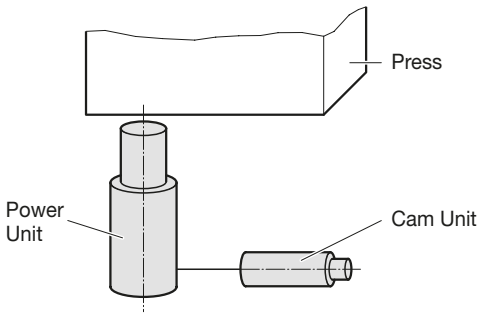
A time delay, and thus a variable working sequence for the Cam Units, can be achieved by combining two different strokes. The first Power Unit to be actuated executes the first step. As the Cam Unit moves beyond its end position, the excess oil is displaced into the Accumulator (not shown in the diagram). The second Power Unit can then enter the working sequence as required.



Variable speed / force drive

The forces or travel speeds can be combined as required by varying the ratio between Power Unit sizes and Cam Unit sizes. The maximum travelling speed should not exceed 0.8 m/s, however.





Transmission ratios in use

Transmission or reduction ratios can be expressed in four different ways:

a) Force

b) Speeds of the individual Cam Units

c) Press travel speed to Cam Unit travel speed

d) Stroke lengths

Transmission ratios

The nominal transmission ratio of 1:1 is normally used throughout the system.
The ratio can vary, however, according to the combination (and number) of Power Units and Cam Units used (see table on page 12).

Flex Cam

Selecting the components

The component sizes are explained step by step below with regard to the forces required, stroke length and the number of operations.

Step 1: Size of the Cam Unit

Calculate the force required for the operation to be carried out. The Cam Unit used should provide sufficient force to execute the operation. If the force required cannot be precisely calculated, we recommend that you use a larger Cam Unit.

Force required (kN)	Cam Unit
0 - 15	2018. □□ .01500. □□□
15 - 40	2018. □□ .04000. □□□
40 - 60	2018. □□ .06000. □□□
60 - 90	2018. □□ .09000. □□□
90 - 150	2018. □□ .15000. □□□

Force required: _____ kN Cam Unit size: _____

Example: If the force required is 22 kN, then a 40 kN Cam Unit should be used. Cam Unit 2018. □□ .04000.□□□

Step 2: Cam Unit stroke length

Determine the Cam Unit stroke required to execute the operation in the tool. Use the Cam Unit with the shortest possible stroke, but remember that the tool must have sufficient space for the workpiece.

Required stroke length (mm)	Max. stroke length of Cam Unit (mm)	Part number
0 - 25	25 (24)***	2018. □□ . □□□□□ .025*
25 - 50	50 (49)***	2018. □□ . □□□□□ .050*
50 - 100	100 (99)**/***	2018. □□ . □□□□□ .100*

*) 2018.11. □□□□□ .024/049/099

**) This stroke length does not apply to Compact Cam 2018.11.01500. □□□

***) Compact cam

Stroke length of Cam Unit: _____ mm

Example: If the stroke length required is 35 mm, use a Cam Unit with a stroke length of 50 mm.

Step 3: Order number of the Cam Unit

Select the Cam Unit according to the type of operation to be performed.

See also pages 6, 7, 12-14

Compact Cam: 2018.11. □□□□□ . □□□
Flange Cam: 2018.12.04000.049
Force Cylinder: 2018.30. □□□□□ . □□□

Example: The order number for the Compact Cam is 2018.11.04000.049

Flex Cam

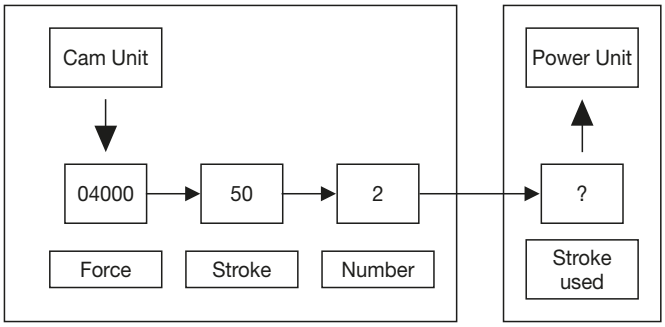
Power unit selection table

Cam Unit force (kN)	Nom. stroke (mm)	No.	Power Unit 15 kN	SU	TR	Power Unit 40 kN	SU	TR	60 kN	SU	TR	Power Unit 90 kN	SU	TR	Power Unit 150 kN	SU	TR
15	25	1	035	35	1,0	035	20	2,5	035	16	4,0	035	14	6,3	035	13	9,8
	25	2	060	60	0,5	035	30	1,5	035	23	2,0	035	18	3,1	035	15	4,9
	25	3	110	85	0,3	060	40	0,8	035	29	1,3	035	22	2,1	035	18	3,3
	50	1	060	60	1,0	035	30	2,5	035	23	4,0	035	18	6,3	035	15	9,8
	50	2	110	110	0,5	060	50	1,2	035	35	2,0	035	26	3,1	035	20	4,9
	50	3				110	70	0,8	060	48	1,3	035	34	2,1	035	25	3,3
	100	1	110	110	1,0	060	50	2,5	035	35	4,0	035	26	6,3	035	20	9,8
	100	2				110	91	1,2	060	60	2,0	060	42	3,1	035	30	4,9
	100	3				160	131	0,8	110	85	1,3	060	58	2,1	060	41	3,3
	150	1	160	160	1,0	110	70	2,5	060	48	4,0	060	34	6,3	035	25	9,8
	150	2				160	131	1,2	110	85	2,0	060	58	3,1	060	41	4,9
	150	3							160	123	1,3	110	82	2,1	060	56	3,3
40	25	1	110	72	0,4	035	35	1,0	035	26	1,6	035	20	2,5	035	16	3,9
	25	2				060	60	0,5	060	41	0,8	035	30	1,3	035	23	2,0
	25	3				110	85	0,3	060	57	0,5	060	40	0,8	035	29	1,3
	50	1				060	60	1,0	060	41	1,6	035	30	2,5	035	23	3,9
	50	2				110	110	0,5	110	72	0,8	060	50	1,3	035	35	2,0
	50	3				160	160	0,3	110	103	0,5	110	70	0,8	060	48	1,3
	100	1				110	110	1,0	110	72	1,6	060	50	2,5	035	35	3,9
	100	2							160	134	0,8	110	89	1,3	060	61	2,0
	100	3										160	129	0,8	110	86	1,3
	150	1							160	103	1,6	110	70	2,5	060	48	3,9
	150	2										160	129	1,3	110	86	2,0
	150	3													160	124	1,3
60	25	1	110	110	0,3	60	50	0,6	035	35	1,0	035	26	1,6	035	20	2,4
	25	2				110	91	0,3	060	60	0,5	060	42	0,8	035	30	1,2
	25	3				160	131	0,2	110	85	0,3	060	58	0,5	060	41	0,8
	50	1				110	91	0,6	060	60	1,0	060	42	1,6	035	30	2,4
	50	2							110	110	0,5	110	74	0,8	060	51	1,2
	50	3							160	160	0,3	110	106	0,5	110	71	0,8
	100	1							110	110	1,0	110	74	1,6	060	51	2,4
	100	2										160	138	0,8	110	92	1,2
	100	3													160	133	0,8
	150	1							160	160	1,6	110	106	1,6	110	71	2,4
	150	2													160	133	1,2
90	25	1				110	73	0,4	060	49	0,6	035	35	1,0	035	26	1,6
	25	2				160	136	0,2	110	88	0,3	060	60	0,5	060	42	0,8
	25	3							160	127	0,2	110	85	0,3	060	58	0,5
	50	1				160	136	0,4	110	88	0,6	060	60	1,0	060	42	1,6
	50	2										110	110	0,5	110	74	0,8
	50	3										160	160	0,3	110	106	0,5
	100	1										110	110	1,0	110	74	1,6
	100	2													160	138	0,8
	150	1										160	160	1,0	110	106	1,6
150	25	1				110	108	0,3	110	71	0,4	060	49	0,6	035	35	1,0
	25	2							160	132	0,2	110	88	0,3	060	60	0,5
	25	3										160	127	0,2	110	85	0,3
	50	1							160	132	0,4	110	88	0,6	060	60	1,0
	50	2													110	110	0,5
	50	3													160	160	0,3
	100	1													110	110	1,0
	150	1													160	160	1,0

Step 4a
Size and stroke of the Power Unit

Follow **step 4a** if one to three **Cam Units of the same size** are connected to a given Power Unit. If **different Cam Units** are connected to a Power Unit, then **step 4b** should be used.

Select the Power Unit from the following table. The table should be read in the following order: Cam Unit – force – stroke – number – Power Unit – stroke length. We recommend that no more than three Cam Units be connected to a single Power Unit.
Make sure that you do not exceed the maximum Cam Unit stroke speed (0.8 m/s).



Selection flowchart

Power Unit	=	Nominal working force / nominal stroke + 10 mm overtravel
SU	=	Working stroke (stroke actually used) + 10 mm
TR	=	Transmission ratio

See also the following examples:

Example 1 (Fig. 1): A Power Unit 2018.20.04000.060 is provided as standard for a Compact Cam 2018.11.04000.049. The nominal stroke of the Power Unit is 60 mm. The transmission ratio is 1:1. The stroke of the Compact Cam is thus performed at the same speed as the press.

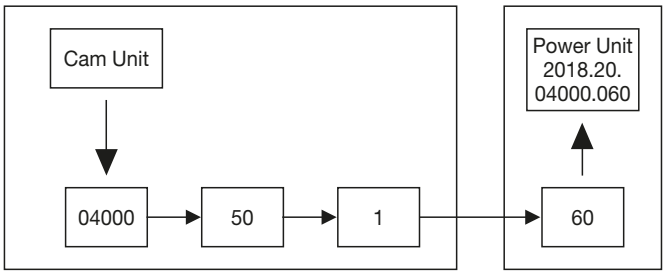


Fig. 1: Selection for example 1

Example 2 (Fig. 2): If a press stroke of just 30 mm can be used to execute the operation, then a larger Power Unit 2018.20.09000.035 should be used for the Cam Unit 2018.11.04000.049. The Power Unit stroke used is 30 mm, the transmission ratio is 2.5. If the press speed is 0.3 m/s, then the Cam Unit stroke speed obtained is 2.5 × 0.3 m/s = 0.75 m/s.

The stroke used by Power Unit and Cam Unit can be perfectly matched to any special constraints associated with the tool.

For some applications, the speed of the Cam Unit must be increased in proportion to the press speed.

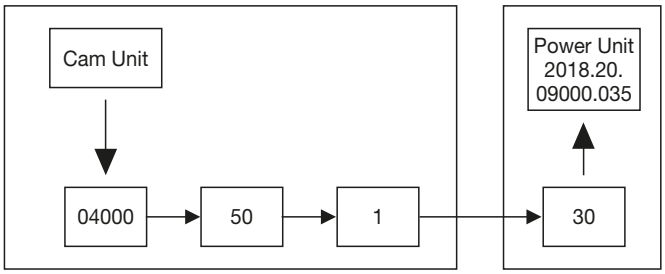
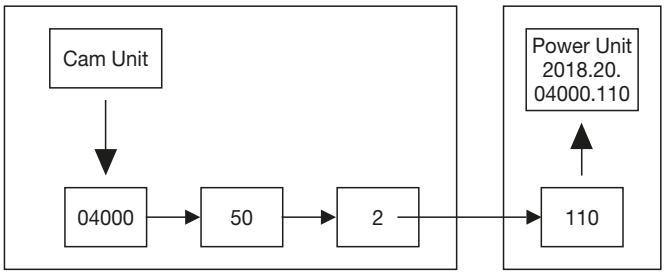


Fig. 2: Selection for example 2

If several Cam Units are connected to a Power Unit, then the individual Cam Units will not have the same stroke speed.

Example 3 (Fig. 3): A Power Unit 2018.20.04000.110 can be used with two Compact Cams 2018.11.04000.049 and a useful press stroke of 110 mm. The Power Unit stroke used is 110 mm and the transmission ratio is 0.5.

If the press speed is 0.3 m/s, then the mean Cam Unit stroke speed obtained is 0.5 × 0.3 = 0.15 m/s.



Power Unit:

2018.20. _____ . _____

Fig. 3: Selection for example 3

Step 4b
Size and stroke of the Power Unit for different Cam Unit sizes

The total volume of oil in the Cam Units should be calculated using the following formula. The total volume of oil is the sum of all the volumes for all Cam Units. The volume is the product of the piston surfaces and strokes used. The total volume of oil VN for the Power Units corresponds to the minimum volume of oil for the Cam Units (in dm³). AN is the piston surface area in the Cam Unit (dm2) as shown in table 2.

(Formula 1)

V_N	=	$[(A_1 \cdot s_1) + (A_2 \cdot s_2) \ldots (A_N \cdot s_N)] : 100$
A_N	=	Piston surface area of Cam Units
s_N	=	Stroke length of Cam Units

WK AZ AK	15 kN	40 kN	60 kN	90 kN	150 kN
A_N (dm²)	0,13	0,31	0,50	0,79	1,23

Tab. 2: Piston surface area of Cam Units

Total volume of oil of Cam Units: V_N = _____ dm³

WK	=	Compact Cam	2018.11. ☐☐☐☐☐ . ☐☐☐
AZ	=	Force Cylinder	2018.30. ☐☐☐☐☐ . ☐☐☐
AK	=	Flange Cams	2018.12. ☐☐☐☐☐ . ☐☐☐

Select the appropriate Power Unit from Table 3.
The Power Unit must supply the minimum volume of oil as calculated above. Calculate the required Power Unit stroke s_{Gerf} using the following formula:

(Formula 2)

s_{Gerf}	=	$[(V_N : V_G) \cdot s_G] + 10$
V_N	=	Total volume of oil of Cam Units
V_G	=	Total volume of oil of Power Unit
S_G	=	Power Unit stroke
S_{Gerf}	=	Power Unit stroke required

Stroke length	Nominal stroke length	s_G	Power Unit size 2018.20 15 kN	40 kN	60 kN	90 kN	150 kN
.035	25		0,031	0,078	0,126	0,196	0,307
.060	50		0,063	0,156	0,251	0,393	0,614
.110	100		0,126	0,312	0,502	0,785	1,227
.160	150		0,188	0,468	0,753	1,178	1,841

Tab. 3: Volume of oil of Power Unit V_G (dm³)

Power Unit stroke used: s_{Gerf} = _____ mm

Example:

Select a Power Unit to operate a Compact Cam 2018.11.01500.049 and a Force Cylinder 2018.30.04000.050 with a used working stroke of just 40 mm.

V_N	=	$[(A_{WK} \cdot s_{WK}) + (A_{AZ} \cdot s_{AZ})] : 100$	
V_N	=	$[(0,13 \cdot 49) + (0,31 \cdot 40)] : 100$	(see formula 1)
V_N	=	0,189	

The volume of oil of the selected Power Unit should be greater than 0,189 dm³. For example, the 2018.20.06000.060 supplies 0,251 dm³. (The 2018.20.04000.110 could also be used) (see table 3) Calculate the used stroke of the Power Unit:

s_{Gerf}	=	$((V_N : V_G) \cdot s_G) + 10$
s_{Gerf}	=	$((0,189 : 0,251) \cdot 50) + 10$ (see formula 2)
s_{Gerf}	=	48 mm

In the above example, we recommend a Power Unit 2018.20.06000.060 with a used stroke of 48 mm. The admissible Cam Unit stroke speeds defined in section 9 must not be exceeded. It should also be noted that the Cam Units will have different stroke speeds if two Cam Units are driven by a single Power Unit.

Step 5

Select appropriate hoses and screwed couplings. The maximum admissible hose length between Power Unit and the Cam Unit is 2000 mm. The nominal hose diameter is determined on the basis of the size of the Power Unit. The hose size is matched to the flow of oil
(see page 50).

Depending on the press speed a nominal hose width smaller than the standard nominal width may be used (see table 4).

Power Unit	Nominal hose size Standard nominal width Max. speed 0,8 m/s	Press speed 0,6 m/s	0,4 m/s	0,2 m/s
2018.20.01500	DN 12	DN 12	DN 12	DN 12
2018.20.04000	DN 20	DN 20	DN 12	DN 12
2018.20.06000	DN 25	DN 20	DN 20	DN 12
2018.20.09000	DN 25	DN 25	DN 20	DN 12
2018.20.15000	DN 32	DN 32	DN 25	DN 20

Table 4: Press speed/nominal hose size

It is easiest to determine the correct hose length if both Power Unit and Cam Unit are installed inside the tool.

Remember to protect the hose against sharp edges etc. The hose moves slightly during operation due to the pulsating oil pressure. Observe the minimum bending radius.

Dimensions and Order No:

Cam Units

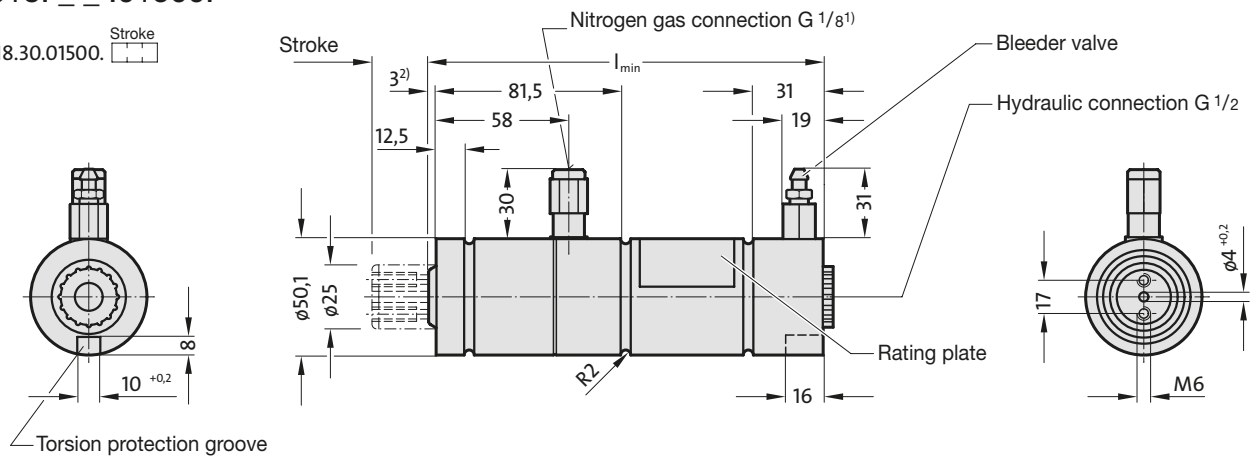
- Force Cylinders
- Compact Cam
- Flange Cam

Power Units

Cam Unit
Force Cylinder 15 kN

2018. _ _ .01500.

2018.30.01500. Stroke



2018.50.01500. Stroke ◎

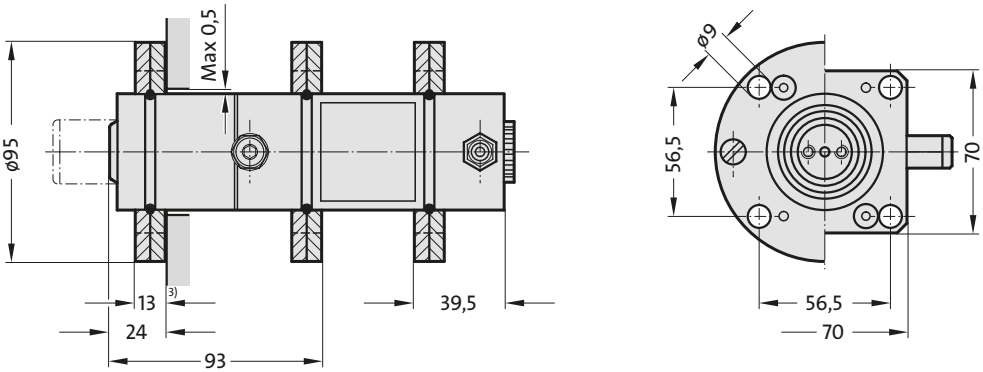
2018.60.01500. Stroke ⊡

Spare parts

Mounting flanges

◎ 2480.055.00750

⊡ 2480.057.00750

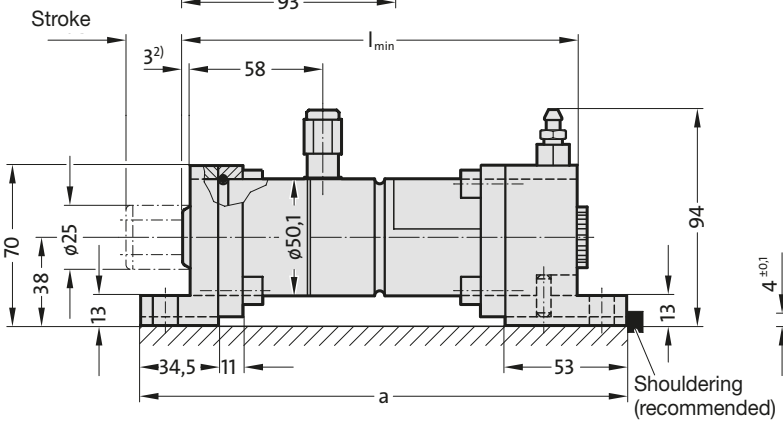


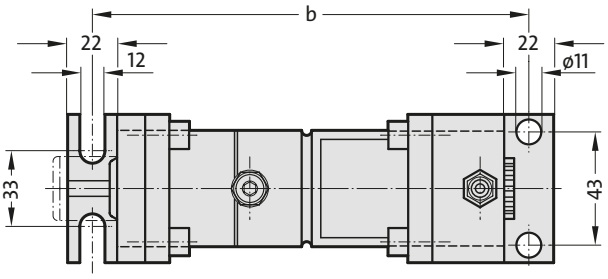
2018.40.01500. Stroke

Spare parts
Mounting flanges

On the piston rod
2480.045.00750

On the hydraulic connector
2480.046.00750





1) Nitrogen gas connector: caution – before removing the connector check that the cylinder has no gas pressure.

2) The cam unit no longer returns completely to its stroke starting position due to the oil expansion which is attributable to the temperature. Allow for an increase of 3 mm to 6 mm.

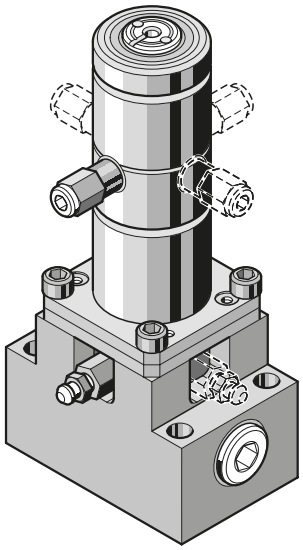
3) This fastening may only be subjected to pressure (by support).

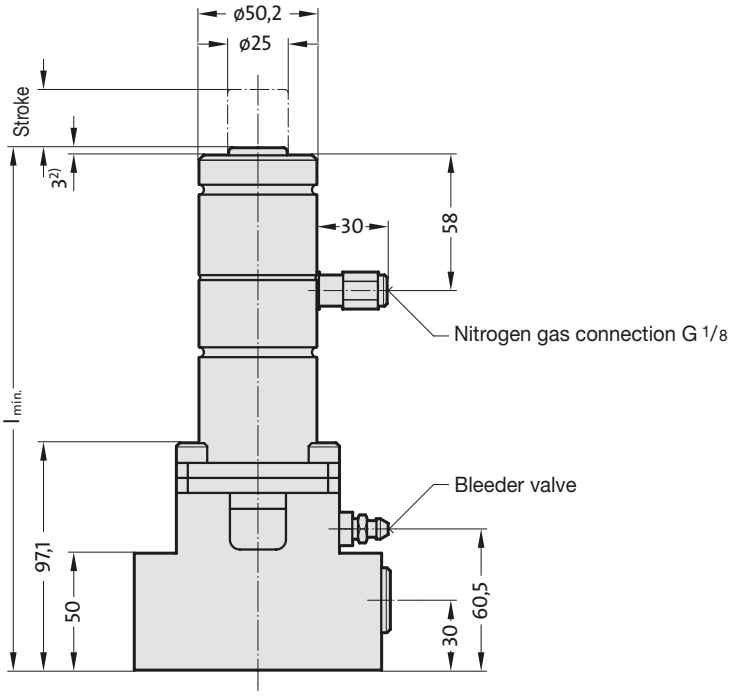
2018. _ _ .01500. Cam Unit Force Cylinder 15 kN

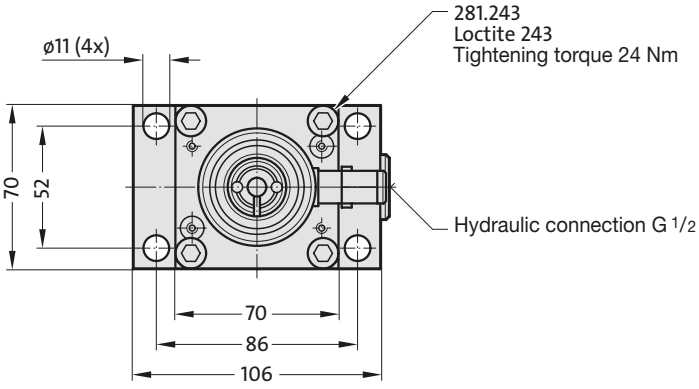
Order no	Stroke	l_{min}	a	b	Restoring force in kN* at 20 bar (max. 40 bar) Stroke $_{start}$	Stroke $_{end}$
2018. _ _ .01500.025	25	173	214	192	1,5	3,1
2018. _ _ .01500.050	50	223	264	242	1,5	3,1
2018. _ _ .01500.100	100	323	364	342	1,5	3,1
2018. _ _ .01500.150	150	423	464	442	1,5	3,1

* isothermic

2018.45.01500.







2) The cam unit no longer returns completely to its stroke starting position due to the oil expansion which is attributable to the temperature. Allow for an increase of 3 mm to 6 mm.

2018.45.01500. Force Cylinder with base plate

Order no	Stroke	l_{min}	Restoring force in kN* at 20 bar (max. 40 bar) Stroke $_{start}$	Stroke $_{end}$
2018.45.01500.025	25	223	1,5	3,1
2018.45.01500.050	50	273	1,5	3,1
2018.45.01500.100	100	373	1,5	3,1
2018.45.01500.150	150	473	1,5	3,1

* isothermic

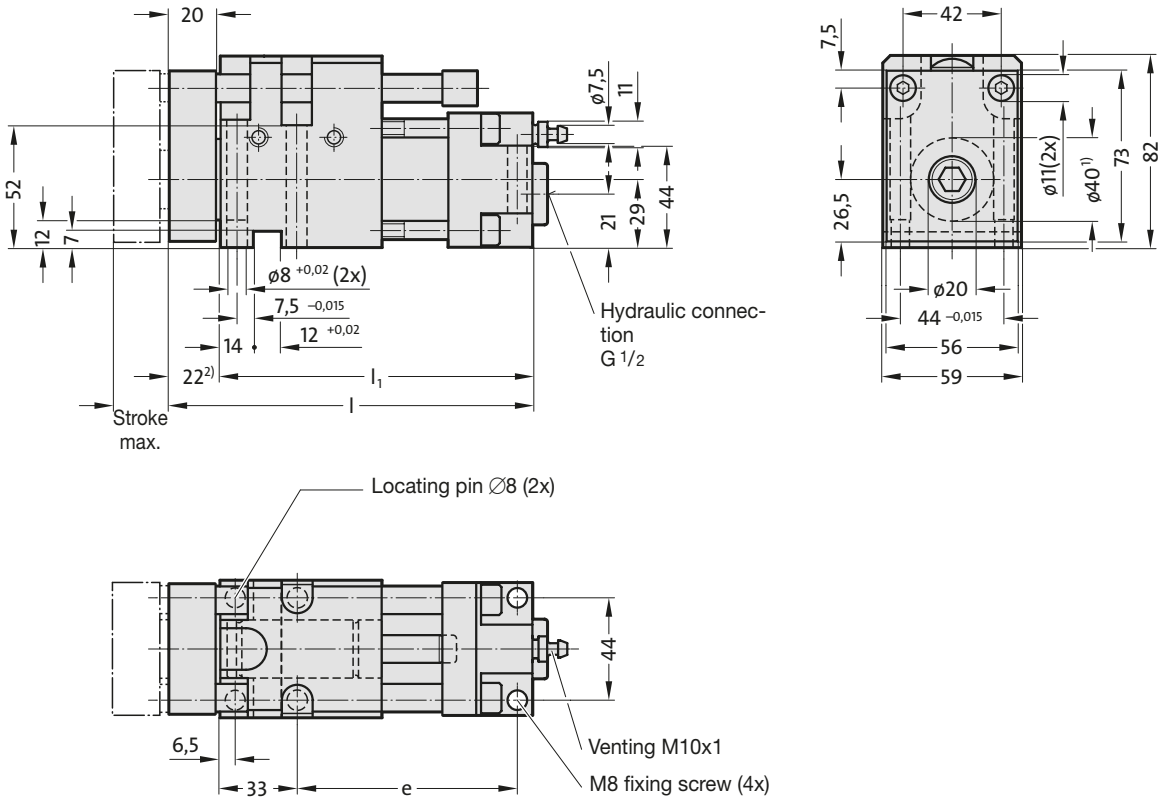
Cam Unit
Compact Cam 15 kN

2018.11.01500.

Note:

[1] Preferably apply the stamp in the middle of the piston rod. Where necessary, the stamp can be placed in the marked area. During disengaging and trimming operations, an external guide must be provided in order to absorb the lateral forces which occur.

[2] The cam unit no longer returns completely to its stroke starting position due to the oil expansion which is attributable to the temperature. An allowance must be made for an increase of 3 mm to 6 mm.



2018. 11.01500. Compact Cam 15 kN

Order no	Stroke max.	e	l	l 1	Restoring force in kN at 180 bar Stroke start	Stroke end
2018.11.01500.010	10	80	141,5	119,5	2	2,6
2018.11.01500.024	24	94	155,5	133,5	2	2,6
2018.11.01500.049	49	119	180,5	158,5	2	2,6

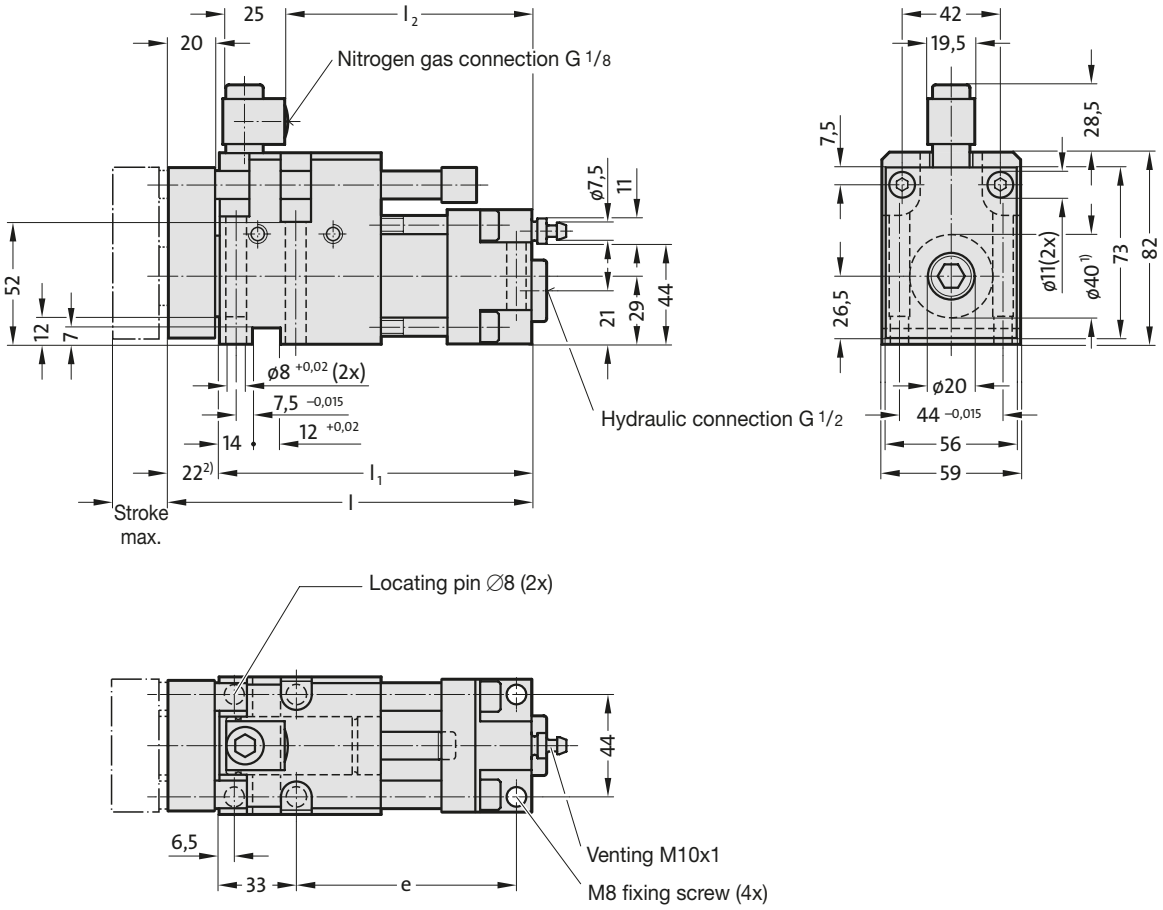
2018.11.01500. _ _ _ .1

Install together with measuring hose and control fitting
(gas spring and nitrogen connection are valveless).

Note:

1) Preferably apply the stamp in the middle of the piston rod. Where necessary, the stamp can be placed in the marked area. During disengaging and trimming operations, an external guide must be provided in order to absorb the lateral forces which occur.

2) The cam unit no longer returns completely to its stroke starting position due to the oil expansion which is attributable to the temperature. An allowance must be made for an increase of 3 mm to 6 mm.

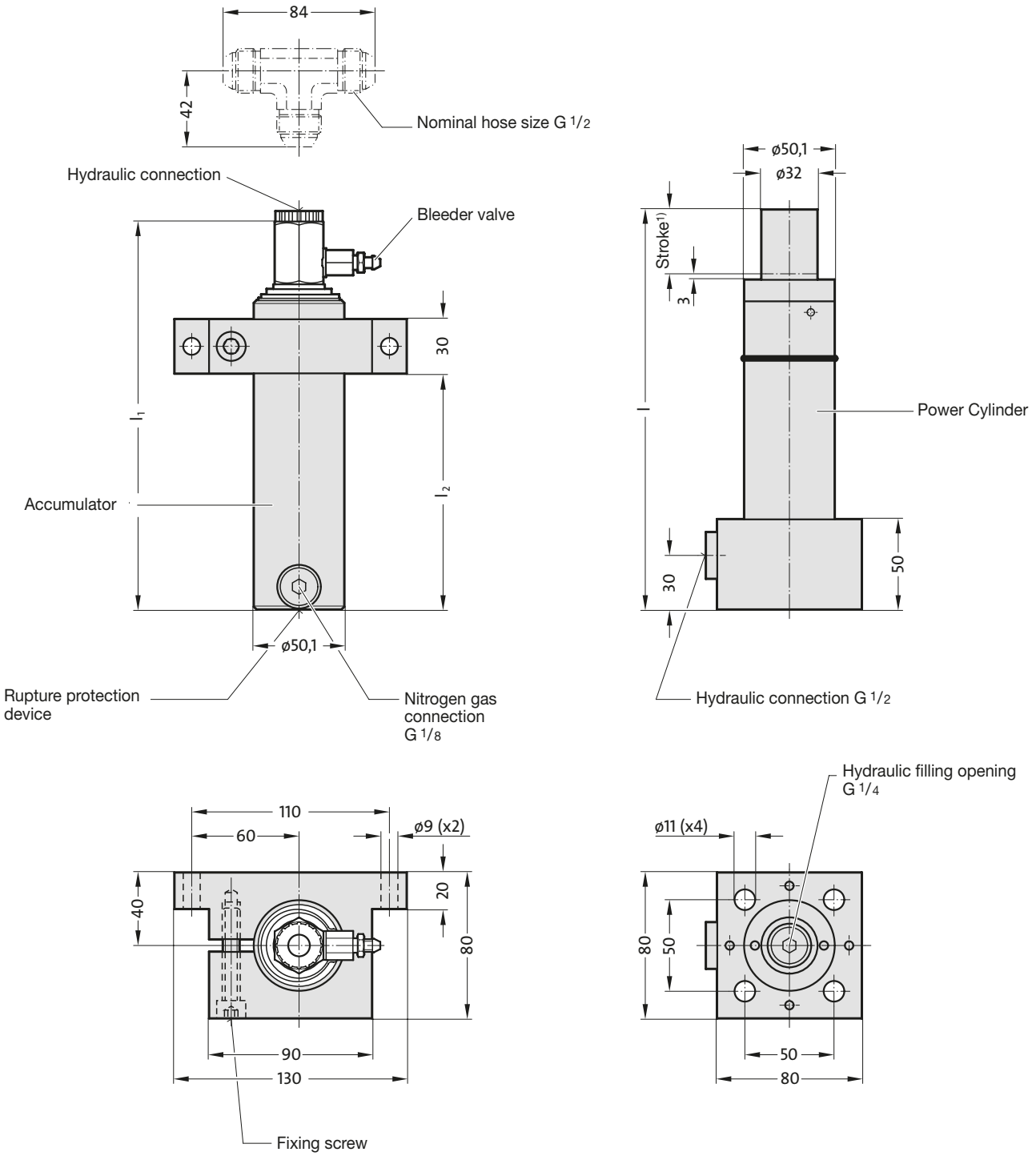


2018. 11.01500. _ _ _ .1 Compact Cam 15 kN with gas monitoring connection

Order no	Stroke max.	e	l	l 1	l 2	Restoring force in kN at 180 bar Stroke start	Stroke end
2018.11.01500.010.1	10	80	141,5	119,5	93	2	2,6
2018.11.01500.024.1	24	94	155,5	133,5	107	2	2,6
2018.11.01500.049.1	49	119	180,5	158,5	132	2	2,6

Power Unit 15 kN with separate Accumulator

2018.25.01500.



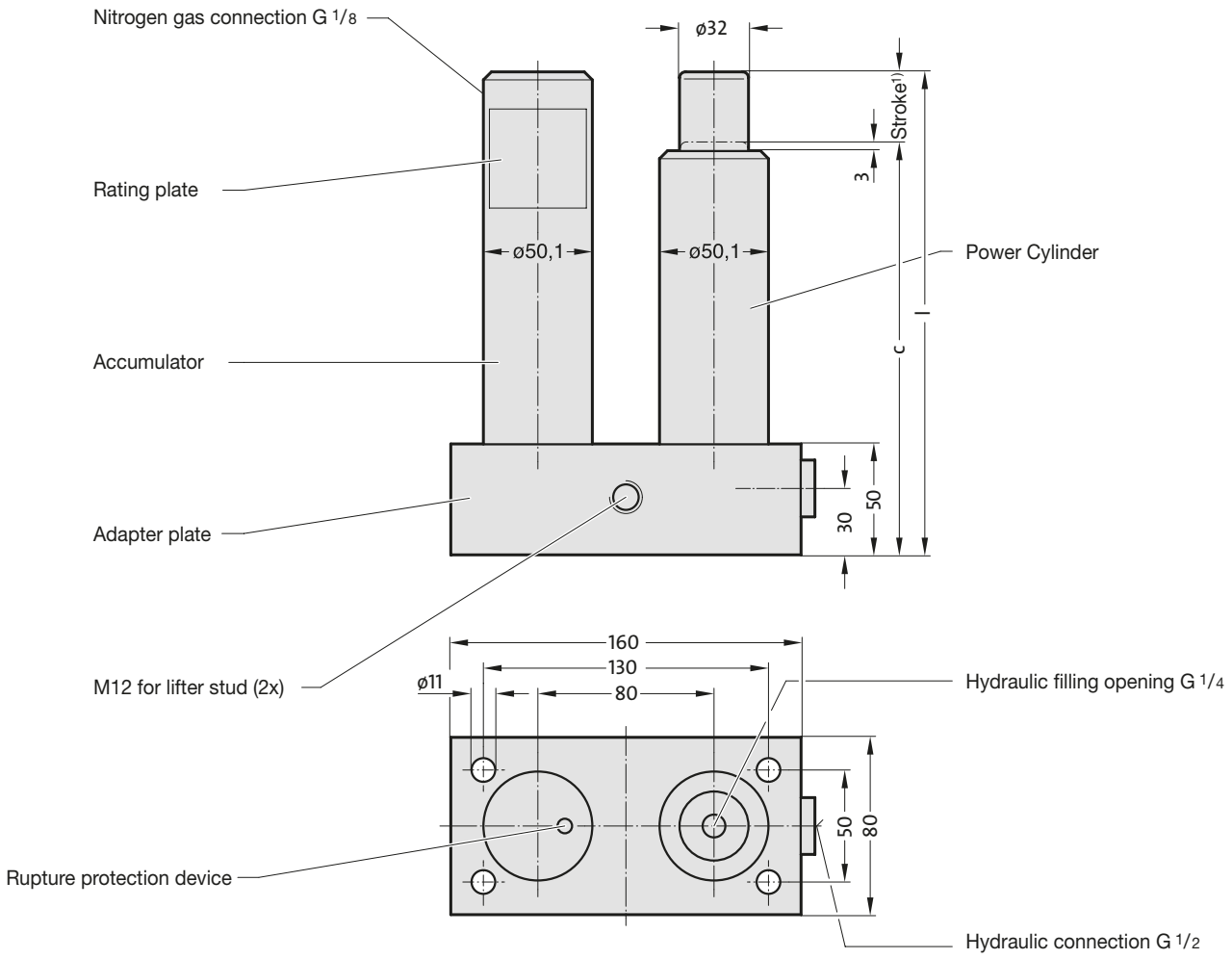
* Tighten M8 fixing screw to 25 Nm

1) The overtravel compensation is the nominal stroke + 10 mm additional stroke.

2018. 25.01500. Power Unit 15 kN with separate Accumulator

Order no	Stroke +10[1)]	l	l_1	l_2
2018.25.01500.035	35	220	213	130
2018.25.01500.060	60	270	264	180
2018.25.01500.110	110	370	364	280
2018.25.01500.160	160	470	464	380

2018.20.01500.



1) The overtravel compensation is the nominal stroke + 10 mm additional stroke.

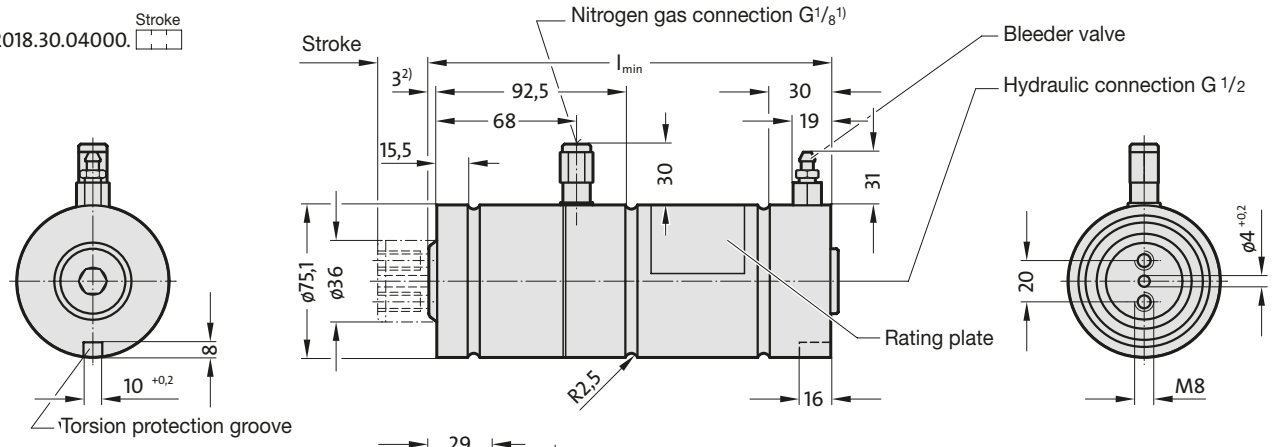
2018.20.01500. Power Unit 15 kN

Order no	c	l	Stroke +10[1)]
2018.20.01500.035	185	220	35
2018.20.01500.060	210	270	60
2018.20.01500.110	260	370	110
2018.20.01500.160	310	470	160

Cam Unit
Force Cylinder 40 kN

2018. _ _ .04000.

2018.30.04000. Stroke



2018.50.04000. Stroke ◎

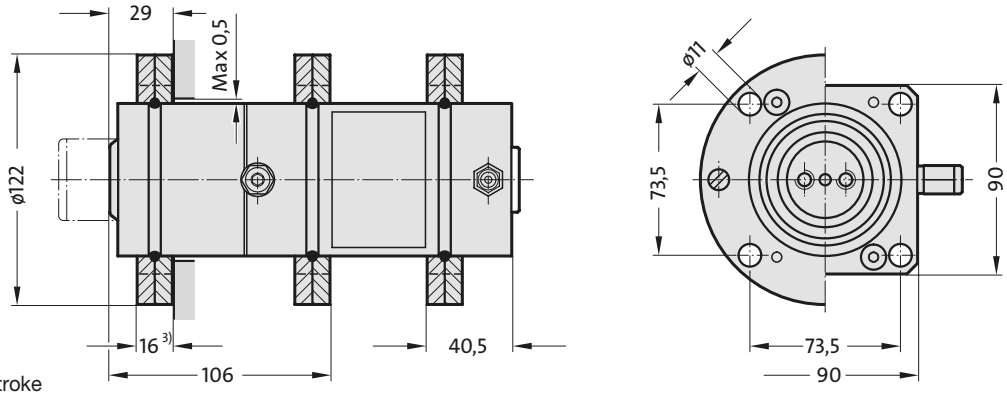
2018.60.04000. Stroke ⊡

Spare parts

Mounting flanges

◎ 2480.055.01500

⊡ 2480.057.01500

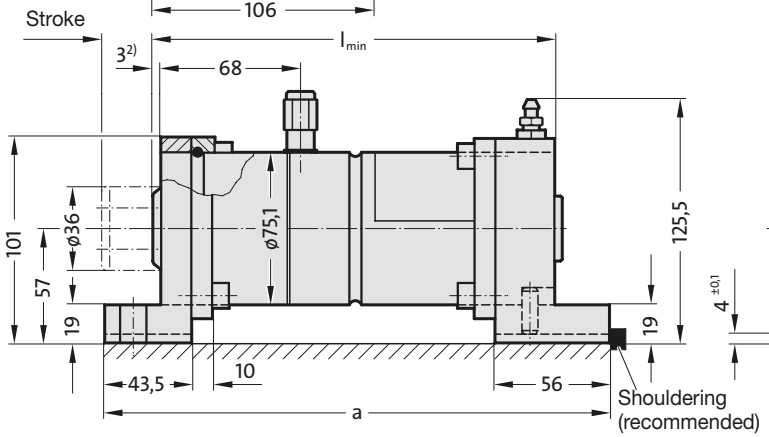


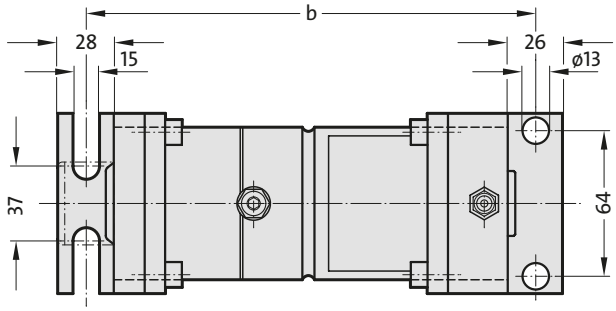
2018.40.04000. Stroke

Spare parts
Mounting flanges

On the piston rod
2480.045.01500

On the hydraulic connector
2480.046.01500





1) Nitrogen gas connector: caution – before removing the connector check that the cylinder has no gas pressure.

2) The cam unit no longer returns completely to its stroke starting position due to the oil expansion which is attributable to the temperature. An allowance must be made for an increase of 3 mm to 6 mm.

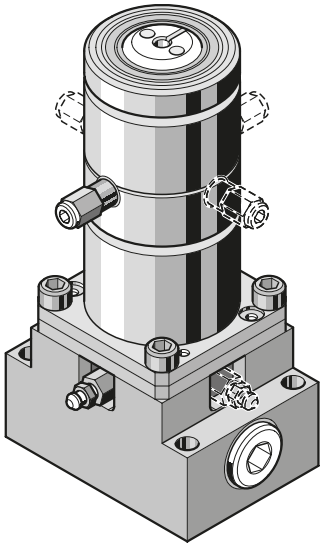
3) This fastening may only be subjected to pressure (by support).

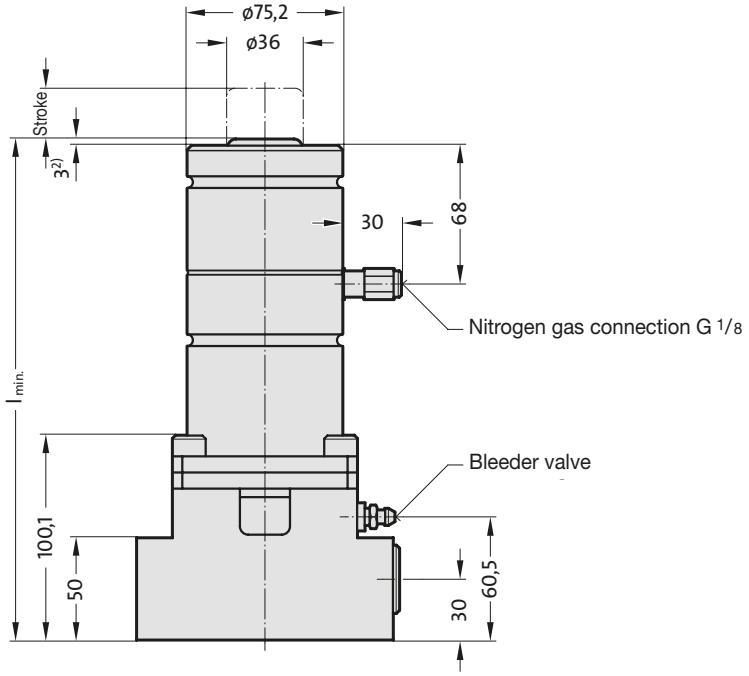
2018. _ _ .04000. Force Cylinder 40 kN

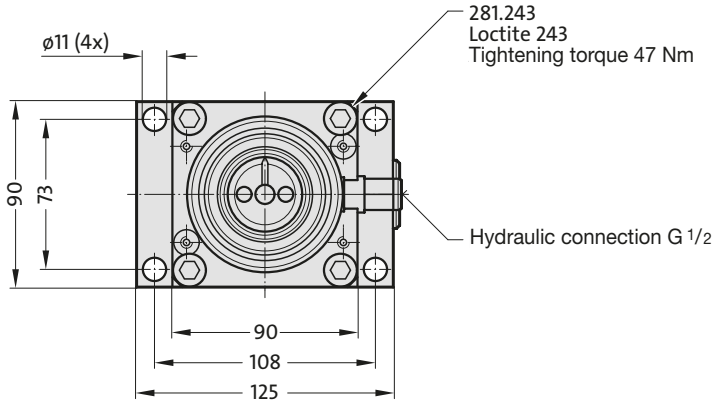
Order no	Stroke	l min	a	b	Restoring force in kN* at 20 bar (max. 40 bar) Stroke start	Stroke end
2018. _ _.04000.025	25	195	246	219	4,2	8,4
2018. _ _.04000.050	50	245	296	269	4,2	8,4
2018. _ _.04000.100	100	345	396	369	4,2	8,4
2018. _ _.04000.150	150	445	496	469	4,2	8,4

* isothermic

2018.45.04000.







2) The cam unit no longer returns completely to its stroke starting position due to the oil expansion which is attributable to the temperature. An allowance must be made for an increase of 3 mm to 6 mm.

2018.45.04000. Force Cylinder 40 kN with base plate

Order no	Stroke	l_{min}	Restoring force in kN* at 20 bar (max. 40 bar) Stroke $_{start}$	Stroke $_{end}$
2018.45.04000.025	25	245	4,2	8,4
2018.45.04000.050	50	295	4,2	8,4
2018.45.04000.100	100	395	4,2	8,4
2018.45.04000.150	150	495	4,2	8,4

* isothermic

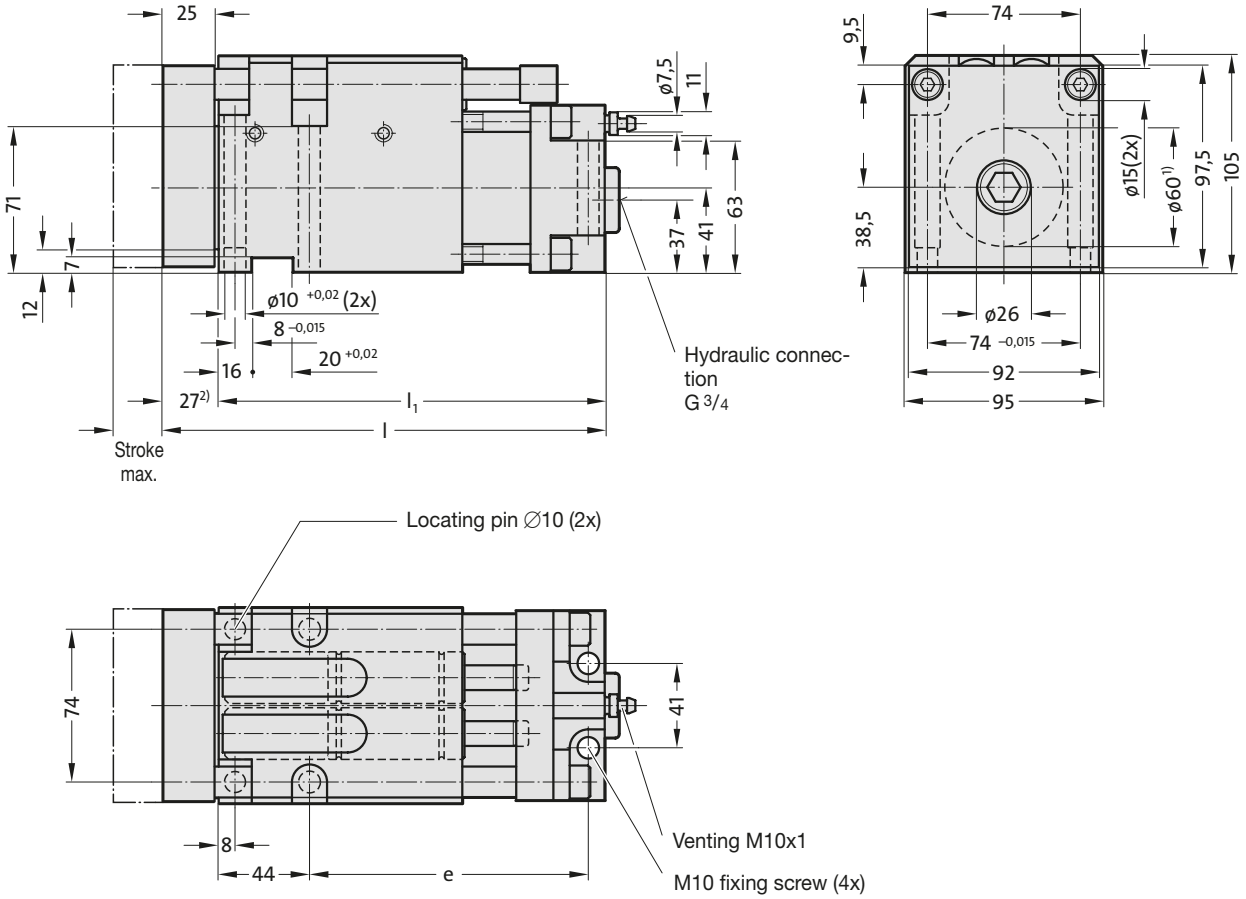
Cam Unit
Compact Cam 40 kN

2018.11.04000.

Note:

[1] Preferably apply the stamp in the middle of the piston rod. Where necessary, the stamp can be placed in the marked area. During disengaging and trimming operations, an external guide must be provided in order to absorb the lateral forces which occur.

[2] The cam unit no longer returns completely to its stroke starting position due to the oil expansion which is attributable to the temperature. An allowance must be made for an increase of 3 mm to 6 mm.



2018.11.04000. Compact Cam 40 kN

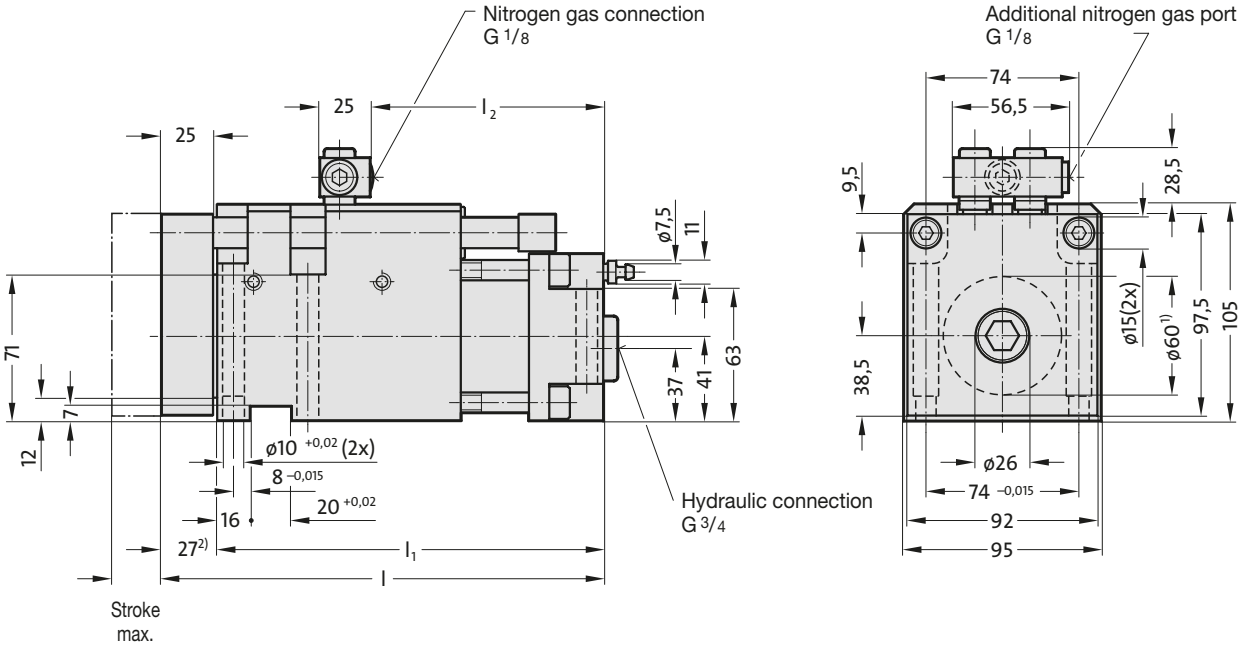
Order no	Stroke max.	e	l	l 1	Restoring force in kN at 180 bar Stroke start	Stroke end
2018.11.04000.024	24	135	214	187	4	5,2
2018.11.04000.049	49	160	239	212	4	5,4
2018.11.04000.099	99	210	289	262	4	5,6

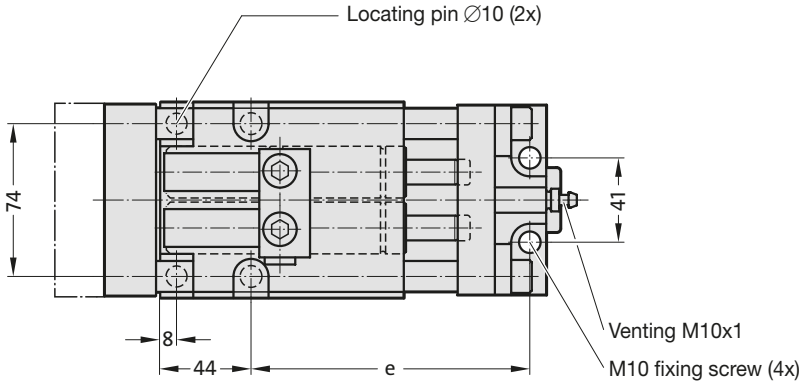
2018.11.04000. _ _ .1

Install together with measuring hose and control fitting (gas spring and nitrogen connection are valveless).

Duplicate nitrogen gas ports for connecting the measuring hose.

Use only one port whilst keeping the other one closed.





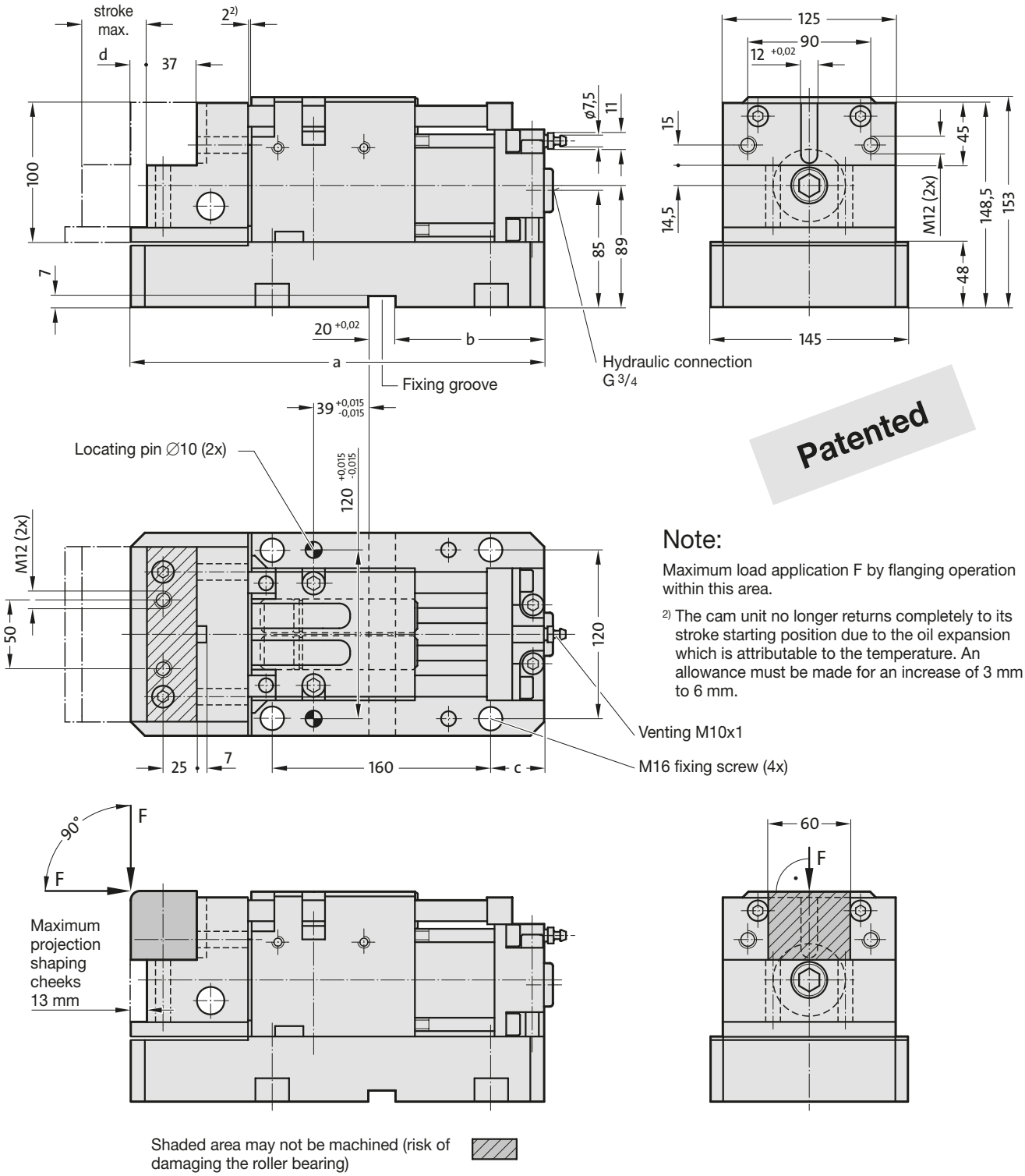
2) The cam unit no longer returns completely to its stroke starting position due to the oil expansion which is attributable to the temperature. An allowance must be made for an increase of 3 mm to 6 mm.

2018. 11.04000. _ _ _ .1 Compact Cam 40 kN with gas monitoring connection

Order no	Stroke max.	e	l	l 1	l 2	Restoring force in kN at 180 bar Stroke start	Stroke end
2018.11.04000.024.1	24	135	214	187	112	4	5,2
2018.11.04000.049.1	49	160	239	212	162	4	5,2
2018.11.04000.099.1	99	210	289	262	237	4	5,2

Cam Unit
Flange Cam 40 kN

2018.12.04000.



Patented

Note:

Maximum load application F by flanging operation within this area.

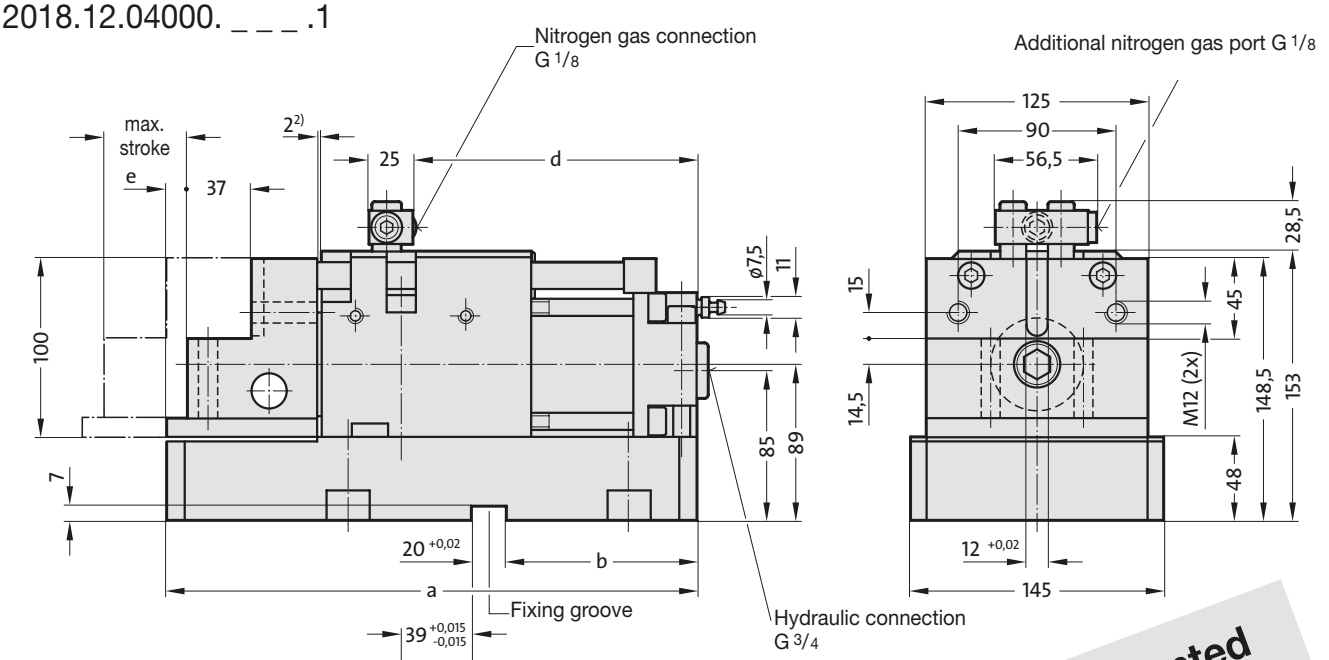
[2] The cam unit no longer returns completely to its stroke starting position due to the oil expansion which is attributable to the temperature. An allowance must be made for an increase of 3 mm to 6 mm.

2018.12.04000. Flange Cam 40 kN

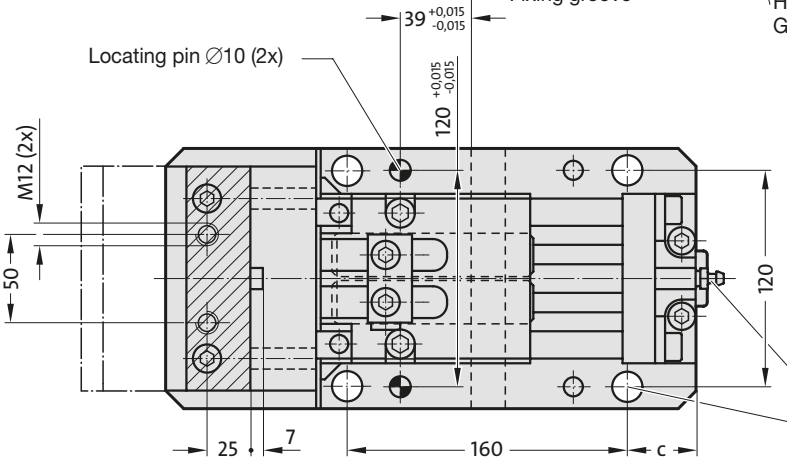
		Restoring force in kN at 180 bar					
Order no	Stroke max.	Stroke start	Stroke end	a	b	c	d
2018.12.04000.049	49	4	5,2	304	109	39	13
2018.12.04000.099	99	4	5,2	404	159	89	63

Cam Unit
Flange Cam 40 kN with gas monitoring connection

2018.12.04000. _ _ _ .1



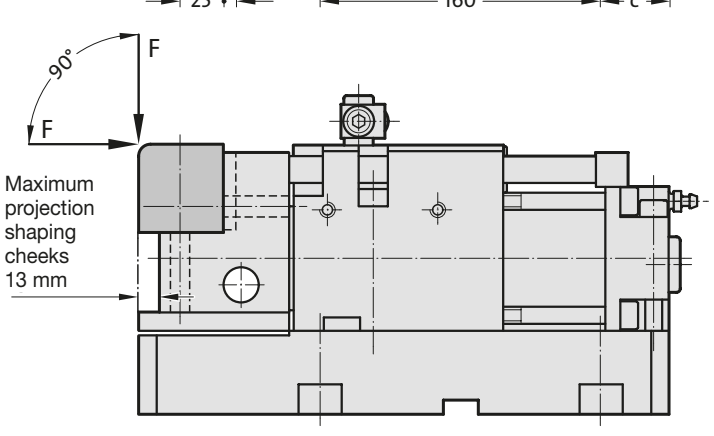
Patented

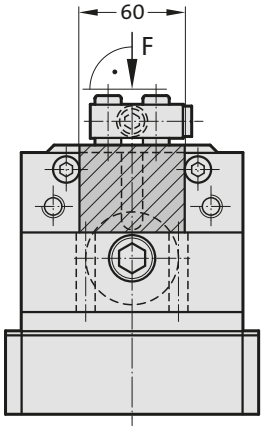


Two nitrogen gas ports for connecting the measuring hose.

Use only one port, whilst keeping the other one closed.

Install together with measuring hose and control fitting (gas spring and nitrogen connection are valveless).





Shaded area may not be machined (risk of damaging the roller bearing)

Note:

Maximum load application F by flanging operations within this area

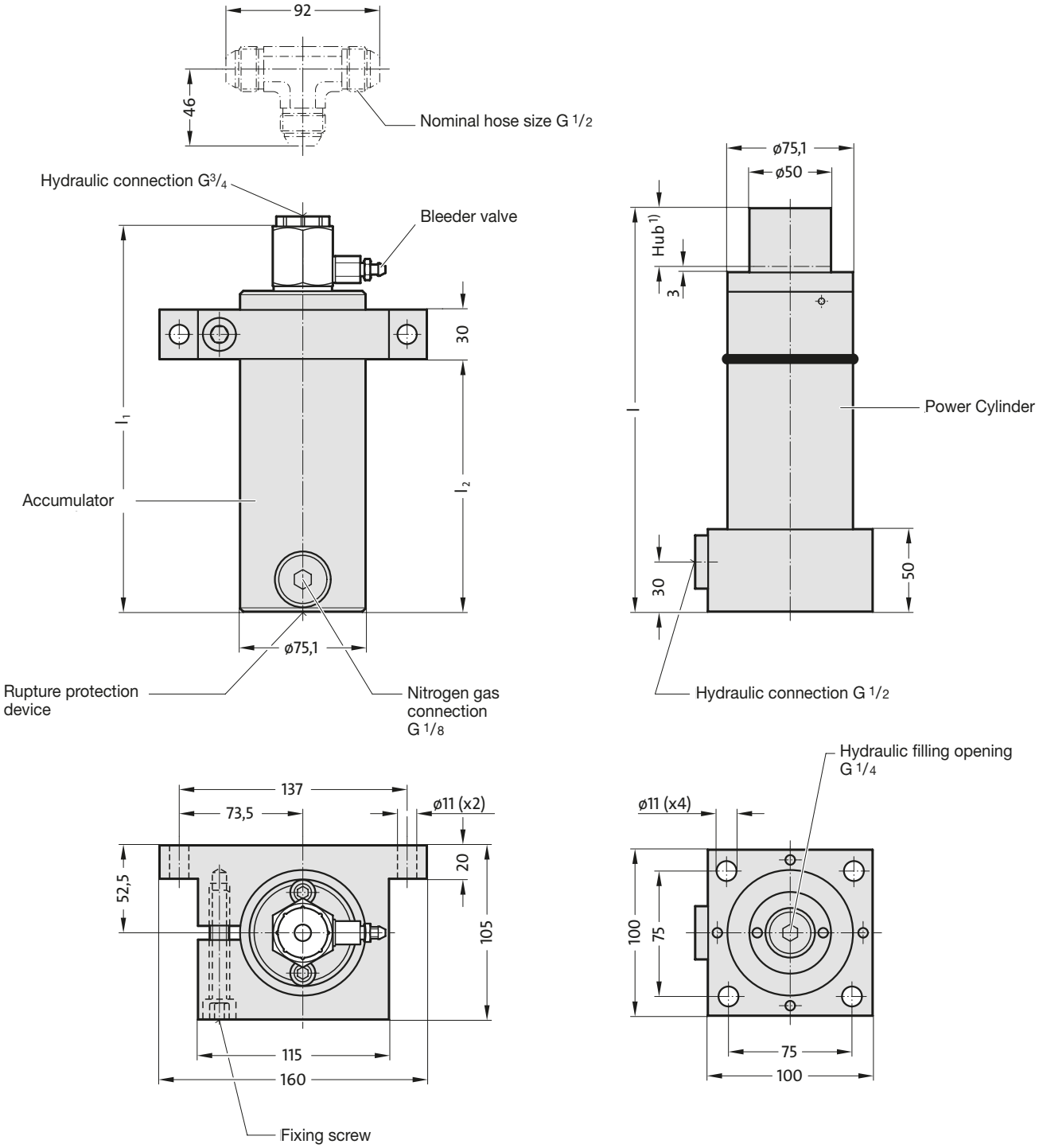
2) The cam unit no longer returns completely to its stroke starting position due to the oil expansion which is attributable to the temperature. An allowance must be made for an increase of 3 mm to 6 mm.

2018.12.04000. _ _ _ .1 Flange Cam 40 kN with gas monitoring connection

Order no	Stroke max.	Restoring force in kN at 180 bar Stroke start	Stroke end	a	b	c	d	e
2018.12.04000.049.1	49	4	5,2	304	109	39	162	13
2018.12.04000.099.1	99	4	5,2	404	159	89	237	63

Power Unit 40 kN with separate Accumulator

2018.25.04000.



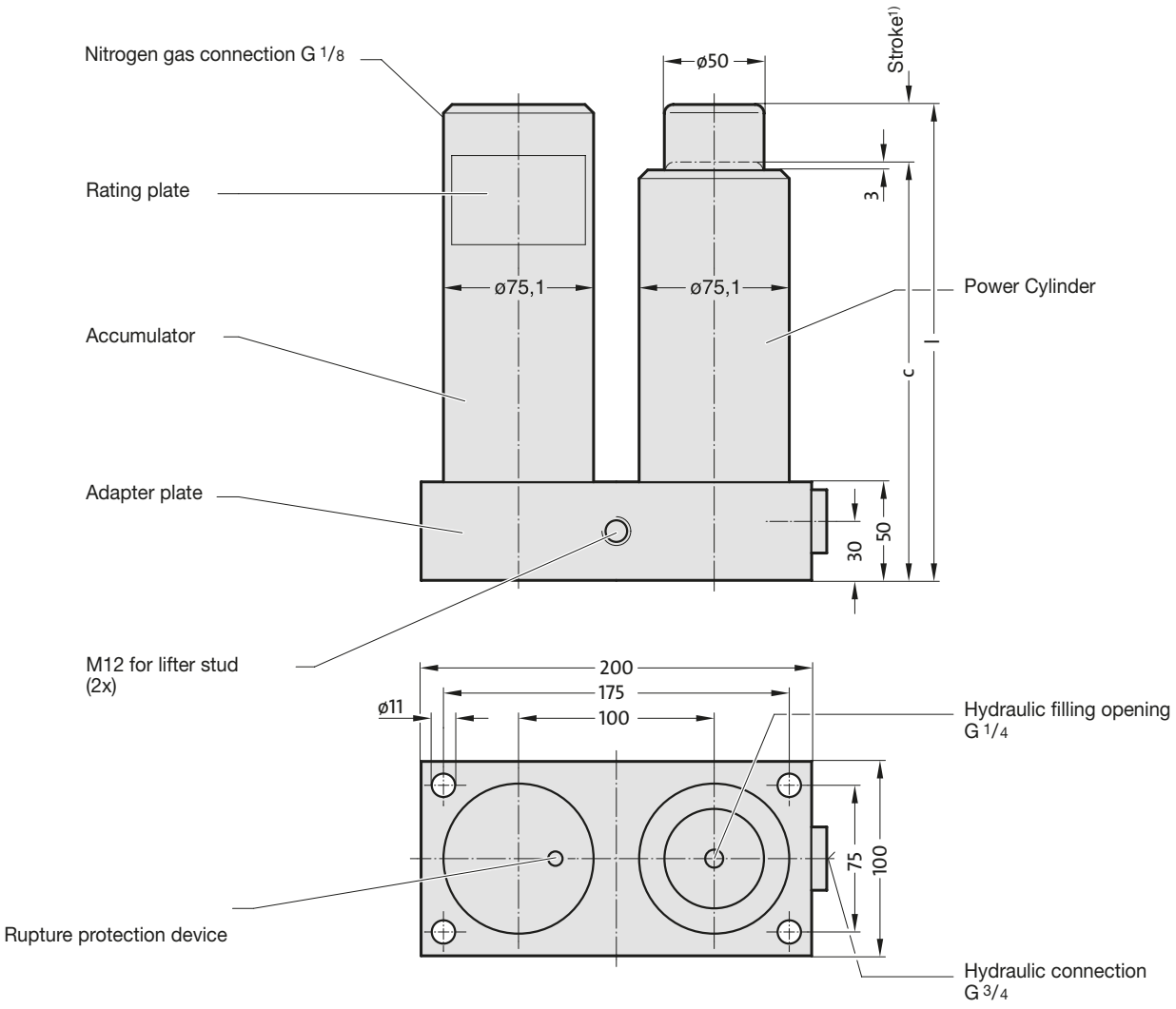
* Tighten M10 fixing screw to 52 Nm

1) The overtravel compensation is the nominal stroke + 10 mm additional stroke.

2018.25.04000. Power Unit 40 kN with separate Accumulator

Order no	Stroke +10[1)]	l	l_1	l_2
2018.25.04000.035	35	242	231	152
2018.25.04000.060	60	292	281	202
2018.25.04000.110	110	392	381	302
2018.25.04000.160	160	492	481	402

2018.20.04000.



1) The overtravel compensation is the nominal stroke + 10 mm additional stroke.

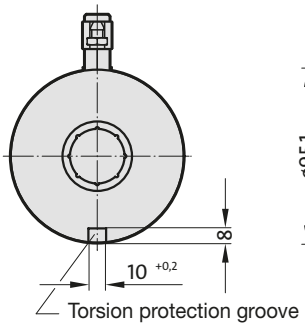
2018.20.04000. Power Unit 40 kN

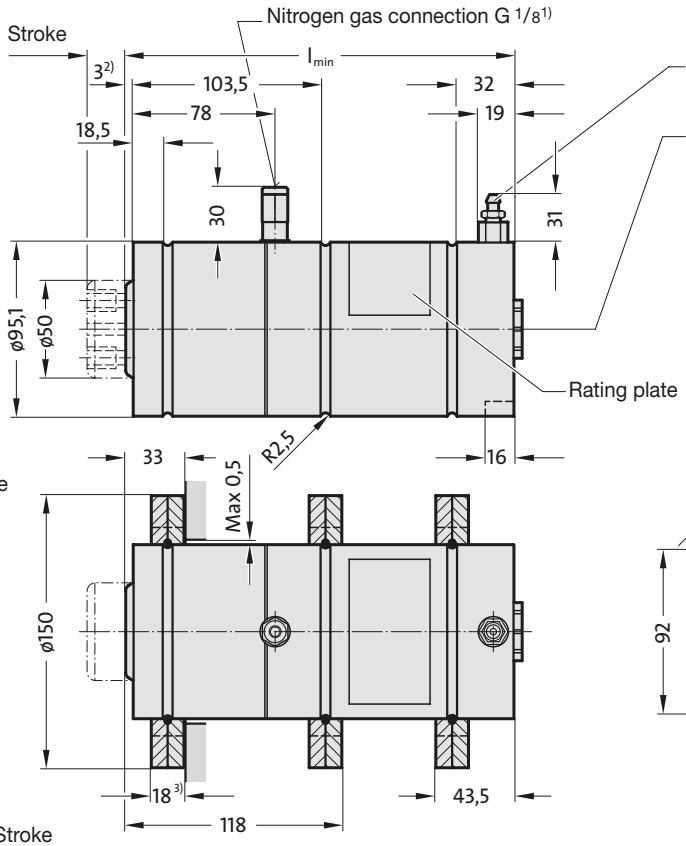
Order no	c	l	Stroke +10[1)]
2018.20.04000.035	207	242	35
2018.20.04000.060	232	292	60
2018.20.04000.110	282	392	110
2018.20.04000.160	332	492	160

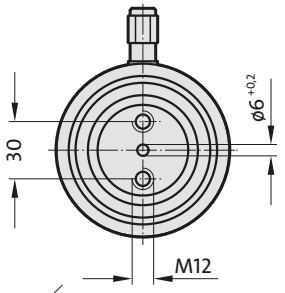
Cam Unit
Force Cylinder 60 kN

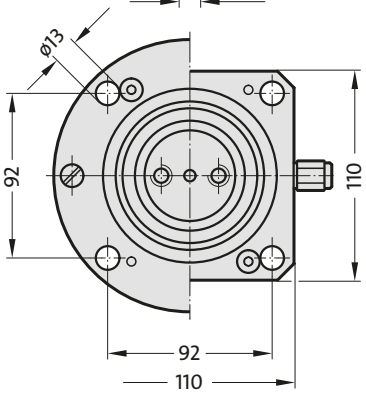
2018. _ _ .06000.

2018.30.06000. Stroke









2018.50.06000. Stroke ⊙

2018.60.06000. Stroke ⊡

Spare parts

Mounting flanges

⊙ 2480.055.03000

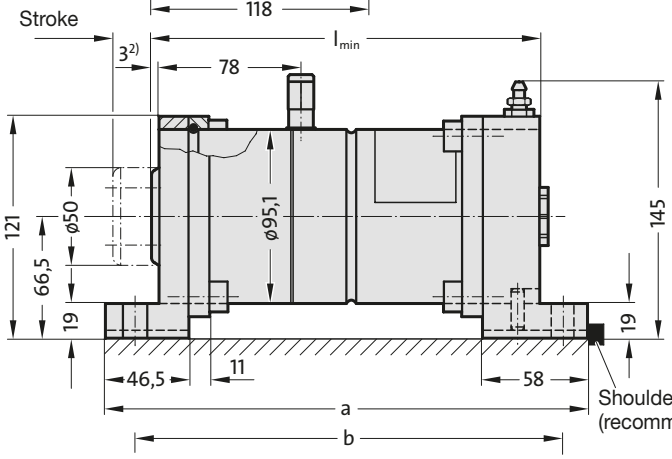
⊡ 2480.057.03000

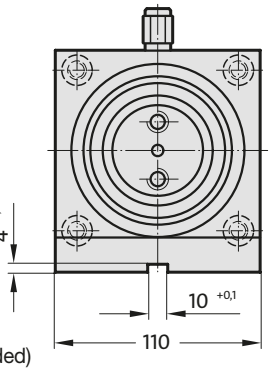
2018.40.06000. Stroke

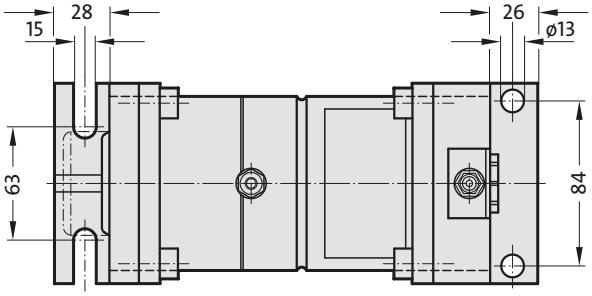
Spare parts
Mounting flanges

On the piston rod
2480.045.03000

On the hydraulic connector
2480.046.03000







1) Nitrogen gas connector: caution – before removing the connector check that the cylinder has no gas pressure.

2) The cam unit no longer returns completely to its stroke starting position due to the oil expansion which is attributable to the temperature. An allowance must be made for an increase of 3 mm to 6 mm.

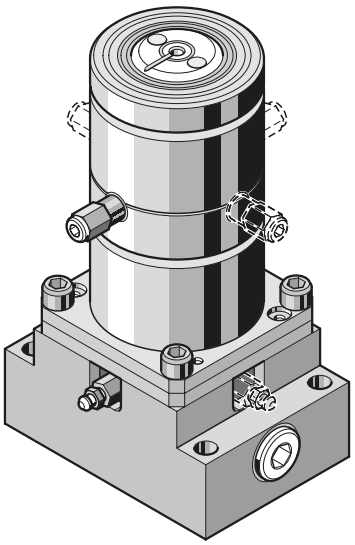
3) This fastening may only be subjected to pressure (by support).

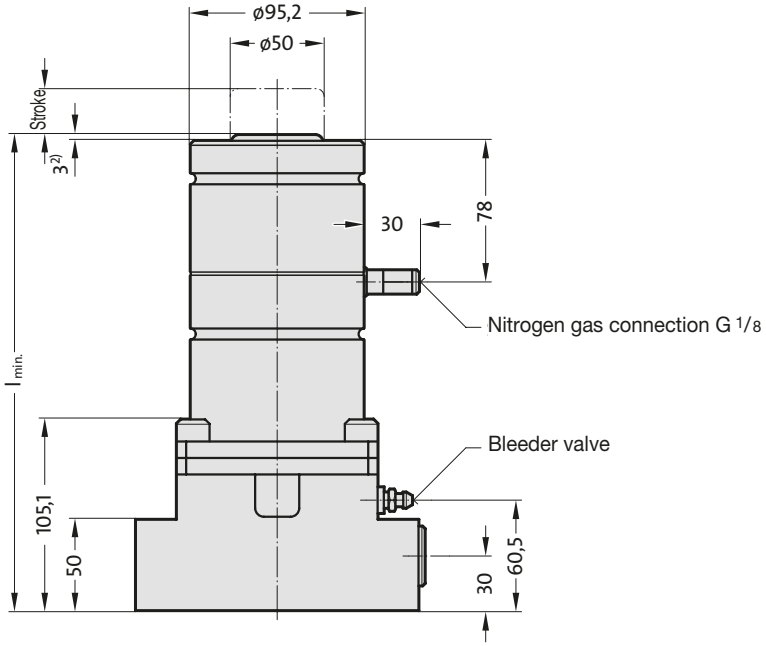
2018. _ _ .06000. Force Cylinder 60 kN

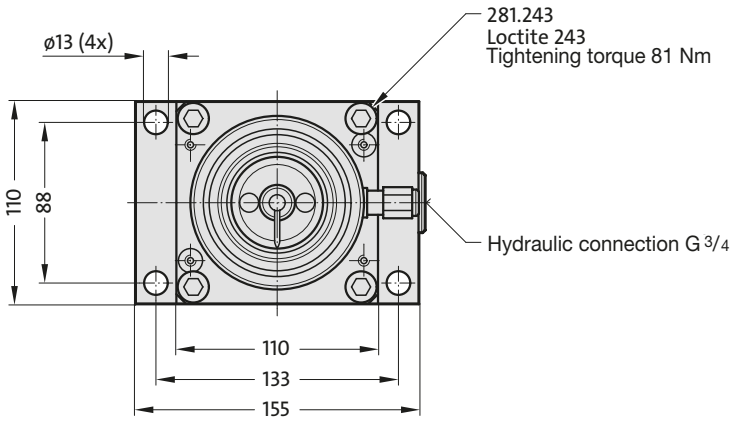
Order no	Stroke	l min	a	b	Restoring force in kN* at 20 bar (max. 40 bar) Stroke start	Stroke end
2018. _ _.06000.025	25	211	262	235	6,1	12,3
2018. _ _.06000.050	50	261	312	285	6,1	12,3
2018. _ _.06000.100	100	361	412	385	6,1	12,3
2018. _ _.06000.150	150	461	512	485	6,1	12,3

* isothermic

2018.45.06000.







2) The cam unit no longer returns completely to its stroke starting position due to the oil expansion which is attributable to the temperature. An allowance must be made for an increase of 3 mm to 6 mm.

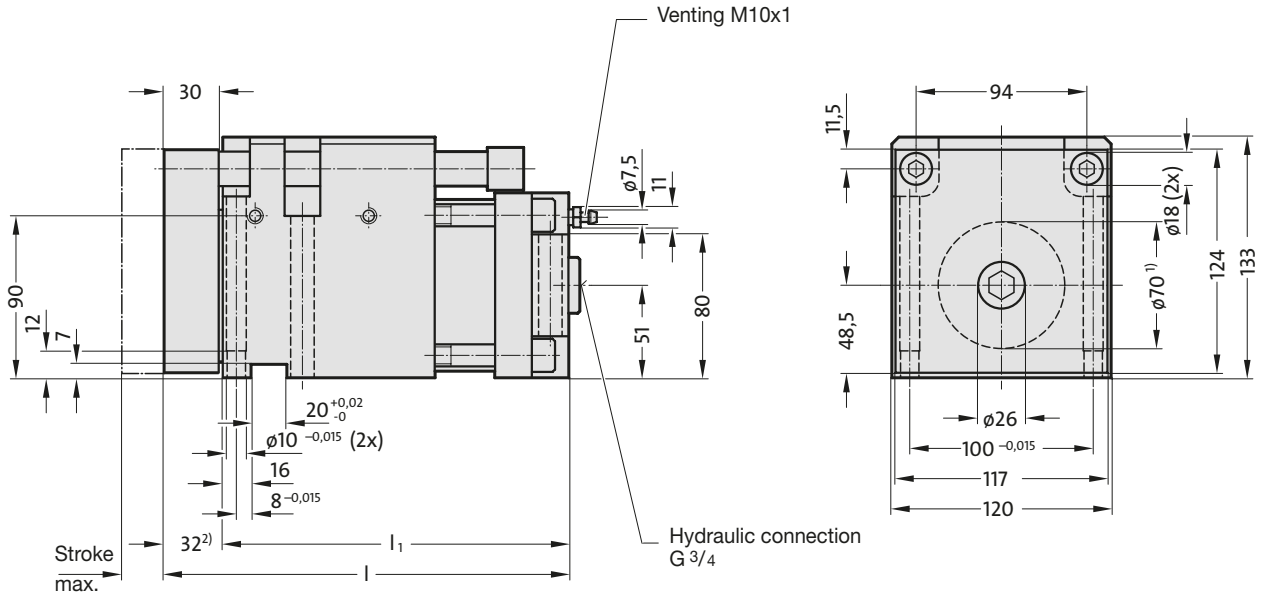
2018.45.06000. Force Cylinder 60 kN with base plate

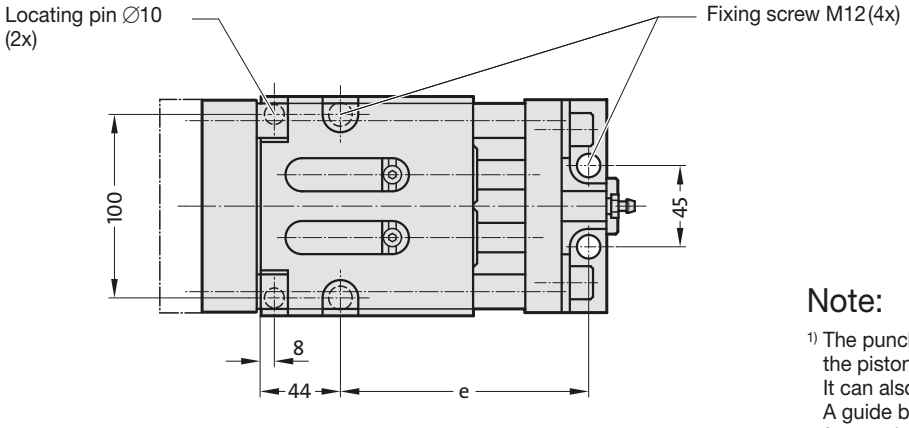
Order no	Stroke	l_{min}	Restoring force in kN* at 20 bar (max. 40 bar) Stroke $_{start}$	Stroke $_{end}$
2018.45.06000.025	25	261	6,1	12,3
2018.45.06000.050	50	311	6,1	12,3
2018.45.06000.100	100	411	6,1	12,3
2018.45.06000.150	150	511	6,1	12,3

* isothermic

Cam Unit
Compact Cam 60 kN

2018.11.06000.





Note:

1) The punch should preferably be mounted in the middle of the piston rod.
It can also be located in the shaded area if necessary.
A guide bolster with external guide to absorb the lateral forces should be provided for coping and cutting operations.

2) The cam unit no longer returns completely to its stroke starting position due to the oil expansion which is attributable to the temperature. An allowance must be made for an increase of 3 mm to 6 mm.

2018.11.06000. Compact Cam 60 kN

Order no	Stroke max.	e	l	l 1	Restoring force in kN at 180 bar Stroke start	Stroke end
2018.11.06000.024	24	137	223	191	7	10,6
2018.11.06000.049	49	162	248	216	7	10,6
2018.11.06000.099	99	212	298	266	7	10,6

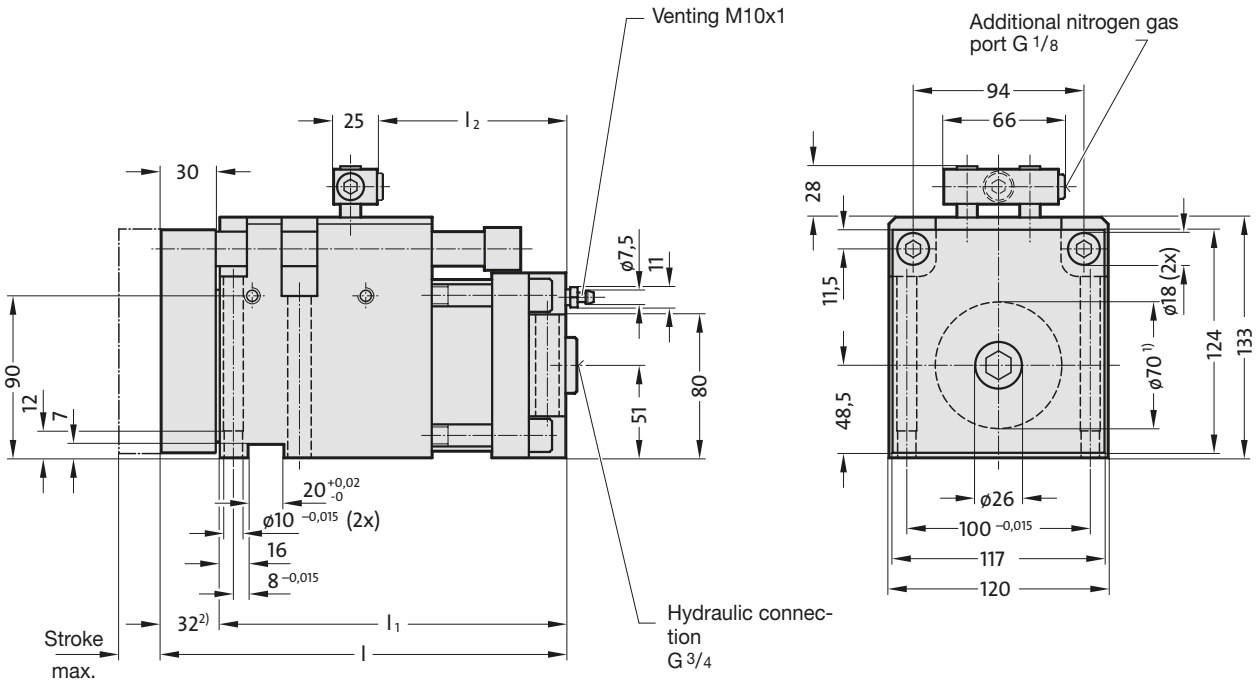
Cam Unit
Compact Cam 60 kN with gas monitoring connection

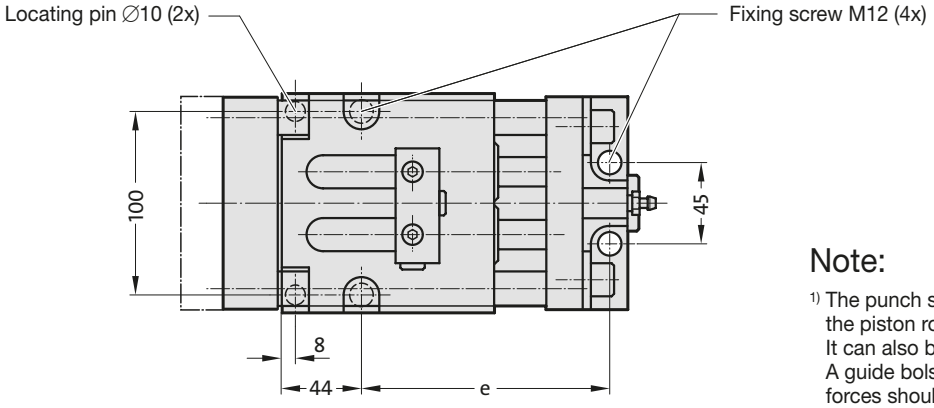
2018.11.06000. _ _ _ .1

Install together with measuring hose and control fitting (gas spring and nitrogen connection are valveless).

Duplicate nitrogen gas ports for connecting the measuring hose.

Use only one port whilst keeping the other one closed.





Note:

1) The punch should preferably be mounted in the middle of the piston rod.
It can also be located in the shaded area if necessary.
A guide bolster with external guide to absorb the lateral forces should be provided for coping and cutting operations.

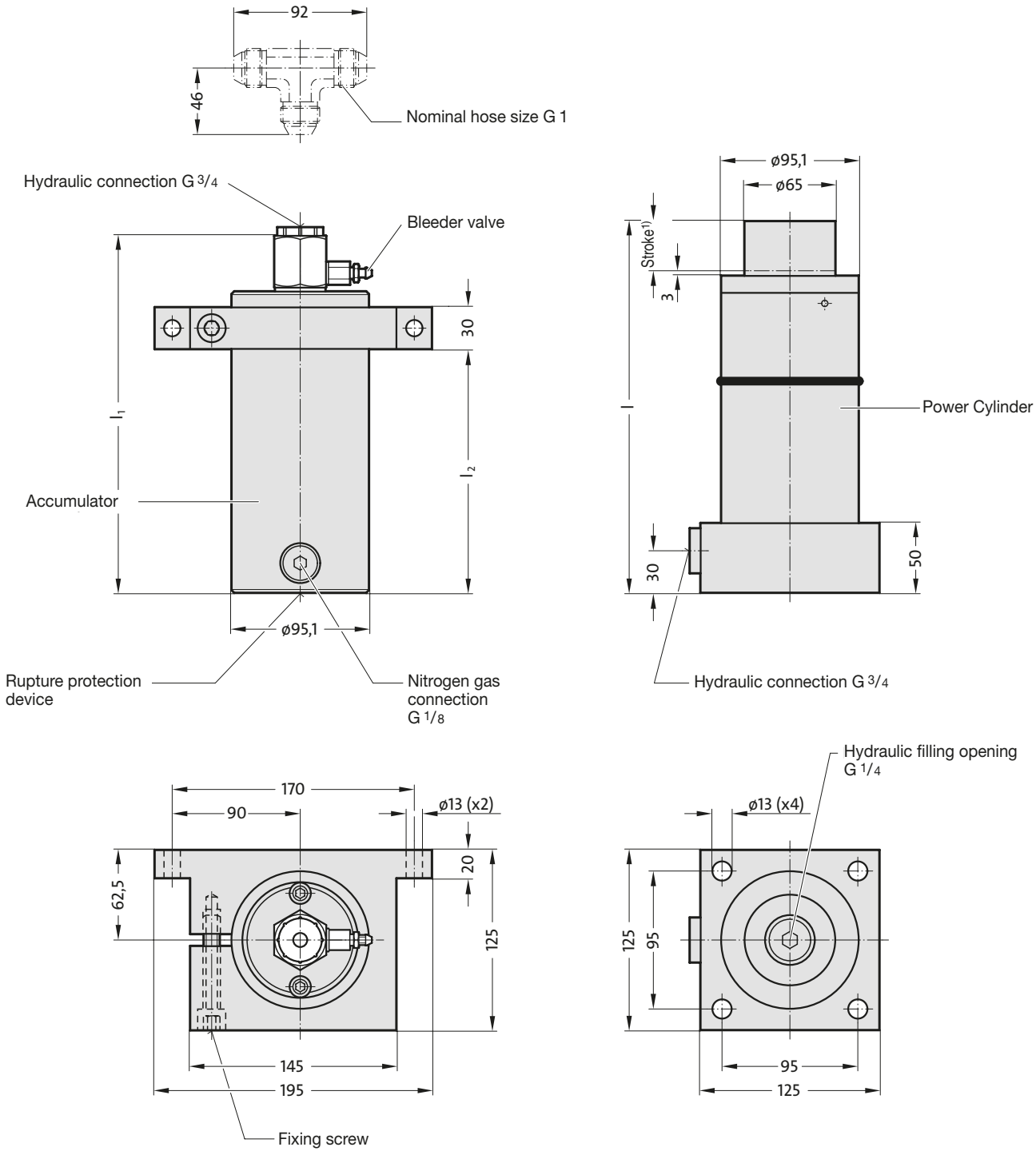
2) The cam unit no longer returns completely to its stroke starting position due to the oil expansion which is attributable to the temperature. An allowance must be made for an increase of 3 mm to 6 mm.

2018.11.06000. _ _ _ .1 Compact Cam 60 kN with gas monitoring connection

Order no	Stroke max.	e	l	l1	l2	Restoring force in kN at 180 bar Stroke start	Stroke end
2018.11.06000.024.1	24	137	223	191	103	7	10,6
2018.11.06000.049.1	49	162	248	216	153	7	10,6
2018.11.06000.099.1	99	212	298	266	228	7	10,6

Power Unit 60 kN with separate Accumulator

2018.25.06000.



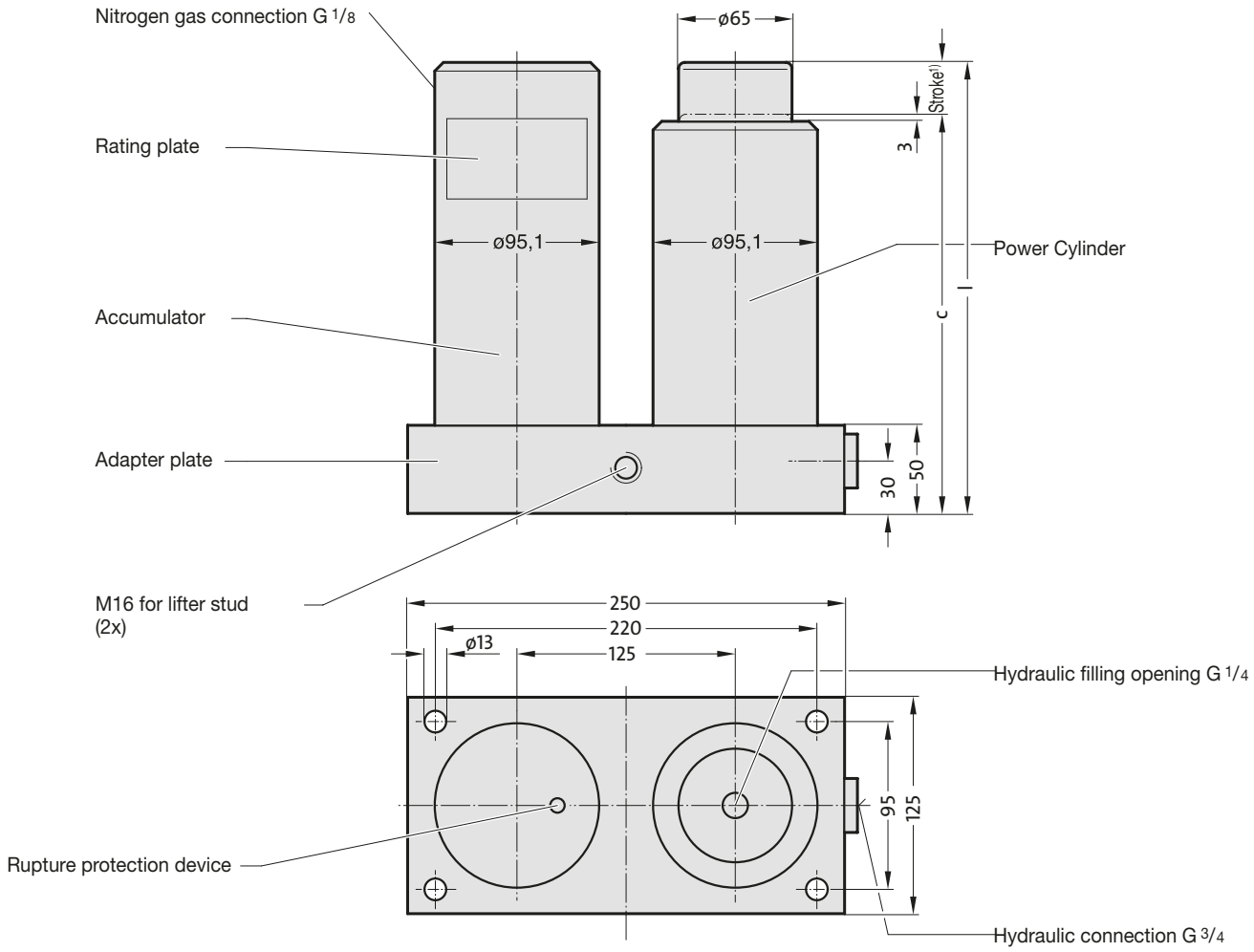
* Tighten M12 fixing screw to 91 Nm

1) The overtravel compensation is the nominal stroke + 10 mm additional stroke.

2018.25.06000. Power Unit 60 kN with separate Accumulator

Order no	Stroke +10[1)]	l	l_1	l_2
2018.25.06000.035	35	258	247	168
2018.25.06000.060	60	308	296	218
2018.25.06000.110	110	408	396	318
2018.25.06000.160	160	508	496	418

2018.20.06000.



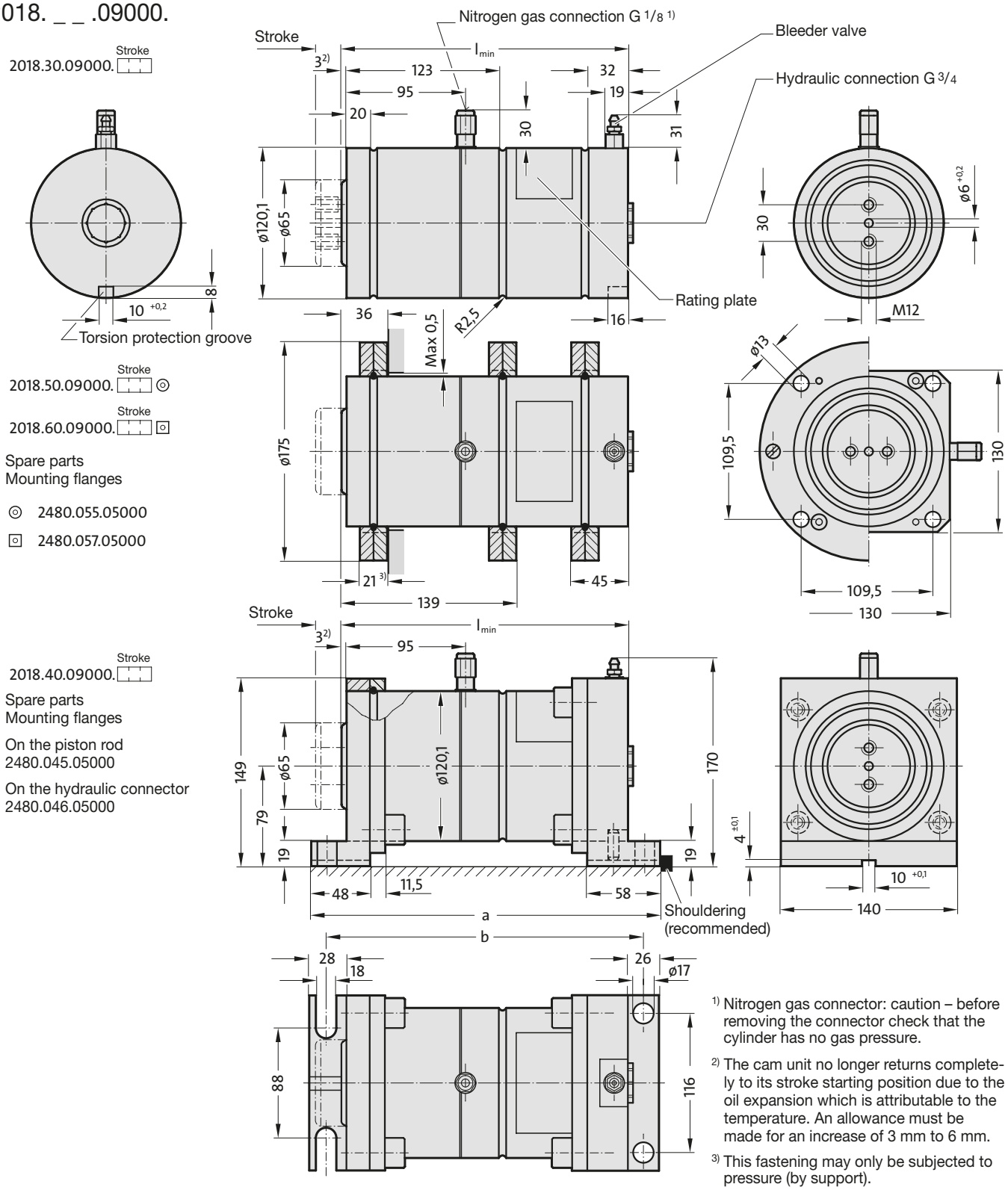
1) The overtravel compensation is the nominal stroke + 10 mm additional stroke.

2018.20.06000. Power Unit 60 kN

Order no	c	l	Stroke +10[1]
2018.20.06000.035	223	258	35
2018.20.06000.060	248	308	60
2018.20.06000.110	298	408	110
2018.20.06000.160	348	508	160

Cam Unit
Force Cylinder 90 kN

2018. _ _ .09000.



[1] Nitrogen gas connector: caution – before removing the connector check that the cylinder has no gas pressure.

[2] The cam unit no longer returns completely to its stroke starting position due to the oil expansion which is attributable to the temperature. An allowance must be made for an increase of 3 mm to 6 mm.

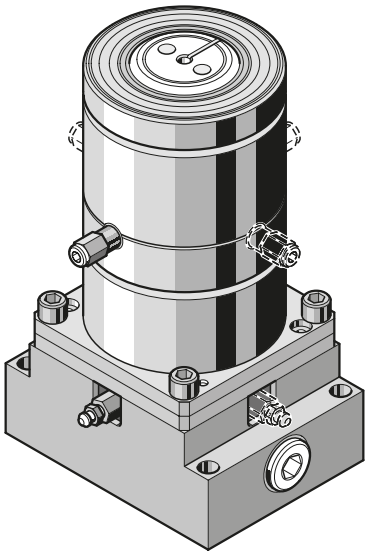
[3] This fastening may only be subjected to pressure (by support).

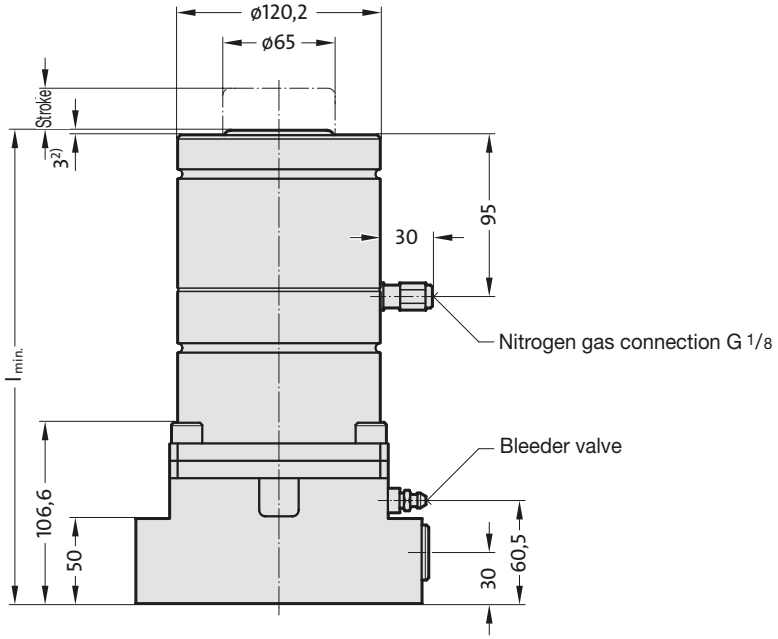
2018. _ _ .09000. Force Cylinder 90 kN

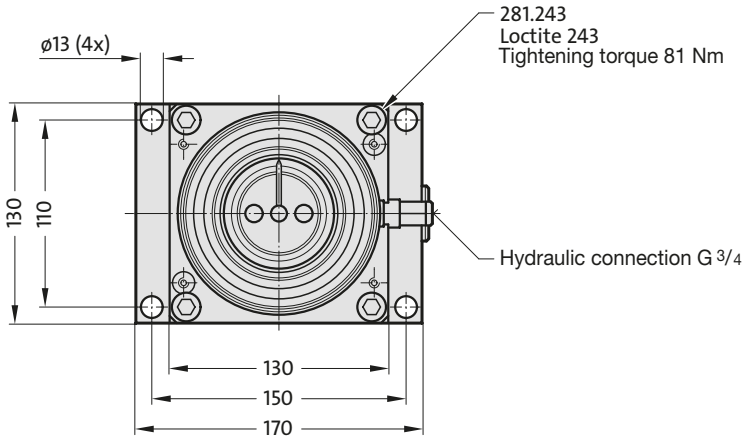
Order no	Stroke	l_{min}	a	b	Restoring force in kN* at 20 bar (max. 40 bar) Stroke start	Stroke end
2018. _ _.09000.025	25	229	280	254	9,1	18,1
2018. _ _.09000.050	50	279	330	304	9,1	18,1
2018. _ _.09000.100	100	379	430	404	9,1	18,1
2018. _ _.09000.150	150	479	530	504	9,1	18,1

* isothermic

2018.45.09000.







2) The cam unit no longer returns completely to its stroke starting position due to the oil expansion which is attributable to the temperature. An allowance must be made for an increase of 3 mm to 6 mm.

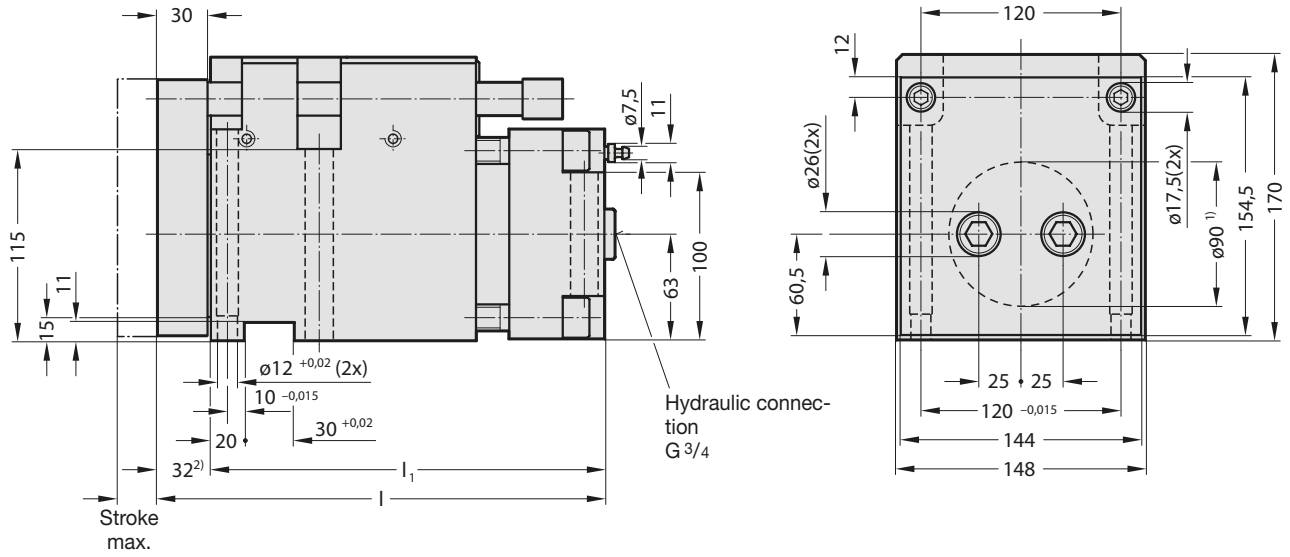
2018.45.09000. Force Cylinder 90 kN with base plate

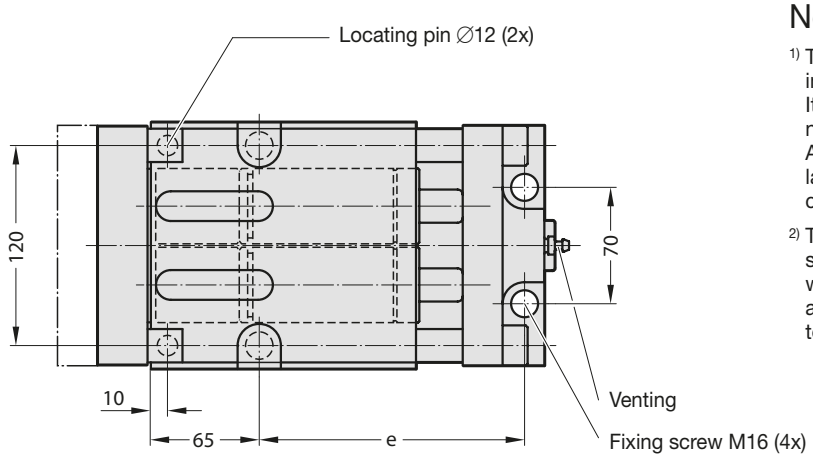
Order no	Stroke	l_{min}	Restoring force in kN* at 20 bar (max. 40 bar) Stroke $_{start}$	Stroke $_{end}$
2018.45.09000.025	25	279	9,1	18,1
2018.45.09000.050	50	329	9,1	18,1
2018.45.09000.100	100	429	9,1	18,1
2018.45.09000.150	150	529	9,1	18,1

* isothermic

Cam Unit
Compact Cam 90 kN

2018.11.09000.





Note:

1) The punch should preferably be mounted in the middle of the piston rod.
It can also be located in the shaded area if necessary.
A guide bolster with external guide to absorb the lateral forces should be provided for coping and cutting operations.

2) The cam unit no longer returns completely to its stroke starting position due to the oil expansion which is attributable to the temperature. An allowance must be made for an increase of 3 mm to 6 mm.

2018.11.09000. Compact Cam 90 kN

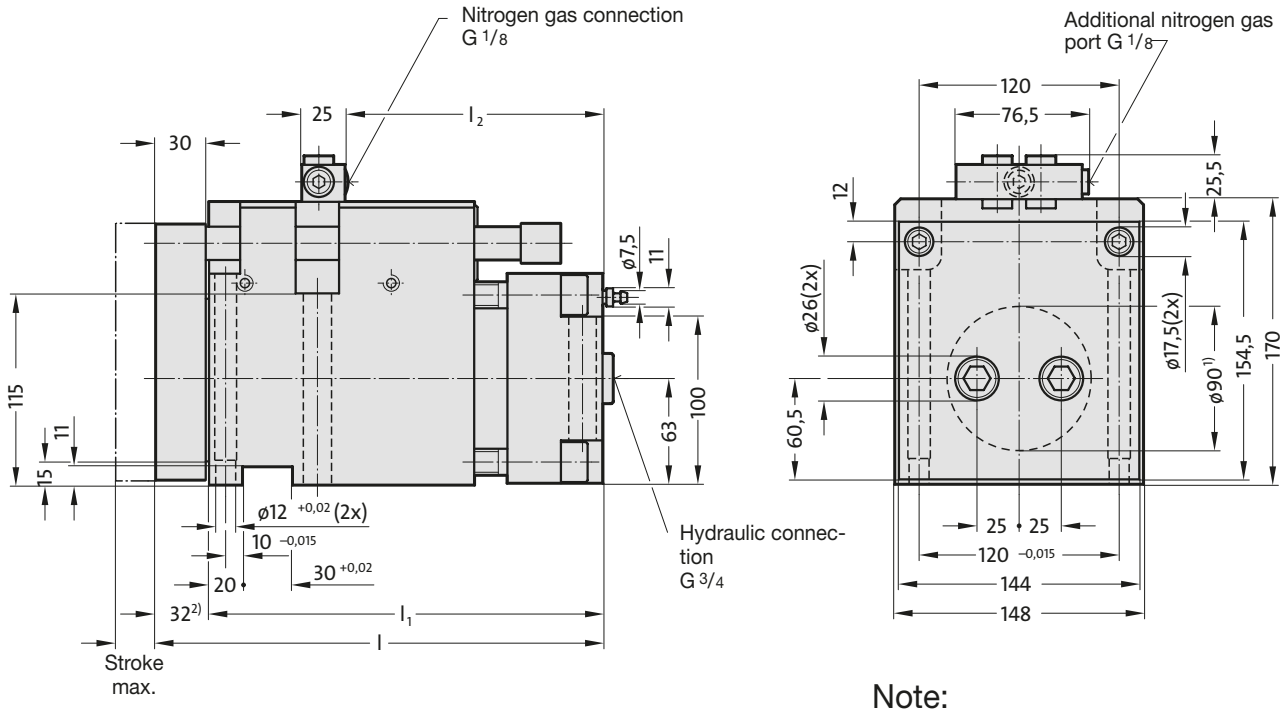
					Restoring force in kN at 150 bar	
Order no	Stroke max.	e	l	l 1	Stroke start	Stroke end
2018.11.09000.024	24	159	268	236	10	14,6
2018.11.09000.049	49	184	293	261	10	14,4
2018.11.09000.099	99	234	343	311	10	14,2

2018.11.09000. _ _ _ .1

Install together with measuring hose and control fitting (gas spring and nitrogen connection are valveless).

Duplicate nitrogen gas ports for connecting the measuring hose.

Use only one port whilst keeping the other one closed.



Note:

1) The punch should preferably be mounted in the middle of the piston rod.
It can also be located in the shaded area if necessary.
A guide bolster with external guide to absorb the lateral forces should be provided for coping and cutting operations.

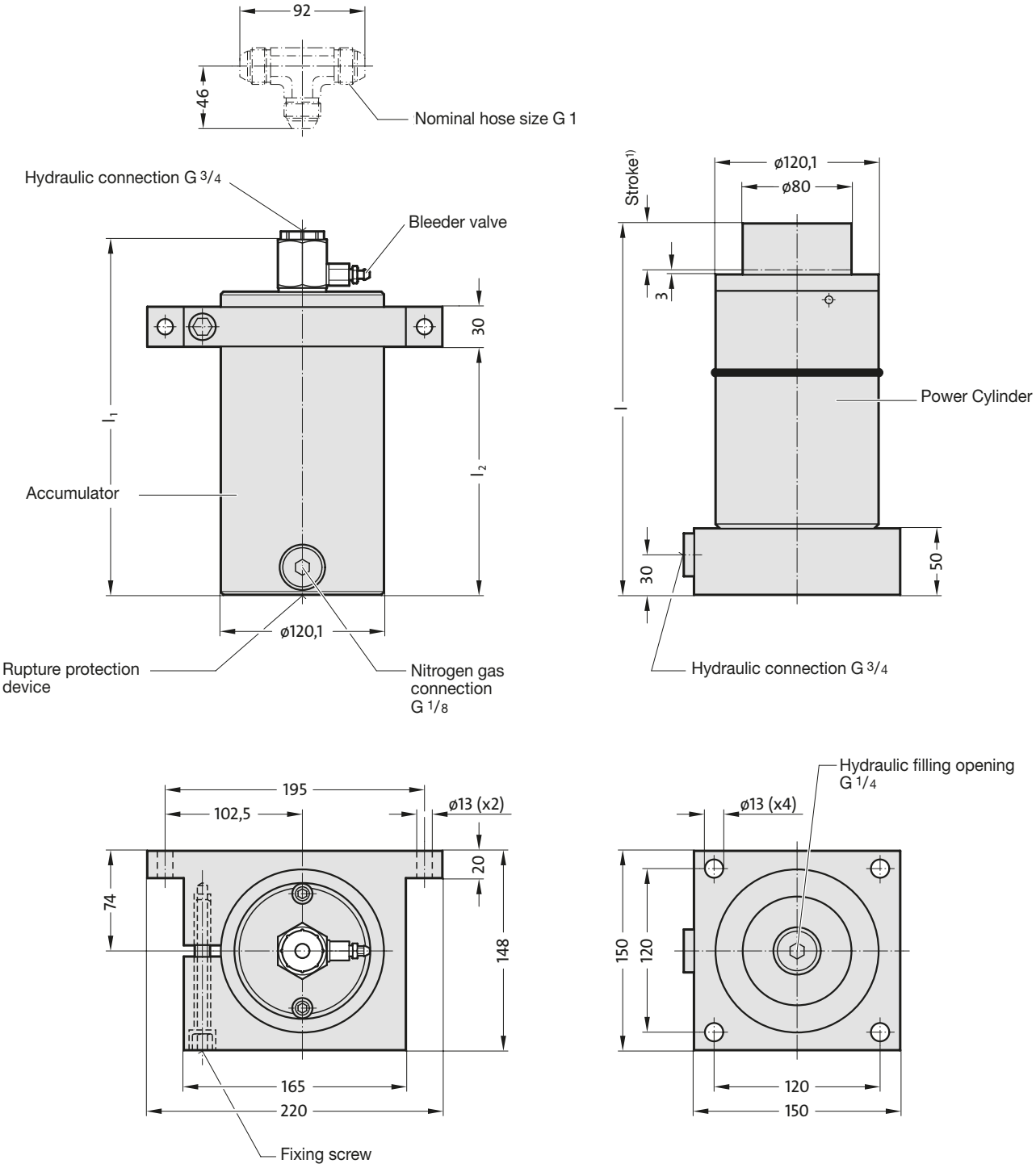
2) The cam unit no longer returns completely to its stroke starting position due to the oil expansion which is attributable to the temperature. An allowance must be made for an increase of 3 mm to 6 mm.

2018.11.09000. _ _ _ .1 Compact Cam 90 kN with gas monitoring connection

Order no	Stroke max.	e	l	l 1	l 2	Restoring force in kN at 150 bar Stroke start	Stroke end
2018.11.09000.024.1	24	159	268	236	158	10	14,6
2018.11.09000.049.1	49	184	293	261	208	10	14,4
2018.11.09000.099.1	99	234	343	311	283	10	14,2

Power Unit 90 kN with separate Accumulator

2018.25.09000.



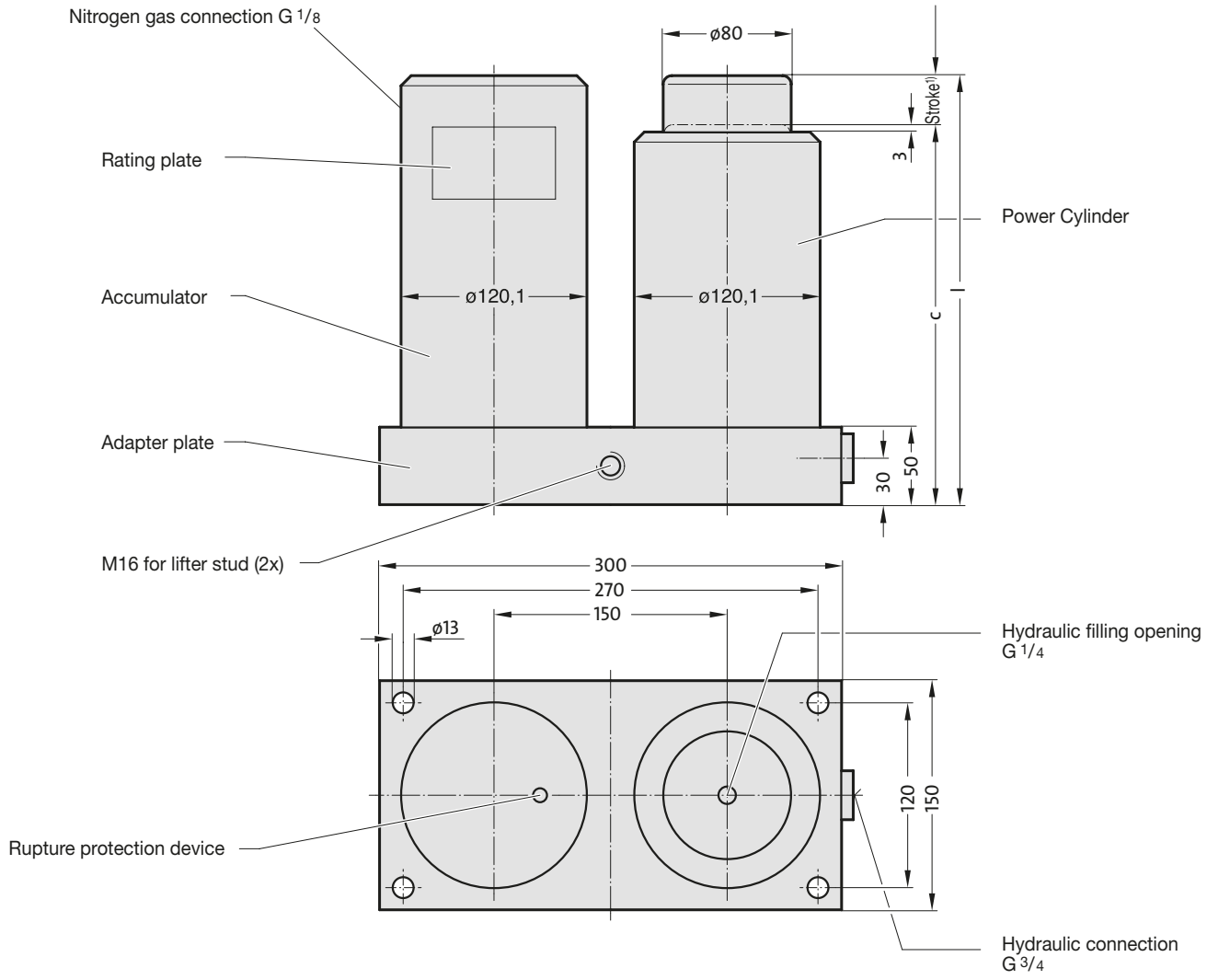
* Tighten M12 fixing screw to 91 Nm

1) The overtravel compensation is the nominal stroke + 10 mm additional stroke.

2018.25.09000. Power Unit 90 kN with separate Accumulator

Order no	Stroke +10[1)]	l	l_1	l_2
2018.25.09000.035	35	276	265	186
2018.25.09000.060	60	326	315	236
2018.25.09000.110	110	426	415	336
2018.25.09000.160	160	526	514	436

2018.20.09000.



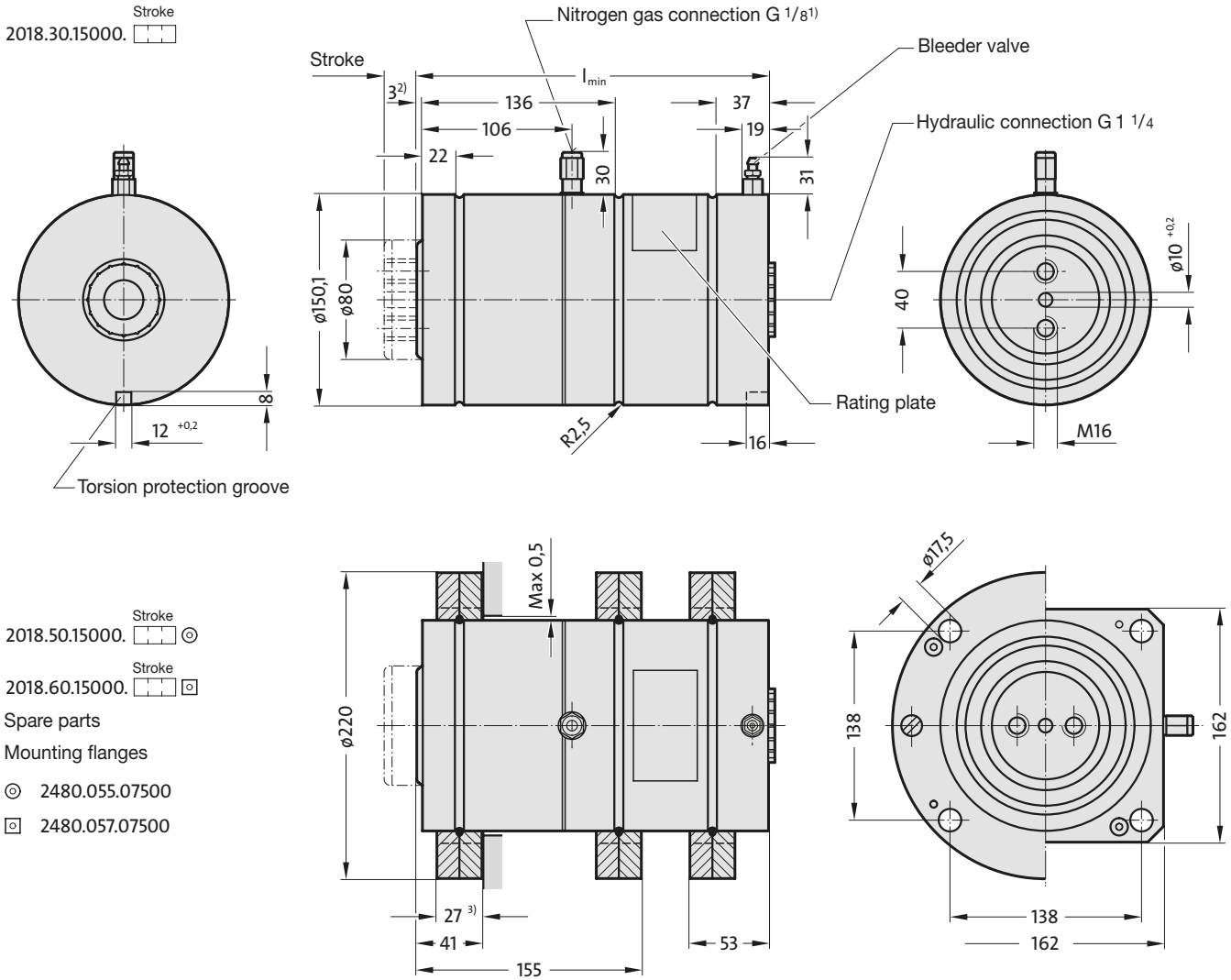
1) The overtravel compensation is the nominal stroke + 10 mm additional stroke.

2018.20.09000. Power Unit 90 kN

Order no	c	l	Stroke +10[1)]
2018.20.09000.035	241	276	35
2018.20.09000.060	266	326	60
2018.20.09000.110	316	426	110
2018.20.09000.160	366	526	160

Cam Unit
Force Cylinder 150 kN

2018. _ _ .15000.



1) Nitrogen gas connector: caution – before removing the connector check that the cylinder has no gas pressure.

2) The cam unit no longer returns completely to its stroke starting position due to the oil expansion which is attributable to the temperature. An allowance must be made for an increase of 3 mm to 6 mm.

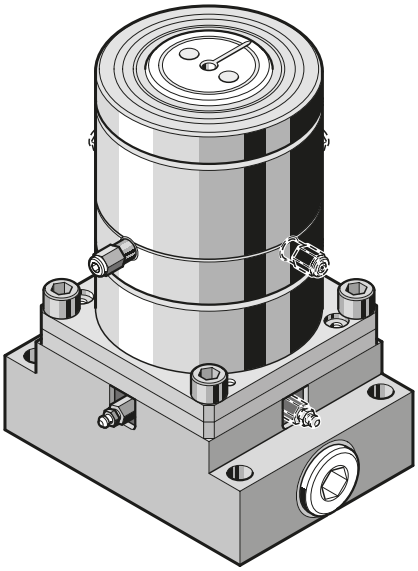
3) This fastening may only be subjected to pressure (by support).

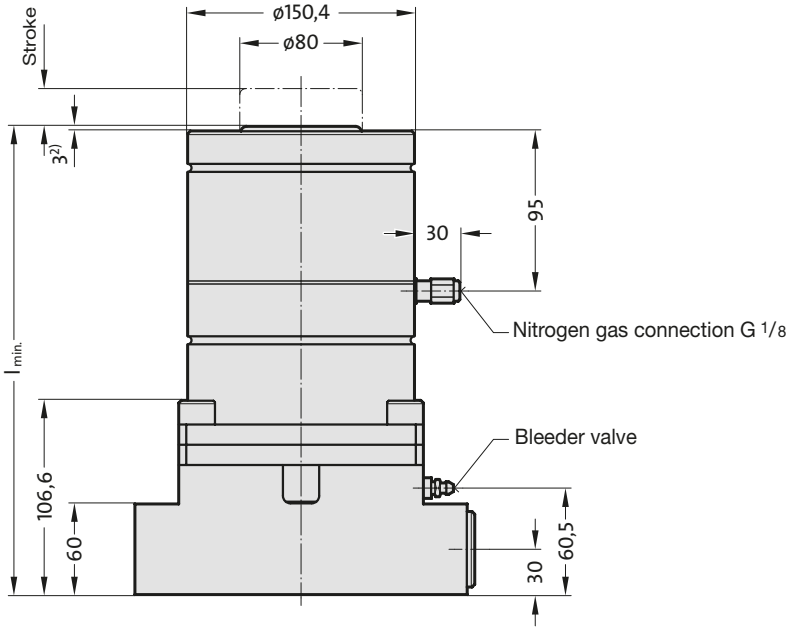
2018. _ _ .15000. Force Cylinder 150 kN

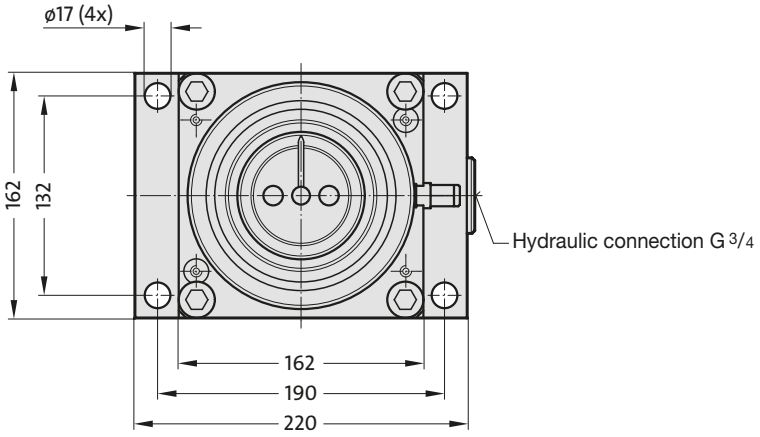
Order no	Stroke max.	l min	Restoring force in kN* at 20 bar (max. 40 bar) Stroke start	Stroke end
2018. _ _ .15000.025	25	250	14,5	29,0
2018. _ _ .15000.050	50	300	14,5	29,0
2018. _ _ .15000.100	100	400	14,5	29,0
2018. _ _ .15000.150	150	500	14,5	29,0

* isothermic

2018.45.15000.







2) The cam unit no longer returns completely to its stroke starting position due to the oil expansion which is attributable to the temperature. An allowance must be made for an increase of 3 mm to 6 mm.

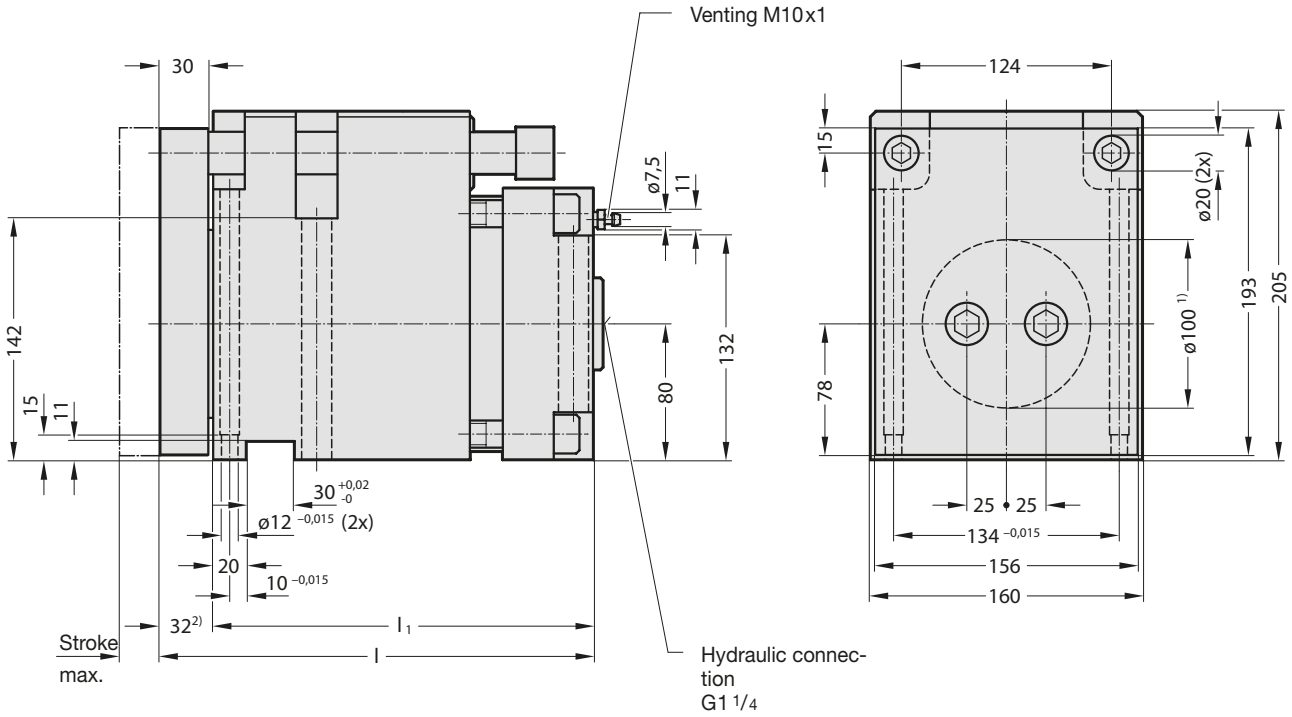
2018.45.15000. Force Cylinder 150 kN with base plate

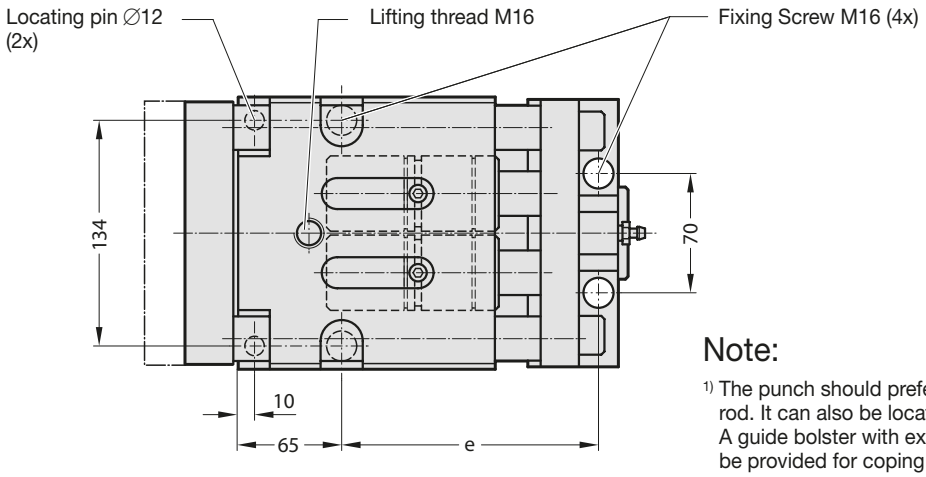
Order no	Stroke	l_{min}	Restoring force in kN* at 20 bar (max. 40 bar) Stroke $_{start}$	Stroke $_{end}$
2018.45.15000.025	25	310	14,5	29,0
2018.45.15000.050	50	360	14,5	29,0
2018.45.15000.100	100	460	14,5	29,0

* isothermic

Cam Unit
Compact Cam 150 kN

2018.11.15000.





Note:

1) The punch should preferably be mounted in the middle of the piston rod. It can also be located in the shaded area if necessary.
A guide bolster with external guide to absorb the lateral forces should be provided for coping and cutting operations.

2) The cam unit no longer returns completely to its stroke starting position due to the oil expansion which is attributable to the temperature. An allowance must be made for an increase of 3 mm to 6 mm.

2018.11.15000. Compact Cam 150 kN

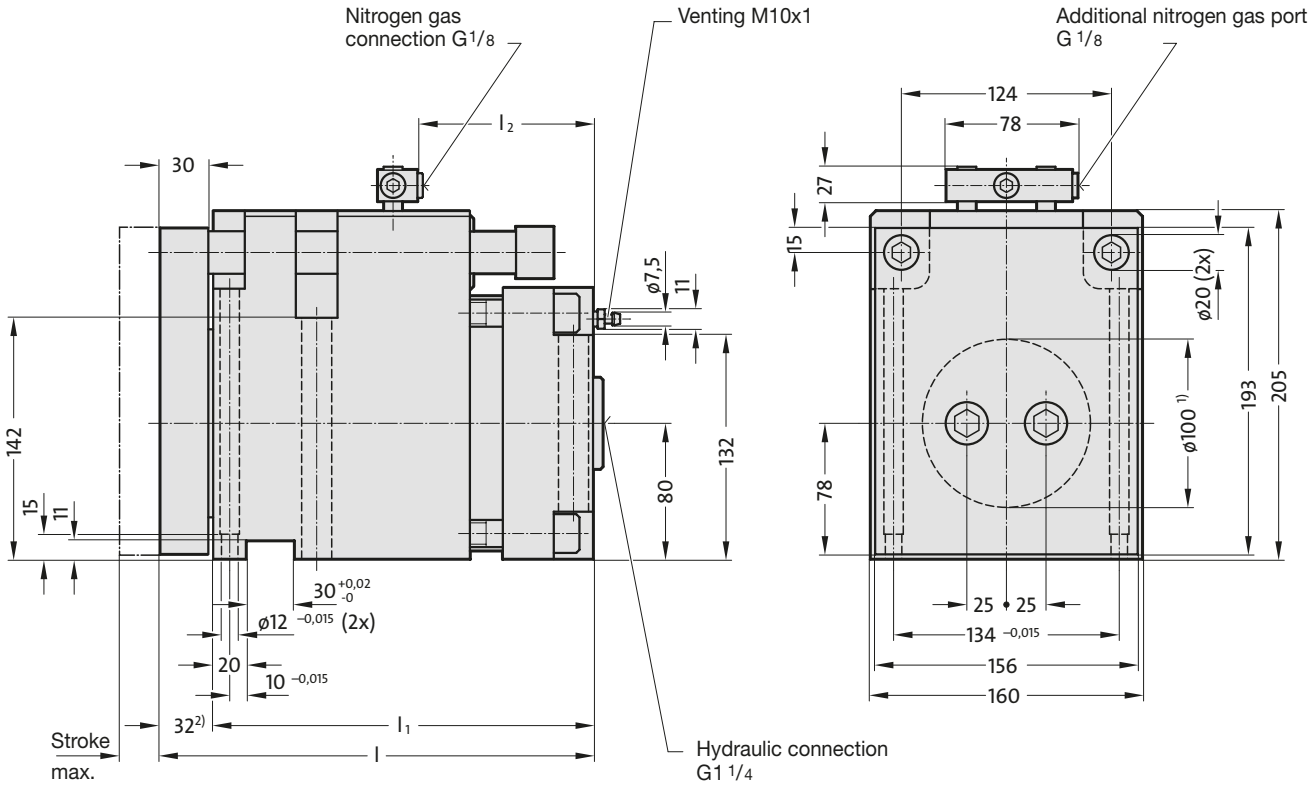
Order no	Stroke max.	e	l	l 1	Restoring force in kN at 150 bar Stroke start	Stroke end
2018.11.15000.024	24	159	268	236	15	24
2018.11.15000.049	49	184	293	261	15	24
2018.11.15000.099	99	234	343	311	15	24

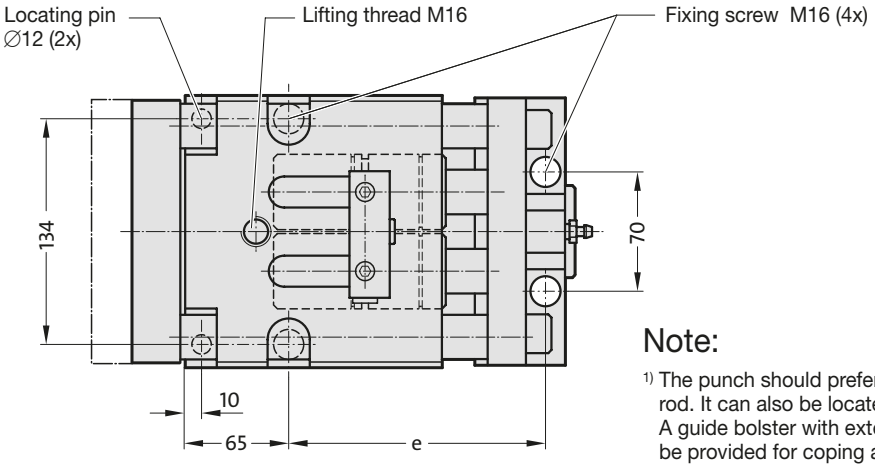
2018.11.15000. _ _ _ .1

Install together with measuring hose and control fitting (gas spring and nitrogen connection are valveless).

Duplicate nitrogen gas ports for connecting the measuring hose.

Use only one port whilst keeping the other one closed.





Note:

1) The punch should preferably be mounted in the middle of the piston rod. It can also be located in the shaded area if necessary. A guide bolster with external guide to absorb the lateral forces should be provided for coping and cutting operations.

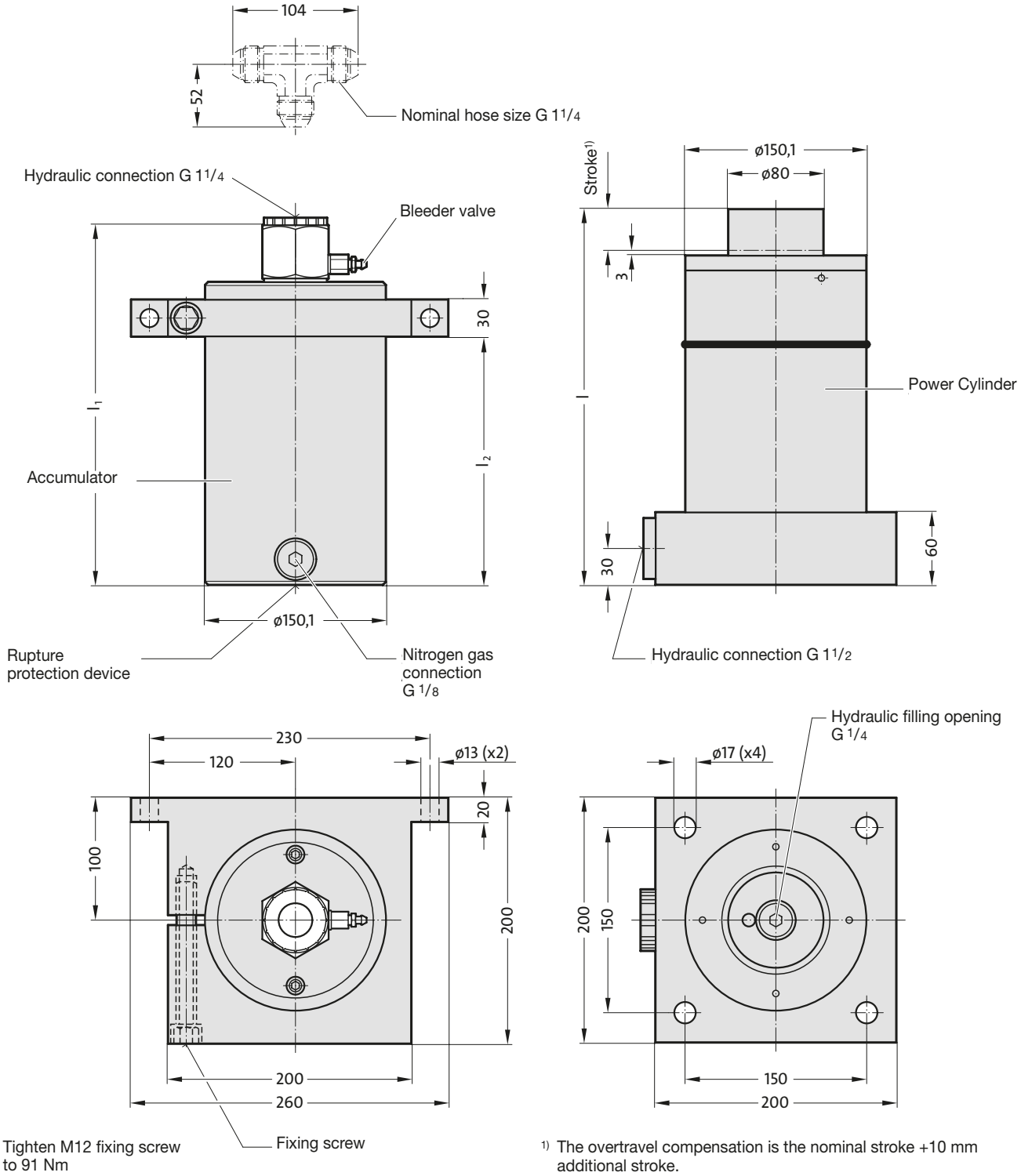
2) The cam unit no longer returns completely to its stroke starting position due to the oil expansion which is attributable to the temperature. An allowance must be made for an increase of 3 mm to 6 mm.

2018.11.15000. _ _ _.1 Compact Cam 150 kN with gas monitoring connection

Order no	Stroke max.	e	l	l 1	l 2	Restoring force in kN at 150 bar Stroke start	Stroke end
2018.11.15000.024.1	24	159	268	236	109	15	24
2018.11.15000.049.1	49	184	293	261	159	15	24
2018.11.15000.099.1	99	234	343	311	234	15	24

Power Unit 150 kN with separate Accumulator

2018.25.15000.



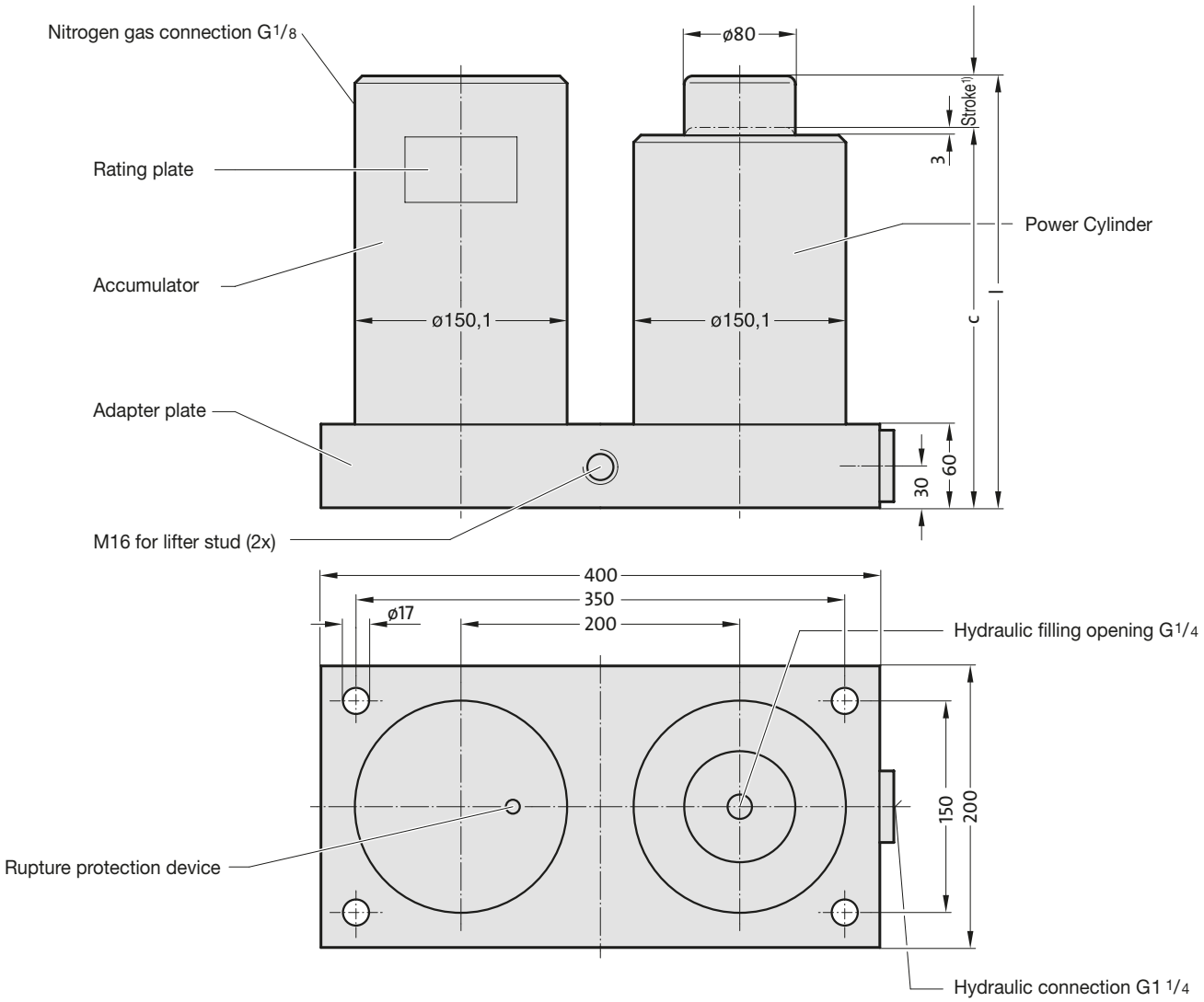
* Tighten M12 fixing screw to 91 Nm

1) The overtravel compensation is the nominal stroke +10 mm additional stroke.

2018.25.15000. Power Unit 150 kN with separate Accumulator

Order no	Stroke +10 1)	l	l_1	l_2
2018.25.15000.035	35	307	294	207
2018.25.15000.060	60	357	344	257
2018.25.15000.110	110	457	444	357
2018.25.15000.160	160	557	544	457

2018.20.15000.



1) The overtravel compensation is the nominal stroke + 10 mm additional stroke.

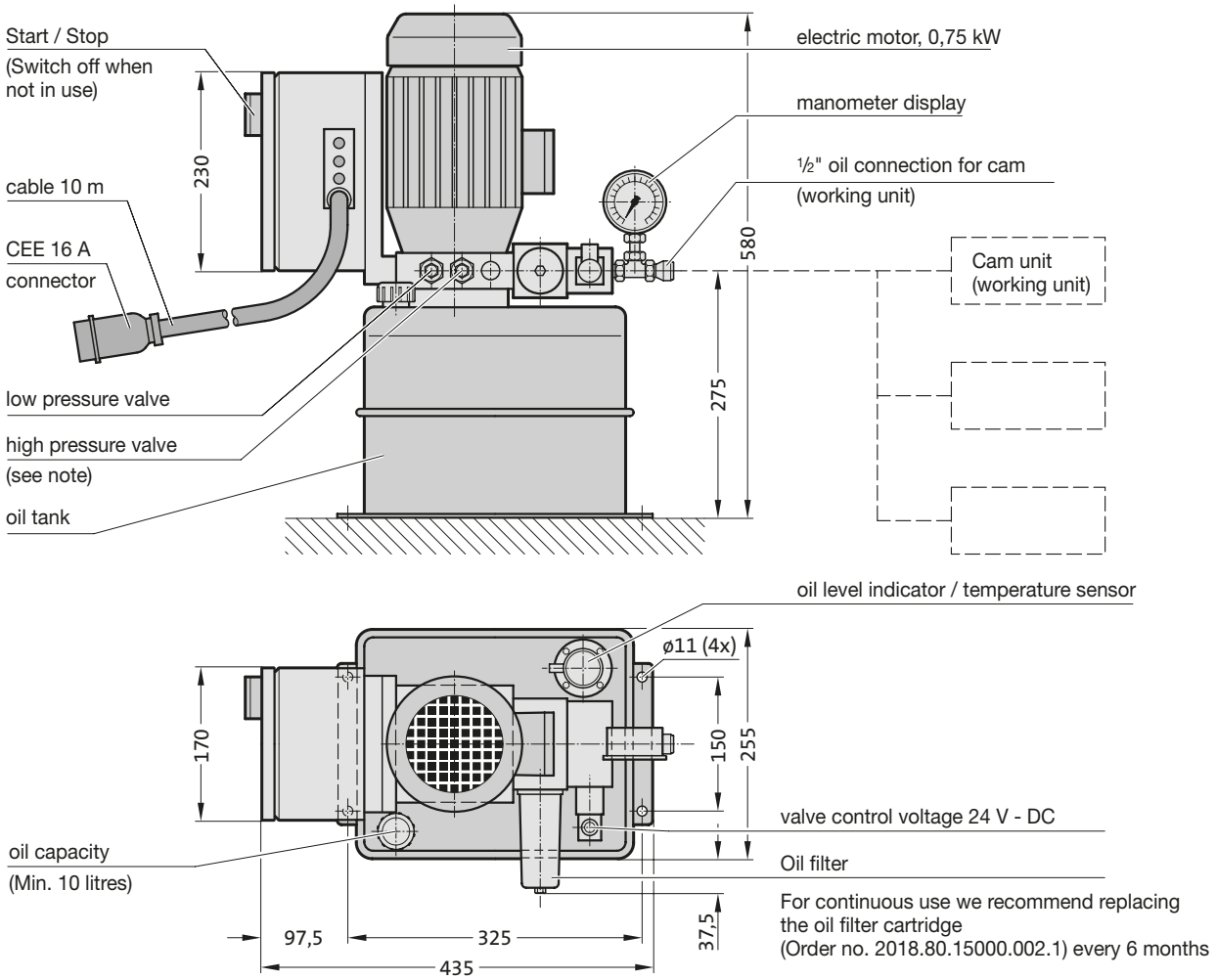
2018.20.15000. Power Unit 150 kN

Order no	c	l	Stroke +10[1)]
2018.20.15000.035	272	307	35
2018.20.15000.060	297	357	60
2018.20.15000.110	347	457	110

Electric hydraulic pump

Electric hydraulic pump

2018.80.15000



Note!

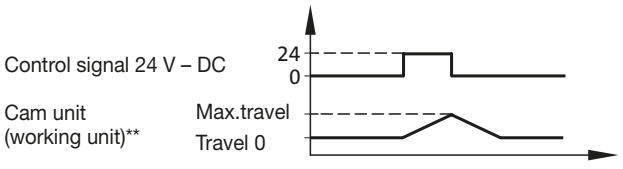
The pressure can be set at both valves.
We recommend setting the low pressure valve to 25 bar.
The high pressure valve can be set to a maximum of 180 bar.
The value to be set depends on the operational requirements.

Technical specifications – hydraulic system

Oil tank volume	15 l
Hydraulic oil ISO VG 32	DIN 51524 HVLP (or similar)
Min. flow at 180 bar	1,6 l/min.
Max. flow at 25 bar	8,7 l/min.
Oil pressure when extending and retracting	10-20 bar
Oil pressure during operation	max. 180 bar
Low and high pressure valves	(see note)

Technical specifications – electrical system

Power supply electrical pump	3x220-440 V-AC 50-60 Hz
Control voltage & control valve	24 V-DC
max. oil temperature	70+/–5° C
Reset switch-on temperature after overheating	50°



Cam speeds*

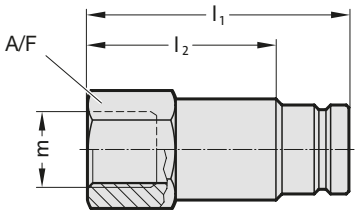
	When extending and retracting	during operation
Size of cam	(Low pressure phase)	(high pressure phase)
2018.11.01500.	115 mm/s	21 mm/s
2018.11.04000.	47 mm/s	9 mm/s
2018.11.06000.	29 mm/s	5 mm/s
2018.11.09000.	18 mm/s	3 mm/s
2018.11.15000.	12 mm/s	2 mm/s

* The table shows the approximate speeds of one cam unit connected to an electric hydraulic pump. If several cam units are connected to an electric hydraulic pump to obtain the speed of each, divide by the numer of cam units.
Example: 3 x 2018.11.01500.024 : 115 mm/s = 38 mm/s

** The control signal (24 V DC) triggers extension of the piston rod and the gas overpressure in the cam unit causes retraction.

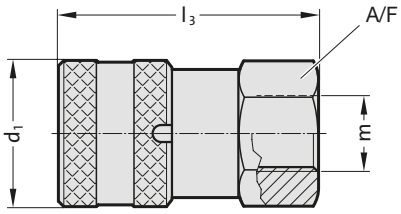
Electric hydraulic pump
Accessories
Quick-release couplings

2018.00.10.00.02.1 Quick-release coupling, male section



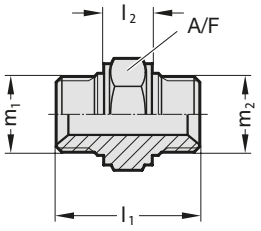
Order no	Nominal hose size	m	Max pressure / Cam Unit speed	l_1	l_2	A/F	*l
2018.00.10.00.02.1	DN 20	¾	0,8 m/s	86	63	1½	152

2018.00.10.00.02.2 Quick-release coupling, female section



Order no	Nominal hose size	m	Max pressure / Cam Unit speed	l_3	A/F	d_1	*l
2018.00.10.00.02.2	DN 20	¾	0,8 m/s	89	1¾	49	152

2018.00.26.02. Quick-release coupling, screw-in adapter (SK)



Order no	Nominal hose size	m_1	m_2	l_1	l_2	A/F
2018.00.26.02.01	DN20	¾	½	44,5	15	32
2018.00.26.02.02	DN20	¾	¾	46	15	32

m_1 = Coupling thread for Power Unit / Cam Unit

m_2 = Coupling thread for quick-release coupling male/female section

Check the press or Cam Unit speed before using the quick-release coupling.

Turn the ring to secure the coupling.

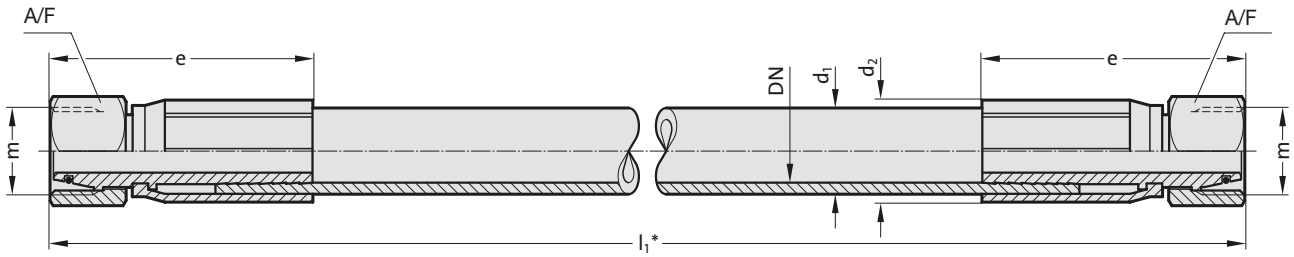
Do not open while the oil is still warm or under pressure.

Note:

Only for use with 2018.80.15000 electric hydraulic pump.

Accessories

2018.00.25.01. Hose with conical seals, union nut and O ring (straight/straight)



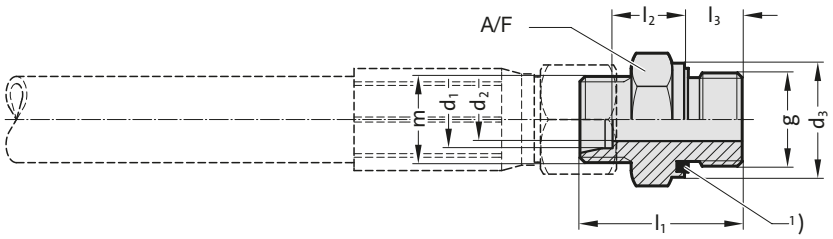
Dimension l_1 specified in the order, e. g. 765 mm, gives order no. 2018.00.25.01.XX.0765

Note: 45° and 90° elbow hoses are not available.
Instead use 2018.00.26.21./22. adapters.

2018.00.25.01. Hose with conical seals, union nut and O ring (straight/straight)

Order no	l_1	DN	Recommended for Power Unit size 2018.20.	Hose connector thread M with (24° cone)	d_1	d_2	e	A/F	Minimum bend radius	Shortest factory length
2018.00.25.01.01.	_ _ _ _	12	01500.	M24x1,5	24	28,5	63	30	90	150
2018.00.25.01.02.	_ _ _ _	20	04000.	M30x2	31	35	72	36	120	165
2018.00.25.01.03.	_ _ _ _	25	06000.	M36x2	38	44	88	46	150	200
			09000.	M36x2	38	44	88	46	150	200
2018.00.25.01.04.	_ _ _ _	32	15000.	M42x2	50	55	114	50	250	250

2018.00.26.03. Threaded connector, straight – G



1) Eolastic seal ED

2018.00.26.03. Threaded connector, straight – G

Order no	Nominal hose size	Hose connector thread m	Standard unit thread g	d_1	d_2	d_3	l_1	l_2	l_3	A/F
2018.00.26.03.01.01	DN 12	M24x1,5	G ½	16	12	27	41	18,5	14	27
2018.00.26.03.01.02	DN 12	M24x1,5	G ¾	16	12	32	45	20,5	16	32
2018.00.26.03.02.01	DN 20	M30x2	G ½	20	12	27	45	20,5	14	32
2018.00.26.03.02.02	DN 20	M30x2	G ¾	20	16	32	47	20,5	16	32
2018.00.26.03.02.04	DN 20	M30x2	G 1¼	20	16	50	53	22,5	20	50
2018.00.26.03.03.01	DN 25	M36x2	G ½	25	12	27	49	23	14	41
2018.00.26.03.03.02	DN 25	M36x2	G ¾	25	16	32	51	23	16	41
2018.00.26.03.03.03	DN 25	M36x2	G 1	25	20	40	53	23	18	41
2018.00.26.03.03.04	DN 25	M36x2	G 1¼	25	20	50	55	23	20	50
2018.00.26.03.04.03	DN 32	M42x2	G 1	30	20	40	55	23,5	18	46
2018.00.26.03.04.04	DN 32	M42x2	G 1¼	30	25	50	57	23,5	20	50

Ordering Code (example):

Threaded connector, straight	=	2018.00.26.03.
Nominal size DN 25	=	03.
Male thread G ½	=	01
Order no	=	2018.00.26.03.03.01

Flex Cam
Accessories
Connecting hoses and connectors

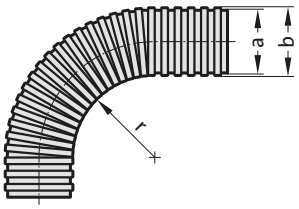
2018.00.25.00.01. Anti-scuff hose

Order no	l in m	DN	a	b	r
2018.00.25.00.01.01.01	1	12	26,6	34,5	180
2018.00.25.00.01.01.02	2	12	26,6	34,5	180
2018.00.25.00.01.01.03	3	12	26,6	34,5	180
2018.00.25.00.01.01.05	5	12	26,6	34,5	180
2018.00.25.00.01.02.01	1	20	33,9	42,6	200
2018.00.25.00.01.02.02	2	20	33,9	42,6	200
2018.00.25.00.01.02.03	3	20	33,9	42,6	200
2018.00.25.00.01.02.05	5	20	33,9	42,6	200
2018.00.25.00.01.03.01	1	25	45,1	54,5	240
2018.00.25.00.01.03.02	2	25	45,1	54,5	240
2018.00.25.00.01.03.03	3	25	45,1	54,5	240
2018.00.25.00.01.03.05	5	25	45,1	54,5	240
2018.00.25.00.01.04.01	1	32	64,3	80,3	235
2018.00.25.00.01.04.02	2	32	64,3	80,3	235
2018.00.25.00.01.04.03	3	32	64,3	80,3	235
2018.00.25.00.01.04.05	5	32	64,3	80,3	235

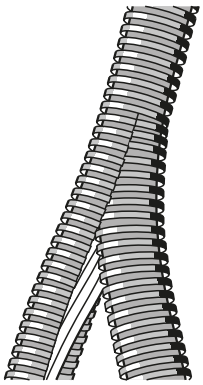
2018.00.25.00.01.

Anti-scuff hose

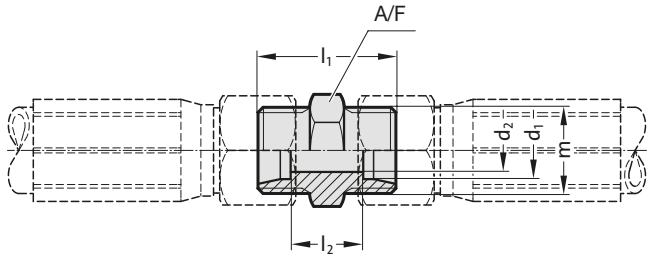
for subsequent installation over hose



Material:
polyamide black



2018.00.26.25.
Adapter straight, hose – hose

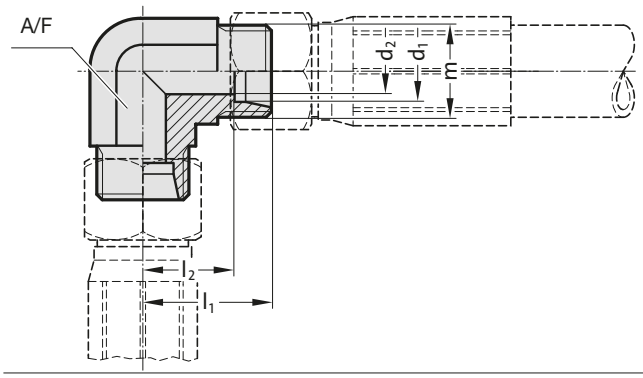


2018.00.26.25. Adapter straight, hose – hose

Order no	DN*	Hose connector thread m	d_1	d_2	l_1	l_2	A/F
2018.00.26.25.01	DN 12	M24x1,5	16	12	38	21	27
2018.00.26.25.02	DN 20	M30x2	20	16	44	23	31
2018.00.26.25.03	DN 25	M36x2	25	20	50	26	41
2018.00.26.25.04	DN 32	M42x2	30	25	54	27	46

* DN = clear width of hose

2018.00.26.26.
90° adapter, hose – hose

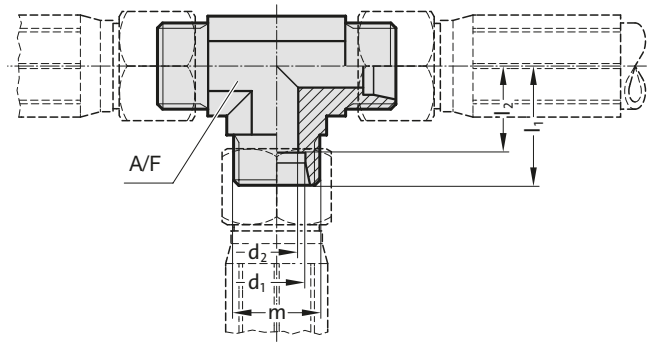


2018.00.26.26. 90° adapter, hose – hose

Order no	DN*	Hose connector thread m	d_1	d_2	l_1	l_2	A/F
2018.00.26.26.01	DN 12	M24x1,5	16	12	33	24,5	24
2018.00.26.26.02	DN 20	M30x2	20	16	37	26,5	27
2018.00.26.26.03	DN 25	M36x2	25	20	42	30	36
2018.00.26.26.04	DN 32	M42x2	30	25	49	35,5	41

* DN = clear width of hose

2018.00.26.27. T-adapter, hose – hose

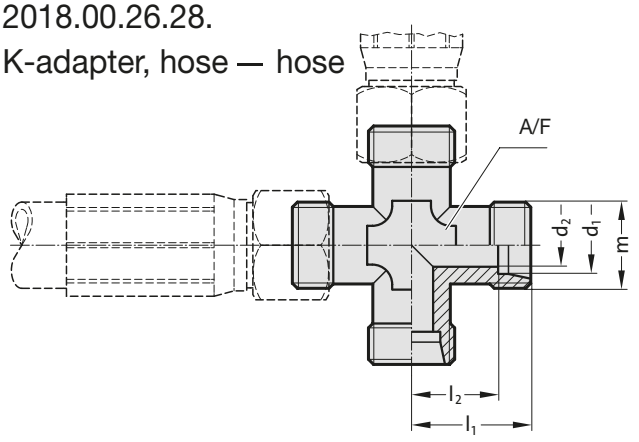


2018.00.26.27. T-adapter, hose – hose

Order no	DN*	Hose connector thread m	d_1	d_2	l_1	l_2	A/F
2018.00.26.27.01	DN 12	M24x1,5	16	12	33	24,5	24
2018.00.26.27.02	DN 20	M30x2	20	16	37	26,5	27
2018.00.26.27.03	DN 25	M36x2	25	20	42	30	36
2018.00.26.27.04	DN 32	M42x2	30	25	49	35,5	41

* DN = clear width of hose

2018.00.26.28.
K-adapter, hose — hose

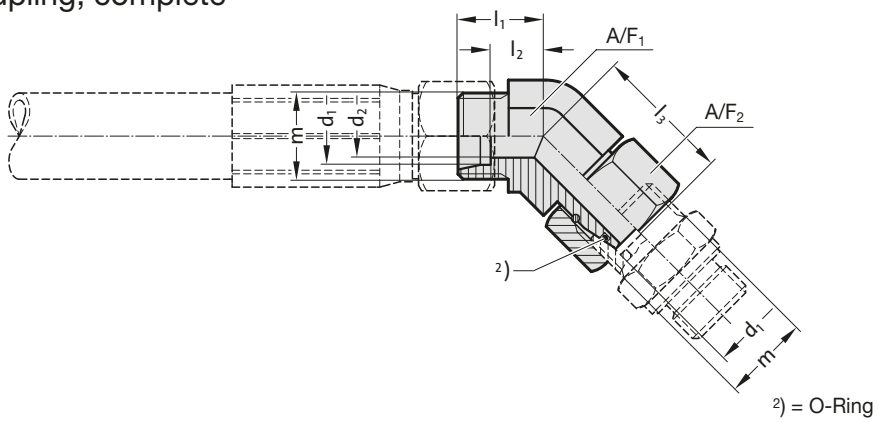


2018.00.26.28. K-adapter, hose – hose

Order no	DN*	Hose connector thread m	d_1	d_2	l_1	l_2	A/F
2018.00.26.28.01	DN 12	M24x1,5	16	12	33	24,5	24
2018.00.26.28.02	DN 20	M30x2	20	16	37	26,5	27
2018.00.26.28.03	DN 25	M36x2	25	20	42	30	36
2018.00.26.28.04	DN 32	M42x2	30	25	49	35,5	41

* DN = clear width of hose

2018.00.26.21. 45° swivel coupling, complete



2) = O-Ring

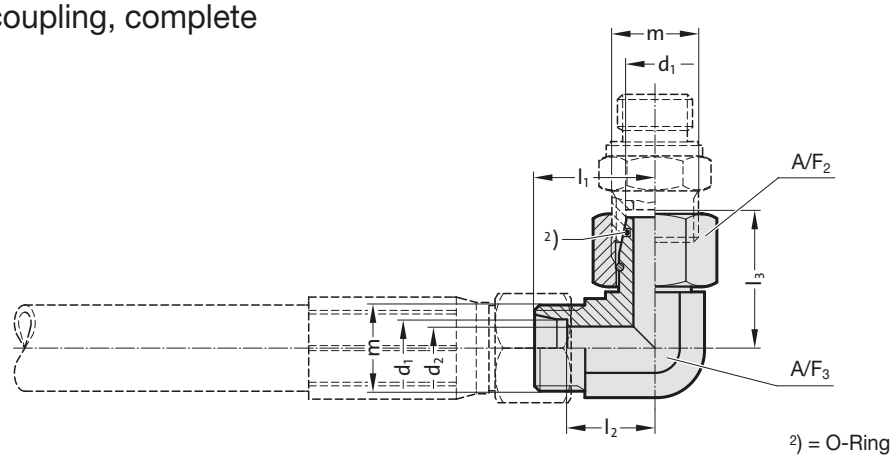
2018.00.26.21. 45° swivel coupling, complete

Order no	Nominal hose size	Hose connector thread m	d_1	d_2	l_1	l_2	l_3	A/F$_1$	A/F$_2$
2018.00.26.21.01	DN 12	M24x1,5	16	12	24	15,5	36,5	27	30
2018.00.26.21.02	DN 20	M30x2	20	16	26,5	16	44,5	30	36
2018.00.26.21.03	DN 25	M36x2	25	20	30,5	18,5	50	36	46
2018.00.26.21.04	DN 32	M42x2	30	25	37	23,5	55	50	50

Ordering Code (example):

45° swivel coupling	=	2018.00.26.21.
Nominal size DN 25	=	03
Order no	=	2018.00.26.21.03

2018.00.26.22. 90° swivel coupling, complete



2) = O-Ring

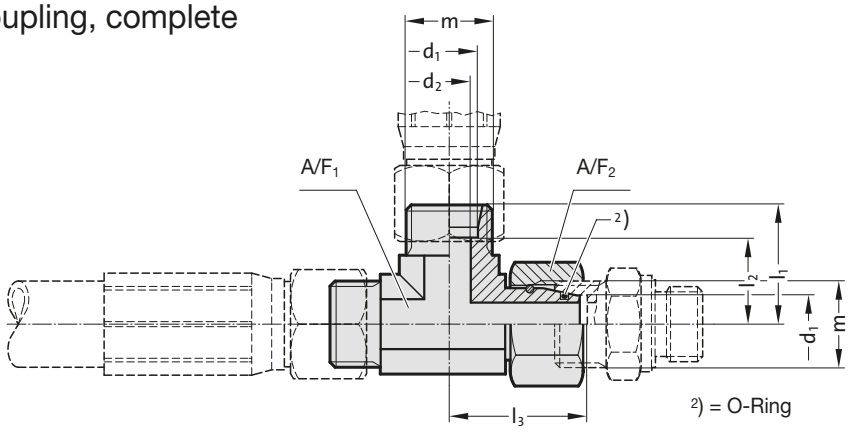
2018.00.26.22. 90° swivel coupling, complete

Order no	Nominal hose size	Hose connector thread m	d_1	d_2	l_1	l_2	l_3	A/F$_1$	A/F$_2$
2018.00.26.22.01	DN 12	M24x1,5	16	12	33	24,5	36,5	24	30
2018.00.26.22.02	DN 20	M30x2	20	16	37	26,5	44,5	27	36
2018.00.26.22.03	DN 25	M36x2	25	20	42	30	50	36	46
2018.00.26.22.04	DN 32	M42x2	30	25	49	35,5	55	41	50

Ordering Code (example):

90° swivel coupling	=	2018.00.26.22
Nominal size DN 25	=	03
Order no	=	2018.00.26.22.03

2018.00.26.23. L swivel coupling, complete



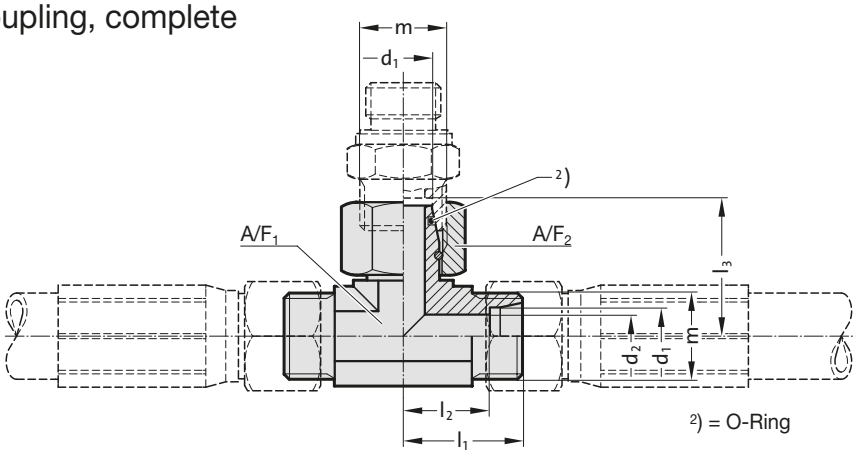
2018.00.26.23. L swivel coupling, complete

Order no	Nominal hose size	Hose coupling thread m	d_1	d_2	l_1	l_2	l_3	A/F_1	A/F_2
2018.00.26.23.01	DN 12	M24x1,5	16	12	33	24,5	36,5	24	30
2018.00.26.23.02	DN 20	M30x2	20	16	37	26,6	44,5	27	36
2018.00.26.23.03	DN 25	M36x2	25	20	42	30	50	36	46
2018.00.26.23.04	DN 32	M42x2	30	25	49	35,5	55	41	50

Ordering Code (example):

L swivel coupling	=	2018.00.26.23.
Nominal size DN 25	=	03
Order no	=	2018.00.26.23.03

2018.00.26.24. T swivel coupling, complete



2018.00.26.24. T swivel coupling, complete

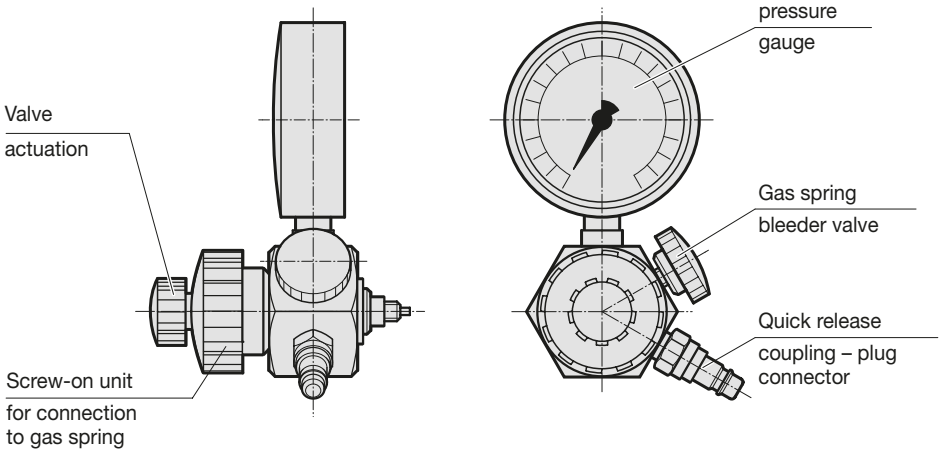
Order no	Nominal hose size	Hose coupling thread m	d_1	d_2	l_1	l_2	l_3	A/F_1	A/F_2
2018.00.26.24.01	DN 12	M24x1,5	16	12	33	24,5	36,5	24	30
2018.00.26.24.02	DN 20	M30x2	20	16	37	26,6	44,5	27	36
2018.00.26.24.03	DN 25	M36x2	25	20	42	30	50	36	46
2018.00.26.24.04	DN 32	M42x2	30	25	49	35,5	55	41	50

Ordering Code (example):

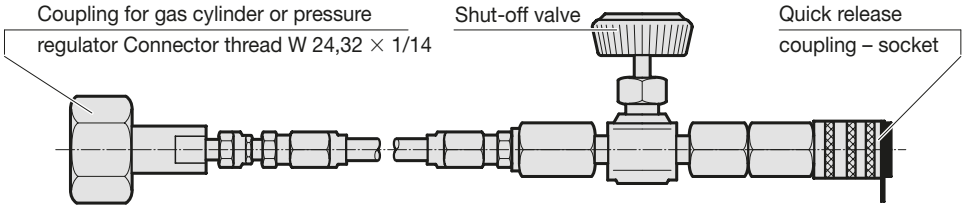
T swivel coupling	=	2018.00.26.24.
Nominal size DN 25	=	03
Order no	=	2018.00.26.24.03

Flex Cam – Accessories
Filling and Control Fitting, Filling hose
Charging Adapter

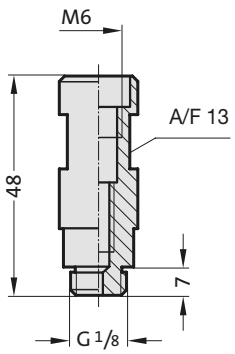
2480.00.32.21 Filling and control fitting



2480.00.31.02 Filling hose



2480.00.32.11 Charging adapter



Description:

The filling and control fitting 2480.00.32.21 is used to fill, vary the pressure setting (e.g. when testing tools) and measure the gas pressure.

The coupling enables the filling hose to be connected directly to the gas cylinder valve or the pressure regulator.

If the fitting is used solely for checking purposes, a simplified arrangement not connected to the gas cylinder is also possible.

Closing the shut-off valve of the filling hose enables the filling to be used to measure the charging pressure in the accumulator / Cam Unit, without detaching the hose.

For constant gas monitoring, we recommend connecting a control fitting 2480.00.30. or 2480.00.31.

The adapter which is required for filling the power/cam units (2480.00.32.11) comes as standard with the filling and control fitting (2480.00.32.21).

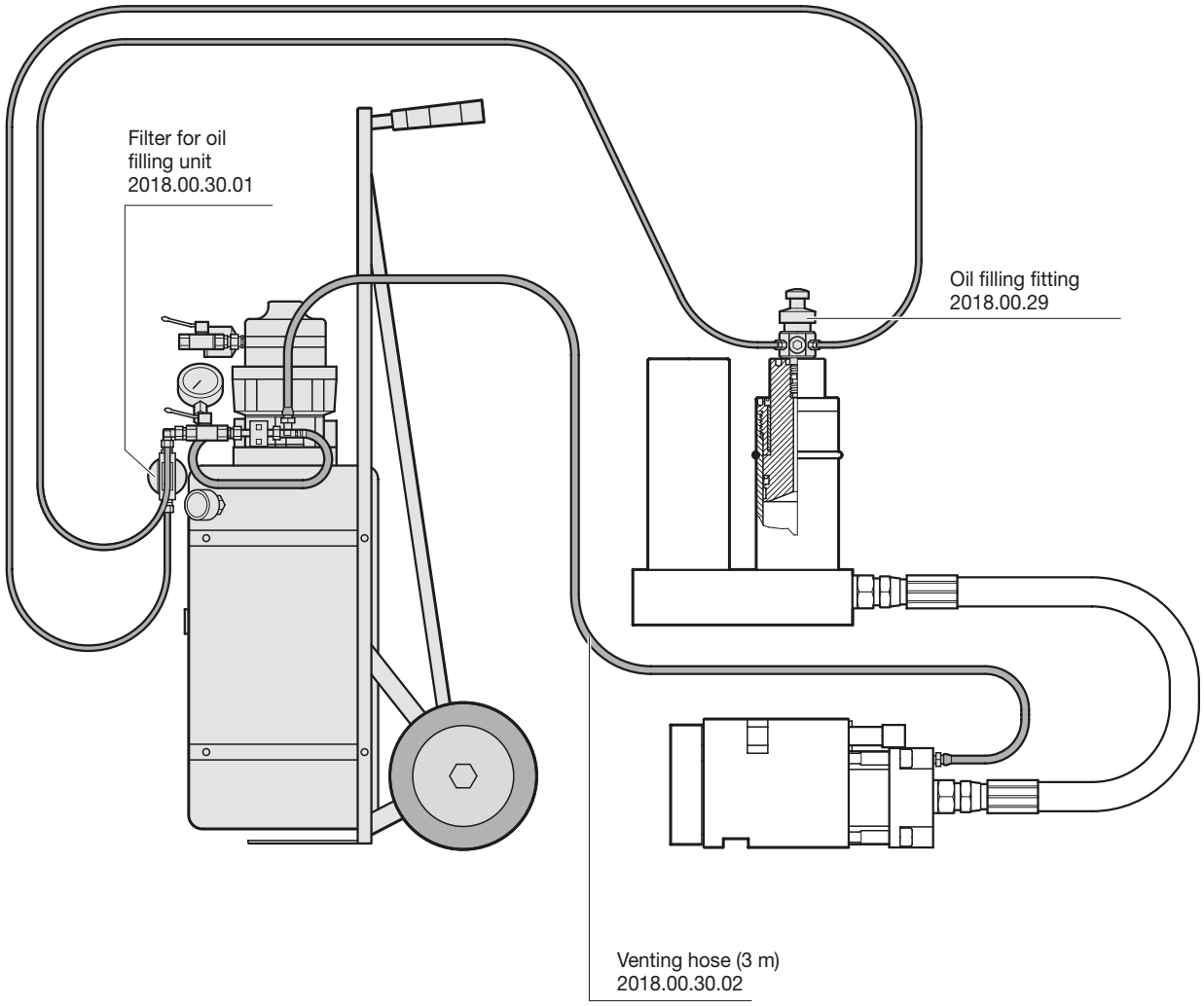
Note:

2480.00.31.02 Filling hose 2 m long with quick release coupling, shut-off valve and gas bottle connector (order separately).

Other filling hose lengths to order.

Flex Cam – Accessories
Oil filling unit
Oil filling fitting

2018.00.30
Oil filling unit



Scope of supply:

Filter	2018.00.30.01
Venting hose	2018.00.30.02
Oil filling fitting	2018.00.29

Description:

The oil filling unit 2018.00.30 is used to fill the system with hydraulic oil DIN 51524 HVLP ISO VG32.

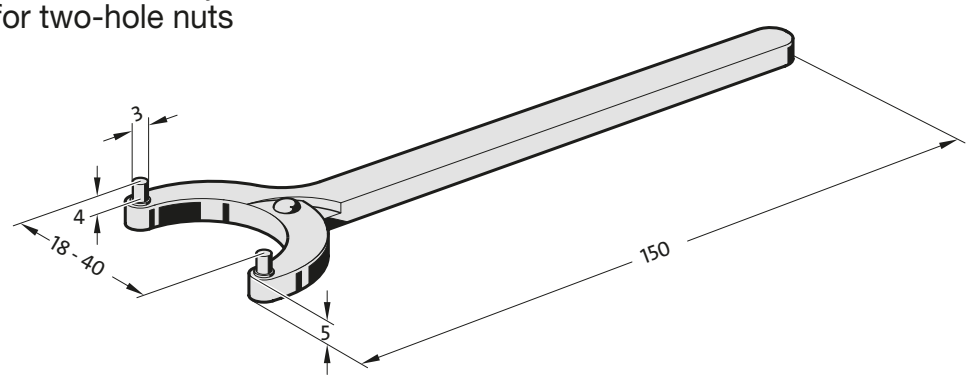
Order no		
280.37.032.01	(1 Liter)	Hydraulic oil UNIVIS N 32
280.37.032.05	(5 Liters)	Hydraulic oil UNIVIS N 32

Precise instructions on filling the system with oil and gas are given in the user manual supplied with the system.

FIBRO

2018.00.20.1840.03

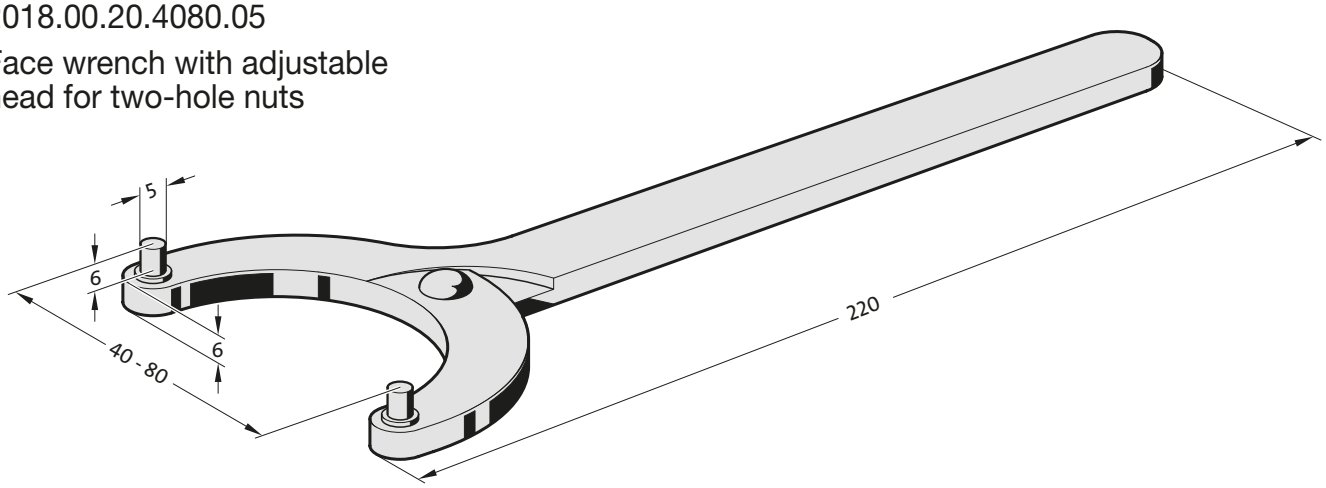
Face wrench with adjustable head for two-hole nuts



Used by Power Unit	Number
	2018.20.01500.
	2018.20.04000.

2018.00.20.4080.05

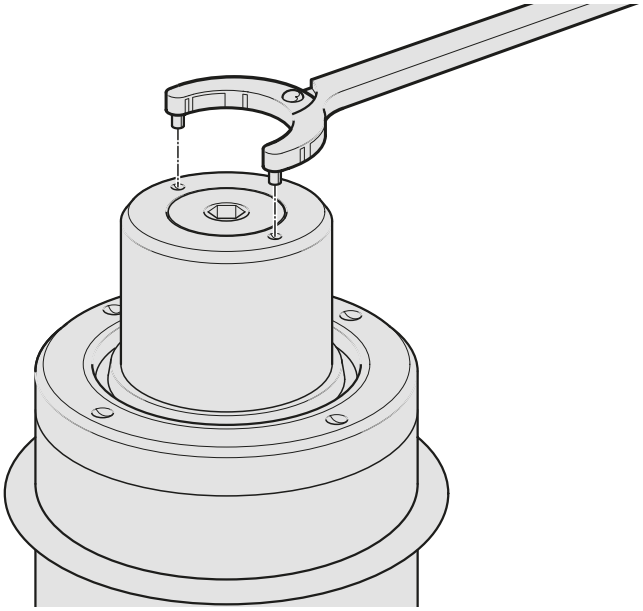
Face wrench with adjustable head for two-hole nuts



Used by Power Unit	Number
	2018.20.06000.
	2018.20.09000.
	2018.20.15000.

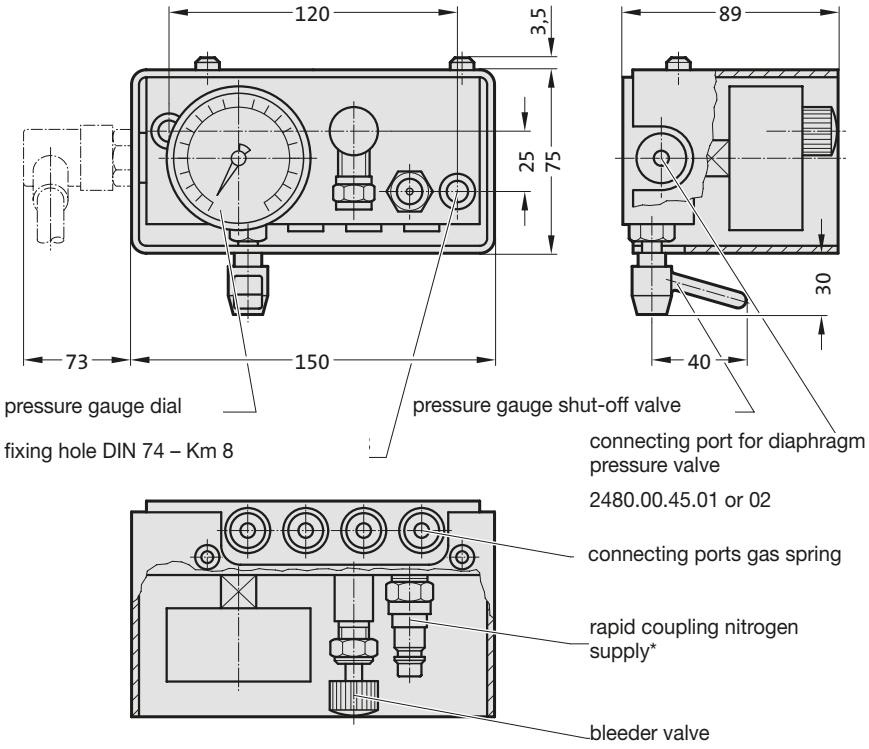
Material:

Special steel, burnished.



Flex Cam
Accessories
Control Armature for Gas Springs

2480.00.30.01 without pressure switch, without pressure relief
2480.00.30.02 with pressure switch, without pressure relief
2480.00.30.03 without pressure switch, with pressure relief
2480.00.30.04 with pressure switch, with pressure relief



Description:

The control armature 2480.00.30.01/03 serves to control the charge presure of up to eight connected gas springs.

Pressure checks during operation can be effected in two ways:

a) by visual monitoring of the gauge dials

b) automatically, by means of diaphragm pressure switch 248.00.15 The switch will stop the associated machine as soon as the charge pressure drops below the value set.

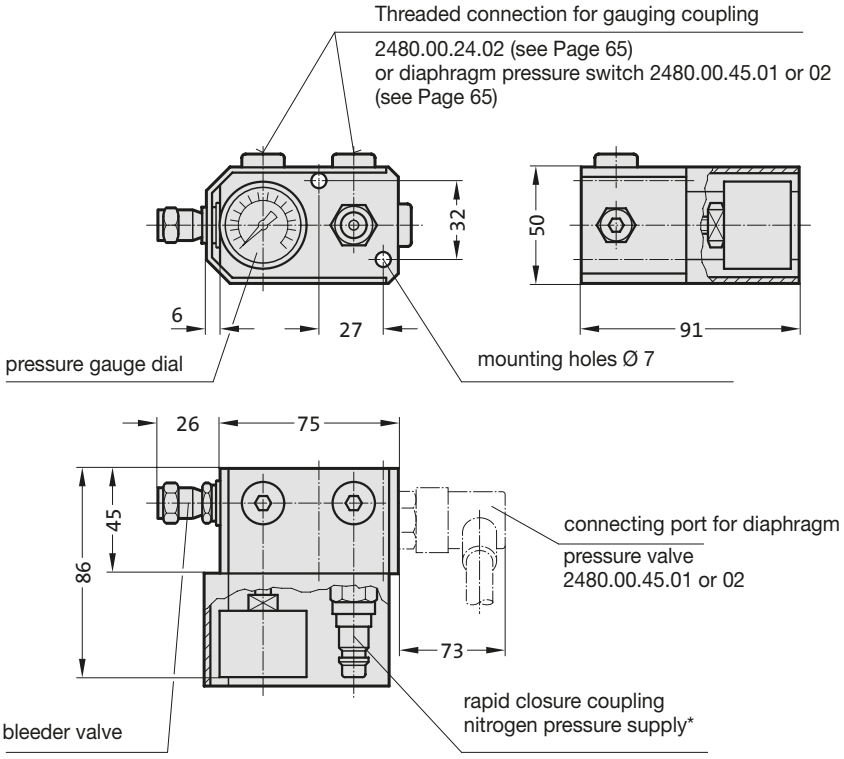
Note:

The shut-off valve may be open or closed during operation.

The closing of the pressure gauge shut-off valve ensures that no pressure peaks from the gas spring act on the pressure gauge.

* 2-m filler hose with rapid coupling and connector for gas bottle Order No. 2480.00.31.02 (to be ordered separately)

2480.00.31.01 without pressure switch
2480.00.31.06 with pressure switch
2480.00.31.07 without pressure switch, with pressure relief

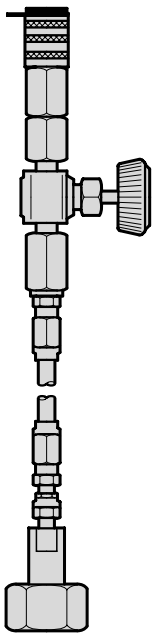


Description:

The control armature 2480.00.31.01 performs the same function as the control armature 2480.00.30.01.

Note:

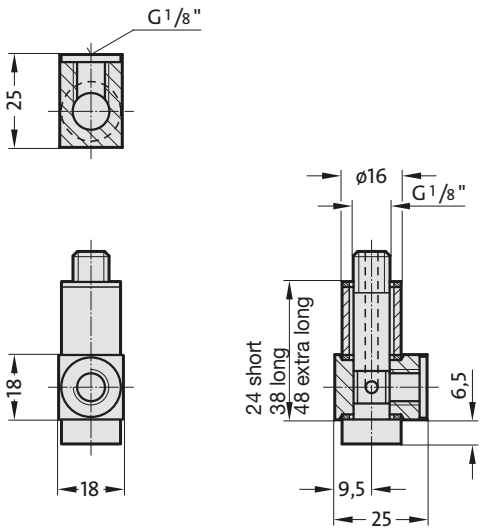
* 2-m filler hose with rapid coupling and connector for gas bottle 2480.00.31.02 (to be ordered separately)



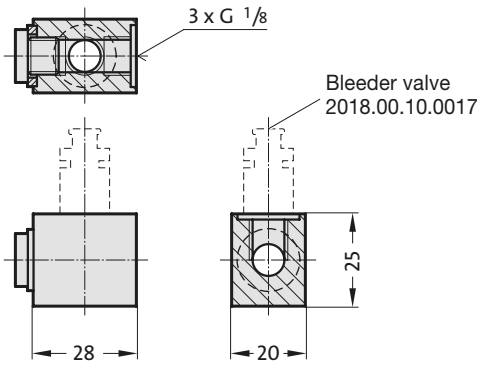
Flex Cam
Compound Threaded Joints

2480.00.24.16 long
2480.00.24.17 short
2480.00.24.18 extra-long

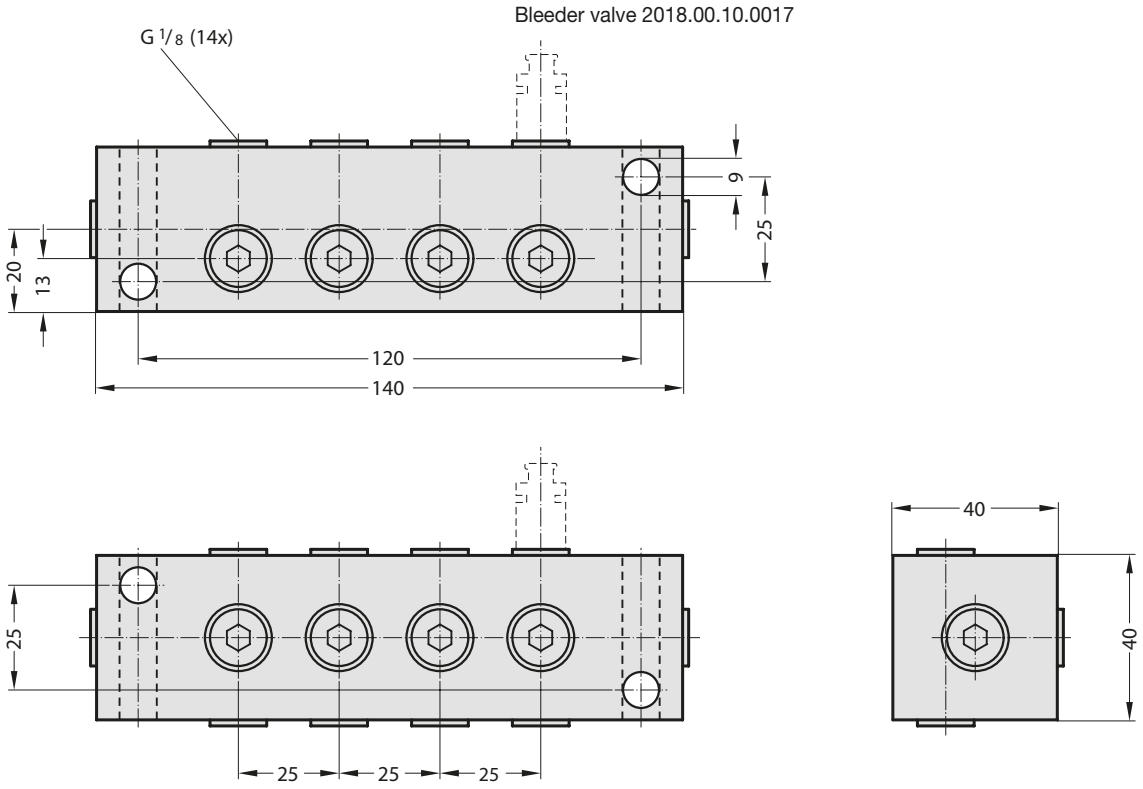
Simple adapters for connecting Hydraulic Cams



2480.00.24.30
Coupling



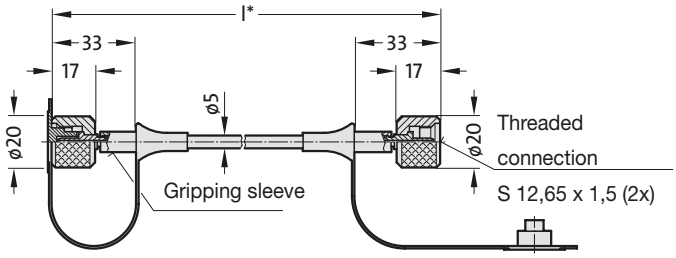
2480.00.24.33
Distributor



Flex Cam
Accessories
Compound Threaded Joints

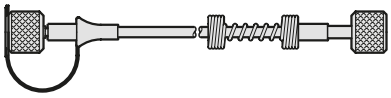
2480.00.23.01.

Gauging hose – both ends straight



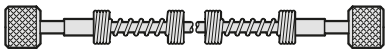
2480.00.23.01. _ _ _ _ .1

Antikink coil, at one end



2480.00.23.01. _ _ _ _ .2

Antikink coil, at both ends



2480.00.23.01. Gauging hose – both ends straight

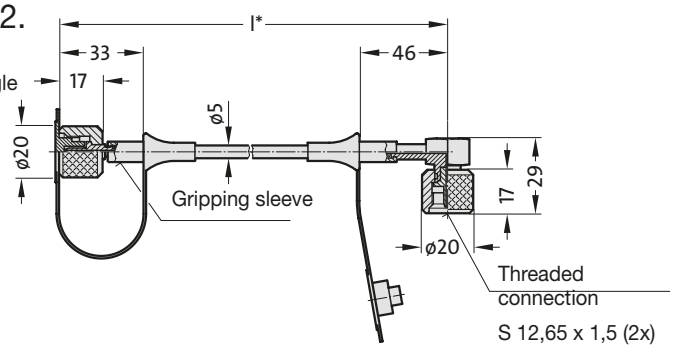
Order no		l*
2480.00.23.01.	0200	0200
2480.00.23.01.	0300	0300
2480.00.23.01.	0400	0400
2480.00.23.01.	0500	0500
2480.00.23.01.	0630	0630
2480.00.23.01.	0800	0800
2480.00.23.01.	1000	1000
2480.00.23.01.	1200	1200
2480.00.23.01.	1500	1500
2480.00.23.01.	2000	2000
2480.00.23.01.	2500	2500
2480.00.23.01.	3000	3000

* other lengths available from 90 mm upwards, in 5 mm steps.

without antikink protection:	90 mm
antikink protection at one end:	150 mm
antikink protection at both ends:	300 mm

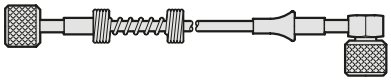
2480.00.23.02.

Gauging hose – one end straight 90°-angle



2480.00.23.02. _ _ _ _ .1

Antikink coil, at one end, straight

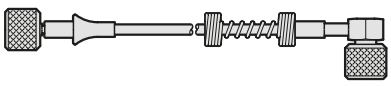


2480.00.23.02. _ _ _ _ .2

Antikink coil, at both ends

2480.00.23.02. _ _ _ _ .3

Antikink coil at one end 90°



2480.00.23.02. Gauging hose – one end straight 90°-angle

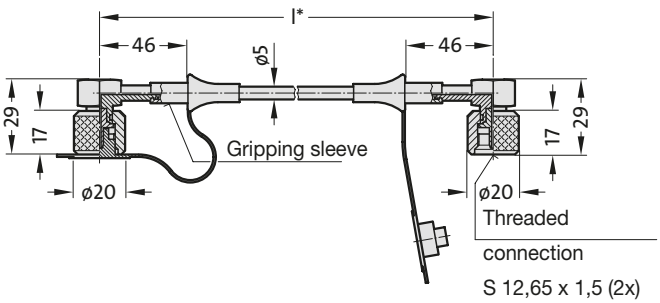
Order no		l*
2480.00.23.02.	0200	0200
2480.00.23.02.	0300	0300
2480.00.23.02.	0400	0400
2480.00.23.02.	0500	0500
2480.00.23.02.	0630	0630
2480.00.23.02.	0800	0800
2480.00.23.02.	1000	1000
2480.00.23.02.	1200	1200
2480.00.23.02.	1500	1500
2480.00.23.02.	2000	2000
2480.00.23.02.	2500	2500
2480.00.23.02.	3000	3000

* other lengths available from 90 mm upwards, in 5 mm steps.

without antikink protection:	90 mm
antikink protection at one end:	150 mm
antikink protection at both ends:	300 mm

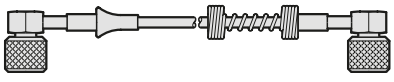
2480.00.23.03.

Gauging hose – both ends 90°-angle



2480.00.23.03. _ _ _ _ .3

Antikink coil, at one end



2480.00.23.03. _ _ _ _ .2

Antikink coil, at both ends

2480.00.23.03. Gauging hose – both ends 90°-angle

Order no		l*
2480.00.23.03.	0200	0200
2480.00.23.03.	0300	0300
2480.00.23.03.	0400	0400
2480.00.23.03.	0500	0500
2480.00.23.03.	0630	0630
2480.00.23.03.	0800	0800
2480.00.23.03.	1000	1000
2480.00.23.03.	1200	1200
2480.00.23.03.	1500	1500
2480.00.23.03.	2000	2000
2480.00.23.03.	2500	2500
2480.00.23.03.	3000	3000

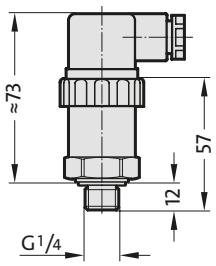
* other lengths available from 105 mm upwards, in 5 mm steps.

without antikink protection:	105 mm
antikink protection at one end:	150 mm
antikink protection at both ends:	300 mm

Flex Cam – Accessories
Diaphragm Pressure Switch
Gauging coupling

2480.00.45.01 50-250 bar for accumulator/ Compact Cams

2480.00.45.02 10-80 bar for cam unit



Technical Data of Diaphragm Pressure Switch

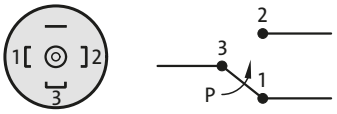
2480.00.45.01

switching range, adjustable	50–250 bar
switching tolerance	±5 bar
overpressure protection	350 bar
voltage (max.)	250 V

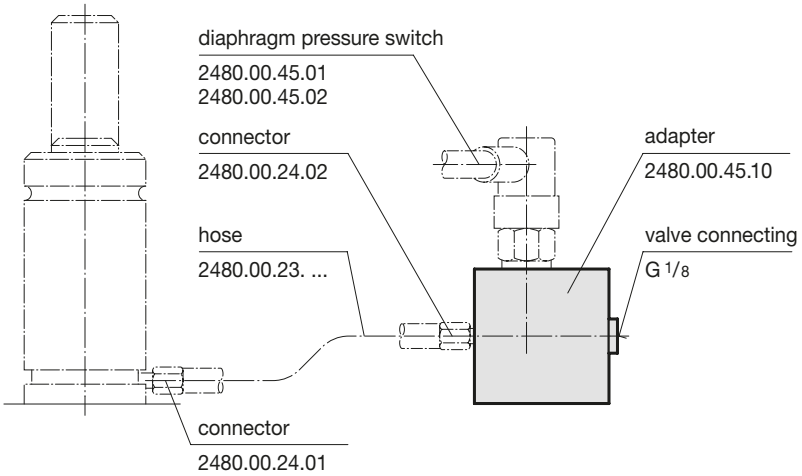
2480.00.45.02

switching range, adjustable	10–80 bar
switching tolerance	±1,6 bar
overpressure protection	350 bar
voltage (max.)	250 V

Circuit diagram for diaphragm pressure switch

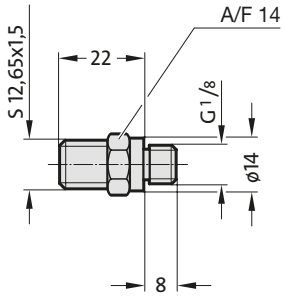


Installation Example:



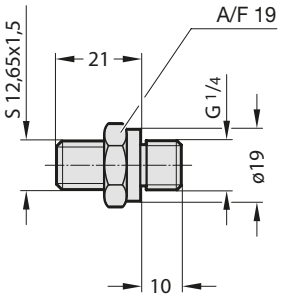
2480.00.24.01

Gauging coupling with valve for connection to accumulator/cam unit



2480.00.24.02

Gauging coupling with valve for connection to control armature

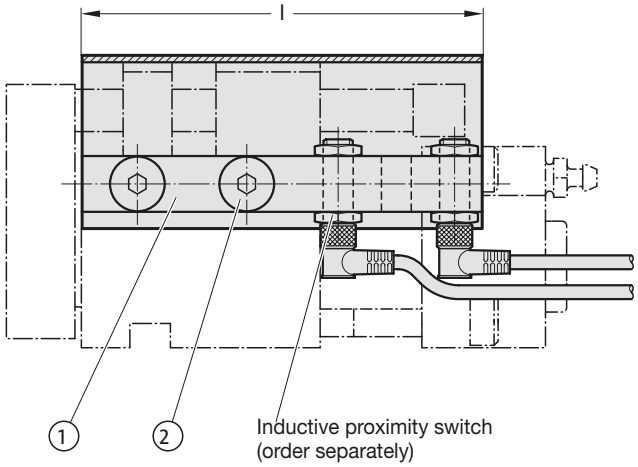


Flex Cam
Accessories

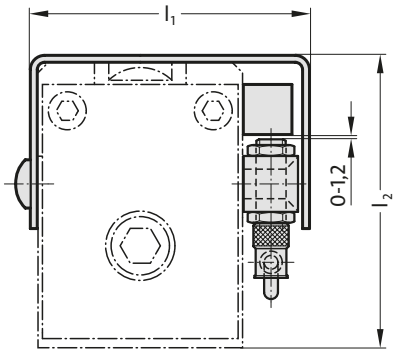
2018.00.60.
Sensor mounting kit for Compact Cam 2018.11.

Description:
The sensor mounting kit with inductive proximity switch (order separately) is used to monitor the end travel positions of the Compact Cam. Both hub positions full extension and full retraction can be monitored.

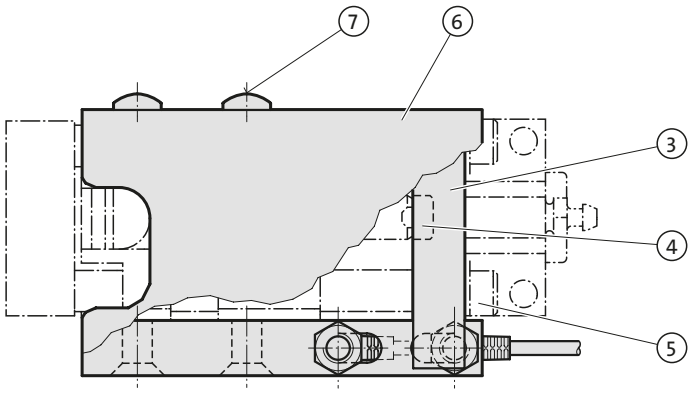
The accuracy of adjustment is ±1 mm.



Inductive proximity switch
(order separately)



Mounting optional left or right



Item	Designation	Number
1	Mounting bracket	1
2	Screw	2
3	Activator flag	1
4	Centering washer*	1 or 2
5	Screw	2
6	Cover plate	1
7	Screw	2

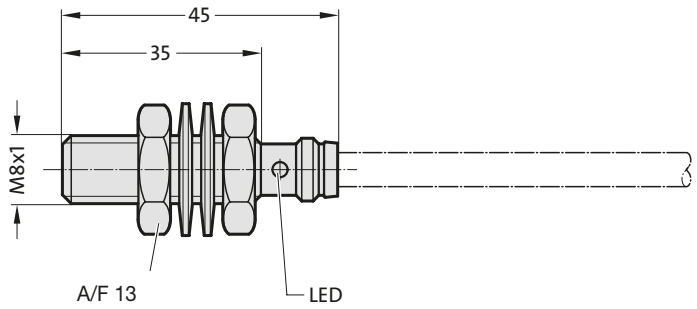
* not for 2018.11.09000.

2480.00.60. Sensor mounting kit for Compact Cam 2018.11.

Order no	l	l_1	l_2	For Compact Cam
2018.00.60.01500.024	115	81	84	2018.11.01500.024
2018.00.60.01500.049	165	81	84	2018.11.01500.049
2018.00.60.04000.024	168	117	107	2018.11.04000.024
2018.00.60.04000.049	193	117	107	2018.11.04000.049
2018.00.60.04000.099	271	117	107	2018.11.04000.099
2018.00.60.06000.024	171	142	135	2018.11.06000.024
2018.00.60.06000.049	196	142	135	2018.11.06000.049
2018.00.60.06000.099	271	142	135	2018.11.06000.099
2018.00.60.09000.024	216	170	172	2018.11.09000.024
2018.00.60.09000.049	241	170	172	2018.11.09000.049
2018.00.60.09000.099	316	170	172	2018.11.09000.099
2018.00.60.15000.024	216	182	207	2018.11.15000.024
2018.00.60.15000.049	241	182	207	2018.11.15000.049
2018.00.60.15000.099	316	182	207	2018.11.15000.099

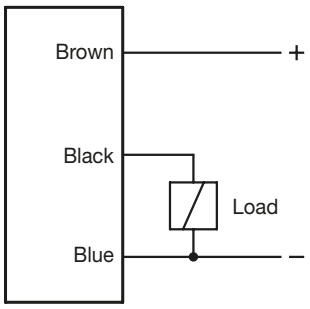
2018.00.60.08.045

Inductive proximity switch



Technical data

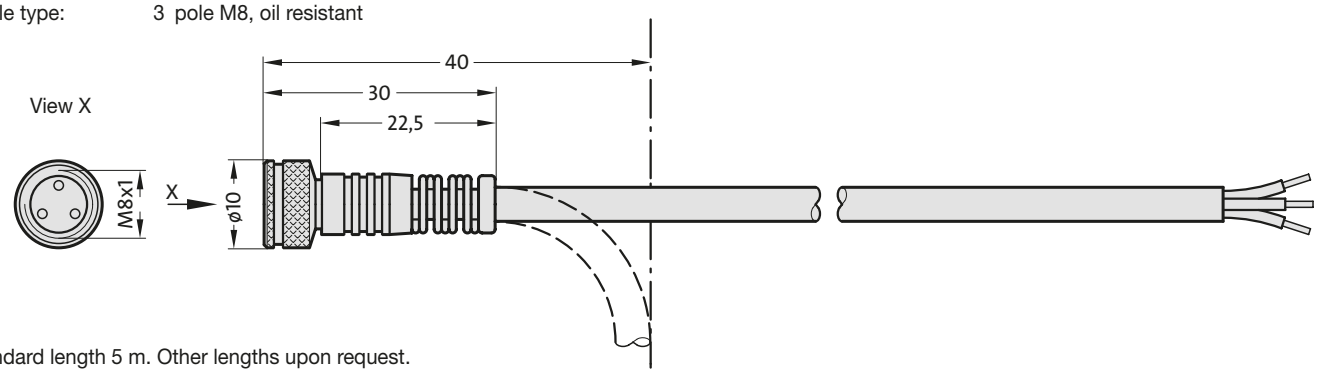
Item	
Rated operating voltage U_e	24 V DC
Operating voltage Us	10-30 V DC
Idle current I_o Damped	9 mA
Repeat accuracy R	≤5%
Ambient temperature T_a	–25 bis +70°C
Switching frequency f	1500 Hz
Protection to IEC 529	IP 68
Casing material	Steel stainless
Connection	connector
Approval	UL



2018.00.60.23.01.5

Connection cable – straight

Cable type: 3 pole M8, oil resistant

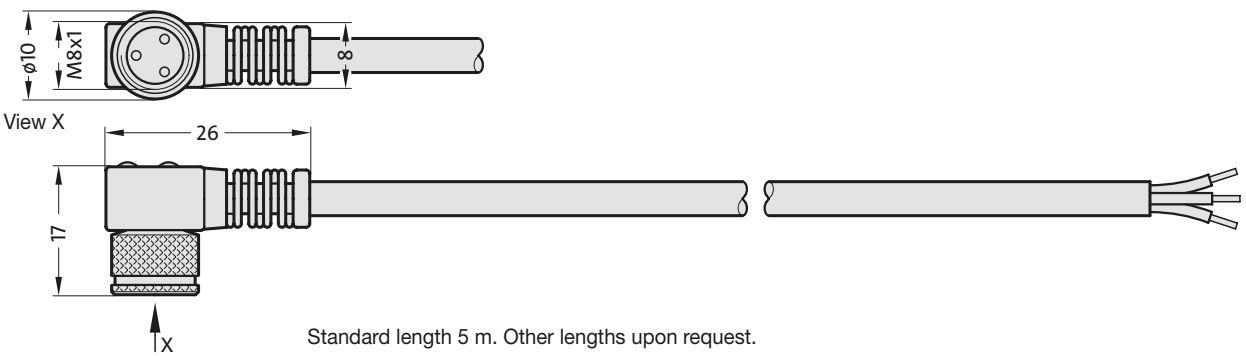


Standard length 5 m. Other lengths upon request.

2018.00.60.23.02.5

Connection cable 90°

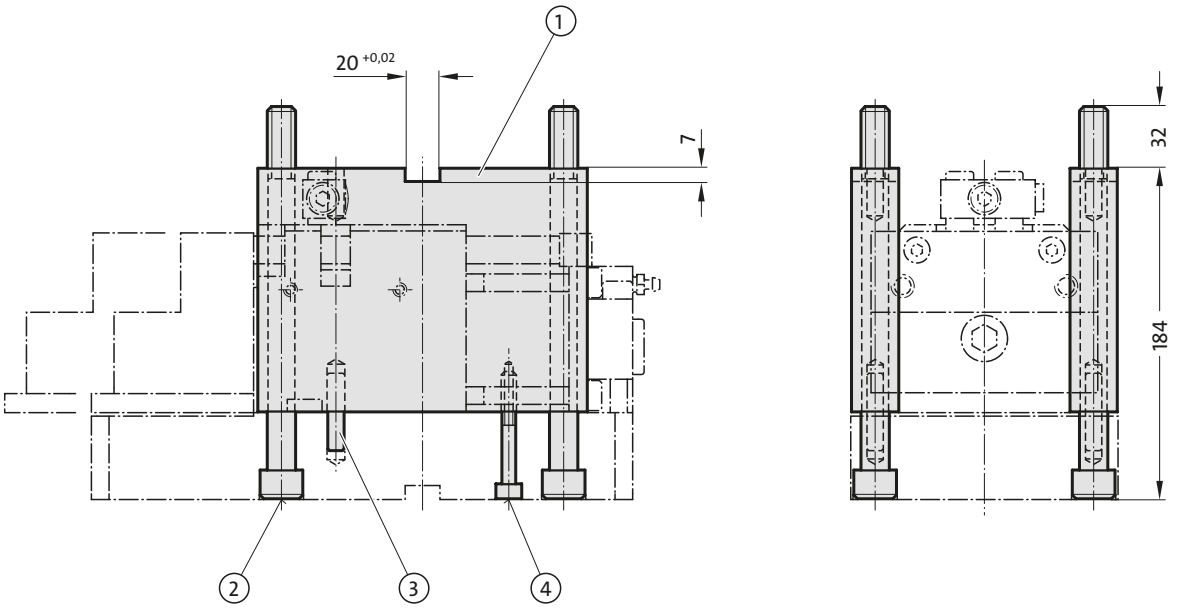
Cable type: 3 pole M8, oil resistant

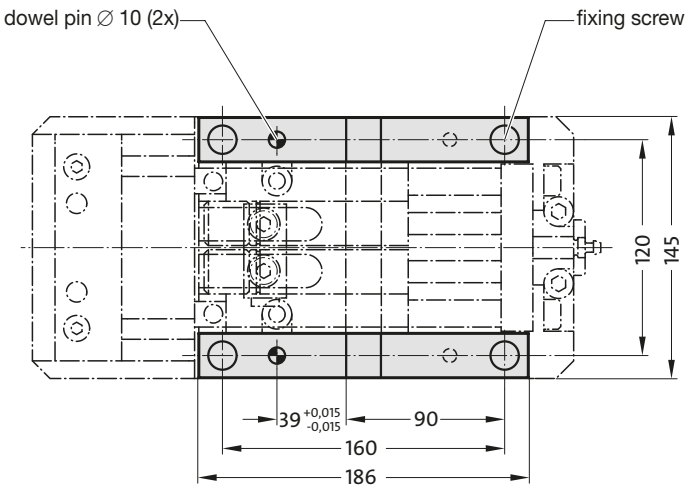


Standard length 5 m. Other lengths upon request.

Flex Cam
Accessories

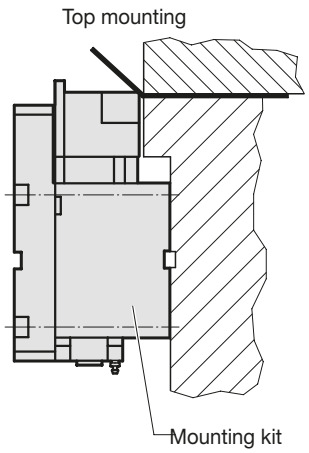
2018.12.01.04000.049
Top mounting for Flange Cam 2018.12.

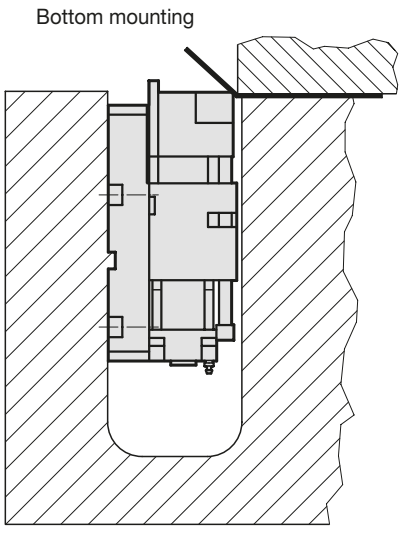




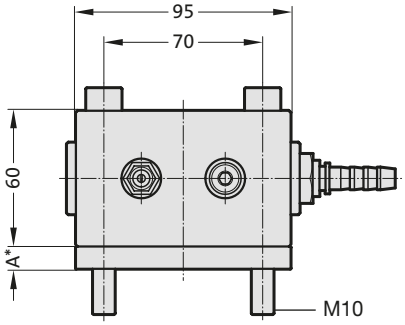
Item	Designation	Number
1	Spacer	2
2	M16×200 Screw	4
3	∅10×40 Dowel pin	2
4	Screw M8×60	2

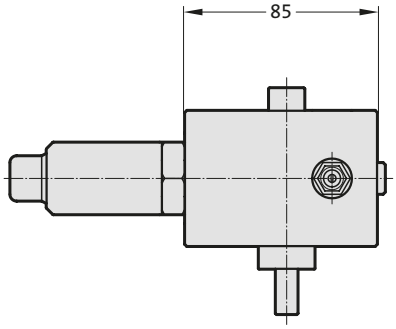
Installation example for Flange Cam

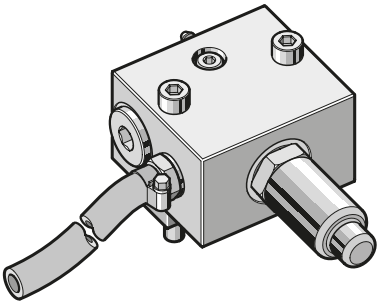




2018.27.01. Safety module

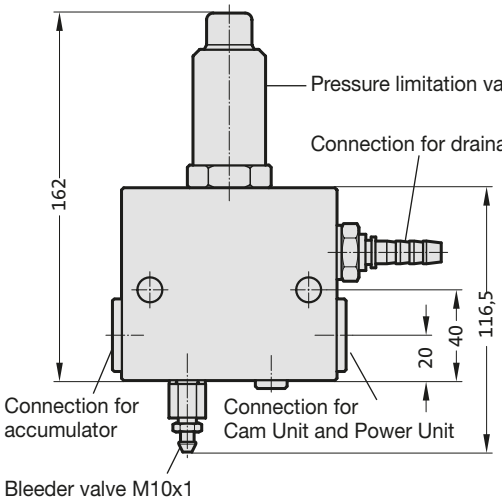






If a malfunction occurs in the primary unit, the system pressure can be released manually on the oil side via the discharge valve in the safety module 2018.27.01.

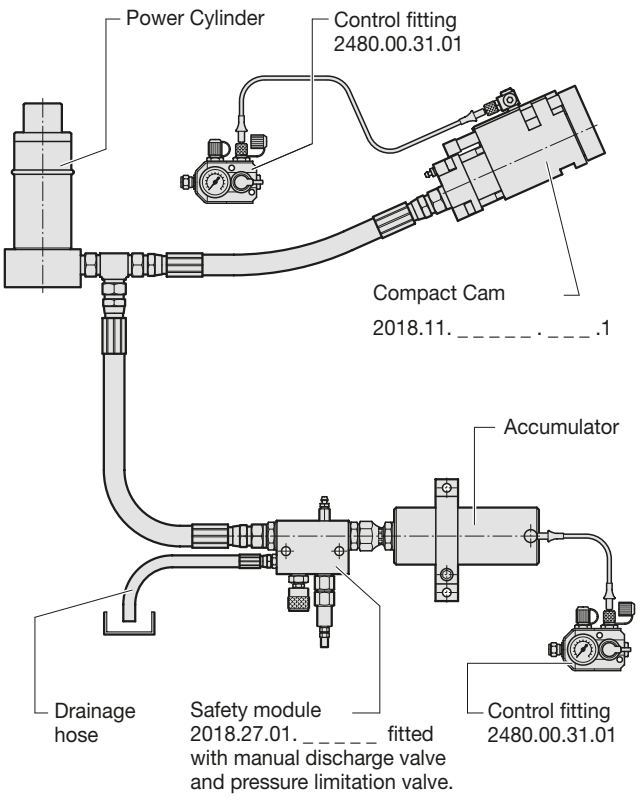
A pressure limitation valve releases the oil pressure if the limit set is exceeded.

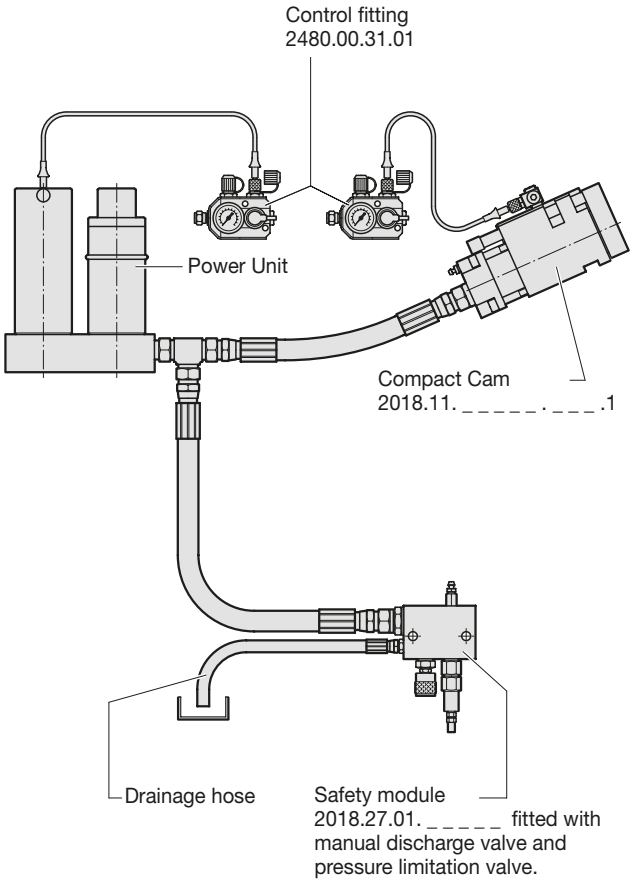


Order no	For Power Unit size 2018.25	A*	recommended nominal hose size
2018.27.01.01500	01500.	10	DN 12
2018.27.01.04000	04000.	22,5	DN 20
2018.27.01.06000	06000.	32,5	DN 25
2018.27.01.09000	09000.	40	DN 25
2018.27.01.15000	15000.	70	DN 32

* allow distance for assembly with accumulator

Installation example for safety module





Use part number 2018.25. _ _ _ _ _ . _ _ _ to order Power Cylinder and Accumulator together

Flex Cam
Safety label

We recommend that the safety warning should be located in a clearly visible position on the toll when hydraulic cam systems are fitted.

FIBRO

Geber-Nehmer-System / Flex Cam / Système maître-cylindre / cylindre récepteur

Werkzeugbauer / Tool maker / Fabricant d'outillage				
Tag der Erstinstallation /Date of first installation / Jour de la première installation				
Werkzeugnummer / Tool number / Numéro d'outil				
max. Hübe / strokes / Nombre de courses / min.				
	Type	genutzter Hub (mm) / Stroke used (mm) / Course utile (mm)	Anzahl der Einheiten / Number of units / Nombre d'unités	Fülldruck (bar) / Pressure (bar) / Pression de remplissage (bars)
Gebereinheit / Primar y unit / Unité maître cylindr e				
Nehmereinheit / Secondar y unit / Unité cylindre récepteu				
	Type	Länge / Lenght / Longueur (mm)	Anzahl / Number / Nombre	
Schlauchverbindungen / Hose connections / Liaisons par tuyaux flexibles				
Achtung! Hoher Druck / **Warning!** High pressure / **Attention !** Haute pression	Vor Wartung und Arbeiten an dem Geber-Nehmer-System unbedingt Benutzerhandbuch lesen! / ALWAYS read the User Manual before working on or with this flex cam system. / Avant de procéder à l'entretien et d'effectuer des travaux sur le système maître cylindre/cylindre récepteur, lire absolument le manuel à l'usage de l'utilisateur !			

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Order no

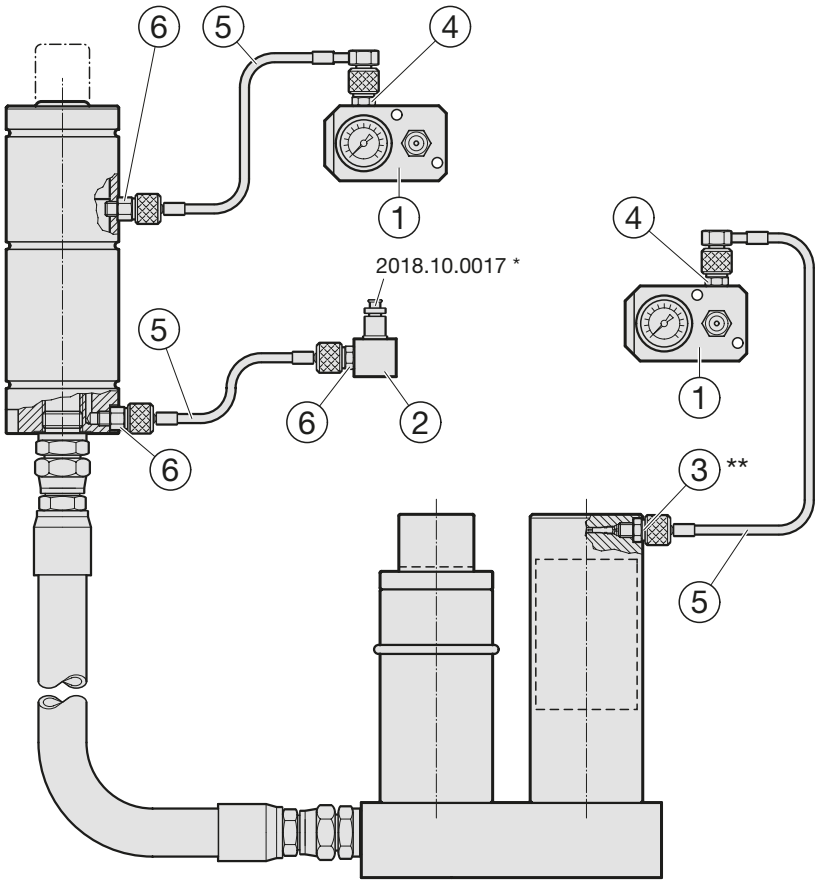
Safety label = 2018.00.105.210.11100

To be applied to machines in which hydraulic cam systems are fitted.

Typical installations for monitoring process safety

Flex Cam
Typical Installations
Monitoring Process Safety

Monitoring a Power Unit and a Cam Unit on the gas side with external venting



* Screw the Cam Unit's bleeder valve 2018.10.0017 into the coupling 2480.00.24.30.

** Before mounting the gauging coupling remove the valve from the pressure reservoir

	Designation	Number	Order no	Comment
1	Control fitting	2	2480.00.31.01	Optionally with diaphragm-type pressure switch 2480.00.45.01 or 02
2	Coupling	1	2480.00.24.30	
3	Gauging coupling with valve	1	2480.00.24.01	
4	Gauging coupling with valve	2	2480.00.24.02	
5	Gauging hose	3	2480.00.23. _ _ . _ _ _ _	Type of connection and length as required
6	Gauging coupling without valve	3	2480.00.24.03	

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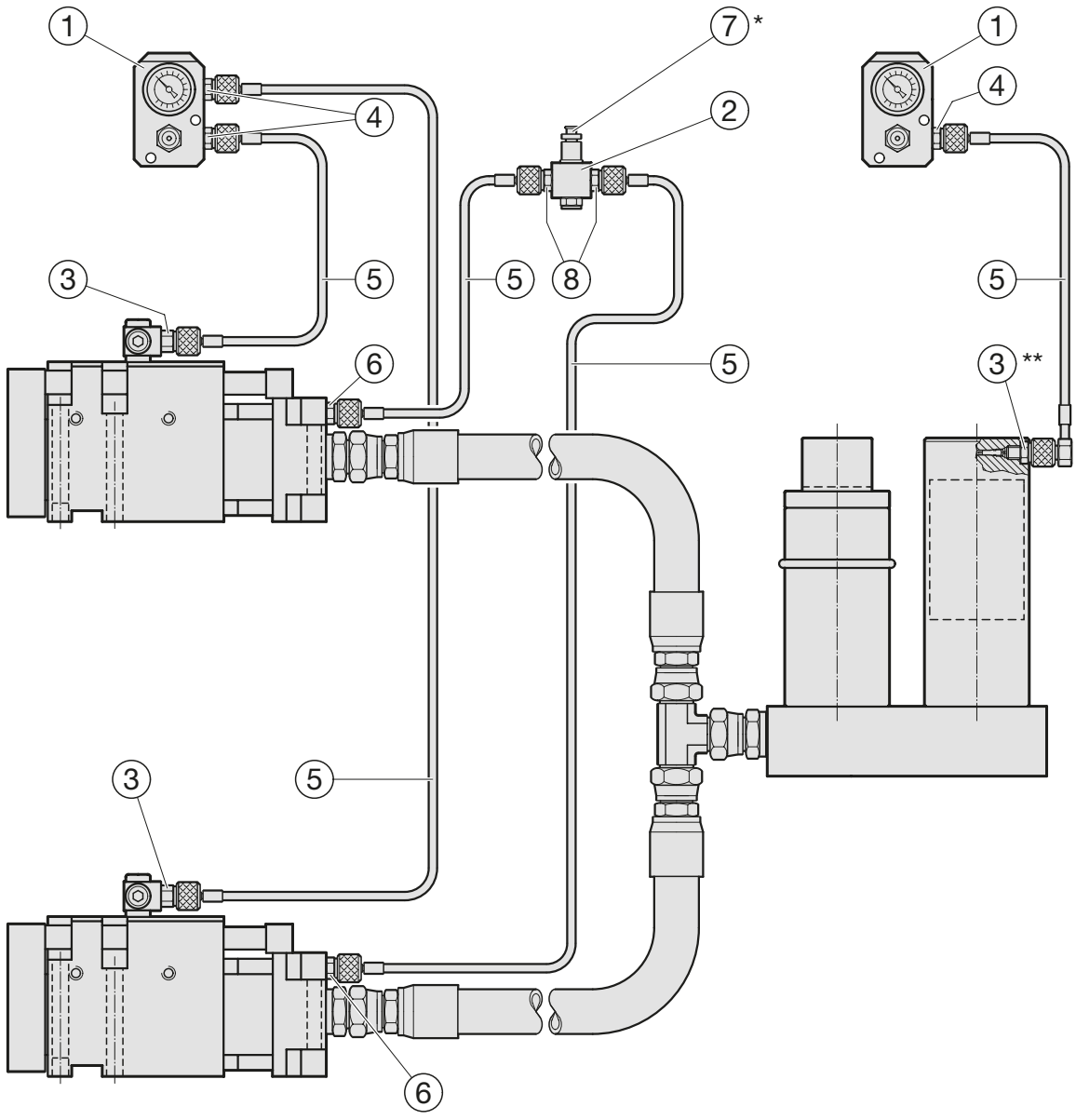
Monitoring a Power Unit and two Cam Units on the gas side with external venting Asynchronous drive



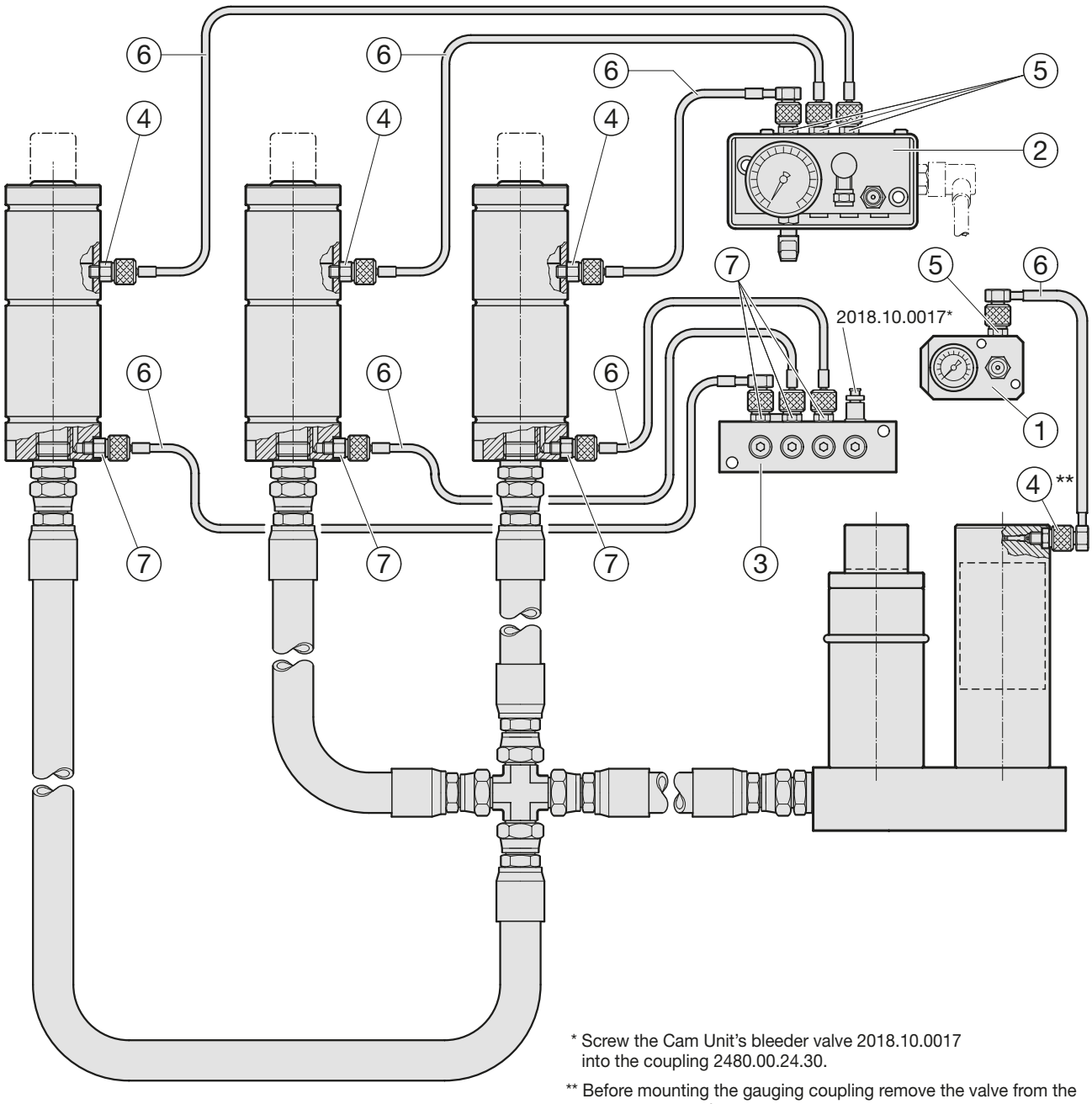
*For Force Cylinder 2018.30 screw the bleeder valve 2018.100.0017 into the coupling 2480.00.24.30.

** Before mounting the gauging coupling remove the valve from the pressure reservoir

	Designation	Number	Order no	Comment
1	Control fitting	2	2480.00.31.01	Optionally with diaphragm-type pressure switch 2480.00.45.01 or 02
2	Coupling	1	2480.00.24.30	
3	Gauging coupling with valve	3	2480.00.24.01	
4	Gauging coupling with valve	3	2480.00.24.02	
5	Gauging hose	3	2480.00.23. _ _ . _ _ _ _	Type of connection and length as required
6	Gauging coupling without valve	2	2018.00.24.05	
7	Bleeder valve	1	2018.10.0017	
8	Gauging coupling without valve	2	2018.00.24.03	

Flex Cam
Typical Installations
Monitoring Process Safety

Monitoring a Power Unit and three Cam Units on the gas side with external venting
Asynchronous drive

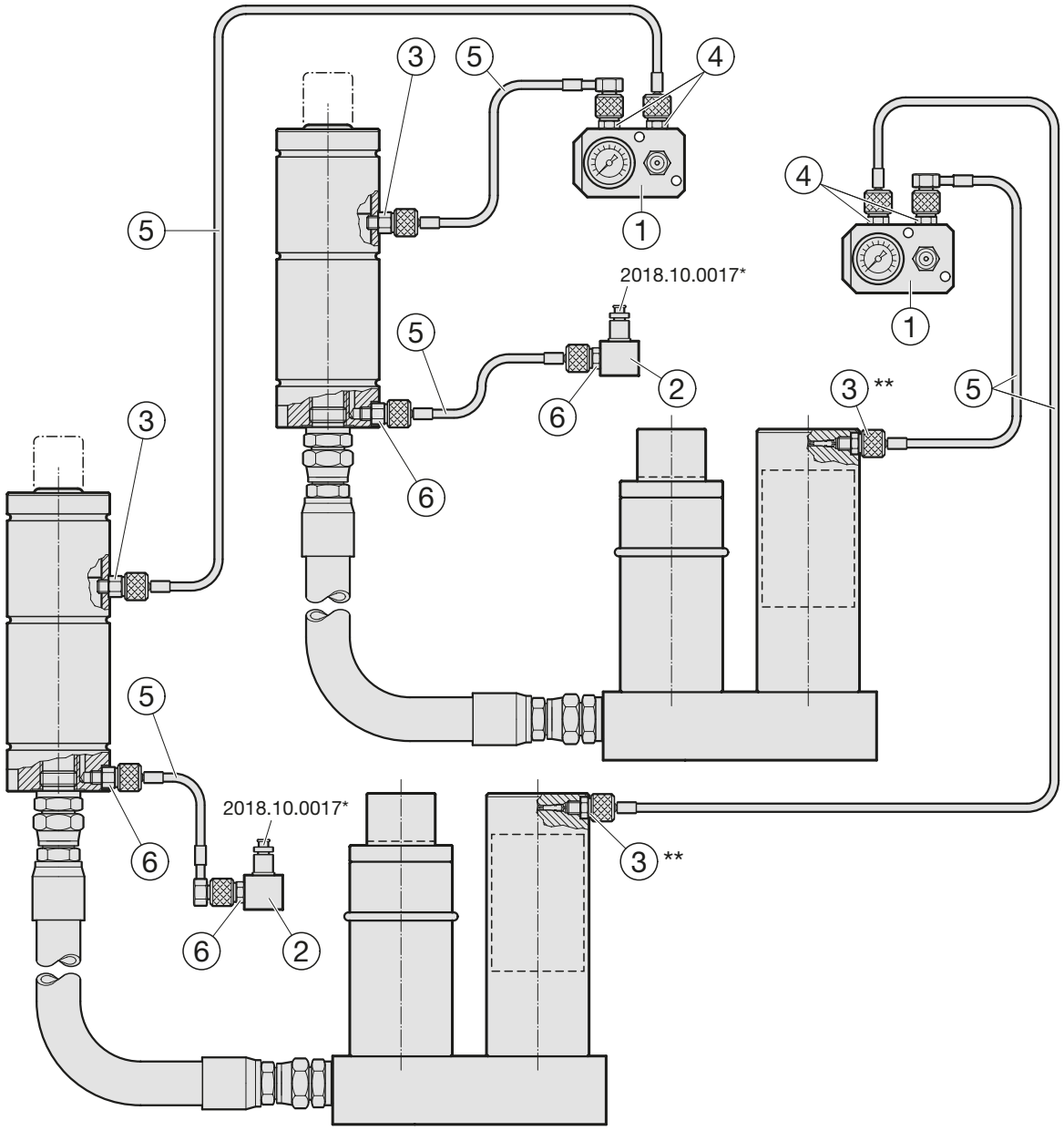


* Screw the Cam Unit's bleeder valve 2018.10.0017 into the coupling 2480.00.24.30.

** Before mounting the gauging coupling remove the valve from the pressure reservoir

	Designation	Number	Order no	Comment
1	Control fitting	1	2480.00.31.01	Optionally with diaphragm-type pressure switch 2480.00.45.01
2	Control fitting	1	2480.00.30.01	Optionally with diaphragm-type pressure switch 2480.00.45.02
3	Distributor box	1	2480.00.24.33	
4	Gauging coupling with valve	4	2480.00.24.01	
5	Gauging coupling with valve	4	2480.00.24.02	
6	Gauging hose	7	2480.00.23. _ _ _ . _ _ _ _	Type of connection and length as required
7	Gauging coupling without valve	6	2480.00.24.03	

Monitoring two Power Units and two Cam Units on the gas side with external venting Synchronous drive



* Screw the Cam Unit's bleeder valve 2018.10.0017 into the coupling 2480.00.24.30.

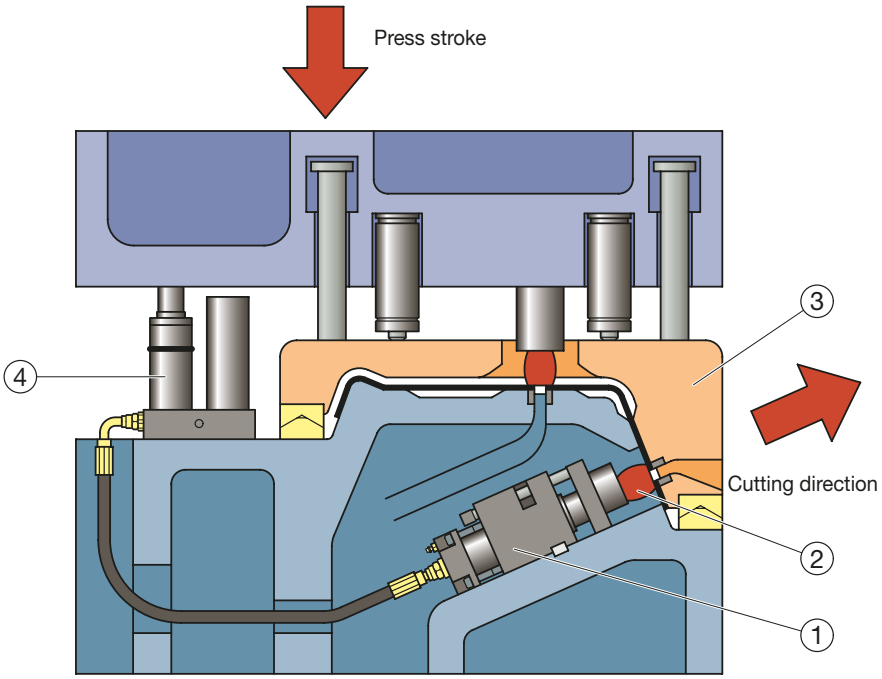
** Before mounting the gauging coupling remove the valve from the pressure reservoir

	Designation	Number	Order no	Comment
1	Control fitting	2	2480.00.31.01	Optionally with diaphragm-type pressure switch 2480.00.45.01 or 02
2	Coupling	2	2480.00.24.30	
3	Gauging coupling with valve	4	2480.00.24.01	
4	Gauging coupling with valve	4	2480.00.24.02	
5	Gauging hose	6	2480.00.23. _ _ . _ _ _ _	Type of connection and length as required
6	Gauging coupling without valve	4	2480.00.24.03	

Typical Applications

Flex Cam
Typical Applications

Application: Cutting with Compact Cam

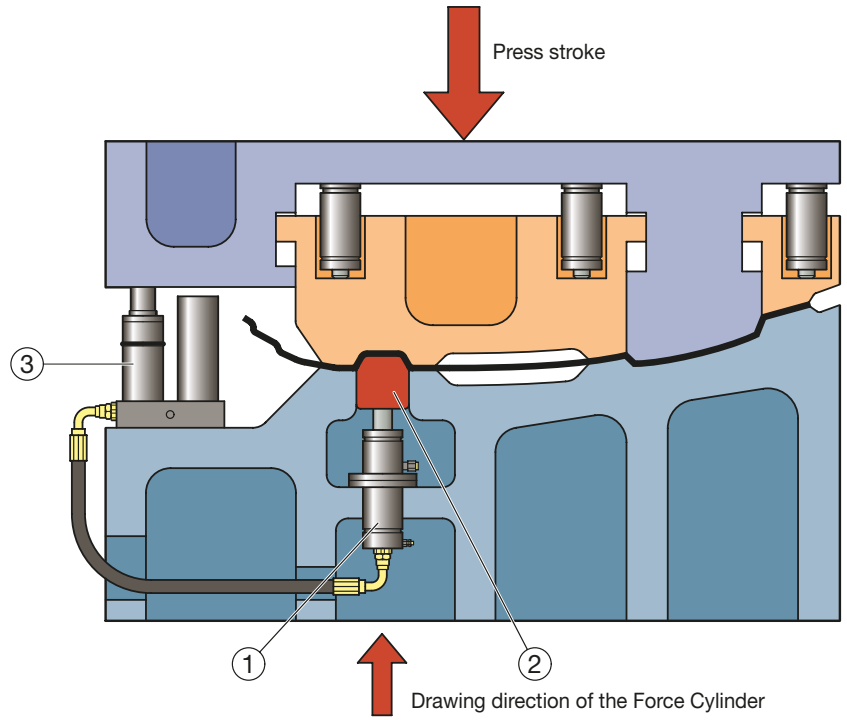


This example shows how a compact cam (1) can be used for punching holes. The punch can be mounted directly to the Compact Cam, which means that no additional guides are required in the tool. The diagram shows that the Power Unit does not have to be installed in the vicinity of the Cam Unit, making it much more flexible compared to conventional mechanical systems. We recommend fitting a stripping unit (2) to the punch.

Working sequence

When the top part of the tool moves down, it actuates the clamping pad (3) that holds the workpiece in position. The clamping pad is centred with respect to the bottom part of the tool by conical spacers. Once the clamping pad reaches its position, the Power Unit is actuated (4) and the Cam Unit executes its operation.

Application: Metal forming



This example shows how one or more Cam Units (1) can be used to drive embossing punches (2) (or tool slides) in a machine tool. The punch (or slide) is guided in the tool. This method of driving tool components allows considerable flexibility in the machine tool layout. The Cam Unit only generates the motion and force. Only shearing and tensile forces are permitted.

Working sequence

As the top part of the tool moves down, it actuates the clamping pad that holds the workpiece in position. When the clamping pad reaches its position, the Power Unit is actuated (3) and the Cam Unit executes its operation. The embossing force can be adjusted, if necessary, by varying the pressure in the Accumulator.

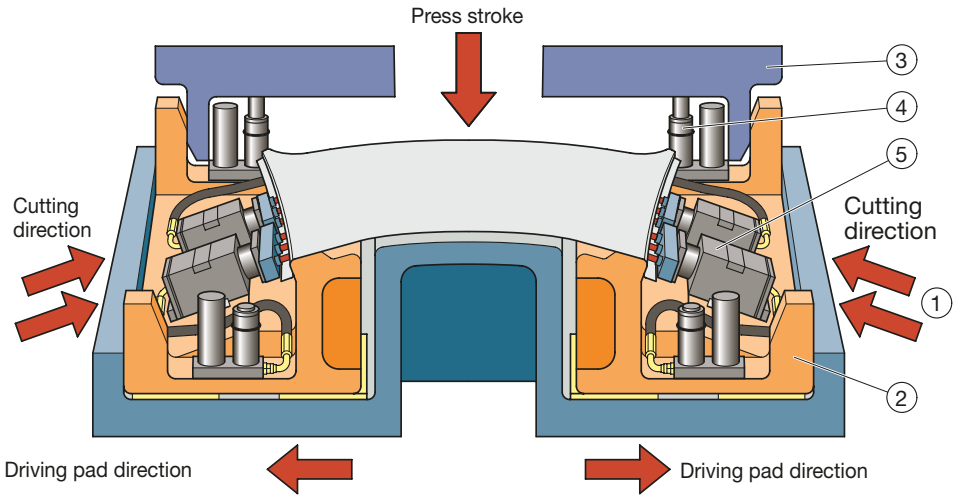
Flex Cam Typical Applications

Application: Cutting with positioning of the overflow wedge

12 holes are punched at a negative angle (1). In this tool, the Flex Cam is equipped with mechanically-driven filling slides 2).

Working sequence:

The filling slide (2) is first moved into position, controlled by the overflow wedge (3). As the press descends further, the four Power Units (4) are pressurised, causing the Cam Units (5) to punch the holes. In this arrangement, the hole punching operation requires no other drivers, which means that it can easily be performed at an angle of 90° to the workpiece.

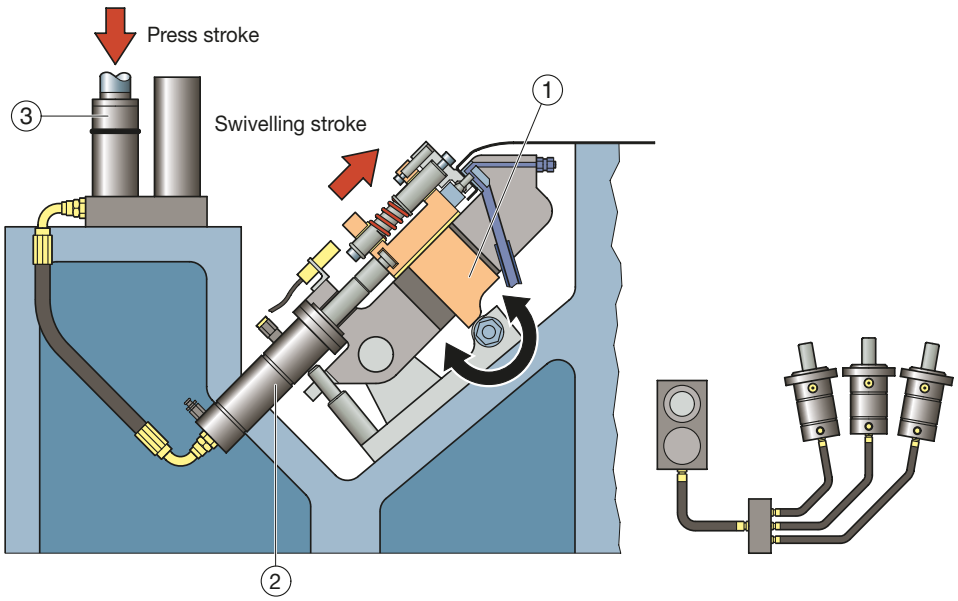


Application: Punching holes with a swivelling die

6 holes are punched at a negative angle using working cylinders that drive a shearing punch unit (1).

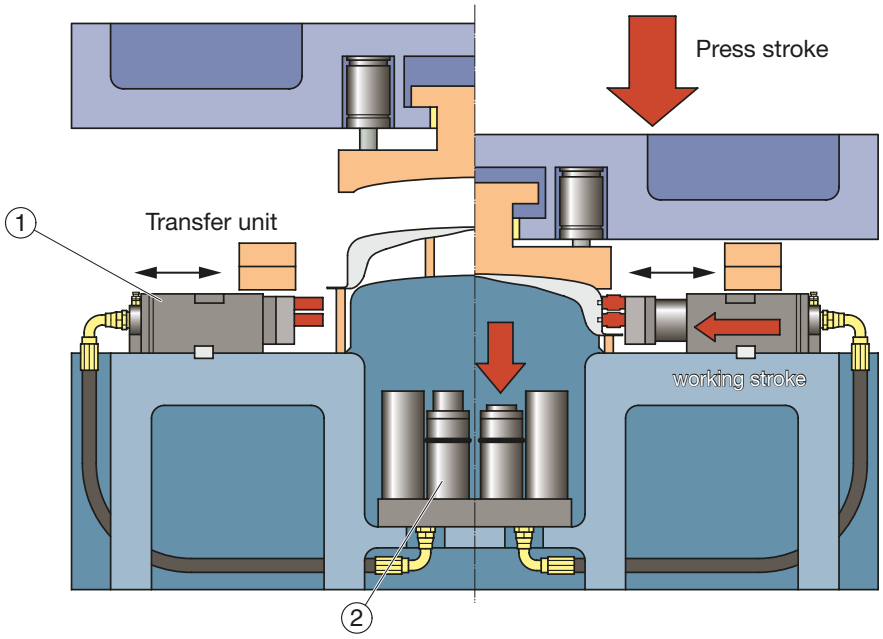
Working sequence:

The diagram shows the Flex Cam in its end position (press at bottom dead centre). As the working cylinder (2) starts to move back, the punch moves out of the punching area. The entire shearing punch then swivels down so that the workpiece can be removed. The operation is reversed when the top part of the press down descends once more. The tool contains two systems: one on the left and the other on the right. Each system consists of a Power Unit (3) that drives three Cam Units.



Flex Cam
Typical Applications

Application: Punching holes with a Flex Cam
Stroke ratio 1:2.5



This tool produces two workpieces at the same time: one on the right and the other on the left. On the left-hand side of the diagram, the press is at the top dead centre position. On the right-hand side, the press is at the bottom dead centre. The transport grippers can be seen above the Cam Units.

The workpiece must be shaped before the holes are punched in the sides.

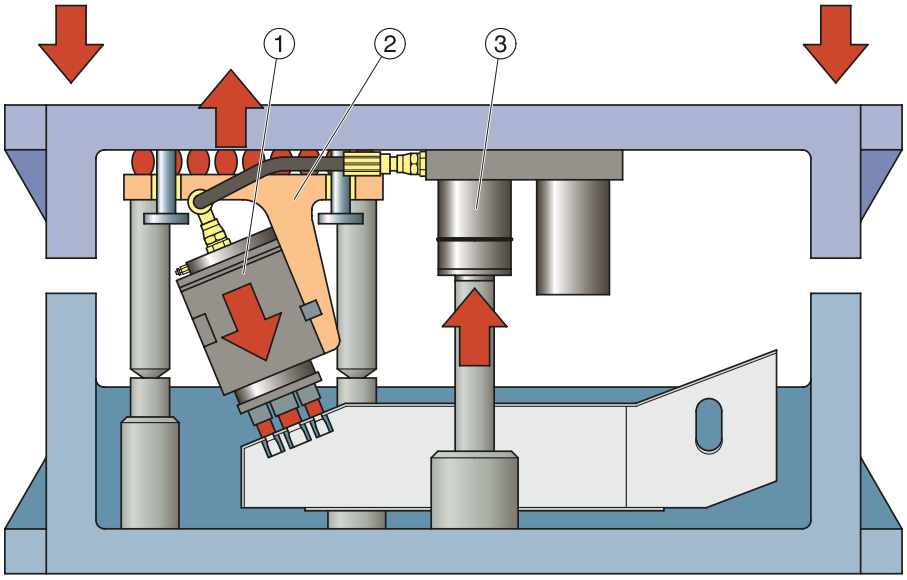
The machining contour requires a relatively large distance between the blank and the punching unit.

Working sequence:

A small Cam Unit (1) is connected to a larger Power Unit (2) in order to guarantee the necessary time/ traverse sequence. This results in a stroke ratio of 1 to 2.5.

Example: If the Power Unit stroke is 10 mm, then the Cam Unit stroke will be 25 mm.

Application: Cutting with floating suspension and conical spacers



This application uses a Flex Cam that is suspended from above (in the top part of the tool).

Working sequence:

The Cam Unit (1) is mounted on a floating die (2). The floating die is spring-mounted and is centred with respect to the bottom part of the tool by conical spacers. As the press moves down and the floating die is centred, the Power Unit (3) is activated and the holes are punched.

Before the Flex Cam was installed, the holes were punched vertically using oval forming punches.

Due to the improved production output and quality that resulted from installing the Flex Cam, the system paid for itself (including installation) within just three months.

Flex Cam
Typical Applications

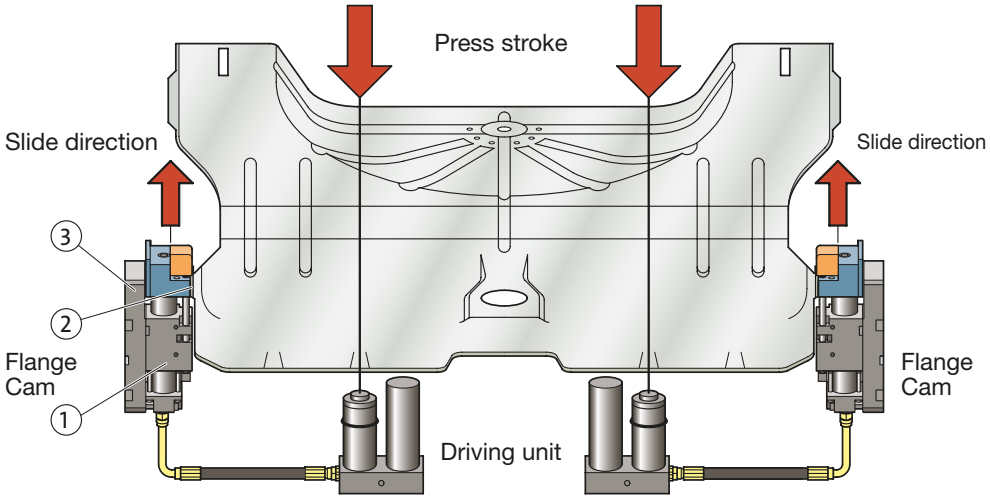
Application: Bending

The diagram shows a base plate which is used in the Flex Cam (1) to cant (bend up) lateral tabs (2).

Working sequence:

The bending punches fixed to the Cam Units (in this case Flange Cams) are supported at the sides (3). These supports absorb the severe lateral forces resulting from the bending operation.

Without this system, it would have been necessary to produce an entire new tool with a floating die or to introduce a second operation.



Application: Bending – slide driven synchronously

This tool has two Force Cylinders for driving an 800 mm wide bending punch.

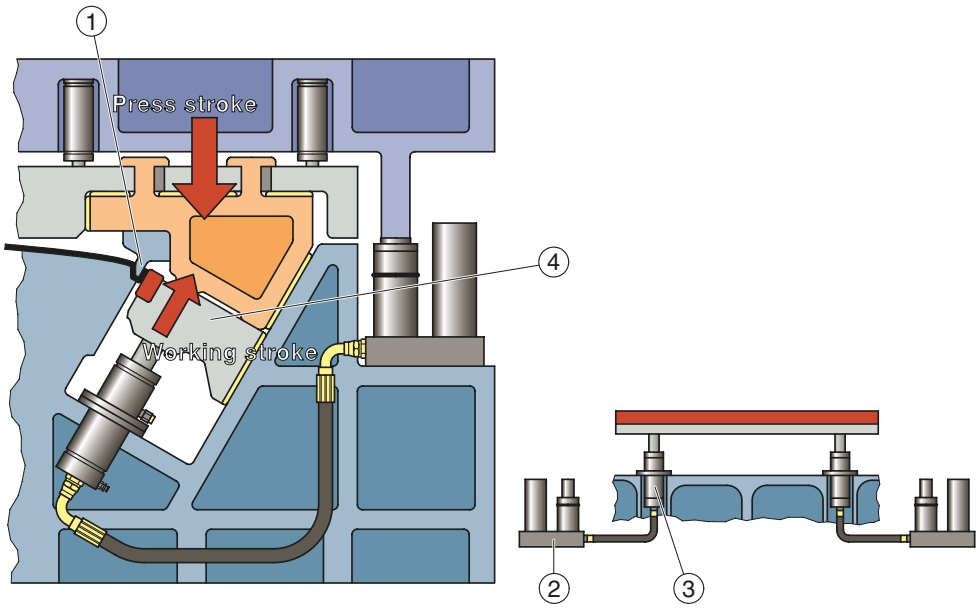
Working sequence:

As can be seen from the diagram, the blank is bent (1) at an angle, against the motion of the press.

Two separate Flex Cam to synchronise the motion of the bending punch. Each system consists of a Power Unit (2) and a Force Cylinder (3).

The bending punch (4) is guided in the tool. As a result, the Force Cylinders only absorb axial forces.

Use of the Flex Cam simplified the structure of this tool, thus reducing the machinery costs.



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- *more than 70 representatives and service stations world-wide*
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