

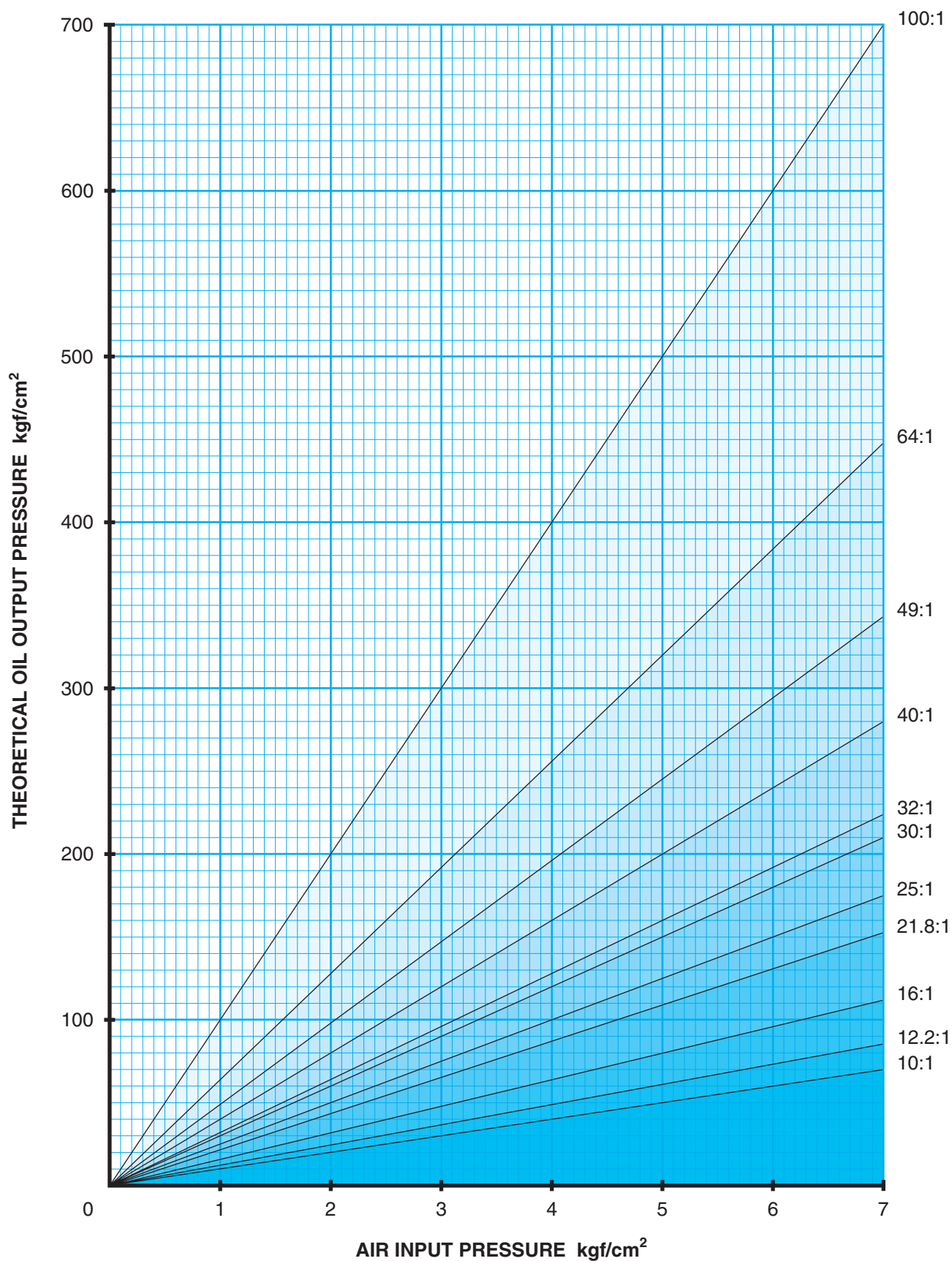
WDS

GLOBAL ENGINEERING SOLUTIONS

Spencer Franklin
Hydraulic
Workholding



BOOSTER SELECTION GRAPH



Select Air Line Pressure on Y axis and read off theoretical oil output pressure depending on ratio of booster selected on X axis

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Spencer Franklin Product Range

Available for the past 30 years the range is particularly suitable for simple clamping and presswork applications.

Using mainly single acting spring return cylinders the range offers a simple and economical solution to clamping and presswork problems.

Air/Oil boosters and pumps are usually part of the above systems – so the only service required is an air supply.

A unique product in the range is the 'Hydraclamp', providing an activated clamp either mechanically or hydraulically operated particularly suitable for hand finishing or assembly work. They are used extensively in the Aerospace Industry for Turbine Blade Finishing.

Clamping Force

Clamping force exerted by piston is dependent on two factors.

- Oil Input Pressure P
- Effective Area of Piston A

Expressed in equation Force = Pressure x Area

Where force is in kilograms

pressure is in kgf/cm² or bar

area is in cm²

Example: A hollow cylinder to produce a force of 200kgs is required a stroke of 6mm and an oil input pressure of 175bar. Using the above equation

$$A = \frac{F}{P} = \frac{2000}{175} = 11.43\text{cm}^2$$

The PowRlock openram junior head SF.3100 MF has an effective area of 12.77 so would give a force of 12.77 x 175 = 2235kgs.

Selection of Pressure Source

For most applications PowRlock Air/Oil boosters are the fastest and most economical pressure source for PowRlock cylinders. Different models or boosters are available and these vary in only two essential details namely:

Pressure Ratio and Oil volume displaced

a) Pressure Ratio

The ratio between the air input pressure and the oil output pressure.

To determine the oil pressure available from any booster use the following formula

$$\text{Oil Pressure P} = \text{Air Input Pressure p} \times \text{Ratio of booster R}$$

Example: To determine the oil pressure available from a type SF2630 Booster with a pressure ratio of 32:1 and with an airline pressure of 5.5 bar

$$5.5 \times 32 = 176\text{kgf/cm}^2$$

Actual working pressure can be up to 10% less than theoretical due to system losses. Once booster oil outlet pressure is known we can determine the theoretical working force on any cylinder using the formula

$$\text{Force} = \text{Pressure} \times \text{Area}$$

Example: To determine the piston force exerted by a junior head SF.3100MF with an effective piston area of 12.77cm² and assuming an oil inlet pressure of 175kgf/cm²

$$F = 175 (P) \times 12.77 (A) = 2235\text{kgf}$$

Again the actual force applied will be slightly less than this amount by the spring force of the SF 3100MF head I E approximately 18kgs.

Oil Displacement

This is the volume of oil available from a particular booster and determines how many small cylinders or indeed how large a cylinder can be operated from the single booster.

$$\text{Oil volume required} = \text{Piston Area (Total)} \times \text{Stroke(s)}$$

Example: To determine the volume of oil required to achieve a stroke of 6mm on a junior head SF.3100MF with a piston area of 12.77cm²

$$\text{Volume of Oil required} = 12.77 \times 0.6 = 7.7\text{cm}^3$$

If 4 PowRlock heads are needed a booster with a minimum oil displacement of 4 x 7.7 = 30.8cm³ is required the SF2640 booster with oil displacement of 53.99cm³ would suffice.

- Note:
- 1) On booster/cylinder systems when using flexible hoses in the hydraulic pipework approximately 2cm³ volume of oil is lost to the cylinder due to hose expansion at 200kgf/cm² per 30cm section.
 - 2) The number of cylinders per booster has no effect on the piston force per cylinder when the full volume is available.

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System Design

Do not use the booster or cylinder return springs as dead stops.

Take care not to subject the linear cylinders to any significant side loading as this can damage the seals.

Calculate the total oil volume per cylinder to complete the stroke required – then select a booster with a capacity of 15-20% above the calculated figure, to allow for expansion etc.

Always use bonded washers when sealing parallel BSP threads.

For general clamping applications $\frac{1}{4}$ bore hoses and $\frac{1}{4}$ BSP air valves are suitable. For maximum speed of operation, i.e. on presswork use $\frac{3}{8}$ or $\frac{1}{2}$ bore pipework and air valves. The shorter the flexible hoses the less the expansion losses.

Whilst booster will operate effectively when sited below the cylinders, the bleeding of the system and maintenance are much easier if the booster is placed at the highest point of the system. The use of a self-bleed reservoir SF.4957 will make air removal easier.

Technical Information

Ridding the Pipework Systems of Entrapped Air

The bleeding of a PowRlock circuit is exactly the same principal as the automobile hydraulic braking systems, except normally the automobile is on level ground and it is recommended to commence bleeding from the farthest point of the hydraulic energy source. The PowRlock system is simpler in effect as it is recommended to bleed from the highest point of the circuit and if it also be the hydraulic energy source (i.e. Booster, Lever or hand pump) so much the better.

If the circuit to be bled is an existing one and has air bubbles entrained, consider at this point the necessity for seal and fluid renewal.

Slacken off connectors (finger tight) and introduce fluid at the highest port connection, filler plug or hose, which shall be referred to as the 'high point' for convenience.

Starting from the lowest point, slacken connection to allow a flow of oil to escape from the system (wasted fluid should be prevented from contaminating floors by using a drip tray). When flow becomes continuous and free from air bubbles – tighten connection, top up system with fluid at high point – continuously during bleeding. Repeat procedure at every clamping head or ram working upwards towards high point.

Should the high point be in the middle of the circuit, start as above from one end working upwards to high point and then repeat from other end of circuit. Having secured all connections including high point, cycle unit several times and then switch off. Remove high point connection and top up with fluid if necessary, repeat until system is fully primed.

On Presswork applications the use of a booster reservoir assembly type ref. 4957 will greatly assist in the bleeding of the circuit and prove most useful as a permanent feature of the hydraulic circuit. If in doubt contact your local Sales Engineer, who will be pleased to advise you.

Recommended Hydraulic Oil

SHELL	TELLUS 37	LORCO	HT32	BP	ENERGOL H.L.P.32
CASTROL	AWS 32	VAUGHAN	HYDRODRIVE HP 150	S.A.E.	S.A.E. 10w HYDRAULIC
ESSO	ESSTIC 43	MOBIL	DTE 24	TOTAL	AZOLLA 32

This list of equivalent fluids has been compiled for the convenience of users who may already use other suppliers.

DO NOT USE AUTOMOBILE HYDRAULIC FLUIDS OF ANY DESCRIPTION.

Conversion Factors

Pressure

1 psi	=	0.069 bar
1 bar	=	14.50 psi
1 bar	=	1kg/cm ²
1 Mpa	=	145 psi

Weight

1 pound	=	0.4536kg
1 kg	=	2.205lbs
1 Metric Tonne	=	2205lbs/1000kgs

Volume

1 ins ³	=	16.387cm ³
1 cm ³	=	0.061 ins ³
1 litre	=	61.02 ins ³ = 0.264 gal.
1 gallon	=	4.546 litres

Others

1 ins	=	25.4mm
1 mm	=	0.039 ins
1 in ²	=	6.452cm ²
1 cm ²	=	0.155 ins ²
1 lb	=	4.448n

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This data sheet has been added in answer to numerous requests from designers using PowRlock equipment as an integral part of their projects.

We wish to point out however, the springs fitted to PowRlock heads are not designed to facilitate stripping loads but purely to retract the piston on completion of the work cycle.

Spring Data PowRlock Heads

Unit No.	Part No.	Rate kgf/mm	Load at Fitted Height kgf	Load at Solid Height kgf	Pressure Induced at Fitted Height kgf/cm ²
3000	3009	1.6	13.6	24	2.63
3100	3109	2.4	18.1	37.87	1.42
3200	3209	1.2	18.1	38	1.42
3300	3309	0.6	18.1	41.6	1.42
3520	3529	1.26	16	34	0.81
3550B	3559	0.6	18.1	41.6	0.79
5000A	5009A	1.66	4.25	27.5	0.8
5100A	5109A	1.2	7.26	39.9	1.37
5300A 5320	8P43222	1.10	3.52	9.02	2.29
5350	8P43220	0.26	3.8	7.7	1.89
5370	8P43276	0.117	0.87	1.22	2.17
5371 5372	8P43277	0.083	1.12	1.45	1.78
5373 5374	8P43278	0.385	2.75	5.06	1.78
5375	8P43279	0.715	3.3	9.02	1.45
5376	8P43280	0.477	6.3	11.07	1.66
5377	8P43281	0.629	9.9	17.45	2.02
5389	8P43282	0.52	9.88	20.28	2.02
5500	5509	0.8	24	38.1	1.13
5700	5709	0.89	29.9	42.5	0.96
6080A	8P43234	1.07	55.4	72.55	1.61
6120A	8P43223	0.29	19.3	32.3	1.43
6160A	8P43251 8P43265	3.3	127	193	1.62
6600A	8P43228	1.8	29	47	1.47
6680A	8P43227	0.57	28.5	45.6	1.45
6840B	8P43230 8P43265	4.17	76	159.4	1.51
6960A	8P43241	0.33	23.1	46.2	1.38

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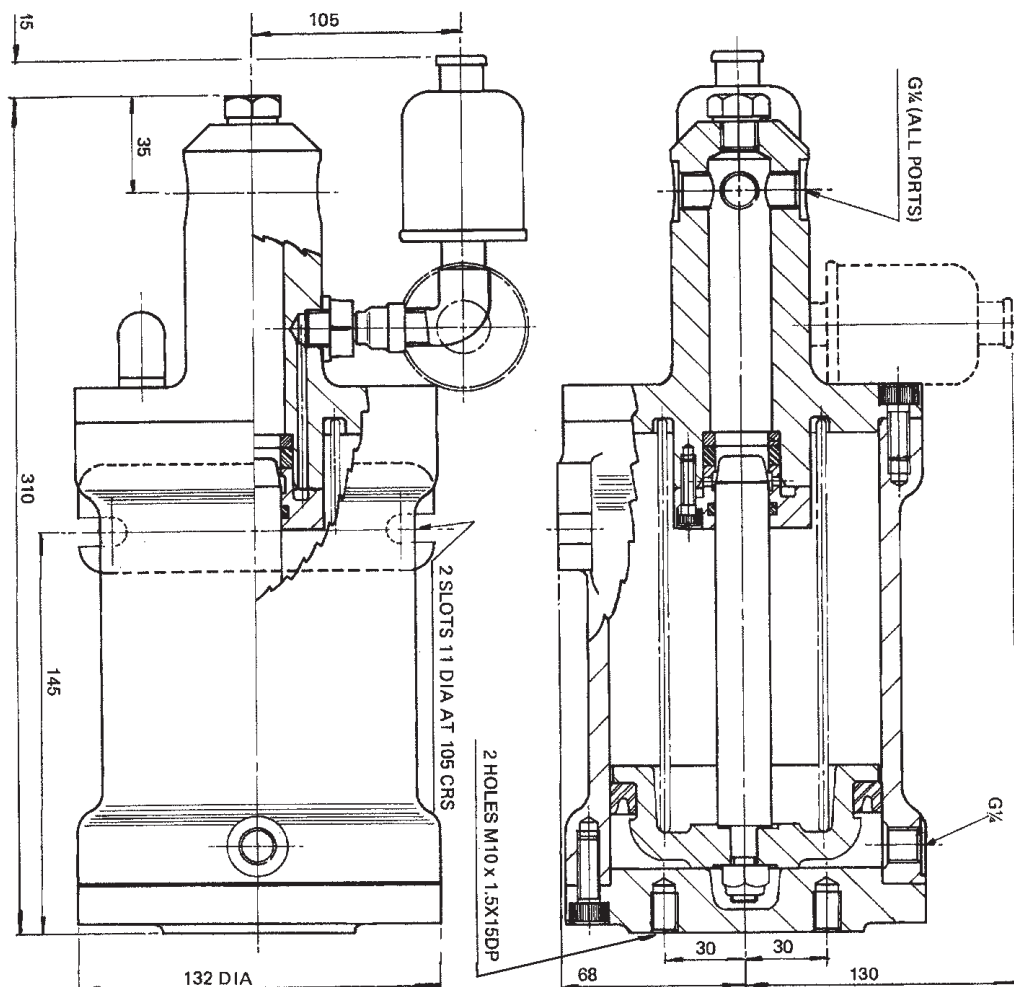
2300/2350

PowRlock® Minibooster

Technical Information

7.0 bar maximum air input pressure

See inside front cover for Booster
Selection Graph



Intensification Ratio	Oil Output (max) cm ³	Air Pressure (max) kgf/cm ²	Air Consumption at 5.62 kgf/cm ² per 25.4mm stroke	Stroke mm	Weight kg	WDS No	Seal Kit No
25:1	31.4	7	.0016m ³	110	7.48	SF-2300	SF-23009
30:1	25.4	7	.0016m ³	110	7.38	SF-2350	SF-23509

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PowRlock® Booster

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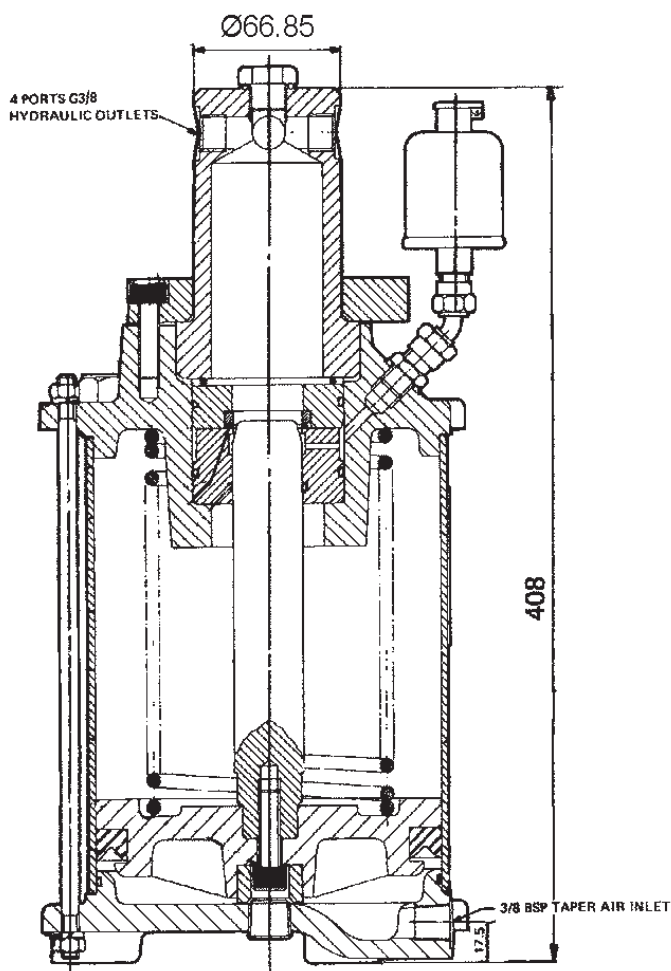
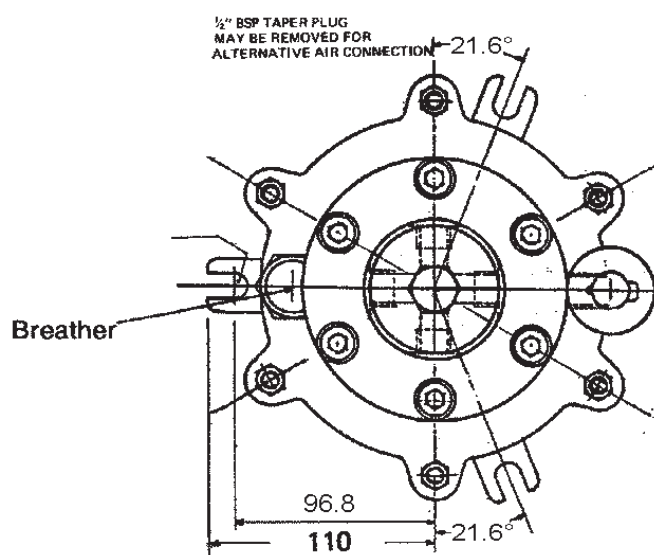
Air Cylinder Stroke : 110mm

Air Cylinder Bore Dia : 160mm

Air Consumption at 5.62kgf/cm² per
25.4mm stroke = 0.0034m³

7.0 bar maximum air input pressure

See inside front cover for Booster
Selection Graph



Mounting: Novel arrangement of the Autofeed device allows Booster to be mounted horizontally or vertically with the outlet ports uppermost, simply by rotating the Autofeed assembly through 90°.

Max Oil Intensification Ratio	Max Output cm ³	Max Oil Output Pressure kgf/cm ²	Max Air Pressure kgf/cm ²	Weight kg	WDS No	Seal Kit No
10:1	215.98	70	7	18	SF-2600	SF-26009
16:1	138.23	112	7	18	SF-2610	SF-26109
25:1	88.46	175	7	18	SF-2620	SF-26209
32:1	67.73	224	7	18	SF-2630	SF-26309
40:1	53.99	280	7	18	SF-2640	SF-26409
64:1	34.55	384	6	18	SF-2650	SF-26509
100:1	22.11	500	5	18	SF-2660	SF-26609

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7600A Series **PowRlock®** **Zoom-ATC Booster**

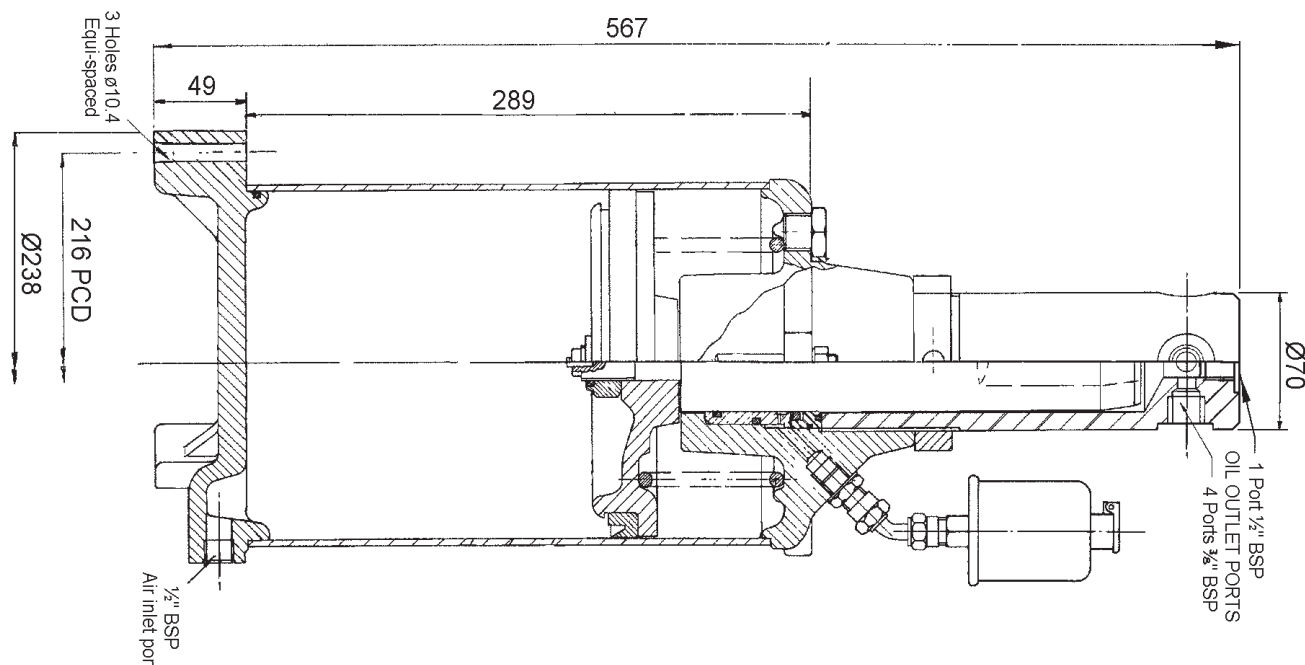
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Maximum Air Pressure 7kgf/cm²
 except for 7635 which must not
 exceed 5.5kgf/cm²

Air Consumption at 5.6kgf/cm² per
 25.4mm stroke = 0.004m³

Maximum Stroke : 152.4mm

See inside front cover for Booster
 Selection Graph



Mounting: Novel arrangement of the Autofeed device allows Booster to be mounted horizontally or vertically with the outlet ports uppermost, simply by rotating the Autofeed assembly through 90°.

Intensification Ratio	Max Oil Output cm ³	Max Air Input kgf/cm ²	Weight kg	WDS No	Seal Kit No
12.2:1	308	7	19.5	SF-7680A	SF-76809
21.8:1	174	7	19.5	SF-7660A	SF-76609
31.4:1	120	7	19.5	SF-7650A	SF-76509
49.0:1	77	7	19.5	SF-7640A	SF-76409
64.0:1	59	5.5	19.5	SF-7635A	SF-76359

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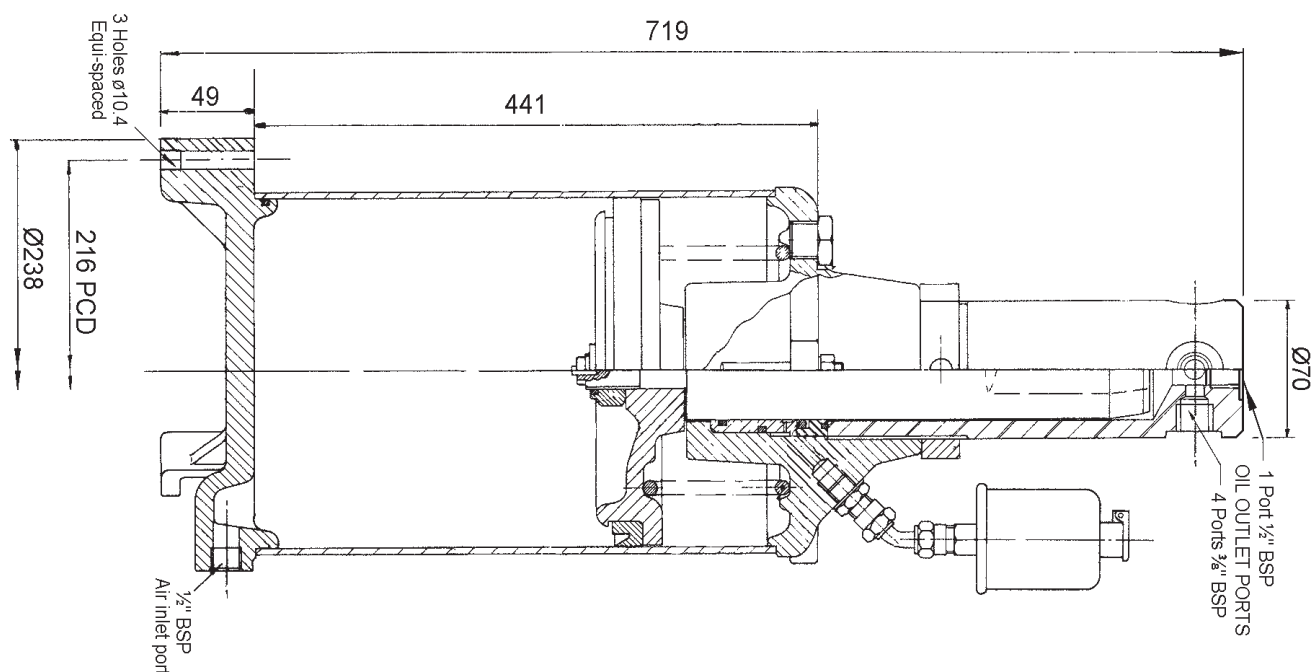
Technical Information

Maximum Air Pressure 7kgf/cm²
except for 7935 which must not
exceed 5.5kgf/cm²

Air Consumption at 5.6kgf/cm² per
25.4mm stroke = 0.004m³

Maximum Stroke : 228.6mm

See inside front cover for Booster
Selection Graph



Mounting: Novel arrangement of the Autofeed device allows Booster to be mounted horizontally or vertically with the outlet ports uppermost, simply by rotating the Autofeed assembly through 90°.

Intensification Ratio	Max Oil Output cm ³	Max Air Input kgf/cm ²	Weight kg	WDS No	Seal Kit No
12.2:1	463	7	21.8	SF-7980A	SF-76809
21.8:1	260	7	21.8	SF-7960A	SF-76609
31.4:1	181	7	21.8	SF-7950A	SF-76509
49.0:1	116	7	21.8	SF-7940A	SF-76409
64.0:1	88	5.5	21.8	SF-7935A	SF-76359

Ordering Information

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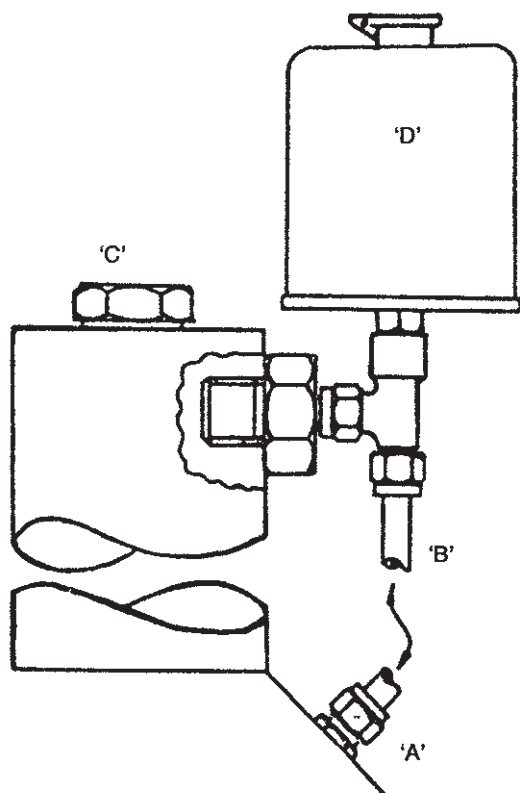
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SF 4957

PowRlock® Self Bleed Booster Reservoir Assembly



Fitting Instructions

1. Fitting bleed valve as shown, using the existing bonded washers.
Use $\frac{1}{4}$ " x $\frac{3}{8}$ " BSP adaptor for intensifiers with $\frac{1}{4}$ " BSP outlet.
2. Remove fitting at 'A' and replace with adaptor supplied (Note: The adaptor has been fitted into top of tee piece for ease of packaging).
3. Fit nylon tube 'B' (cut to suit).
4. Fill intensifier with oil through 'C' and refit plug.
5. Fill reservoir 'D' $\frac{3}{4}$ full and operate system.
6. The oil level in reservoir 'D' will drop as air in the system escapes.
7. When the reservoir level stabilises, fill to $\frac{3}{4}$ full.
8. The booster is now ready for use but the remainder of the system should be bled as described in the introduction.

NOTE: Fit to side port of all SF-2600 and SF-7000 series boosters by fitting the $\frac{3}{8}$ " BSP threaded 'Tee' directly into booster outlet port. When fitting into the $\frac{1}{4}$ " BSP port of SF-2300 and SF-2350 mini boosters a standard no. SF-4108 male/female adaptor must be fitted to the 'Tee' first.

Self Bleed Booster Reservoir Assembly
Quick Exhaust Valve $\frac{1}{4}$ " BSP
Quick Exhaust Valve $\frac{1}{2}$ " BSP
Air Silencer $\frac{1}{8}$ " BSP
Air Silencer $\frac{1}{4}$ " BSP
Air Silencer $\frac{3}{8}$ " BSP

WDS No

SF-4957
SF-4053
SF-4069
SF-4921
SF-4923
SF-4924

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PowRlock® Micro Ram Head

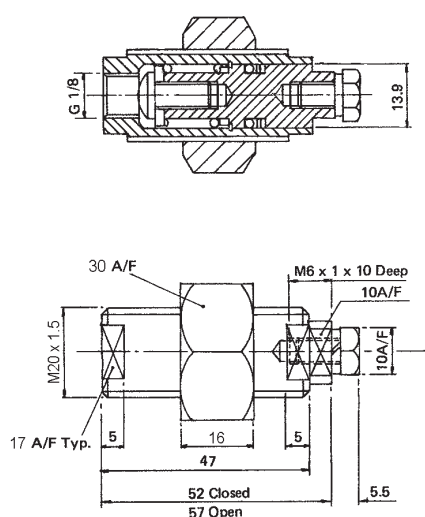
Technical Information

Two versions are available – a 5mm stroke and a 15mm stroke, both have an outside thread for easy bench mounting. An essential feature is that both are designed with a removable contact bolt so that the user can customise the Ram to suit various work applications.

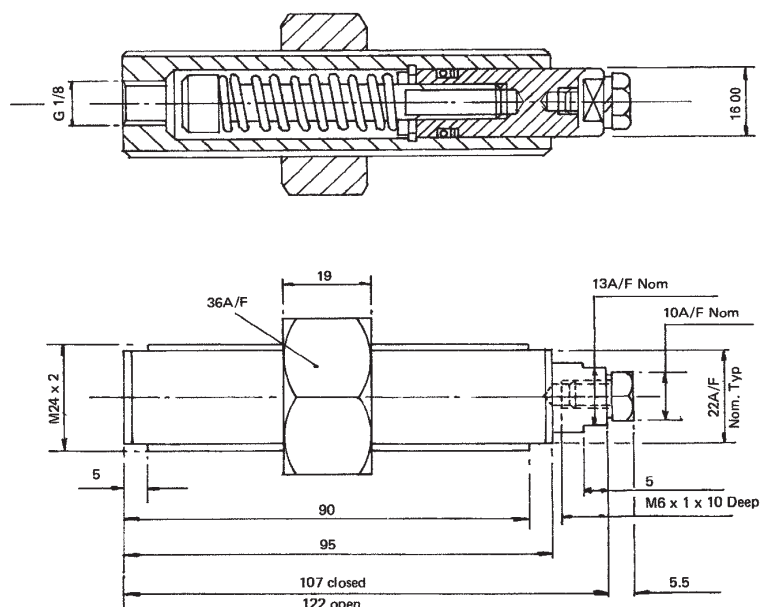
See inside front cover for Booster Selection Graph



SF-5300



SF-5350



Stroke* mm	Piston Area cm ²	Swept Volume cm ³	Return Spring Rate kg/mm	Spring Load at Fitted Height kg/mm	Thrust at 140 kgf/cm ²	Weight kg	WDS No	Seal Kit No
5	1.53	0.78	1.1	3.52	214	0.17	SF-5300A	SF-53209
15	2	3.0	0.255	3.8	280	0.4	SF-5350	SF-53509

* Do not exceed Maximum Stroke

Ordering Information

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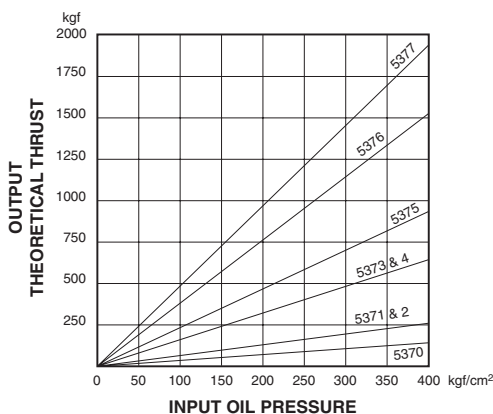
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5370-5377

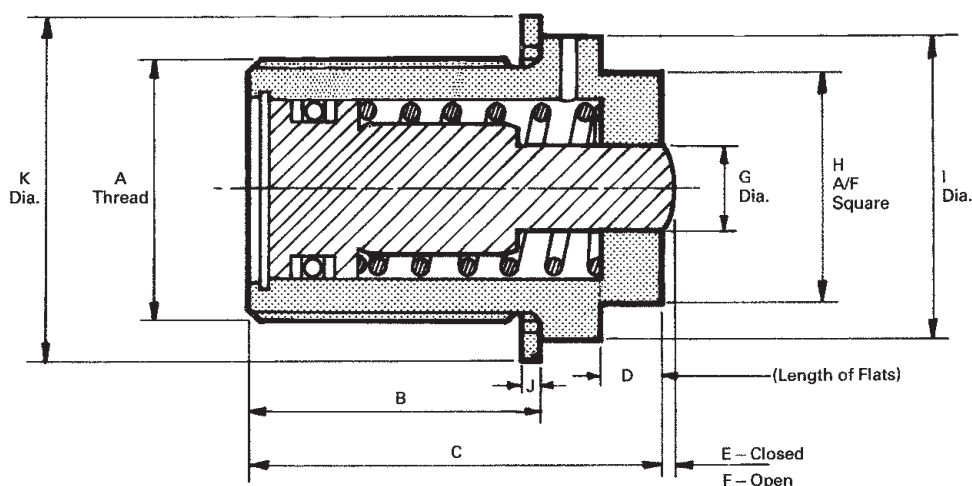
PowRlock® Button Heads

Technical Information

- 8 types
- Single acting
- Spring return
- Threaded body
- 3 to 12mm stroke



To calculate thrust per head obtain system oil pressure from booster data sheet (inside front cover) and read off from graph.



Max Stroke*	Effective Area	Swept Volume	Max Force at 300kgf/cm²	Dimensions in mm											Weight kg	WDS No	Seal Kit No
				A	B	C	D	E	F	G	H	I	J	K			
3	0.4	0.12	120	G½	19	29	4	0.6	3.6	3.1	13	18	2.03	20.57	0.03	SF-5370	SF-53709
4	0.63	0.25	189	M16 x 1.5	23	33	5	0.7	4.7	4	17	21.5	2.03	23.8	0.03	SF-5371	SF-53719
4	0.63	0.25	189	G¾	23	33	5	0.7	4.7	4	17	21.5	2.03	23.8	0.05	SF-5372	SF-53729
6	1.54	0.92	462	M20 x 1.5	23	36	6	0.9	6.9	6	19	25.4	2.34	28.58	0.05	SF-5373	SF-53739
6	1.54	0.92	462	G½	23	36	6	0.9	6.9	6	19	25.4	2.34	28.58	0.06	SF-5374	SF-53749
8	2.27	1.81	681	M24 x 1.5	27	40	6	1	9	8	22	28.8	2	33	0.125	SF-5375	SF-53759
10	3.8	3.8	1140	G1	32	50	9	1.3	11.3	10	32	39.4	3.25	42.8	0.13	SF-5376	SF-53769
12	4.9	5.88	1470	M36 x 1.5	41	59	9	1.6	13.6	12	32	42	2.5	48	0.42	SF-5377	SF-53779

* Do not exceed Maximum Stroke

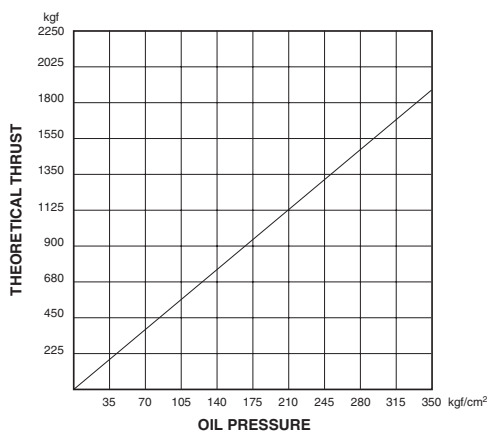
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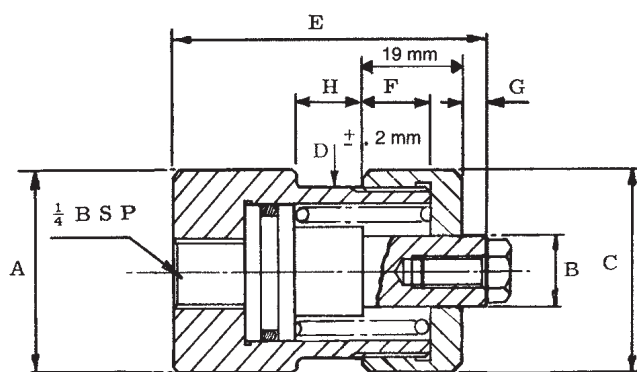
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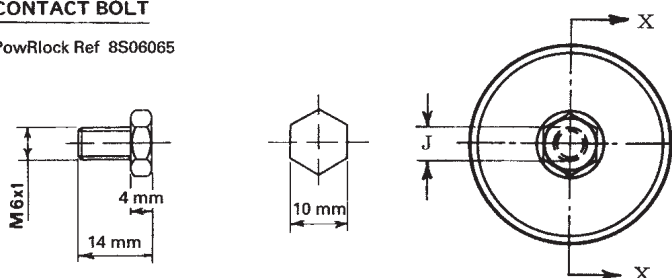
To calculate thrust per head obtain system oil pressure from booster data sheet (inside front cover) and read off from graph.



SECTION XX

CONTACT BOLT

PowRlock Ref 8S06065



Body/Cap Thread
M32 x 1.5

Stroke* mm	Effective Area cm²	Swept Volume cm³	Dimensions in mm									Weight kg	WDS No	Seal Kit No
			A	B	C	D	E	F	G	H	J			
12.5	5.31	6.64	38	13	38	32	58	13	5	11	M6 x 1	0.36	SF-5000A	SF-5099
25	5.31	13.28	38	13	38	32	83	13	5	36	M6 x 1	0.45	SF-5100A	SF-5099

* Do not exceed Maximum Stroke

Ordering Information

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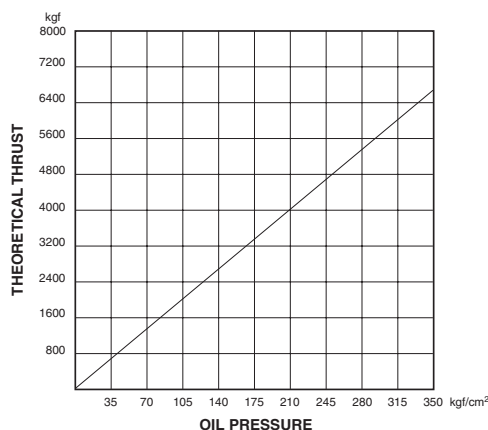
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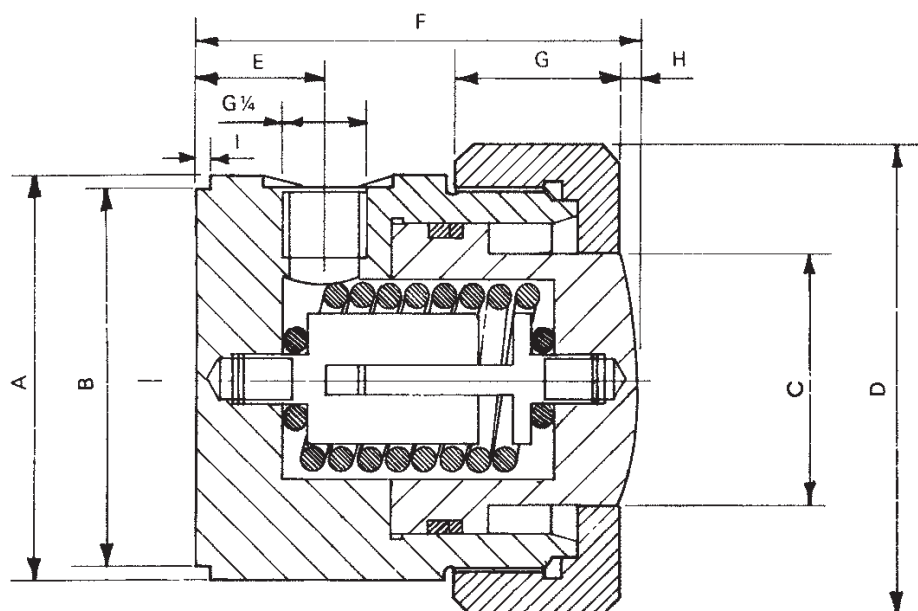
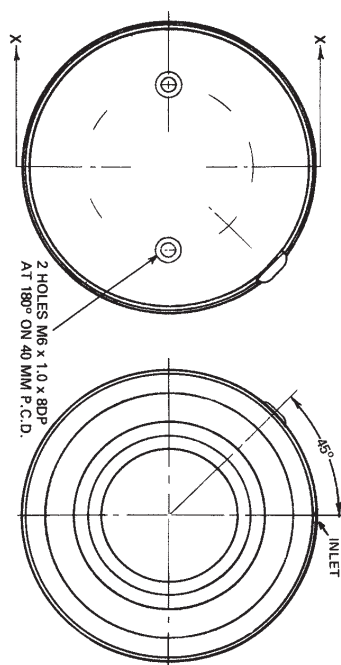

3520

PowRlock® PowRam Head

Technical Information



To calculate thrust per head obtain system oil pressure from booster data sheet (inside front cover) and read off from graph.



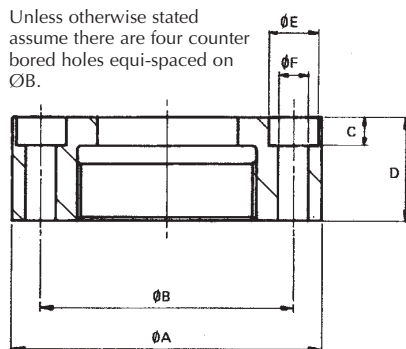
Body/Cap Thread
M62 x 1.5

Stroke* mm	Effective Area cm²	Swept Volume cm³	Dimensions in mm									Weight kg	WDS No	Seal Kit No
			A	B	C	D	E	F	G	H	I			
15	19.64	29.46	65	60	40	75	20	70	27	3	2	1.68	SF-3520	SF-4413

* Do not exceed Maximum Stroke

Mounting: To include these heads in a fixture it is only necessary to retain them in position by the 2 tapped holes in the rear location, allowing the back face of each head to react against a rigid face.

Unless otherwise stated assume there are four counter bored holes equi-spaced on ØB.



OPTIONAL VARIATIONS FOR STANDARD TYPE 3520 POWRAM

Part No SF-3520FL – Front flange mounted (circular) instead of screwed cap.

Dimensions in mm						Flange No
A	B	C	D	E	F	
108	85.7	10.4	30.1	16.6	10.3	SF-3501FL

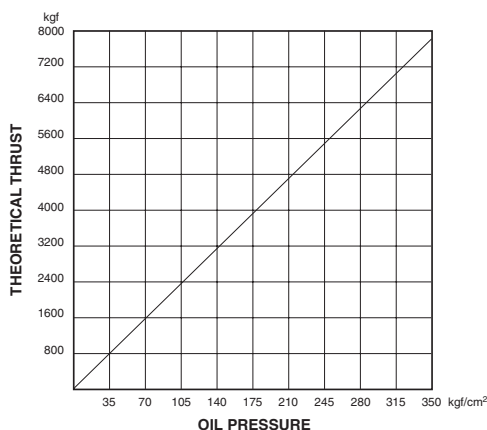
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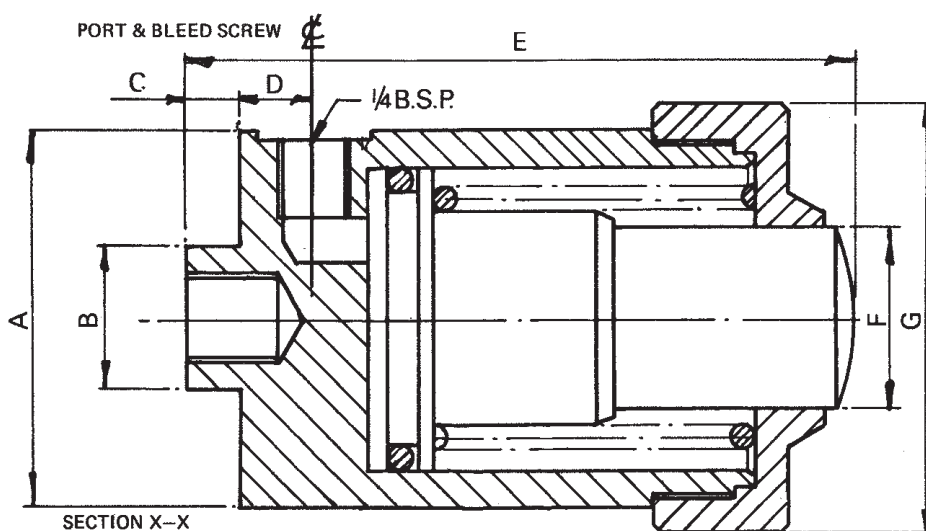
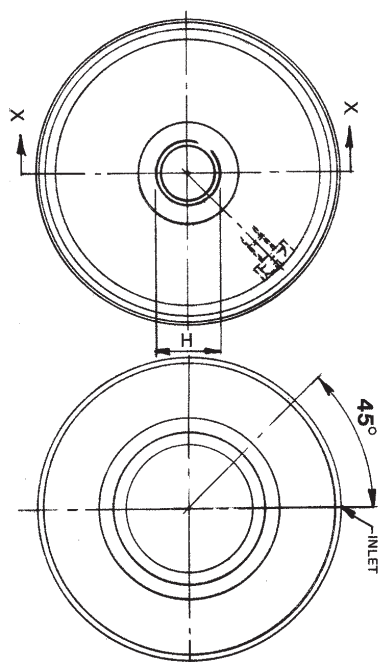
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To calculate thrust per head obtain system oil pressure from booster data sheet (inside front cover) and read off from graph.



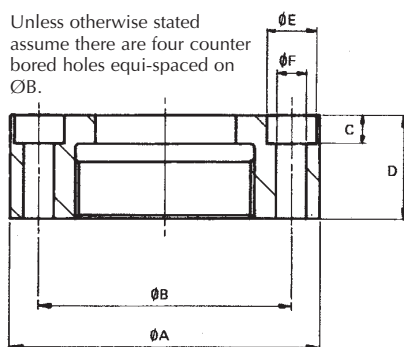
Body/Cap Thread
2½ – 16 – UNS

Effective Stroke* mm	Swept Area cm²	Volume cm³	Dimensions in mm							Weight kg	WDS No	Seal Kit No
			A	B	C	D	E	F	G			
25.4	22.9	58.17	66.58	25.4	9.53	12.7	119.06	31.75	76.2	2.27	SF-3550B	SF-4798

* Do not exceed Maximum Stroke

Mounting: To include these heads in a fixture it is only necessary to retain them in position by the tapped hole in the rear spigot, allowing the back face of each head to react against a rigid face.

Unless otherwise stated assume there are four counter bored holes equi-spaced on ØB.



OPTIONAL VARIATIONS FOR STANDARD TYPE 3550B POWRAM

Part No SF-3550BFL – Front flange mounted (circular) instead of screwed cap.

Dimensions in mm						Flange No
A	B	C	D	E	F	
108	85.7	10.4	30.1	16.6	10.3	SF-3551FL

Ordering Information

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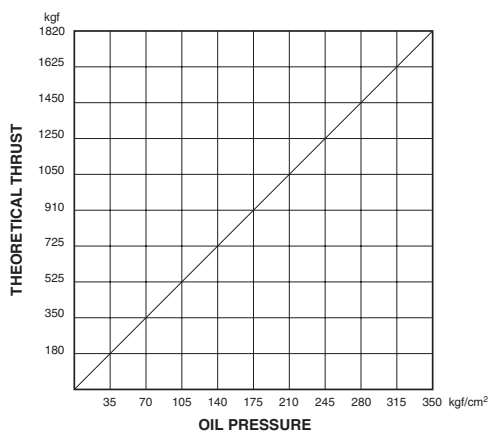
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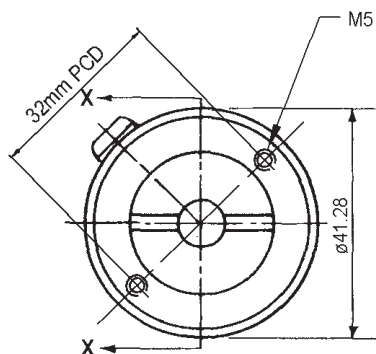
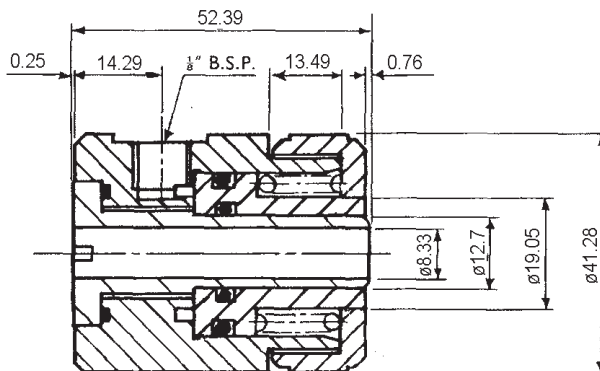


PowRlock® OpenRam Midget Head

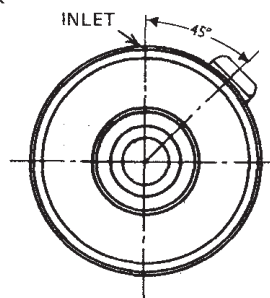
Technical Information



To calculate thrust per head obtain system oil pressure from booster data sheet ((inside front cover) and read off from graph.



SECTION XX



Body/Cap Thread
1 3/8 – 18 – UNEF

Stroke*		Effective Area cm²	Swept Volume		Weight		WDS No	Seal Kit No
With Spring mm	Without Spring mm		With Spring cm³	Without Spring cm³	With Spring kg	Without Spring kg		
6.35	15.49	5.16	3.28	8.03	0.43	0.40	SF-3000MF	SF-3099

* Do not exceed Maximum Stroke

Mounting: To include these heads in a fixture it is only necessary to mount them over 8mm dia. studs or bolts via the hole through the centre of each head.

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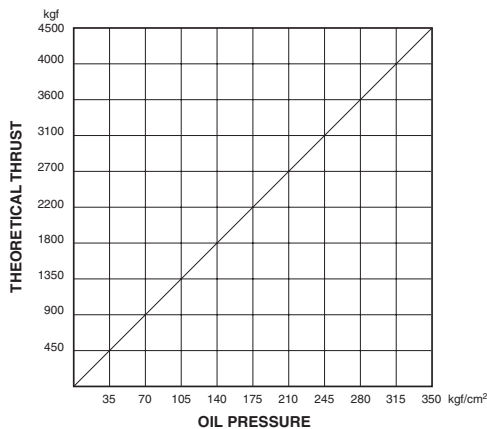
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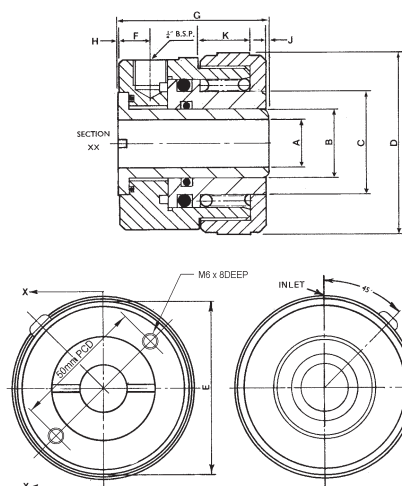
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Technical Information

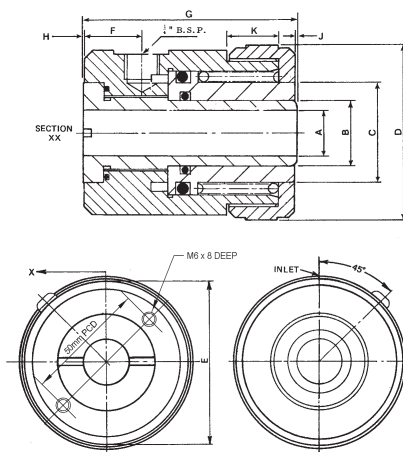
All ports are 1/4" BSP



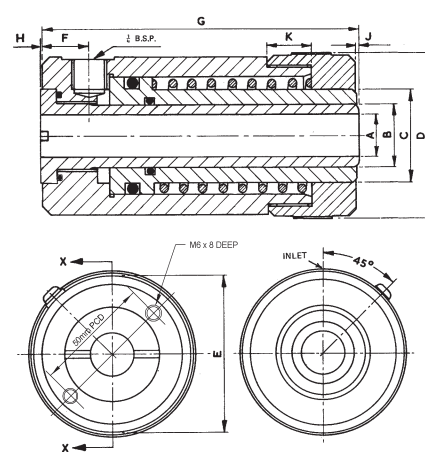
To calculate thrust per head obtain system oil pressure from booster data sheet (inside front cover) and read off from graph.



SF-3100MF



SF-3200MF



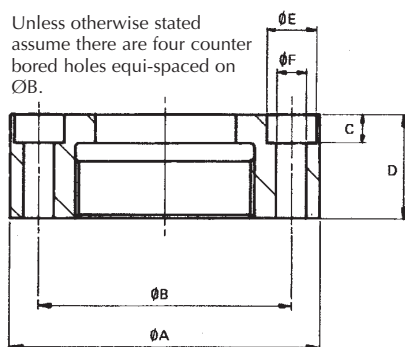
SF-3300MF

Stroke*		Effective Area cm²	Swept Volume		Dimensions in mm										Weight		WDS No	Seal Kit No
With Spring mm	Without Spring mm		With Spring cm³	Without Spring cm³	A	B	C	D	E	F	G	H	J	K	With Spring kg	Without Spring kg		
7.87	18.03	12.77	10.49	22.94	17.46	25.4	38.1	66.68	63.5	11.11	55.56	0.25	0.76	19.84	0.91	0.86	SF-3100MF	SF-3199
15.75	31.24	12.77	20.48	39.98	17.46	25.4	38.1	66.68	63.5	22.23	82.55	0.25	0.76	19.84	1.5	1.45	SF-3200MF	SF-3199
38.1	63.5	12.77	48.68	81.12	17.46	25.4	38.1	66.68	63.5	19.05	127.8	0.25	0.76	17.46	2.61	2.5	SF-3300MF	SF-3199

* Do not exceed Maximum Stroke

Mounting: To include these heads in a fixture it is only necessary to mount them over 16mm dia. studs or bolts via the hole through the centre of each head.

Unless otherwise stated assume there are four counter bored holes equi-spaced on ØB.



OPTIONAL VARIATIONS FOR STANDARD TYPE 3100MF/3200MF/3300MF OPENRAM

Part No SF-3100FL/SF-3200FL/SF-3300FL – Front flange mounting (circular) instead of screwed cap.

Dimensions in mm						Flange No.
A	B	C	D	E	F	
95.2	77.8	8.4	25.4	14.3	8.7	SF-3101FL
95.2	77.8	8.4	25.4	14.3	8.7	SF-3201FL
95.2	77.8	8.4	35.6	14.3	8.7	SF-3301FL

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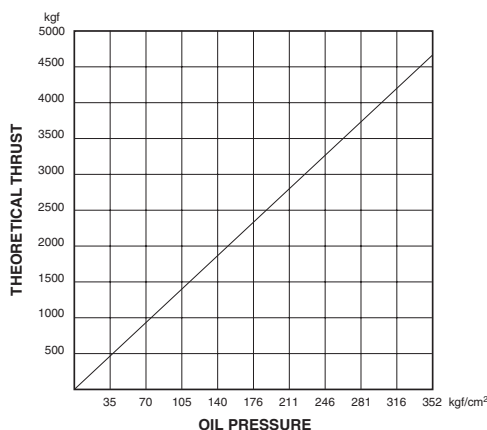
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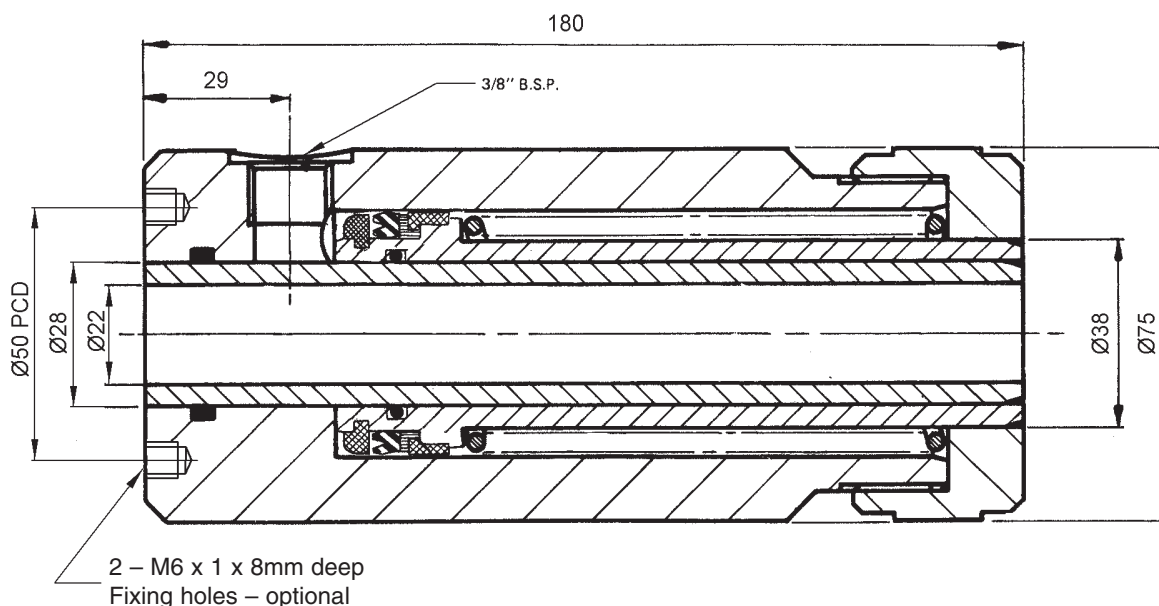
SF 6120A

PowRlock® OpenRam Superstroke Head

Technical Information



To calculate thrust per head obtain system oil pressure from booster data sheet (inside front cover) and read off from graph.

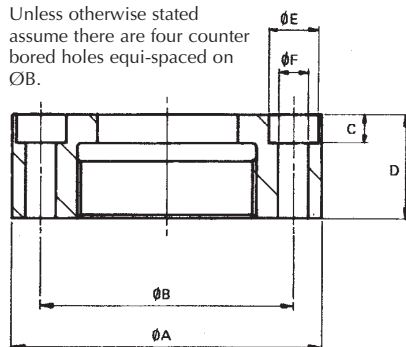


Stroke*		Effective Area cm ²	Swept Volume		Weight kg	WDS No	Seal Kit No
With Spring mm	Without Spring mm		With Spring cm ³	Without Spring cm ³			
44	100	13.47	59.27	134.7	4.84	SF-6120A	SF-4377

* Do not exceed Maximum Stroke

Mounting: To include these heads in a fixture it is only necessary to mount them over 20mm dia. studs or bolts via the hole through the centre of each head.

Unless otherwise stated assume there are four counter bored holes equi-spaced on ØB.



OPTIONAL VARIATIONS FOR STANDARD TYPE 6120A OPENRAM

Part No. 6140A – Front flange mounting (circular) instead of screwed cap.

Dimensions in mm						Flange No
A	B	C	D	E	F	
110	90	10	35	18	11	SF-6P26422

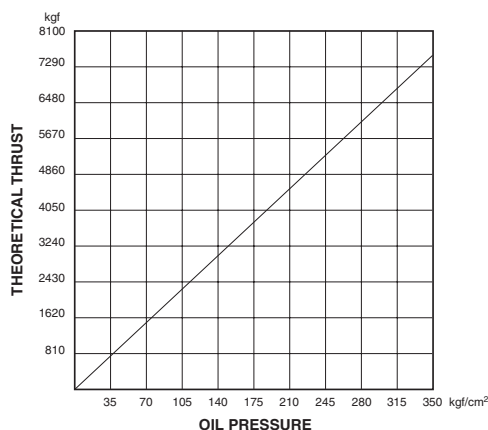
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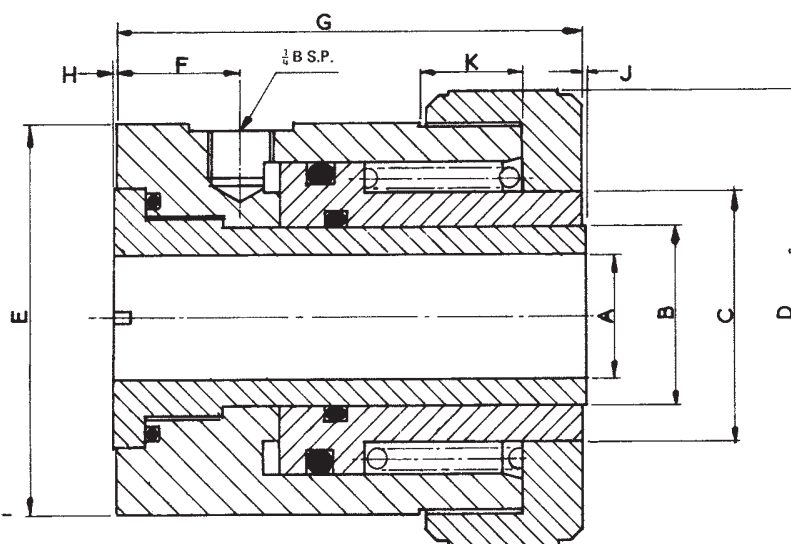
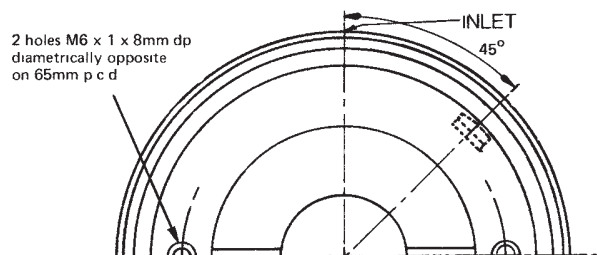
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To calculate thrust per head obtain system oil pressure from booster data sheet (inside front cover) and read off from graph.



Body/Cap Thread
3/8 – 16 – UN

Stroke*			Swept Volume		Dimensions in mm										Weight		WDS No	Seal Kit No
With Spring	Without Spring	Effective Area	With Spring	Without Spring	A	B	C	D	E	F	G	H	J	K	With Spring	Without Spring		
mm	mm	cm²	cm³	cm³											kg	kg		
17.02	31.75	21.23	33.44	67.35	25.80	36.51	50.80	92.08	79.38	25.40	96.80	0.25	0.76	20.64	3.18	3.13	SF-5500	SF-5599

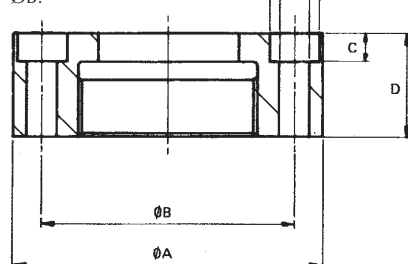
* Do not exceed Maximum Stroke

Mounting: To include these heads in a fixture it is only necessary to mount them over 25mm dia. studs or bolts via the hole through the centre of each head.

OPTIONAL VARIATIONS FOR STANDARD TYPE 5500 OPENRAM

Part No. SF-5500FL – Front flange mounting (circular) instead of screwed cap.

Unless otherwise stated assume there are four counter bored holes equi-spaced on ØB.



Dimensions in mm						Flange No
A	B	C	D	E	F	
127	101.6	10.4	31.7	16.6	10.3	SF-5501FL

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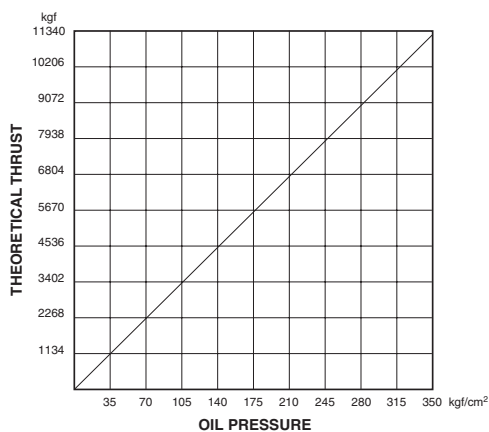
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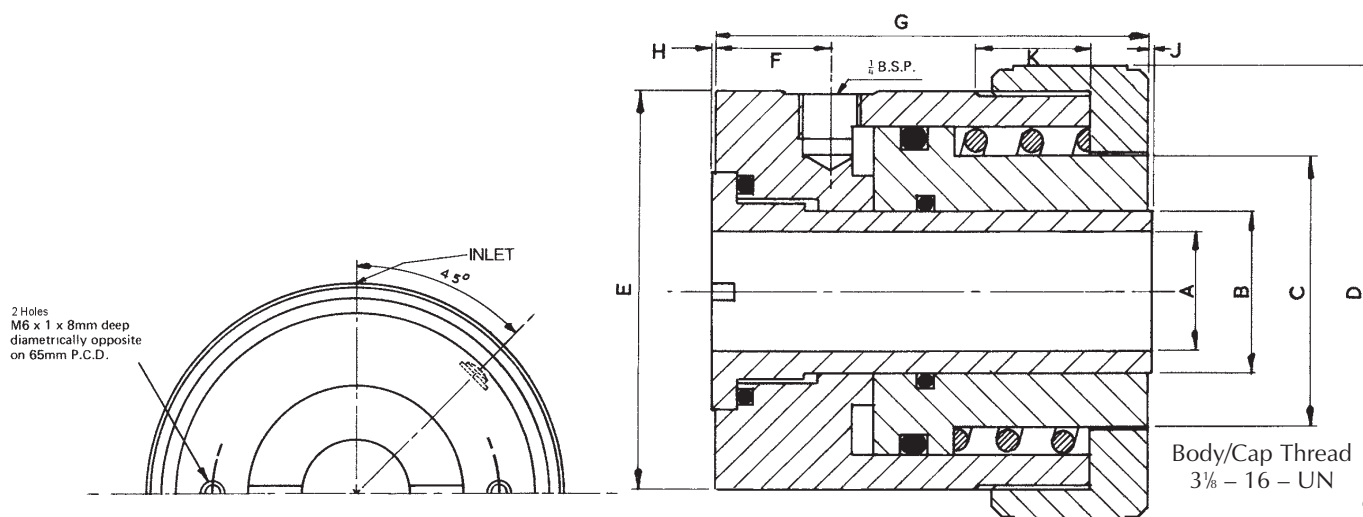
5700

PowRlock® OpenRam Seven-Ton Head

Technical Information



To calculate thrust per head obtain system oil pressure from booster data sheet (inside front cover) and read off from graph.

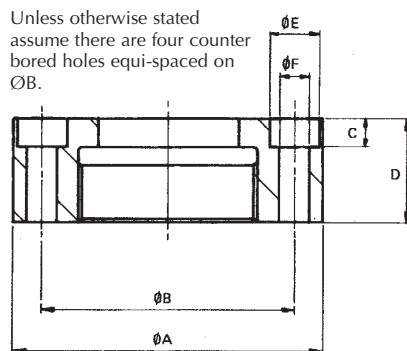


Stroke*		Effective Area cm²	Swept Volume		Dimensions in mm										Weight		WDS No	Seal Kit No
With Spring mm	Without Spring mm		With Spring cm³	Without Spring cm³	A	B	C	D	E	F	G	H	J	K	With Spring kg	Without Spring kg		
13.46	29.97	31.42	42.29	94.39	25.80	36.50	60.30	101.6	88.90	25.40	95.25	0.25	0.76	23.81	3.86	3.74	SF-5700	SF-5799

* Do not exceed Maximum Stroke

Mounting: To include these heads in a fixture it is only necessary to mount them over 25mm dia. studs or bolts via the hole through the centre of each head.

Unless otherwise stated assume there are four counter bored holes equi-spaced on ØB.



OPTIONAL VARIATIONS FOR STANDARD TYPE 5700 OPENRAM

Part No SF-5700FL – Front flange mounting (circular) instead of screwed cap.

Dimensions in mm						Flange No
A	B	C	D	E	F	
139.7	114.3	13.2	35	20.6	13.5	SF-5701FL

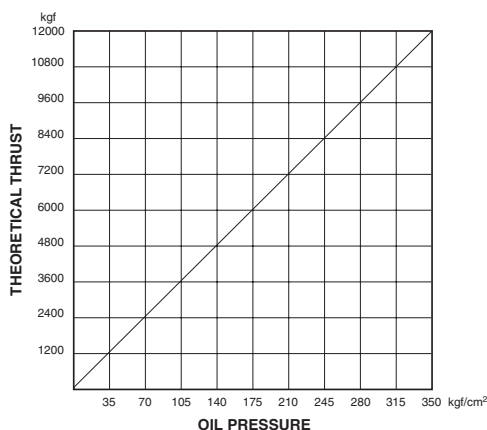
Ordering Information

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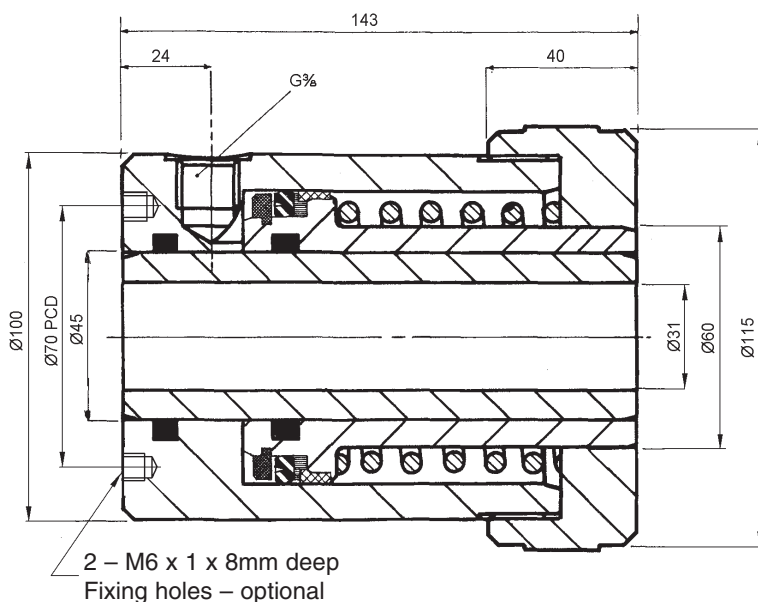
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To calculate thrust per head obtain system oil pressure from booster data sheet (inside front cover) and read off from graph.

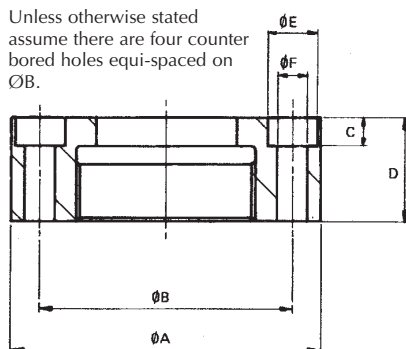


Stroke*		Effective Area cm ²	Swept Volume		Weight		WDS No	Seal Kit No
With Spring mm	Without Spring mm		With Spring cm ³	Without Spring cm ³	With Spring kg	Without Spring kg		
16	60	34.36	54.97	206.2	8.65	8.48	SF-6080A	SF-4376

* Do not exceed Maximum Stroke

Mounting: To include these heads in a fixture it is only necessary to mount them over 30mm dia. studs or bolts via the hole through the centre of each head.

Unless otherwise stated assume there are four counter bored holes equi-spaced on ØB.



OPTIONAL VARIATIONS FOR STANDARD TYPE 6080 OPENRAM

Part No SF-6040FL – Front flange mounting (circular) instead of screwed cap.

Dimensions in mm						Flange No
A	B	C	D	E	F	
160	130	16	40	26	18	SF-6P26432

Ordering Information

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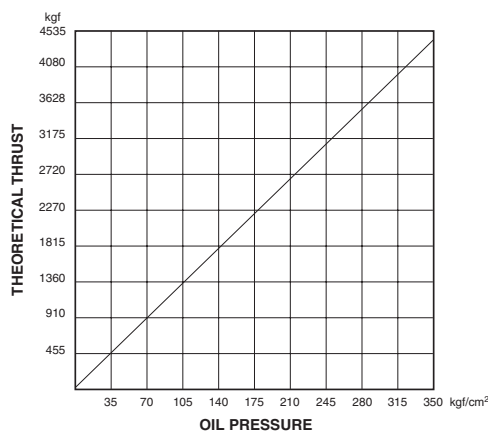
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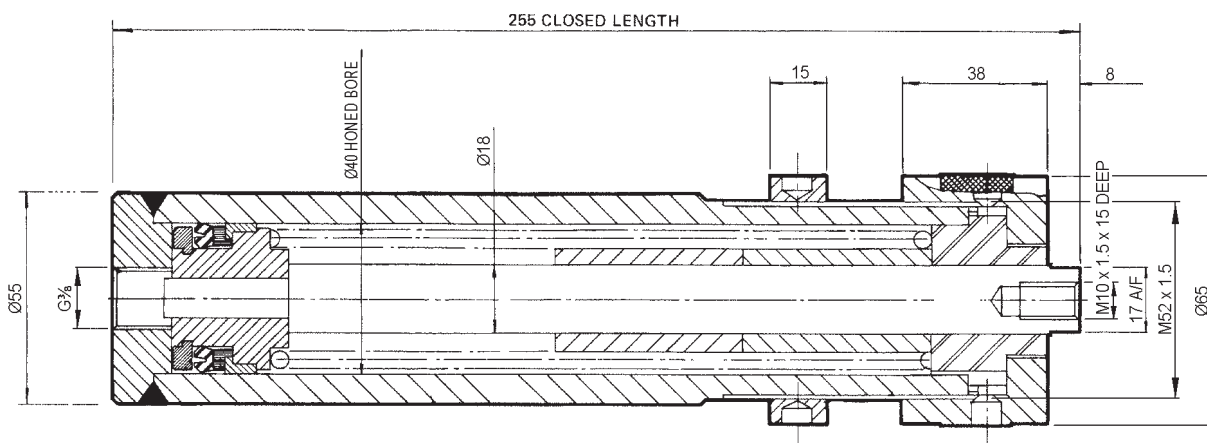
SF 6960A

PowRlock® PowerRam Head

Technical Information



To calculate thrust per head obtain system oil pressure from booster data sheet (inside front cover) and read off from graph.

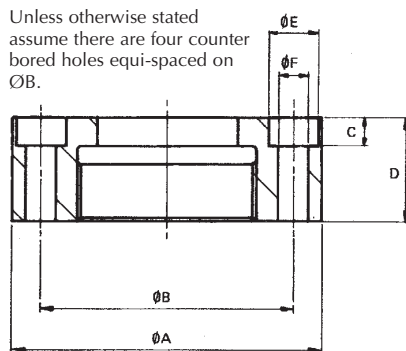


Please note: If this unit is to be used without Return Spring at least one Spacer must remain fitted.

Stroke*			Swept Volume		Max Operating Pressure kg/cm²	Weight		WDS No	Seal Kit No
With Spring mm	Without One Distance Tube and Spring mm	Effective Area cm²	With Spring cm³	Without One Distance Tube and Spring cm³		With Spring kg	Without One Distance Tube and Spring kg		
70	120	12.57	89.25	153	350	3.8	3.52	SF-6960A	SF-4378

* Do not exceed Maximum Stroke

Unless otherwise stated assume there are four counter bored holes equi-spaced on ØB.



OPTIONAL VARIATIONS FOR STANDARD TYPE 6960 POWRAM

Part No SF-6980A – Front flange mounting (circular) instead of screwed cap.

Dimensions in mm						Flange No
A	B	C	D	E	F	
90	70	8	38	15	9	SF-6P26427

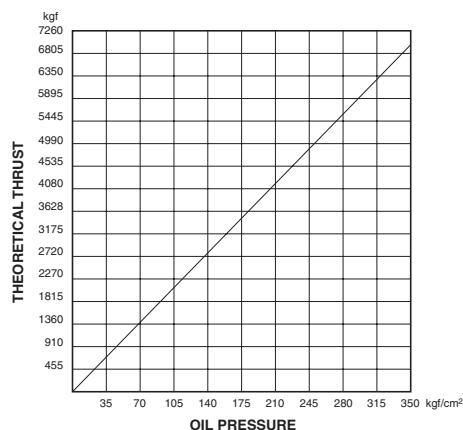
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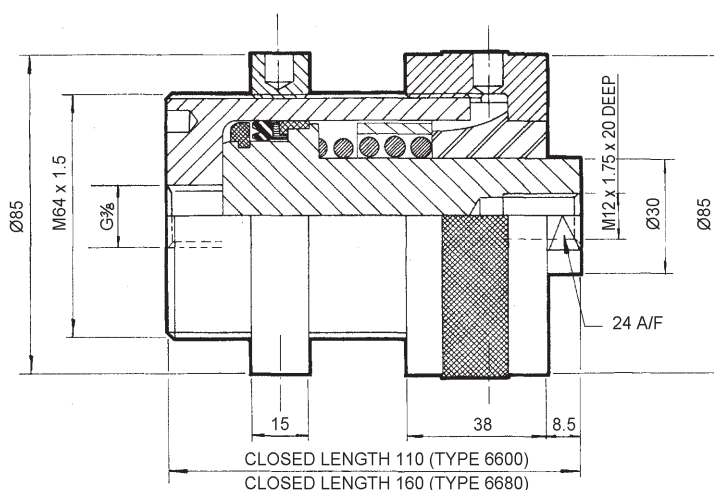
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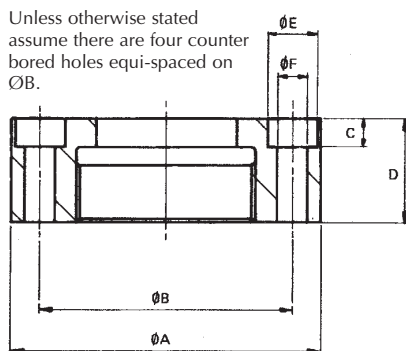


Note for SF-6680A: Overall closed length = 160mm

Stroke*			Swept Volume		Max Operating Pressure kg/cm²	Weight		WDS No	Seal Kit No
With Spring mm	Without One Distance Tube and Spring mm	Effective Area cm²	With Spring cm³	Without One Distance Tube and Spring cm³		With Spring kg	Without One Distance Tube and Spring kg		
10	30	19.6	19.6	58.8	350	3.12	2.89	SF-6600A	SF-4379
30	80	19.6	58.8	156.8	350	3.87	3.46	SF-6680A	SF-4379

* Do not exceed Maximum Stroke

Unless otherwise stated assume there are four counter bored holes equi-spaced on ØB.



OPTIONAL VARIATIONS FOR STANDARD TYPE 6600/6680 POWRAM

Part No SF-6620A and SF-6700A – Front flange mounting (circular) instead of screwed cap.

Dimensions in mm						Flange No
A	B	C	D	E	F	
110	90	10	38	18	11	SF-6P26429

Ordering Information

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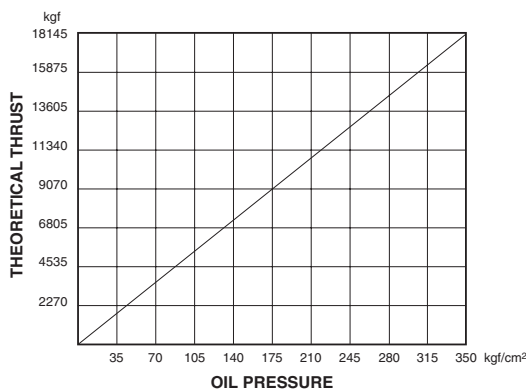
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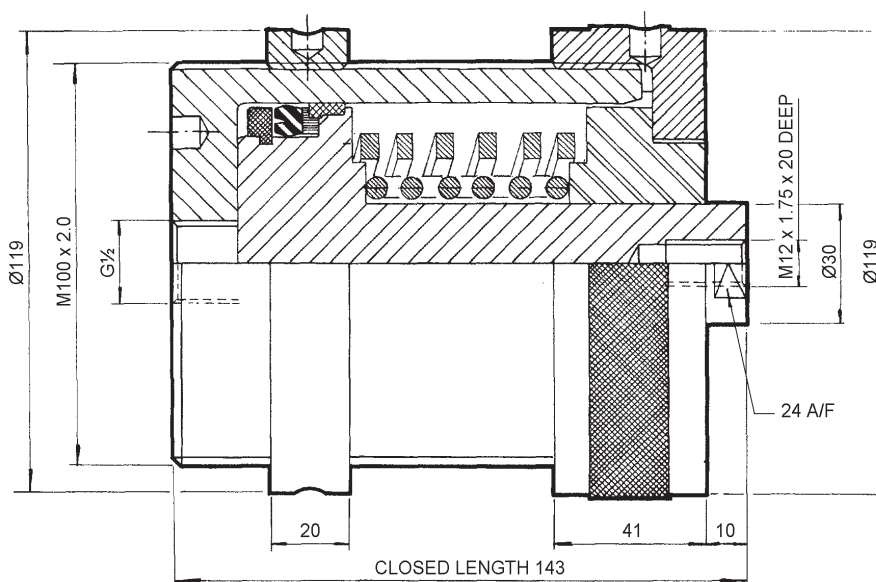
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6840B **PowRlock®** **PowRam Head**

Technical Information



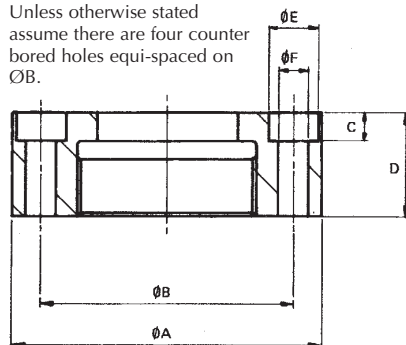
To calculate thrust per head obtain system oil pressure from booster data sheet (inside front cover) and read off from graph.



Stroke*		Effective Area cm²	Swept Volume		Max Operating Pressure kg/cm²	Weight		WDS No	Seal Kit No
With Spring mm	Without Spring mm		With Spring cm³	Without Spring cm³		With Spring kg	Without Spring kg		
20	50	50.2	100.4	251	350	7.24	6.6	SF-6840B	SF-4382

* Do not exceed Maximum Stroke

Unless otherwise stated assume there are four counter bored holes equi-spaced on ØB.



OPTIONAL VARIATIONS FOR STANDARD TYPE 6840 POWRAM

Part No SF-6860B – Front flange mounting (circular) instead of screwed cap.

Dimensions in mm						Flange No
A	B	C	D	E	F	
160	130	18	38	26	18	SF-6P26425

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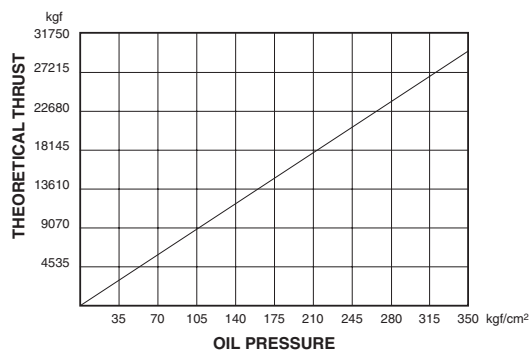
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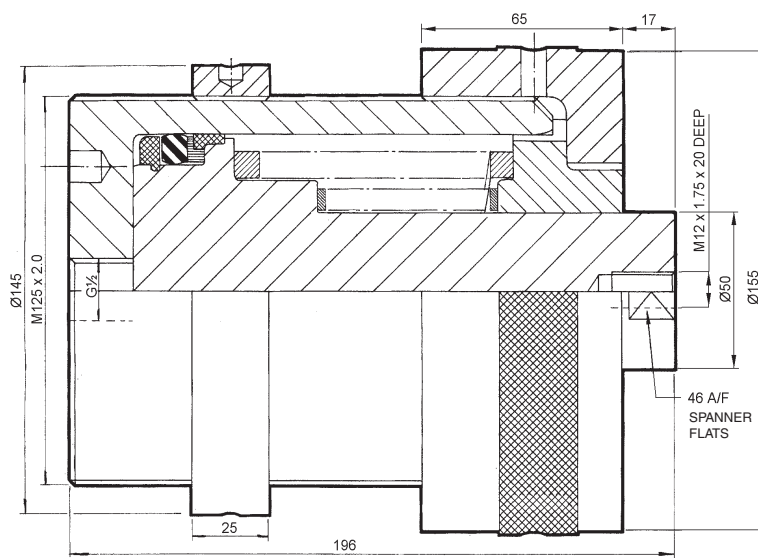
SF 6160A

PowRlock® PowRam Head

Technical Information



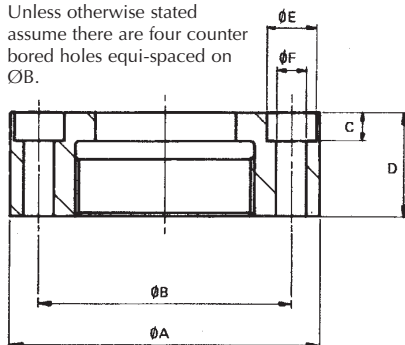
To calculate thrust per head obtain system oil pressure from booster data sheet (inside front cover) and read off from graph.



Stroke*		Effective Area cm²	Swept Volume		Max Operating Pressure kg/cm²	Weight		WDS No	Seal Kit No
With Spring mm	Without Spring mm		With Spring cm³	Without Spring cm³		With Spring kg	Without Spring kg		
20	58	78.54	157.08	455.5	350	16.67	15.87	SF-6160A	SF-4380

* Do not exceed Maximum Stroke

Unless otherwise stated assume there are four counter bored holes equi-spaced on ØB.



SF-6180A POWRAM WITH CIRCULAR FLANGE

Part No SF-6180A – Front flange mounting (circular) instead of screwed cap.

Dimensions in mm						Flange No
A	B	C	D	E	F	
200	160	18	65	26	18	SF-6P26439

Please note: Flange No. 6P26439 has six counter bored mounting holes equi-spaced on ØB.

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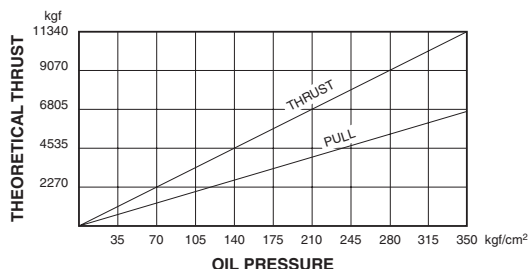
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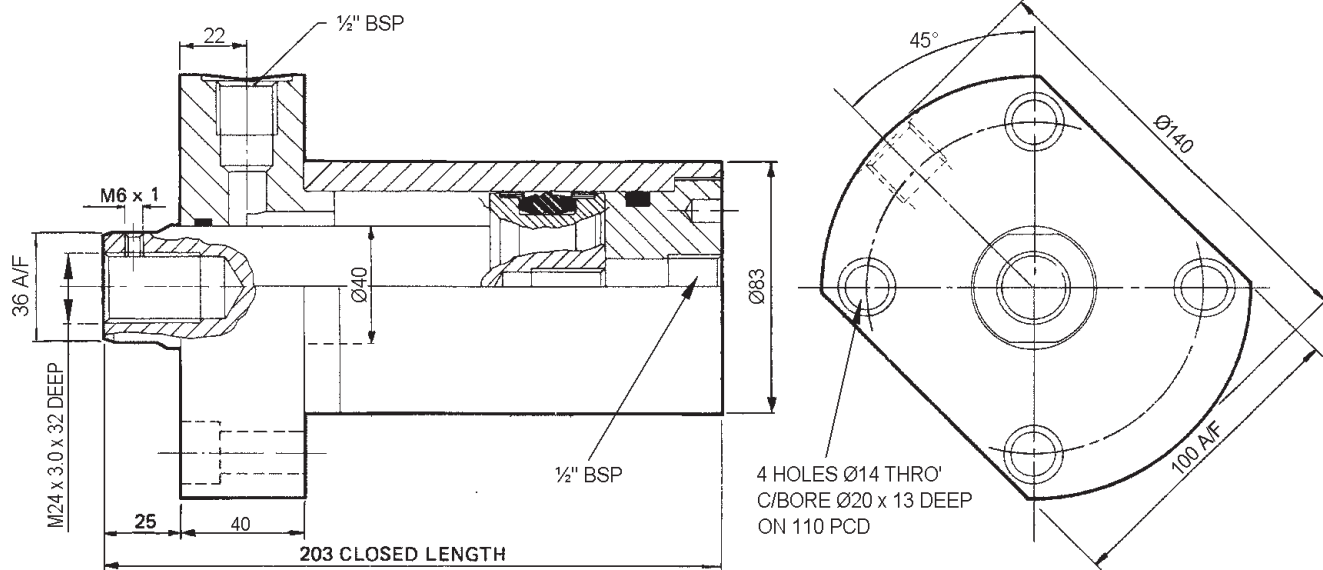
SF 6920A

PowRlock® Double Acting Piercing Head

Technical Information



To obtain thrust per head obtain system pressure from Booster Data Sheet (inside front cover) and read off from graph.



Stroke*	Effective Area		Swept Volume		Max Operating Pressure kg/cm²	Weight kg	WDS No	Seal Kit No
	Full Bore Side cm²	Annulus Side cm²	Full Bore Side cm³	Annulus Side cm³				
50	31.17	18.61	155.85	93.05	350	8.2	SF-6920A	SF-4394

* Do not exceed Maximum Stroke

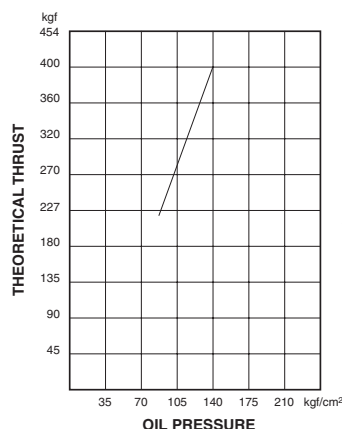
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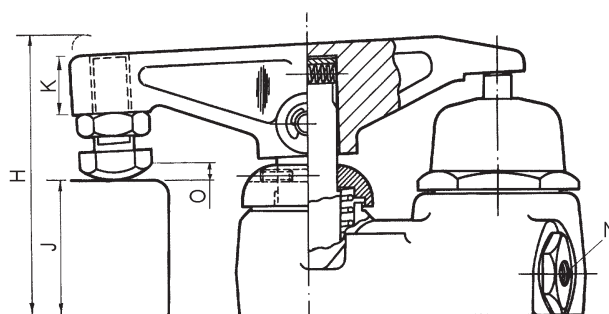
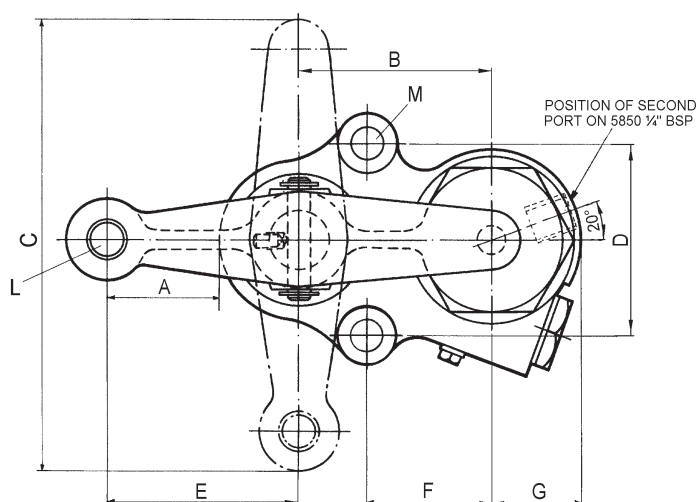


Note: 2 port type 5850 for external sequencing.

MAXIMUM WORKING OIL PRESSURE
170kg/cm²



To calculate thrust per head obtain system oil pressure from booster data sheet (inside front cover) and read off from graph.



The Swing Clamp can be adjusted to either clockwise or anti-clockwise movement. It is supplied to swing clockwise. The drawings in full line show swing clamp in the 'on' position. Arm automatically swings from dotted position to clamping position when pressure is applied to inlet port. When pressure is released the arm automatically returns.

A minimum working pressure of 90kg/cm² is required to raise the clamping plunger after the arm is in position.

Vertical Stroke mm	Clamp Force at 138kg/cm²	Swept Volume cm³	Weight kg	WDS No	Seal Kit No
6.35	409kg	3.93	2.29	SF-5800	SF-4325
6.35	409kg	3.93	2.29	SF-5850	SF-4325

Dimensions in mm												
A	B	C	D	E	F	G	H	J	K	L	M	N
40.50	73.15	149.34	63.50	76.19	22.20	22.20	94.00	50.80	20.60	½ – 20 – UNF	10.32	¼" – BSP

NB: Single port versions should be used in conjunction with a Booster

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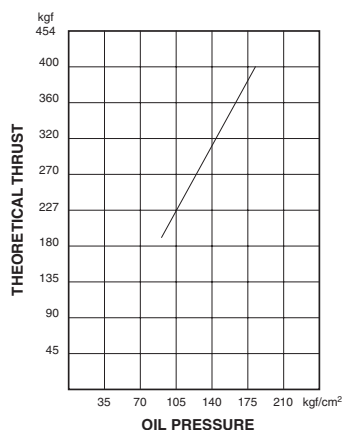
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5900/5950

PowRlock® Swing Clamp

Technical Information

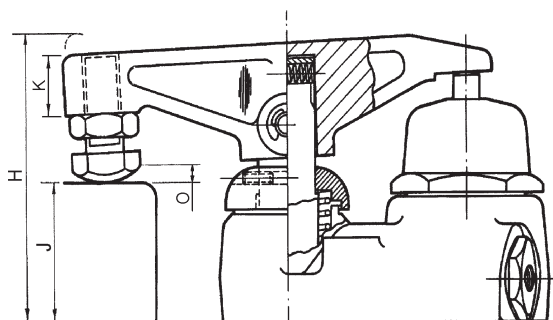
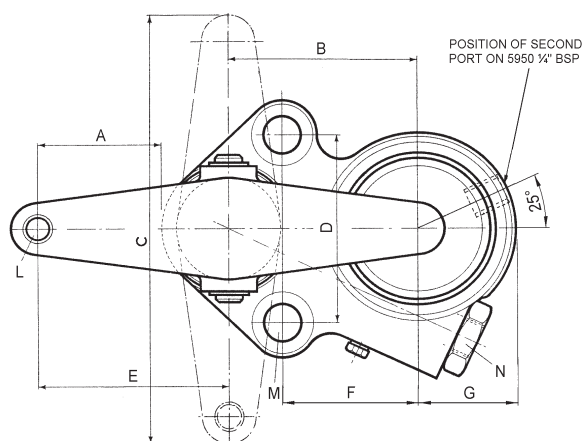


Note: 2 port type 5950 for external sequencing.

MAXIMUM WORKING
OIL PRESSURE
170kg/cm²



To calculate thrust per head obtain system oil pressure from booster data sheet (inside front cover) and read off from graph.



The Swing Clamp can be adjusted to either clockwise or anti-clockwise movement. It is supplied to swing clockwise. The drawings in full line show swing clamp in the 'on' position. Arm automatically swings from dotted position to clamping position when pressure is applied to inlet port. When pressure is released the arm automatically returns.

A minimum working pressure of 90kg/cm² is required to raise the clamping plunger after the arm is in position.

Vertical Stroke	Clamp Force at 138kgf/cm²	Swept Volume cm³	Weight kg	WDS No	Seal Kit No
11	1510kg	20	7.3	SF-5900	SF-4326
11	1510kg	20	7.3	SF-5950	SF-4326

Dimensions in mm													
A	B	C	D	E	F	G	H	J Max	K	L	M	N	O
57.15	88.90	203.20	88.90	88.90	63.50	46.00	138.11	71.05	38.10	½ - 20 - UNF	16.70	¼ - BSP x 12.70	11.00

NB: Single Port versions should be used in conjunction with a Booster

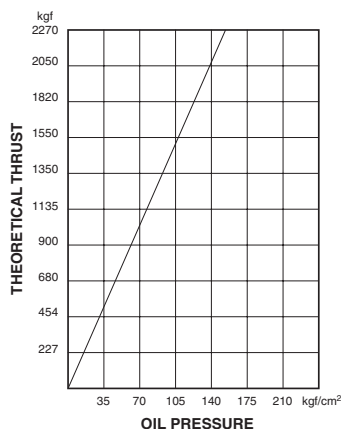
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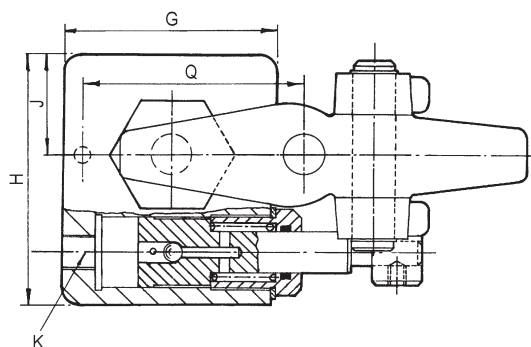
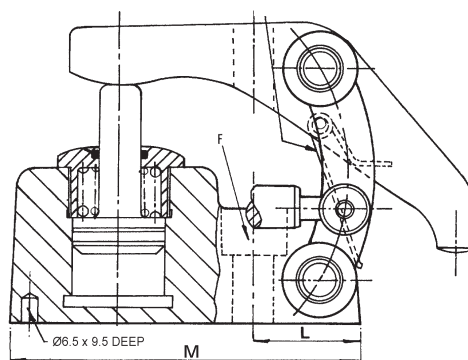
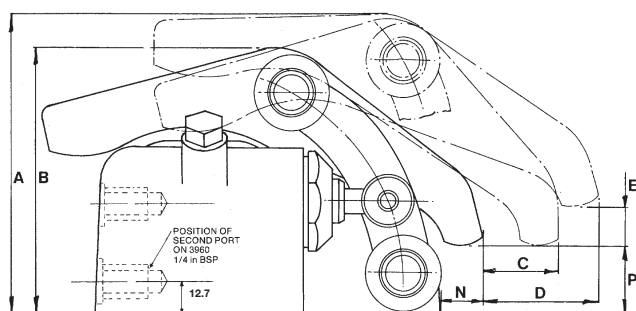
SINGLE PORT TYPE
3850A

2 PORT TYPE 3960
for external sequencing

MAXIMUM WORKING
OIL PRESSURE
210kg/cm²



To obtain thrust per head obtain system pressure from Booster Data Sheet (inside front cover) and read off from graph.



Vertical Stroke mm	Effective Area cm ²	Swept Volume cm ³	Weight kg	WDS No	Seal Kit No
15.88	9.55	23	5.90	SF-3850A	SF-3899
15.88	9.55	23	5.90	SF-3960	SF-3899

Dimensions in mm															
A	B	C	D	E	F Dia	G	H	J	K	L	M	N	P	Q	
114.3	101.6	27.78	43.66	15.88	16.28	80.96	95.25	38.1	1/4 BSP	39.69	131.76	15.88	26.99	84.14	

NB: Single Port versions should be used in conjunction with a Booster

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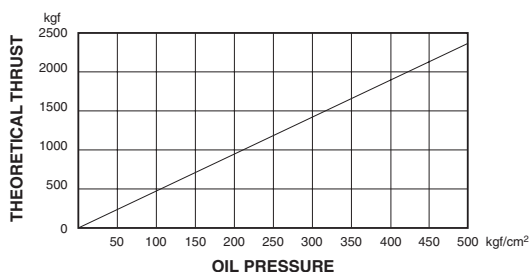
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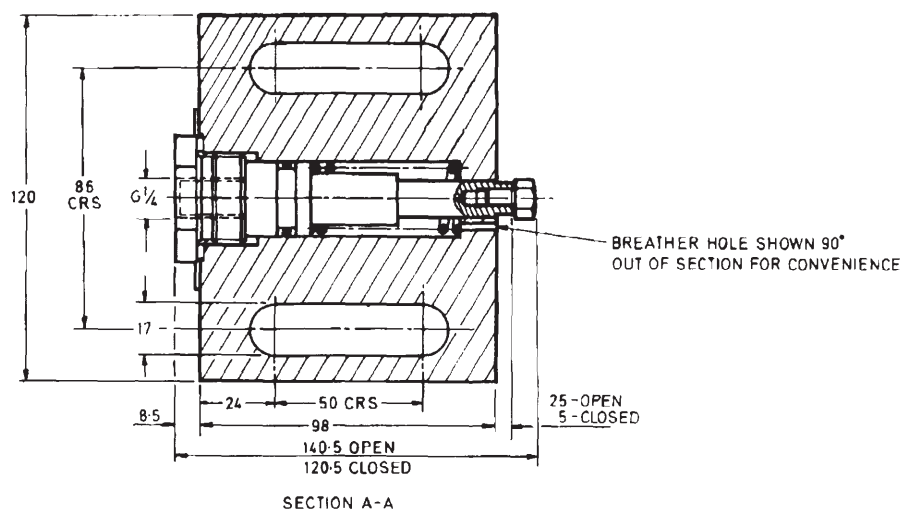
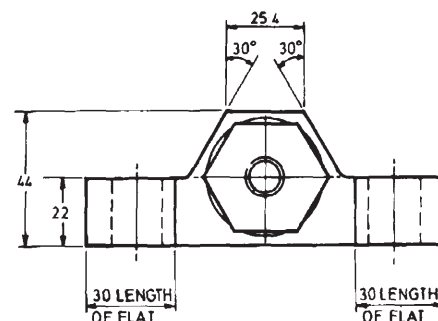
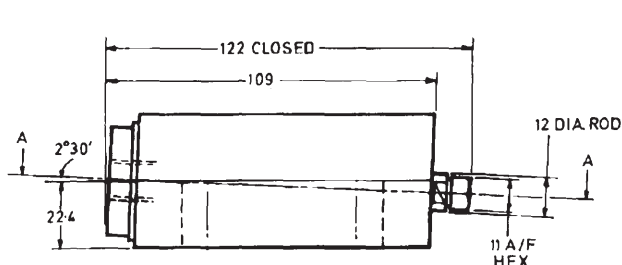
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5389 **PowRlock®** **Low Line Clamp**

Technical Information



To obtain thrust per head obtain system pressure from Booster Data Sheet (inside front cover) and read off from graph.



Stroke mm	Effective Area cm²	Swept Volume cm³	Max Operating Pressure kgf/cm²	Thrust at 510kgf/cm²	Spring Load at fitted Height kg	Return Spring Rate kgf/mm	WDS No	Seal Kit No
20	4.9	9.8	510	2489kgf	9.88	0.52	SF-5389	SF-53899

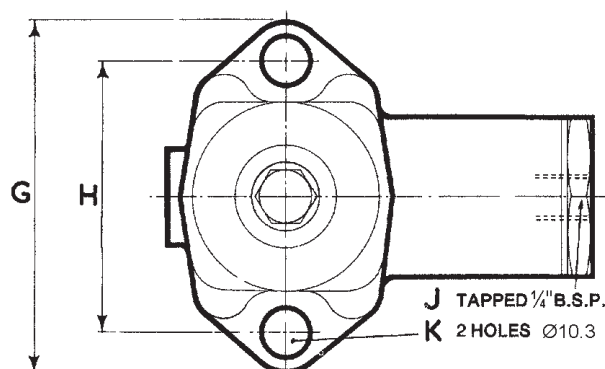
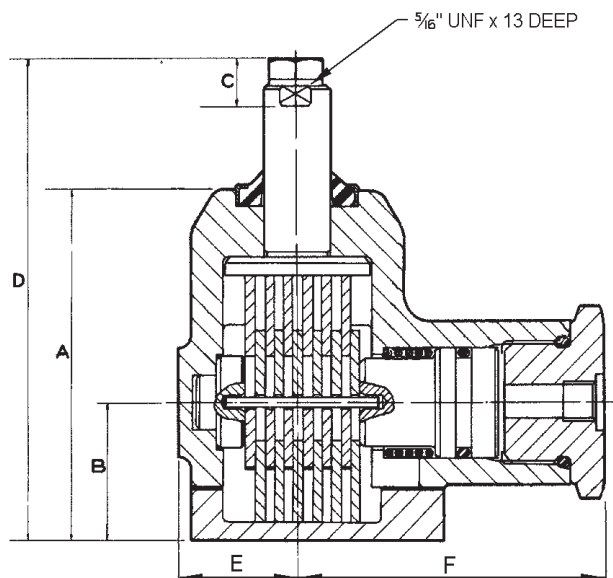
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Vertical Stroke mm	Force to Depress Plunger kg	Load Supported at 130kgf/cm ²	Weight kg	Max Pressure kg/cm ²	Swept Volume cm ³	WDS No	Seal Kit No
12.70	6.35	900kg	1.47	211	0.82	SF-OE12929	SF-4328

Dimensions in mm									
A	B	C Max Stroke	D	E	F	G	H	J	K Dia
81.79	33.27	12.70	113.28	28.32	72.64	82.35	63.50	¼ BSP	10.31

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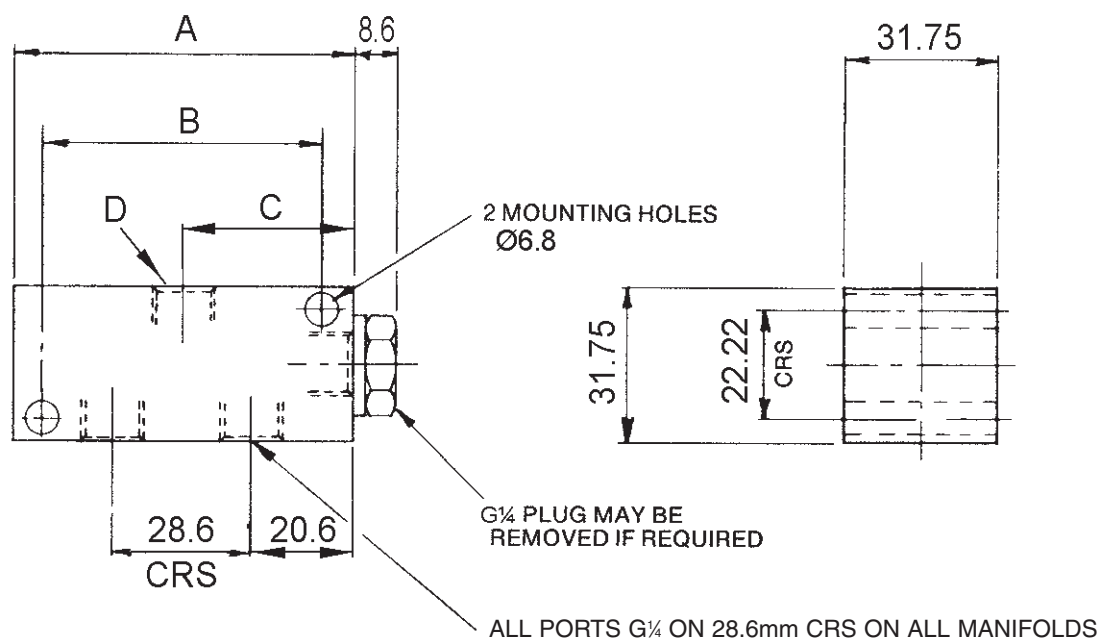
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4071-4074

PowRlock® Manifolds

Technical Information



Number of Ports	Dimensions in mm				Weight kg	WDS No
	A	B	C	D		
2	70	57.2	35	G $\frac{1}{4}$	0.46	SF-4071
4	127	114.3	64	G $\frac{1}{2}$	0.82	SF-4072
6	184	171.5	92	G $\frac{1}{2}$	1.21	SF-4073
8	241	228.6	120	G $\frac{1}{2}$	1.57	SF-4074

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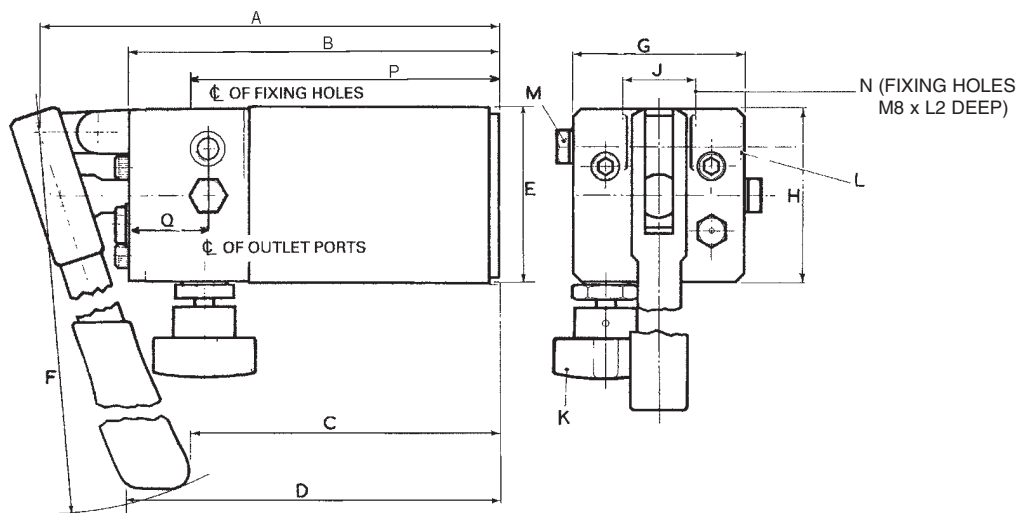
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PowRlock® Lever Pump

Technical Information



PORTS 1/8" BSP WITH Ø13.5 SPOTFACE (SEAL WITH COPPER WASHER)

Fluid Capacity cm ³	Displacement per Cycle cm ³	Normal Operating Pressure kg/cm ²	Max Pressure kg/cm ²	Weight kg	WDS No	Seal Kit No
163.87	4.91	141	175	3.17	SF-OE00690	SF-4405
327.74	4.91	141	175	3.4	SF-OE00691	SF-4405

Dimensions in mm												WDS No
A	B	C	D	E	F	G	H	J	N	P	Q	
167.4	135.73	57.15	317.5	64.76	298.45	63.5	63.5	26.98	12.7	117.5	29.4	SF-OE00690
237.49	205.74	127	307.35	64.76	298.45	63.5	63.5	26.98	12.7	187.2	29.4	SF-OE00691

Note: Exchange unit available.

- All dimensions in millimeters
- K-release knob (anti-clockwise to release)
- M-port may be used as additional outlet
- Double acting lever pumps must be installed with lever mechanism and plunger at the top – maximum tilt from vertical 30°
- Internal relief valve set to limit pressure to 175kg/cm² – it is adjustable

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OE00729/OE00730

PowRlock® **Standard Hand Pump**

Technical Information

1.5 litre container

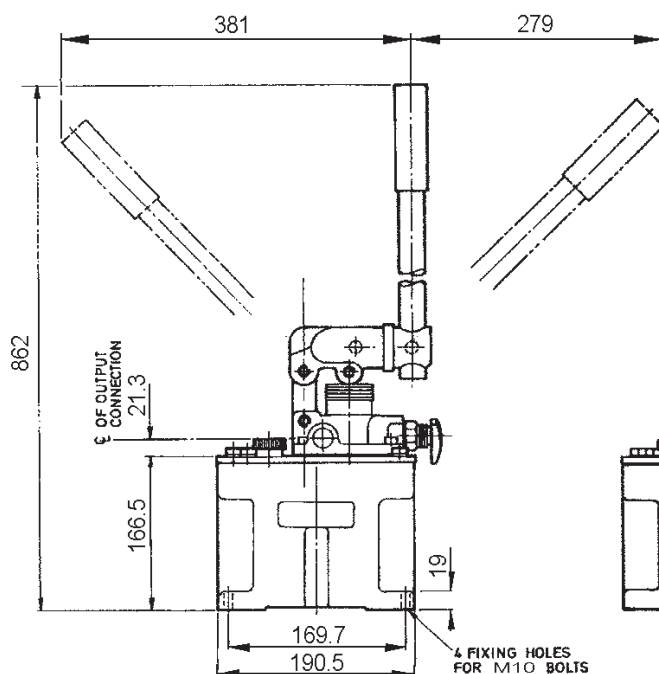
Output complete cycle 25cm³

Maximum pressure (blow off) 175kgf/cm²

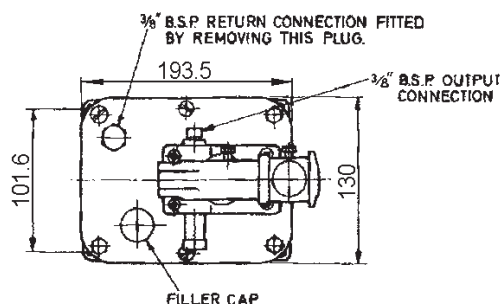
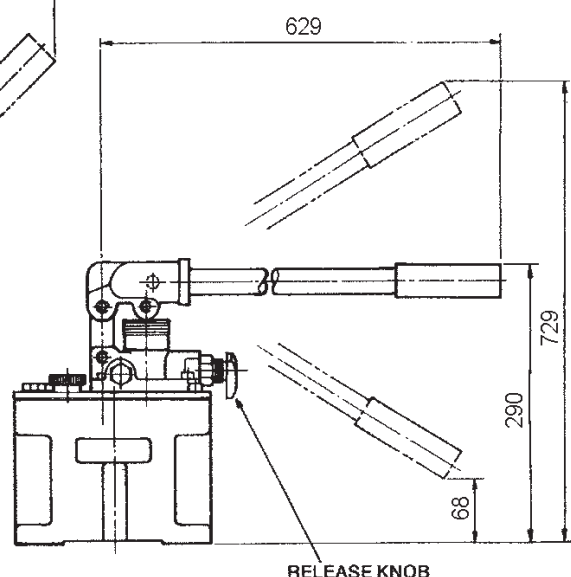
Effort required on handle at operating pressure of 100 bar = 22kgs



VERTICAL HANDLE



HORIZONTAL HANDLE



Handle Position	Weight kg	WDS No	Seal Kit No
Vertical	8.6	SF-OE00729	SF-4440
Horizontal	8.6	SF-OE00730	SF-4440

Ordering Information

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PowRlock® Standard Hand Pump

Technical Information

3.3 litre container

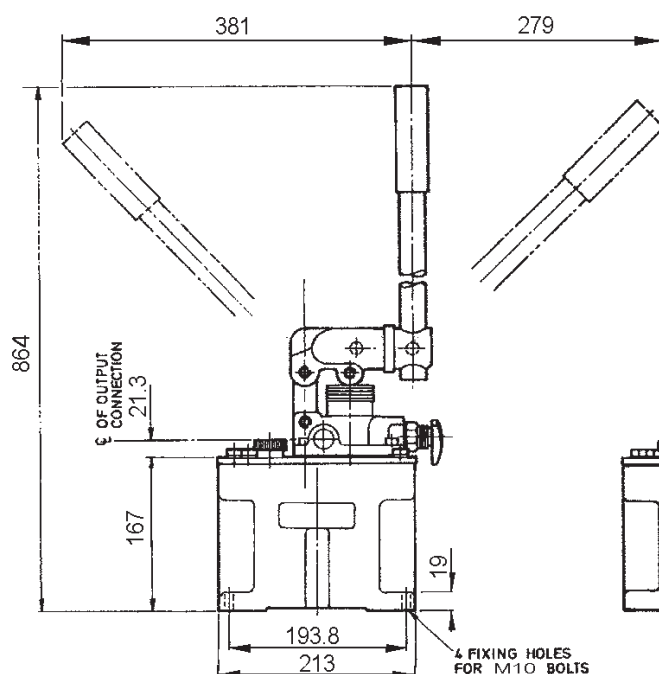
Output complete cycle 25cm³

Maximum pressure (blow off) 175kgf/cm²

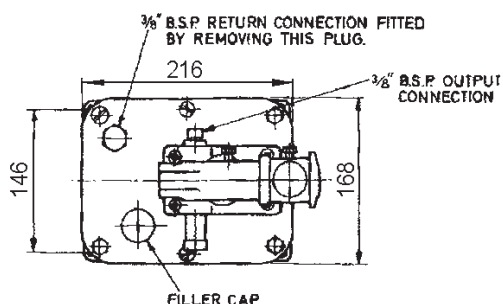
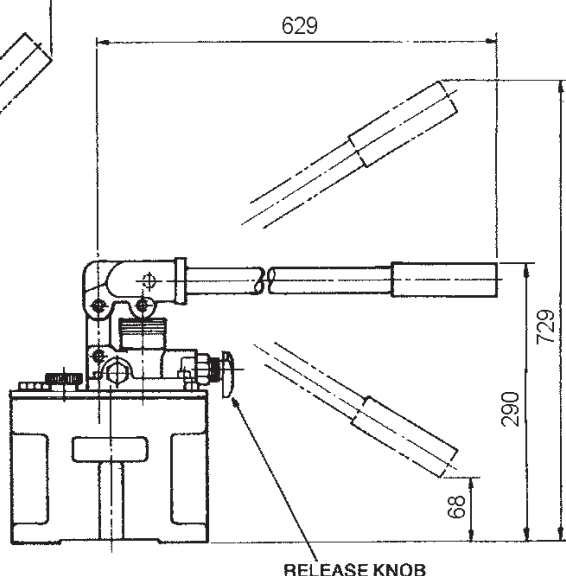
Effort required on handle at operating pressure of 100 bar = 22kgs



VERTICAL HANDLE



HORIZONTAL HANDLE



Handle Position	Weight kg	WDS No	Seal Kit No
Vertical	11.3	SF-OE00731	SF-4440
Horizontal	11.3	SF-OE00732	SF-4440

Ordering Information

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SF OE00733/OE00736

PowRlock® Standard Hand Pump

Technical Information

Large container

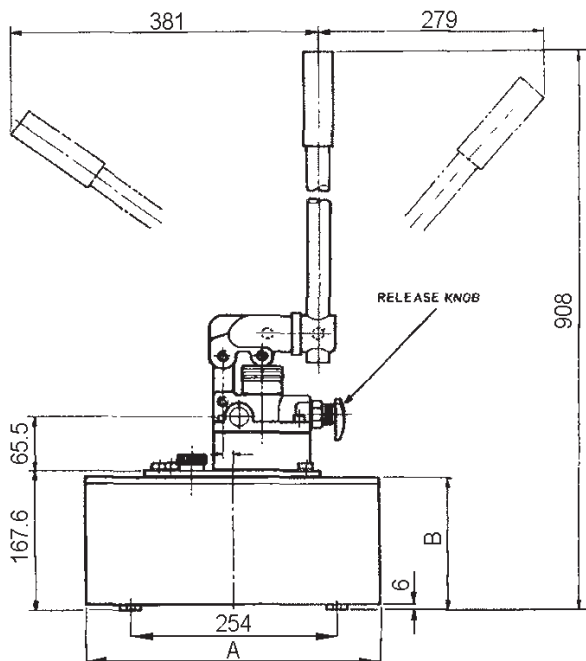
Output complete cycle 25cm³

Maximum pressure (blow off) 175kgf/cm²

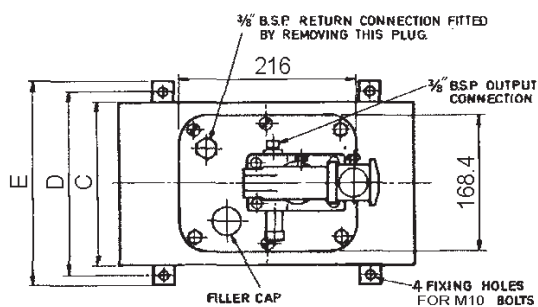
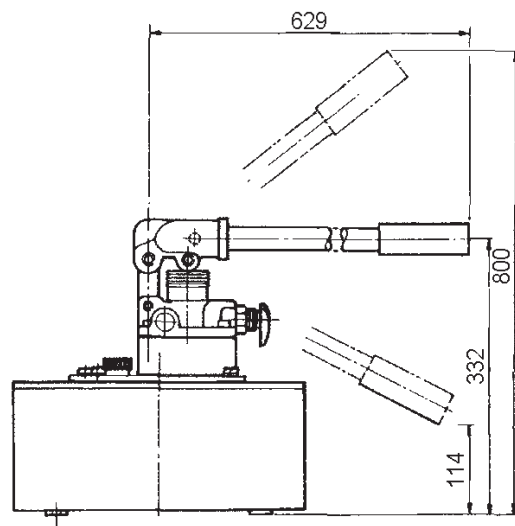
Effort required on handle at operating pressure of 100 bar = 22kgs



VERTICAL HANDLE



HORIZONTAL HANDLE



Fluid Capacity Litres	Handle Position	A	B	C	D	E	Weight kg	WDS No	Seal Kit No
9	Vertical	363	160	203.2	229	254	13	SF-OE00733	SF-4440
9	Horizontal	363	160	203.2	229	254	13	SF-OE00734	SF-4440
18	Vertical	591	152.4	254	279	305	17	SF-OE00735	SF-4440
18	Horizontal	591	152.4	254	279	305	17	SF-OE00736	SF-4440

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PowRlock® Dual Displacement Pump

Technical Information

2.9 litre container

Normal operating pressure 100 bar

Change over pressure 33 bar

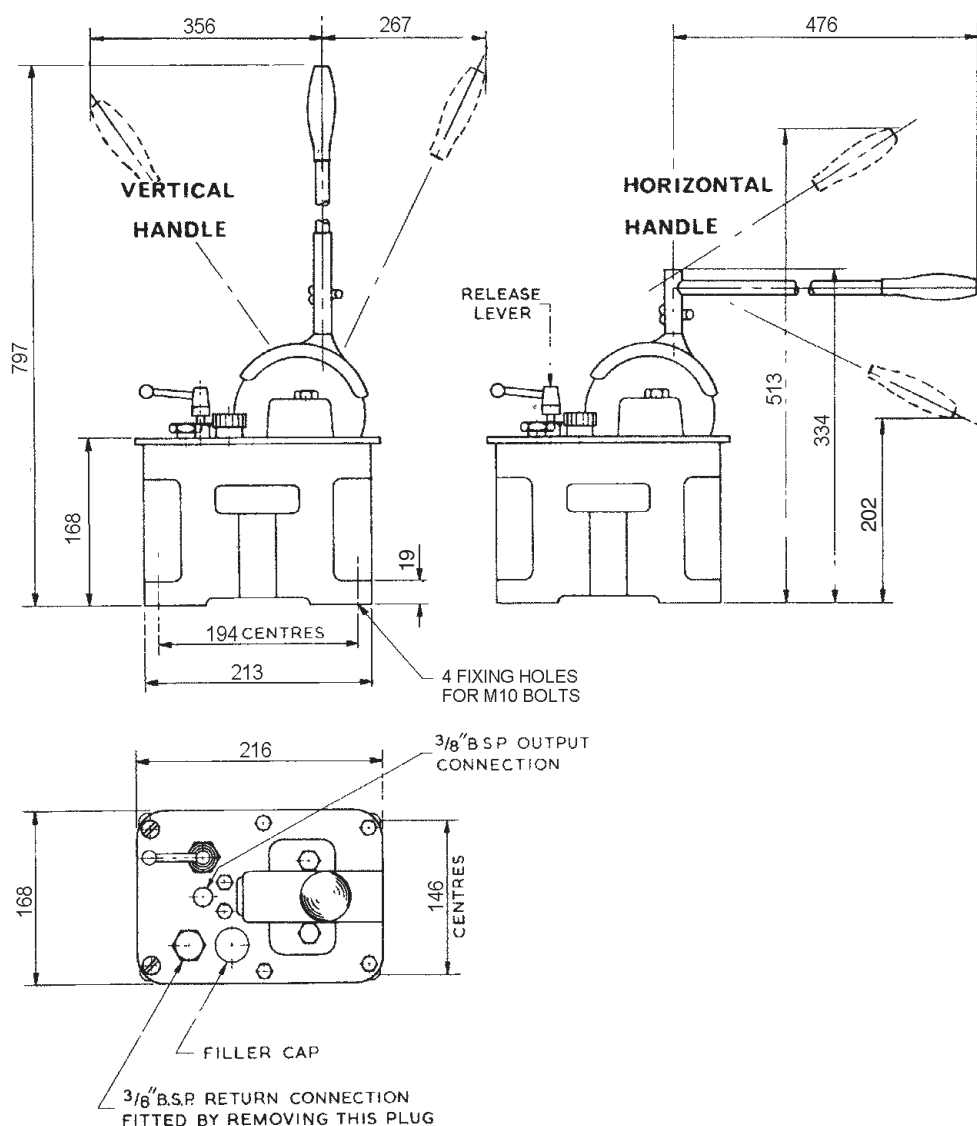
Maximum pressure (blow off) 175kgf/cm²

Effort required on handle at operating pressure of 100 bar = 18kgs

Output/complete cycle Ratio

1st Stage 47.33cm³ 3.5:1

2nd Stage 13.55cm³ 1:1



Handle Position	Weight kg	WDS No	Seal Kit No
Vertical	10	SF-OE00490	SF-4404
Horizontal	10	SF-OE00491	SF-4404

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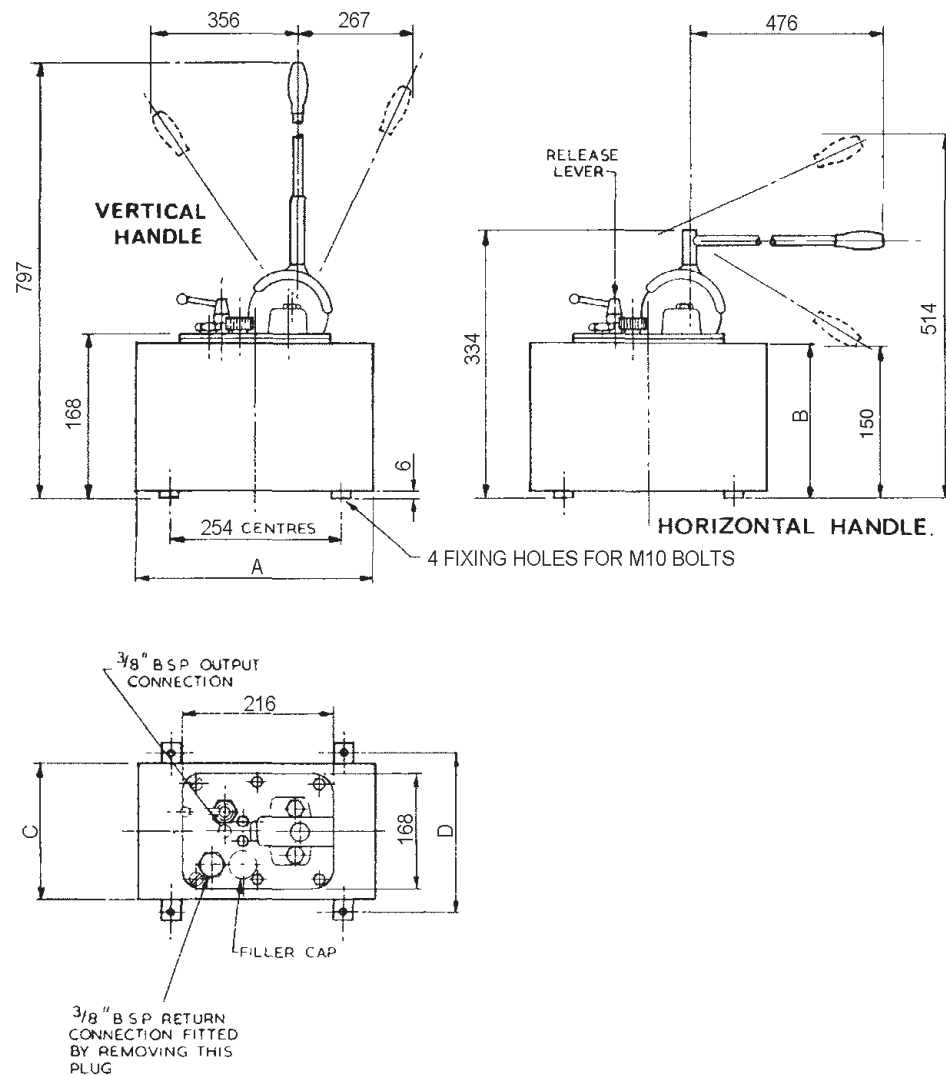


OE00481/OE00484

PowRlock® **Dual Displacement** **Pump**

Technical Information

Large container	Output/complete cycle	Ratio
Change over pressure 100 bar	1st Stage 47.33cm ³	3.5:1
Maximum pressure (blow off) 175kgf/cm ²	2nd Stage 13.55cm ³	1:1
Effort required on handle at operating pressure of 100 bar = 18kgs		



Fluid Capacity Litres	Handle Position	Dimensions in mm				Weight kg	WDS No	Seal Kit No
		A	B	C	D			
9	Vertical	363	160	203	229	12	SF-OE00481	SF-4404
9	Horizontal	363	160	203	229	12	SF-OE00482	SF-4404
18	Vertical	591	152.4	254	279	16	SF-OE00483	SF-4404
18	Horizontal	591	152.4	254	279	16	SF-OE00484	SF-4404

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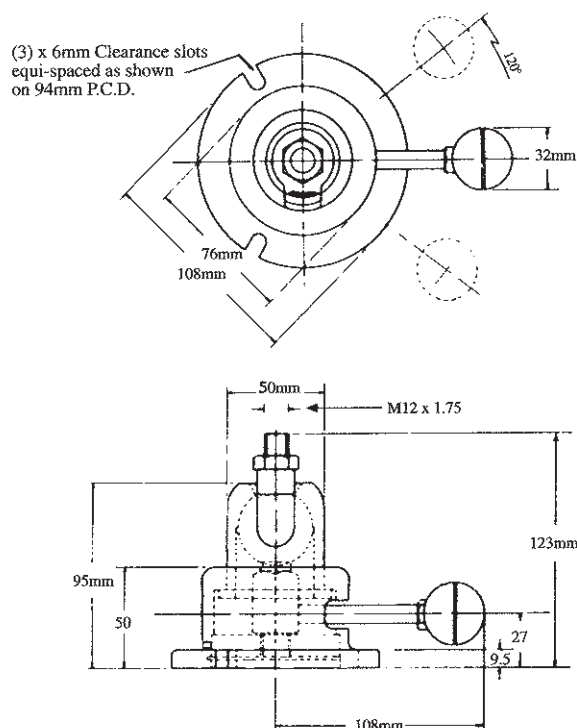
PowRlock® Hydraclamps Miniclamp Type 1200M

Mechanical Operation

Maximum loading 6kg
300mm from Ball Centre at 45°

One motion of the operating lever locks the work in any desired position. It is the ideal tool for the assembly of all light components and will hold any fitment or jig which can be drilled and tapped for mounting direct on the thread.

To reset preload, or adjust handle position, it is only necessary to slacken the adjustment lock screw in the side of the body, reposition the nut plate and lock in required new position.



ACCESSORIES



LOCK GRIP PLIERS
Type 1208M

Instantaneous self-locking pliers making a convenient light vice for small assemblies.



SUCTION PAD BASE
Type 1242

Allows the Miniclamp to be fixed rigidly wherever required without drilling and to be moved instantly to any position. Height 29mm.

Description	Weight kg	WDS No
Hydraclamp	1.2	SF-1200M
Lock Grip Pliers	0.5	SF-1208M
Suction Pad Base	0.5	SF-1242

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SF 1300M/1320M

PowRlock® Hydraclamps

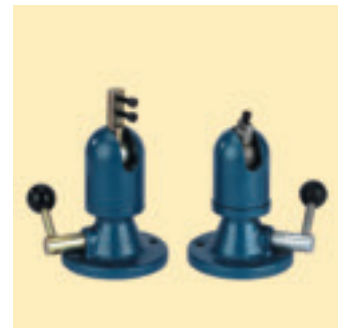
Maxi Type 1300M/1320M

Mechanical Operation

Maximum loading 13kg
300mm from Ball Centre at 45°

TYPE 1300M

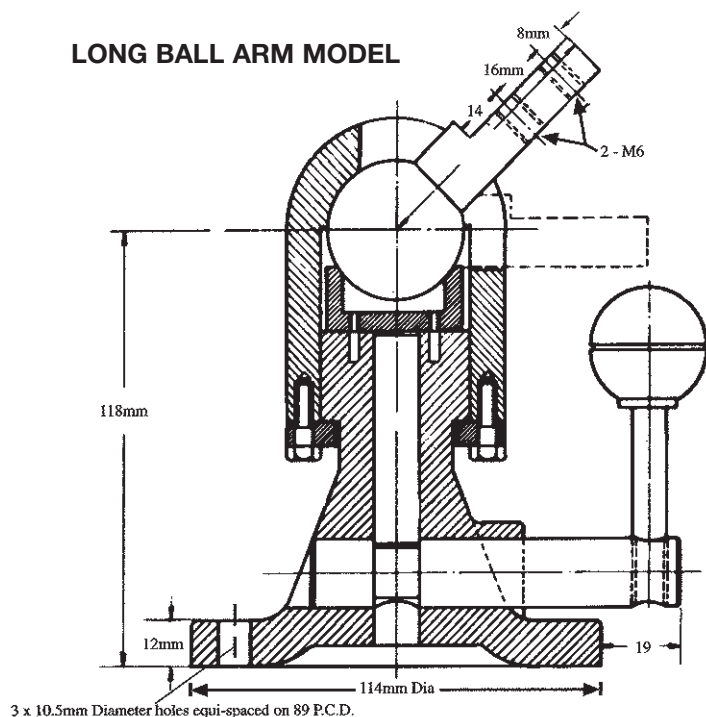
This standard Short Ball arm Maxiclamp is a sturdy small sized Mechanical Positioner produced to meet a demand from users requiring a capacity exceeding that of the Miniclamp but insufficient to warrant the use of our larger Hydraulic models.



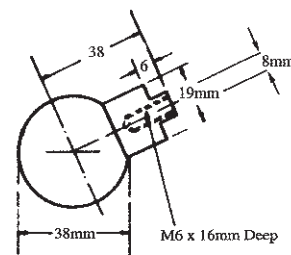
TYPE 1320M

The original long ball model Maxiclamp remains available for cases where this provides a more suitable means of mounting work.

LONG BALL ARM MODEL



SHORT BALL ARM MODEL



Type	Weight kg	WDS No
Short Ball arm	3.4	SF-1300M
Long Ball arm	3.4	SF-1320M

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Hydraulic Operation

SENIOR HYDRACLAMP TYPE 1400M

Standard Model – Short Ball arm

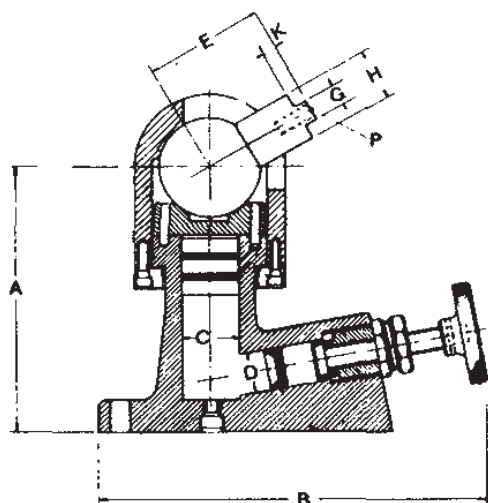
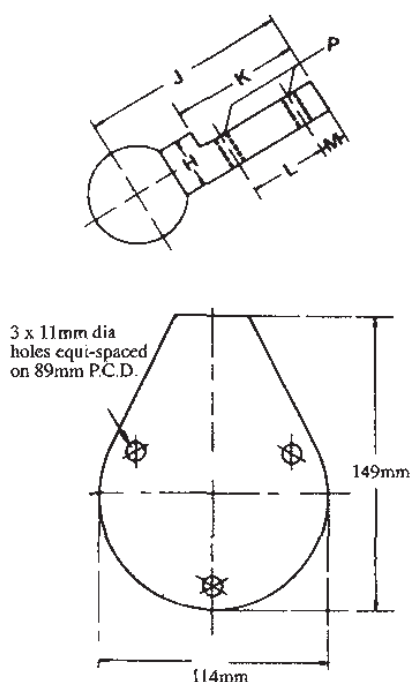
SENIOR HYDRACLAMP TYPE 1420M

The long ball arm model Hydraclamp remains available for cases where this provides a more suitable means of mounting work

Maximum loading

45kg 300mm from Ball Centre at 45°

The senior Hydraclamp is hand screw operated permitting pressure to be readily applied or released in accordance with the requirements of the load. A pre-load sleeve is provided which controls the pressure release and enables any desired degree of sustained pressure to be maintained to form a permanent partial lock if required. This standard model is arranged with a short ball arm to keep the height of work above bench level at a minimum and avoid any needless loss of loading capacity.


TYPE 1420M
TYPE 1400M


Weight 5.5kg

ACCESSORIES


**178mm DIA FACE PLATE
Type 1405M**

This is the most useful general purpose adaptor for the use either as a direct holder for work or as a suitable base on which to mount an existing fixture.

Dimensions in mm												WDS No	Seal Kit No.
A	B	C	D	E	G	H	J	K	L	M	P		
132	203	28.57	19.05	51	9.5	25.4	—	6.35	—	—	M8 x 1.25	SF-1400M	SF-4776
132	203	28.57	19.05	—	—	25.4	108	63.5	38.1	12.7	M10 x 1.5	SF-1420M	SF-4776

Ordering Information

Tel: 0845 606 6677 • Fax: 0845 601 1173

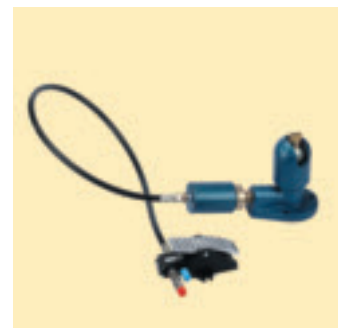
Order online at www.wdslt.co.uk • E-mail: sales@wdslt.co.uk

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SF 1401M/1421M

PowRlock® Hydraclamp Senior Type 1401M/1421M Foot operated

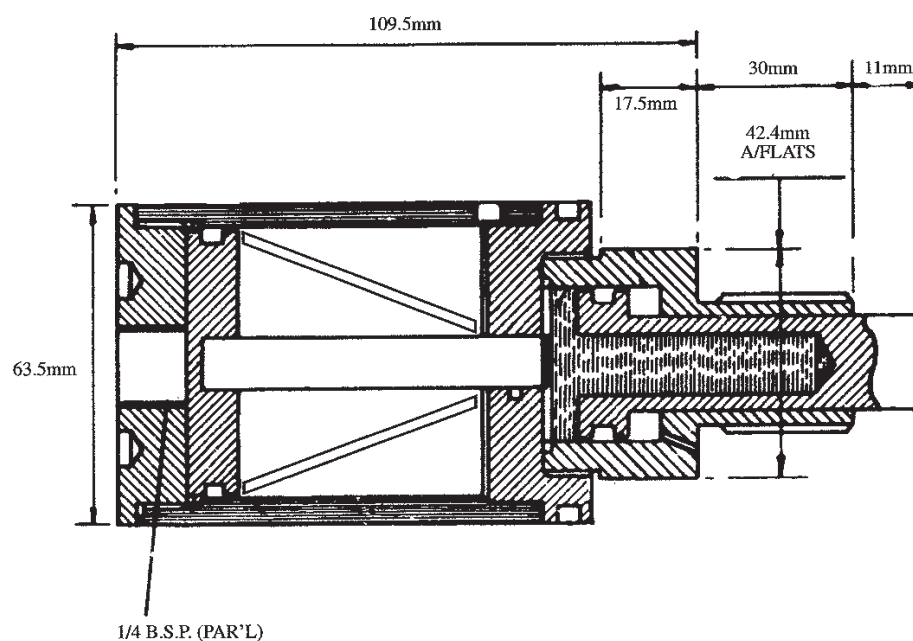


Hydraulic Operation

Both hands are free to manipulate the work mounted on Senior Hydraclamp by the direct coupling of an air-hydraulic booster. This gives complete control from a foot pedal. Two independent safety factors are incorporated. They ensure that the work will stay locked in the event of sudden failure of the air supply or under a pre-determined degree of sustained pressure if the foot pedal is operated in error.

Technical Information

Maximum air pressure 5.5 bar



AIR-HYDRAULIC BOOSTER

Type	Weight kg	WDS No	Seal Kit No
Full Unit – Short Ball arm	8.5	SF-1401M	SF-4776
Full Unit – Long Ball arm	8.5	SF-1421M	SF-4776
Separate Air Hydraulic Booster	1.9	SF-1490	SF-4777

Note: Separate flexible hose and foot valve available on request.

Ordering Information

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PowRlock® Hydraclamps Major Type 1500M

Hydraulic Operation
MAJOR TYPE 1500M

Maximum loading

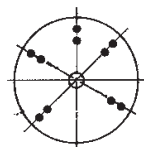
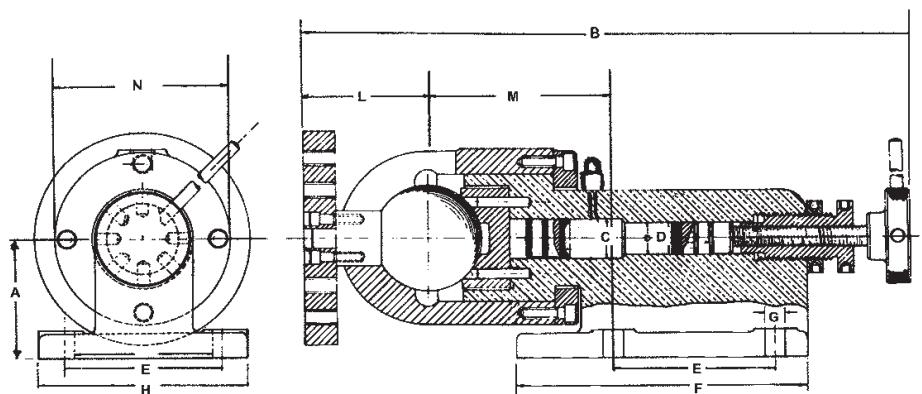
325kg 300mm from Ball Centre at 45°

The Major model Hydraclamp provides a really robust positioner suitable for horizontal or vertical mounting.

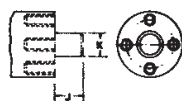
Tightening is effected by a handwheel with final locking by tommy bar.

A pre-load sleeve is fitted to enable any desired degree of sustained pressure to be applied and maintained.

Weight 37.5kg



FACE PLATE



BALL ARM

Dimensions

Diameter 178mm

Thickness 24mm

Drilling twelve

M12 x 1.75 holes.

Six equispaced on 130mm P.C.D.

Six equispaced on 75mm P.C.D.

Drilling

Four M8 x 1.25 holes x 19mm

deep equispaced on 32mm P.C.D.

Dimensions in mm													WDS No	Seal Kit No.
A	B	C	D	E	F	G	H	J	K	L	M	N		
96.5	483	31.75	25.4	127	235	17.5	159	19	16	95	148	143	SF-1500M	SF-4778

Ordering Information

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1501M

PowRlock® Hydraclamp

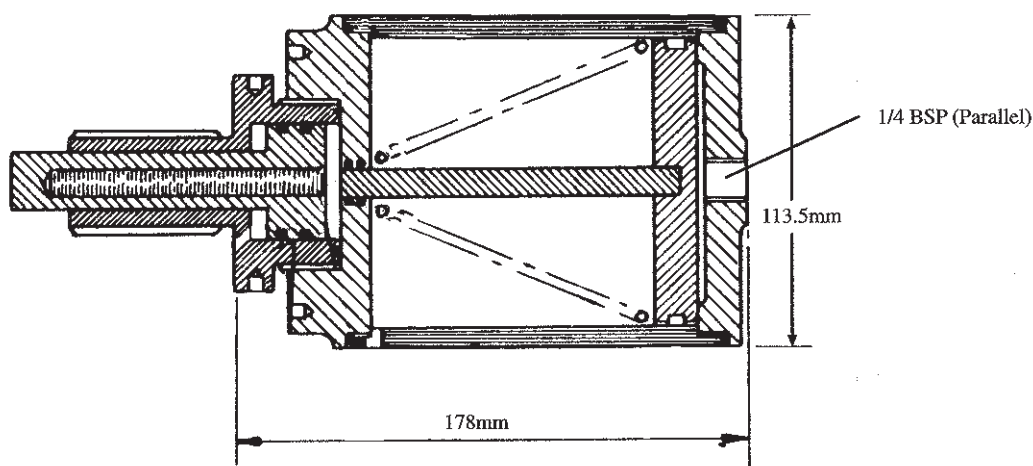
Major Foot Operation

Type 1501M

Technical Information

Both hands are free to manipulate the work mounted on Major Hydraclamp by the direct coupling of an air-hydraulic booster. This gives complete control from a foot pedal which can be placed at any convenient position for right or left foot. Two independent safety factors are incorporated. They ensure that the work will stay locked in the event of sudden failure of the air supply or under a pre-determined degree of sustained pressure if the foot pedal is operated in error

Max air pressure 4 bar



AIR-HYDRAULIC BOOSTER TYPE 1590

Type	Weight kg	WDS No	Seal Kit No
Full Unit	44.0	SF-1501M	SF-4778
Separate Air Hydraulic Booster	7.0	SF-1590	SF-4779

Note: Separate flexible hose and foot valve available on request.

Ordering Information

Tel: 0845 606 6677 • Fax: 0845 601 1173

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WDS

Conditions of Sale

These Conditions of Sale shall apply to sales of WDS Products.

1. CONDITIONS TO PREVAIL

Unless otherwise agreed in writing by the seller these Conditions of Sale shall override any terms and conditions stipulated, incorporated or referred to by the buyer whether in the order or in any other negotiations.

No representative, agent or salesman has any authority to waive or vary any of these conditions on behalf of the seller and any suggested qualification in these conditions shall be deemed to be excluded unless actually written into this form and signed by a Director or the Secretary on behalf of the seller.

2. NO ACKNOWLEDGEMENT OF ORDER

The seller shall be under no obligation to acknowledge receipt of an order from the buyer and shall be entitled to execute the order without further reference to the buyer.

No binding contract is created until an order is accepted by the seller.

3. AGENTS AND DISTRIBUTORS

Agents and Distributors with whom the seller has made arrangements for the sale of its goods are local representatives appointed for the convenience of buyers and through whom enquiries or orders may be received and dealt with by the seller. They are not authorised by the seller to incur any liability, give any guarantee or warranty, make any representations or transact any business whatsoever on behalf of the seller other than the offering for sale of the seller's goods upon the terms of these conditions.

4. TECHNICAL DATA

All drawings, descriptive matter, weights, dimensions, power consumptions, the descriptions and illustrations contained in the seller's catalogues, price lists or advertisements, whether or not supplied with this quotation or tender are approximate only and intended merely to give a general idea of the goods described therein and shall not form part of the contract. The seller offers its designs for the buyer's approval. Unless supplied or approved by the seller it undertakes no responsibility for sites or foundations, or for any framework or support for machinery, or for compliance with any local bye-laws or statutory regulations, or for the fulfilment of any special requirements which the buyer may be bound to observe or fulfil.

5. HEALTH AND SAFETY

Where the goods are supplied to the buyer's specification or design the buyer shall be responsible for ensuring that the goods are so designed as to be safe and without risk to health when properly used. The buyer shall indemnify the seller against any claims which may be made against the seller and for all costs and expenses incurred by the seller in dealing with any such claims and rectifying any defects in the goods.

6. VARIATIONS TO SPECIFICATION

The seller reserves the right to substitute other components or materials of equivalent strength and quality when the components or materials specified are not readily available.

7. PRICES

Prices are the seller's prices ruling at the date of despatch. If extra expense is incurred as a result of the buyer's error or inadequate instructions the seller shall be entitled to increase the contract price and recover such an increase from the buyer.

8. TERMS OF PAYMENT

Payment shall be paid net at the seller's registered office by the end of the month following the month in which the goods are despatched by the seller.

The seller shall be entitled to charge interest on all overdue accounts at a rate of 3% per annum above Lloyds Bank PLC base rate for the time being.

9. DELIVERY AND PASSING OF RISK

Any stipulated time for delivery shall date from the receipt by the seller of the buyer's written order. For deliveries within the United Kingdom, unless otherwise agreed, the seller shall deliver the goods to the buyer and the goods shall be at the buyer's risk on delivery. For delivery outside the United Kingdom, the seller shall deliver the goods F.O.B. United Kingdom Port.

The seller may deliver the goods in instalments and invoice the buyer as if each such instalment comprised a separate contract upon the terms of these Conditions of Sale.

If delivery of the goods is delayed through any act or omission of the buyer, the seller may put the goods into storage at the buyer's risk and expense.

10. LOSS OR DAMAGE IN TRANSIT

Any liability which the seller may incur for loss of or damage to the goods whilst in transit shall in no case exceed the invoice value of the goods and in no circumstances shall the seller be liable for any indirect or consequential loss however caused.

11. DELAY IN DELIVERY

Delay in completion of work, delivery or in the case of a contract for delivery by instalments, delay in the delivery of an instalment shall not give rise to any liability upon the seller, whether or not any time or date is given in this respect and shall not entitle the buyer to terminate the contract.

12. PASSING OF PROPERTY

- (a) Reservation of title of any goods sold by WDS Ltd remains with WDS Ltd until such time that the goods have been paid for in full.
- (b) The buyer acknowledges that the buyer is in possession of the goods solely as bailee for the seller until such time as the full price thereof is paid to the seller together with the full price of any other goods the subject of any other contract with the seller.
- (c) Until such a time as the buyer becomes the owner of the goods, the buyer will store them on his premises separately to the buyer's own goods or those of any other person and in a manner which makes them readily identifiable as the goods of the seller.
- (d) The buyer's right to possession of the goods shall cease if he, not being a company, commits an available act of bankruptcy or if he, being a company does anything or fails to do anything which would entitle a receiver to take possession of any assets or which would enable any person to present a petition for winding-up. The seller may for the purpose of recovery of his goods enter upon any premises where they are stored or where they are reasonably thought to be stored and may repossess the same.
- (e) Subject to the terms hereof the buyer is licensed by the seller to agree to sell the seller's goods, subject to the express condition that such an agreement to sell shall take place as agents and bailees for the seller whether the buyer sells on his own account or not and that entire proceeds thereof are held in trust for the seller and are not mingled with other monies and shall be at all times identifiable as the seller's monies.
- (f) If the buyer has not received the proceeds of any such sale, he will upon being called upon so to do by the seller; within seven days thereof assign to the seller all rights against the person or persons to whom the buyer has supplied the goods.

13. SUSPENSION OR CANCELLATION OF DELIVERIES

- (a) If the buyer shall fail to pay to the seller on the due date any sum payable hereunder, or shall have a receiving order in bankruptcy made against him, or shall make any arrangement with his creditors, or being a body corporate shall have a receiver appointed or if any order shall be made or any resolution passed for winding up the same, the seller may, without prejudice to its other rights, demand immediate payment by the buyer of all unpaid accounts and suspend further deliveries and cancel this and any other contract between the seller and the buyer without any liability attaching to the seller in respect of such suspension or cancellation and debit the seller with any loss sustained thereby.
- (b) If the buyer cancels his order the seller shall be entitled to recover any loss sustained thereby from him.

14. DIRECT, INDIRECT OR CONSEQUENTIAL LOSS OR DAMAGE

Except as provided in S.2 of the Unfair Contract Terms Act 1977 (liability for death or personal injury resulting from negligence), the seller accepts no responsibility in any circumstances for any direct, indirect or consequential loss or damage, howsoever arising, which the buyer may sustain in connection with goods supplied, whether such goods are of the seller's own manufacture or not.

15. LIABILITY

- (a) If the goods or any part thereof are defective solely as a result of the faulty materials or workmanship of the seller, the seller's liability shall be limited, at its discretion, either to replacing such goods or the defective part thereof (as the case may be) or to giving the buyer credit for the value thereof but no such liability shall arise unless notification of any defect is received by the seller in writing within ten days (United Kingdom) or thirty days (Export) from the receipt of the goods by the buyer and the allegedly defective goods are thereafter returned to the seller carriage paid.
- (b) Save as is provided by these Conditions of Sale and save for the seller's implied undertaking as to title, etc contained in S.12 of the Sale of Goods Act 1979, all conditions and warranties express or implied statutory or otherwise and, except as provided in S.2 of the Unfair Contract Terms Act 1977 (liability for death or personal injury resulting from negligence), all other obligations and liabilities whatsoever of the seller whether in contract or in tort or otherwise are excluded.

16. MODIFICATIONS REQUESTED BY BUYER

Where the buyer requests the seller to make any amendment or modification to its standard goods or design any new goods, the following terms shall apply:-

- (a) The seller shall use reasonable care in carrying out the design and manufacture of the goods.
- (b) The seller shall not be liable to any buyer in respect of any defects in any such goods save where the seller has failed to take reasonable care in which case provisions of Clause 15 above shall apply.
- (c) The buyer shall indemnify the seller from and against all or any costs, claims, losses or damages whatsoever arising by virtue of any defects in any such goods save where such defect is directly attributable to a failure by the seller to comply with the provisions of sub clause (a) above.

17. INDEMNITY

The buyer shall indemnify the seller against all claims in respect of any loss, injury or damage sustained by a third party arising from the sale of the goods to the buyer howsoever caused and also against all actions, proceedings, costs, claims, demands and expenses made, brought or claimed against the seller in respect of the infringement of any patent, trade mark, registered design or similar right arising from the manufacture or supply of any goods or the doing of any work or the use of any article or material by the seller to the design or specification or upon the instruction or order of the buyer.

18. LIEN

In addition to any right of lien given by law the seller shall have a general lien upon all goods to be supplied to the buyer in respect of all sums due from or claims against the buyer.

Without prejudice to any other rights given by law to the seller, the seller may, upon fourteen days notice to the buyer, sell any goods of the buyer upon which the seller has any lien and, where the property in such goods is at the time of such sale in the buyer, shall be deemed to be his agent for the purpose of effect in such sale. The seller may apply the proceeds of such sale towards the satisfaction of sums due from or claims against the buyer without prejudice to the seller's right to recover the balance thereof from the buyer.

19. PERFORMANCE OF CONTRACT

Each delivery shall be considered a separate transaction and the failure of any one delivery shall not effect the due performance of the contract as regards other deliveries.

20. FORCE MAJEURE

- (a) If the performance of the contract shall be delayed by any circumstances or conditions beyond the control of the seller including (but without prejudice to the generality of the foregoing) war, industrial disputes, strikes, lock-outs, riots, fire, storm, Act of God, accidents, non-availability or shortage of materials or labour, any statute, rule, bye-law, order or requisition made or issued by any Government or Government Department, local or other duly constituted authority, then the seller shall have the right to suspend further performance of the contract until such time as the cause of the delay shall no longer be present.
- (b) If the performance of the contract by the seller be prevented by any such circumstances or conditions beyond the control of the seller, then the seller shall have the right to be discharged from further performance of and liability under the contract. If the seller exercises such rights the buyer shall thereupon pay the contract price less a reasonable allowance for what has not been performed by the seller.

21. ARBITRATION

Any dispute, difference or question which shall at any time arise between the parties to the contract as to the construction, meaning or effect of these Conditions of Sale or the rights and liabilities of the parties or otherwise howsoever relating thereto shall be referred to the decision of a single arbitrator to be nominated in the event of disagreement between the parties by the President for the time being of the London Chamber of Commerce and shall be deemed to be a submission to arbitration within the meaning of the Arbitration Act 1950 or any amendments or re-enactment thereof for the time being in force.

22. LAW

This contract shall be construed in accordance with English Law and shall be subject to the jurisdiction of the English Courts.

23. RETURNS POLICY

Subject to the Goods being returned in a Resaleable condition and not the subject of a special manufactured order, WDS will issue a Credit Note to the customer for the full value of the goods, or re-issue goods to the same net value.

However the Customer will incur both the Carriage costs of the return and the replacement goods if necessary, and also incur a Handling Charge that will be a maximum of 25% of the total invoice value. WDS will make all reasonable efforts to ameliorate the costs of the handling charge but this cannot be guaranteed.



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DISTRIBUTOR STAMP

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