SuperBrute®

ENGINEERED NITROGEN MANIFOLD SYSTEMS

FORWARD INDUSTRIES

Go Forward With Us

Greater press versatility, constant force through-out the stroke, space savings, adjustable force, reduced set-up and maintenance – all contribute to increased productivity in your metal stamping operations, and all are available with Forward Industries SuperBrute manifold systems and press cushions.

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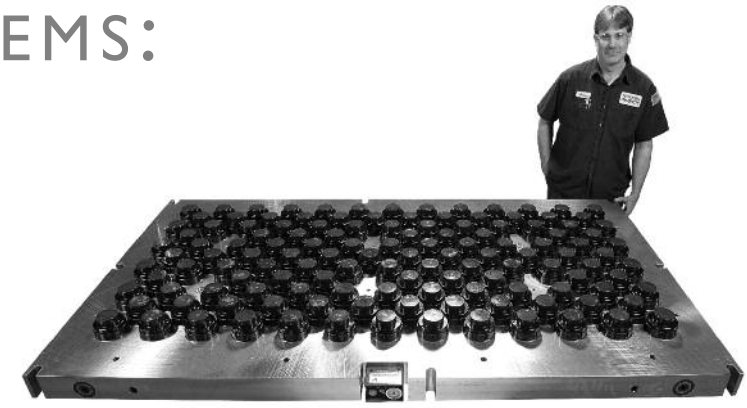
COMPARE OUR NITROGEN GAS MANIFOLDS TO OTHER SYSTEMS:



792 ton cushion used for forming steel doors

Greater Press Versatility

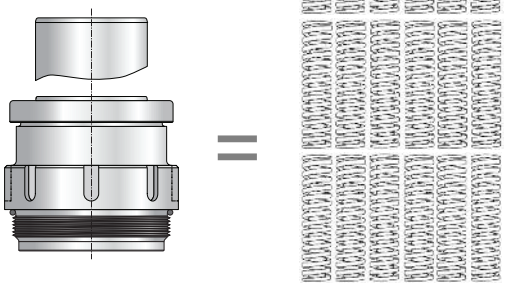
SuperBrute manifold systems are an integral part of the die, so the die can be moved from one press to another easily, with minimal set-up.

Constant Force Throughout the Stroke

SuperBrute nitrogen cylinders provide a constant force throughout the stroke while mechanical springs increase their load as they are compressed. Standard SuperBrute models are supplied in travels from one-quarter to six inches, with longer strokes available on request.

Space Savings

SuperBrute nitrogen cylinders provide full force on contact without the preload necessary with mechanical springs. To achieve the force of a single 6-ton SuperBrute cylinder, these 18 heavy-duty die springs must travel one inch.



Adjustable Force

SuperBrute nitrogen cylinders provide precise system pressure at all times through the simple use of a control console that allows adding or releasing nitrogen. There's no need to shut down the press so production levels and part quality are maintained.

Reduced Set-Up

SuperBrute nitrogen systems are self-contained and do not require valves, compressors, and other complicated connections that air cushions do. This not only saves space but reduces set-up since manual installation of such items as pressure pins is not needed.

Reduced Maintenance

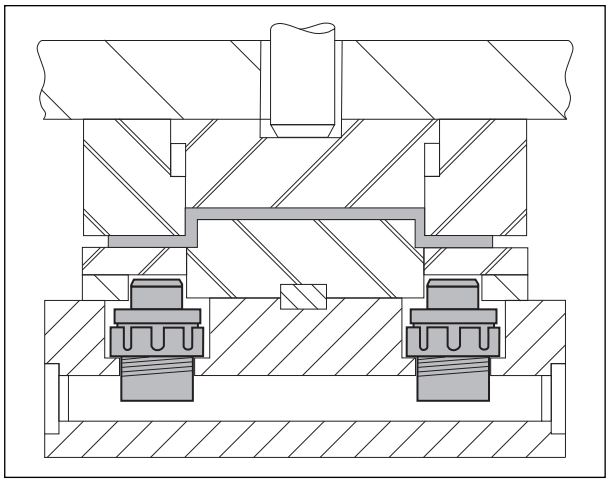
The self-contained SuperBrute nitrogen system simplifies maintenance. The ability to add or release nitrogen gas from the system without shutting down during production allows maintenance to be done at a convenient time in the factory schedule.

Nitrogen Systems for Every Stamping Need

SuperBrute nitrogen systems include manifolds, bolster cushions, ram cushions and pressure parallels to meet a wide variety of size and force requirements.

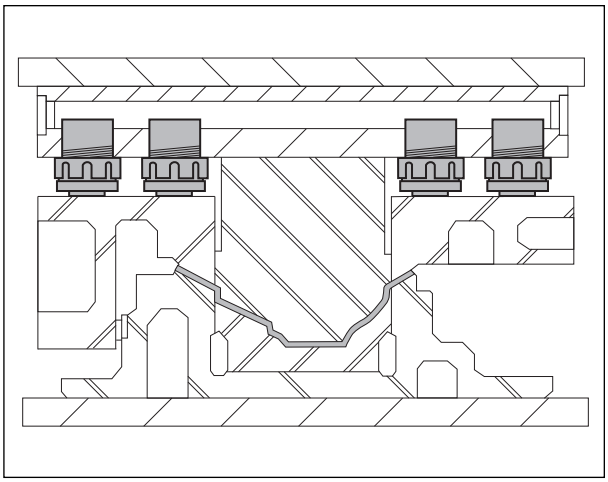
APPLICATIONS

For Draw Dies, Progressive Dies, Transfer Dies, Combined Dies, and Form Dies



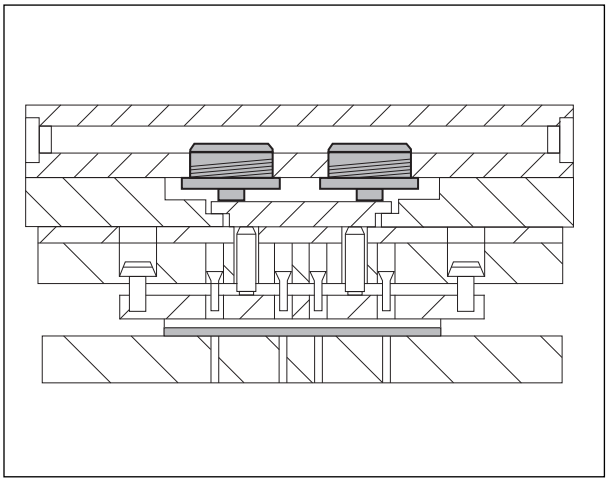
CONVENTIONAL DRAW

The adjustable force of the nitrogen system allows precise pressure not available using conventional springs.



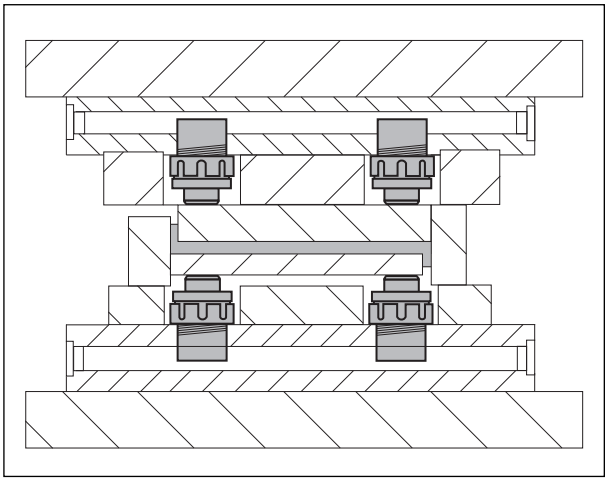
INVERTED DRAW

A common use of nitrogen manifold cylinders is in upper die applications, often in transfer or progressive dies.



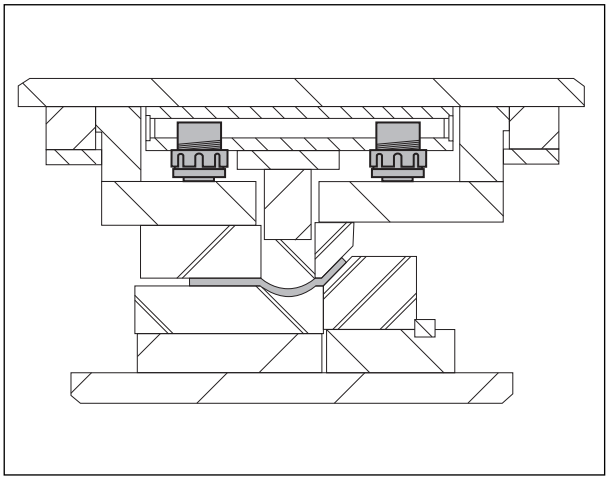
STRIP PUNCHES

Nitrogen systems deliver high force on contact without preload to hold the strip securely. Punches can be stripped without breaking.



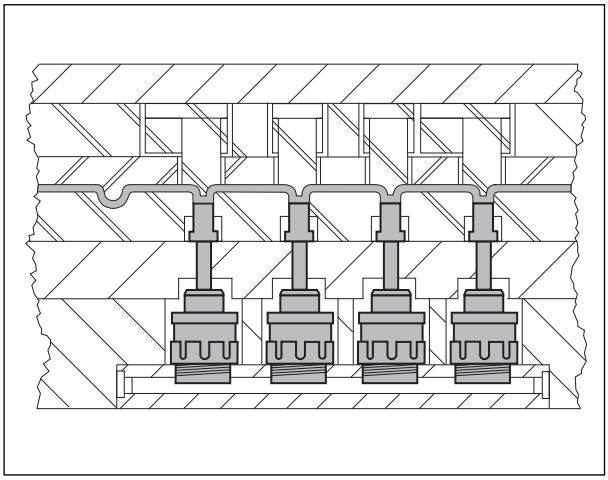
FORM UP AND DOWN

Forming in two directions is simple with a nitrogen system but difficult with conventional springs. The nitrogen cylinders provide precise control and the balance needed to produce quality parts consistently.



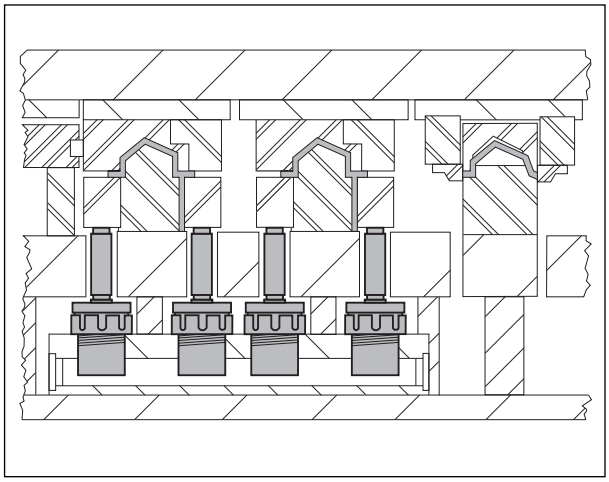
Combined Operations

Nitrogen systems allow two or more operations to be performed in one press stroke to save both time and money. High force on contact pre-forms the part and embossing, piercing or another operation can be performed at the bottom of the stroke.



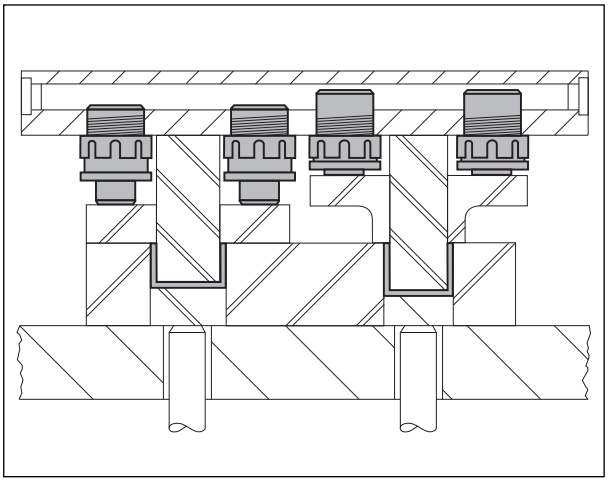
Close Station Centers

In a nitrogen system, each cylinder has the same pressure because they are interconnected. Each system, whether upper or lower application, maintains its own pressure setting for precise control that conventional springs cannot offer.



No Balancing Problems

While air cushions can experience balancing problems when pressure is required in off-center stations, this is not an issue with nitrogen systems where cylinders of different tonnages can be used and still maintain precise control.



High Speed

Nitrogen cylinders react quickly and precisely, making them ideal for high speed production runs.

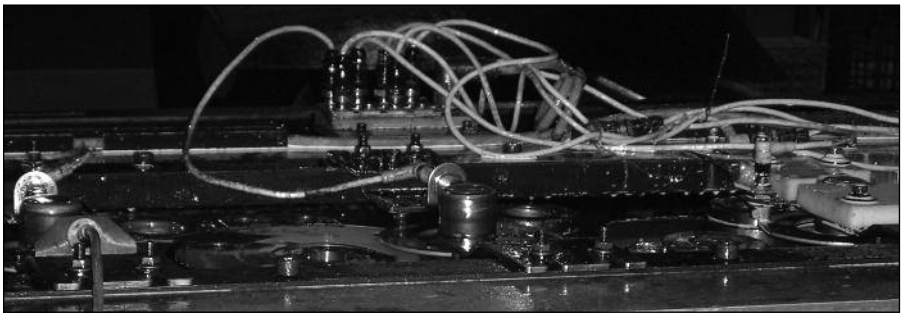
NITROGEN SYSTEMS FOR EVERY STAMPING NEED

SuperBrute Manifolds

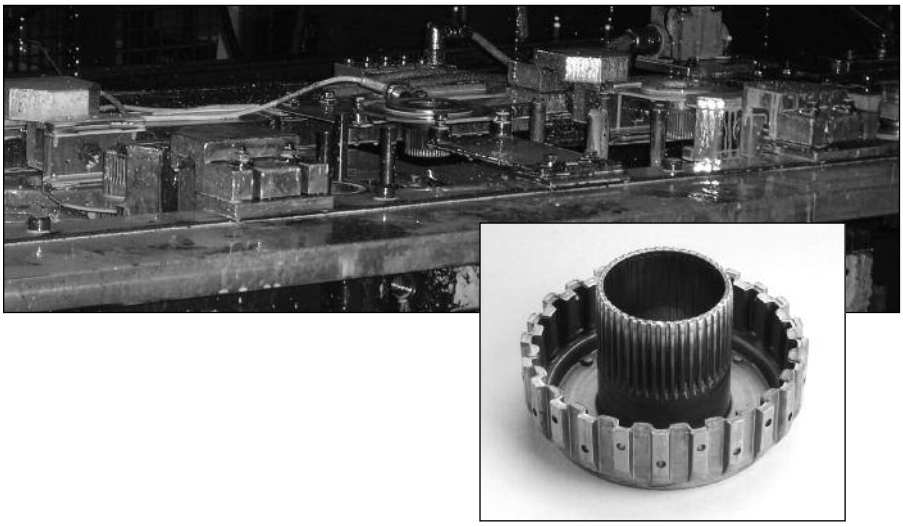
Consisting of a metal manifold plate, nitrogen gas cylinders, and passageways through which the nitrogen gas is delivered, the SuperBrute manifold delivers constant force throughout the stroke, adjustable force, low pressure rise, and other features that contribute to today's lean productivity goals.

Transform Automotive in Sterling Heights, Michigan, produces transmission parts with the help of a SuperBrute manifold system. They value the benefits of the low pressure rise including less heat build-up, longer seal life, and less maintenance and downtime for this deep draw operation.

Forming the crown of the part.



Final shaping of the crown.



After gear slots are made, the part is flipped to produce the bowl shape around the geared portion.

SuperBrute Bolster Cushions

With up to 10 times more force than an air cushion, the SuperBrute bolster cushion mounts on top or replaces the existing bolster. The bolster cushion is self-contained and does not require the complicated plumbing and compressors that an air cushion needs, so it costs less initially, and simplifies installation and maintenance for cost savings later.

SuperBrute Ram Cushions

Designed for new or existing presses, the SuperBrute ram cushion features a low profile that conserves shut height and allows installation in virtually any press. Ram cushions are built to customer specifications with cylinders and T-slots on JIC, ISO or specified locations. Cylinders are mounted over each pressure pin to maintain balance.

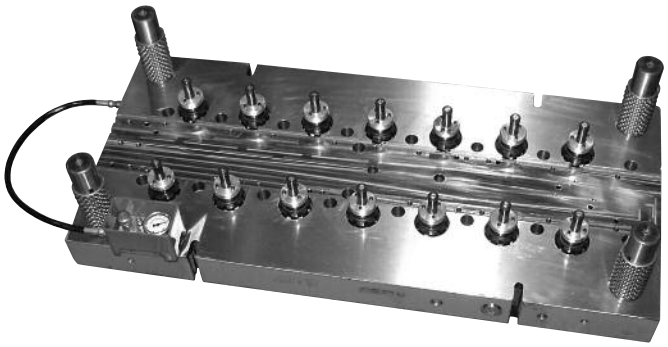
SuperBrute Pressure Parallels

Pressure parallels are modular ram cushions, easily moved to provide high force where needed. SuperBrute pressure parallels operate at individual pressure or can be hosed together for a common pressure.

SuperBrute Modular Press Cushions

Ideal for small OBI, gap and straight-sided presses with limited shut height and small bed areas, this modular cushion eliminates the need for rubber pads and box car spring type cushions.

Standard manifold with clearances for die details.



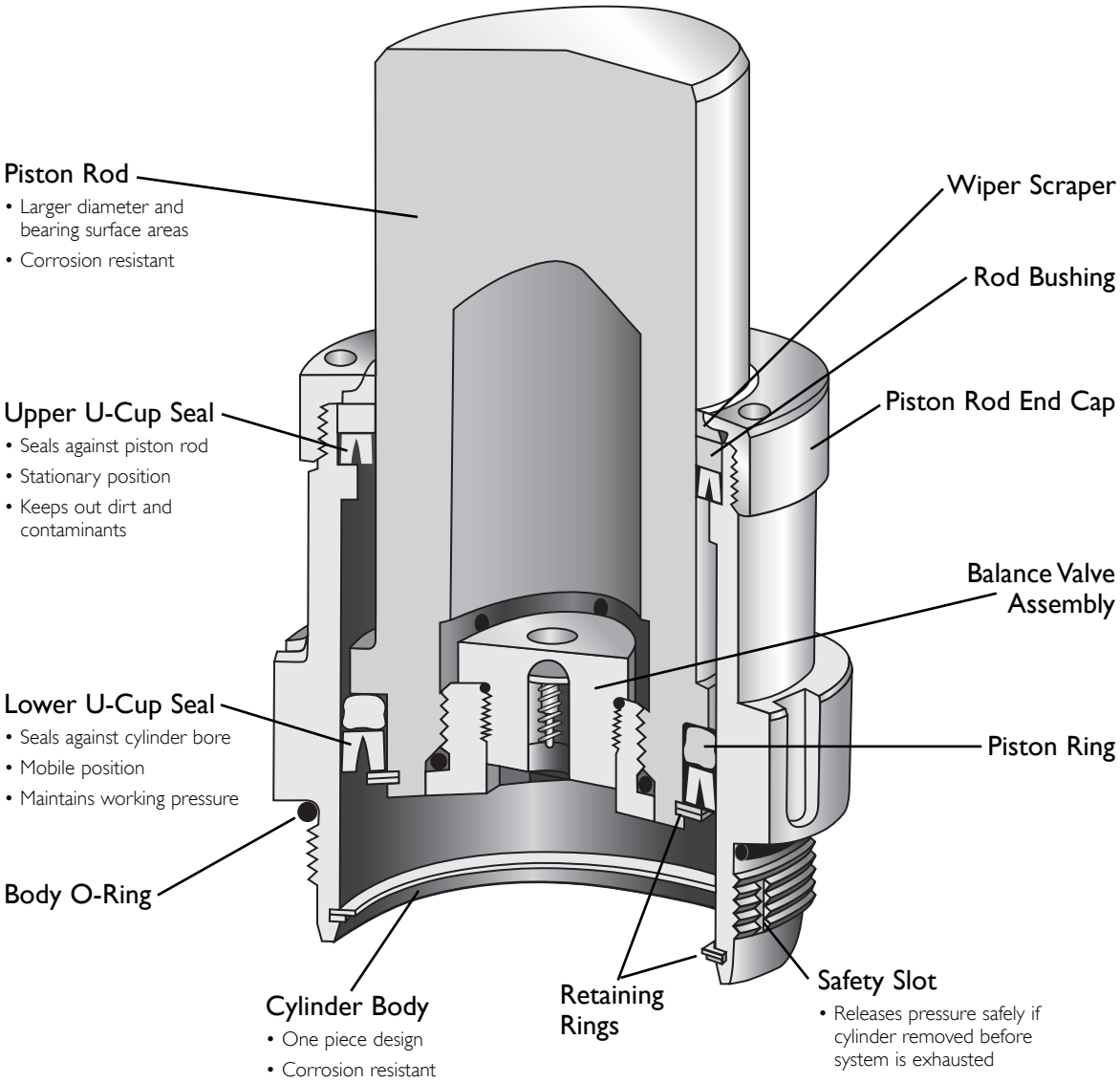
Manifold incorporated into a die set saves costs and space.

SuperBrute®

NITROGEN MANIFOLD CYLINDER

Unique Double U-Cup Seals for Double Reliability

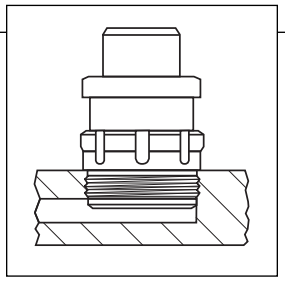
SuperBrute manifold cylinders are engineered to withstand harsh stamping environments where dies encounter a near-constant flood of dirt, coolants and lubricants. SuperBrute manifold cylinders feature two high pressure U-cup seals. The upper seal is stationary and seals against the hardened piston rod to form a solid barrier that protects the cylinder interior from destructive die fluids and other contaminants. The lower seal is located on the interior and seals against the cylinder bore. In the unlikely event that one seal fails, the other serves as back-up to ensure that the system maintains pressure and press productivity.



A CYLINDER FOR EVERY APPLICATION

There is a SuperBrute manifold cylinder for virtually every stamping operation.

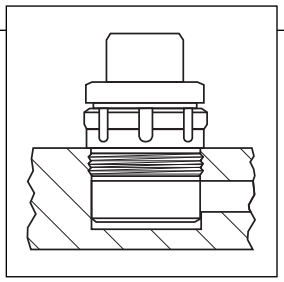
Basic

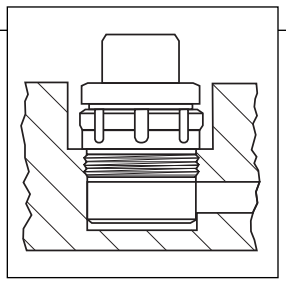


Basic cylinders are available in both English and Metric models. They mount with the shoulder of the cylinder flush with the surface of the manifold plate. Using basic cylinders offers a variety of advantages:

- Thinner manifold plates.
- Drain slots machined into the manifold plate are not usually required.
- Elimination of machining recessed holes for the cylinders.
- Easy accessibility to cylinders for maintenance.

STUB

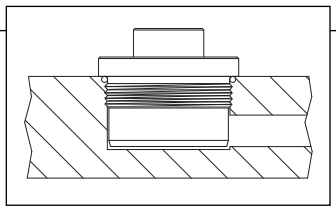




Stub cylinders mount with the shoulder of the cylinder flush or below the surface of the manifold plate. Using stub cylinders offers advantages as well:

- Useful when die space or press shut height is limited.
- Mounting in a recessed cavity saves additional space.

LOW PROFILE (PANCAKE)

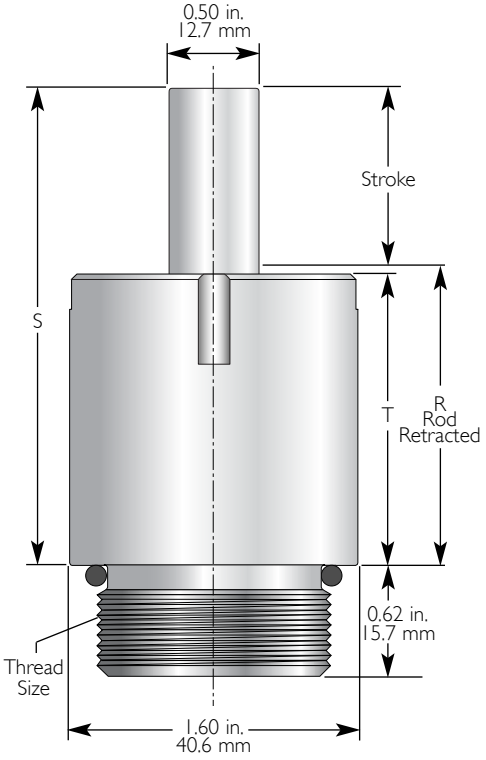


Low profile or pancake cylinders are short stroke stub models. These are venting cylinders, used in relatively clean environments and usually in upper die applications. Using low profile cylinders provides:

- High force in applications where die space or press shut height is very limited.

1/2 TON MINI MODEL

CBFM: Basic models for manifold mounting.



PRODUCT SPECIFICATIONS

Maximum Force at 1500 psi/103 bar	1178 lbs./5240 N
Effective Piston Area	0.785 in.^{2}/5.06 cm^2
Rod Diameter	0.50 in./12.7 mm
English Thread Size	1-5/16-12
Seal Kit Order Number	16-100-7000

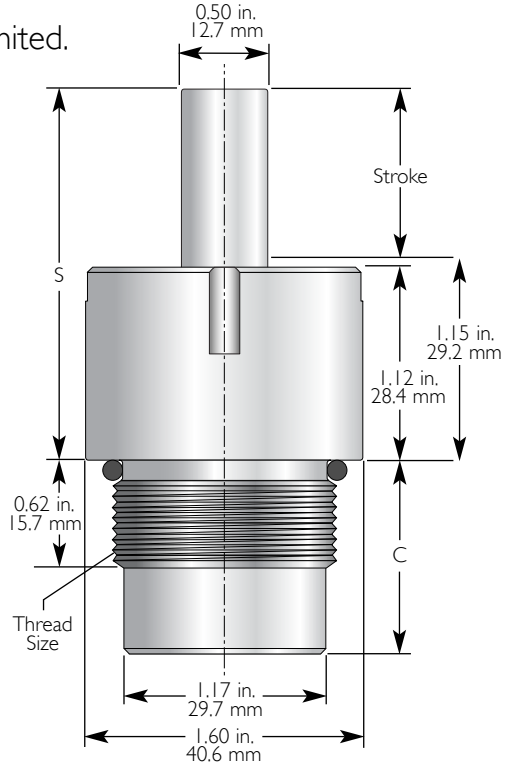
MAINTENANCE TOOLS (FOR BOTH MODELS)

Seal Kit	16-100-7000
Spanner Wrench	FS-482
Cylinder Socket Wrench	SW-.5-ton

DIMENSIONS

Max. Working Stroke		T		S		R	
in.	mm	in.	mm	in.	mm	in.	mm
0.50	12.7	1.12	28.4	1.65	41.9	1.15	29.2
1.00	25.4	1.62	41.1	2.65	67.3	1.65	41.9
1.50	38.1	2.12	53.8	3.65	92.7	2.15	54.8
2.00	50.8	2.62	66.5	4.65	118.1	2.65	67.3
2.50	63.5	3.12	79.2	5.65	143.5	3.15	80.0
3.00	76.2	3.62	91.9	6.65	168.9	3.65	92.7

CSFM: Stub models for applications where shut height is limited.



PRODUCT SPECIFICATIONS

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Effective Piston Area	0.785 in.^{2}/5.06 cm^2
Rod Diameter	0.50 in./12.7 mm
English Thread Size	1-5/16-12
Seal Kit Order Number	16-100-7000

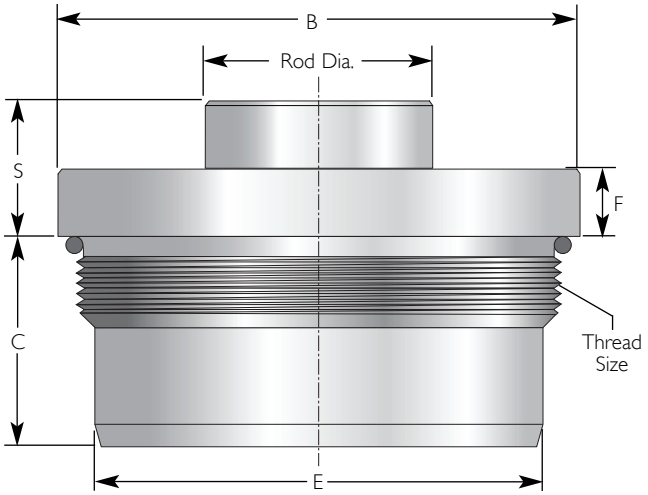
DIMENSIONS

CSFM

Max. Working Stroke		C		S	
in.	mm	in.	mm	in.	mm
0.50	12.70	0.62	15.70	1.65	41.90
1.00	25.40	1.12	28.40	2.15	54.60
1.50	38.10	1.62	41.10	2.65	67.30
2.00	50.80	2.12	53.80	3.15	80.00
2.50	63.50	2.62	66.50	3.65	92.70
3.00	76.20	3.12	79.20	4.15	105.40

LOW PROFILE (PANCAKE) MODELS

The RFPS models are short stroke stub cylinders designed to provide high force in applications where die space or press shut height is very limited. These are venting cylinders, used in relatively clean environments and usually in upper die applications.



PRODUCT SPECIFICATIONS

Low Profile Models

Model	Max. Force @ 1500 psi/103 bar	Effective Piston Area	Rod Diameter	Diameter B	Diameter E	Bore	English Thread Size	Std. Seal Kit Order Number
RFP1S	2220 lbs./1008 kg	1.48 in.²/9.55 cm²	0.75 in./19.1mm	2.12 in./53.8mm	1.70 in./43.2mm	1.37 in./34.9mm	1-7/8-12	0500-1002
RFP2.5S	5325 lbs./2416 kg	3.55 in.²/22.9 cm²	1.25 in./31.8mm	2.75 in./70.0mm	2.34 in./2.12mm	2.12 in./53.9mm	2-1/2-12	0500-2503
RFP4S	8118 lbs./3582 kg	5.41 in.²/34.9 cm²	1.75 in./44.5mm	3.62 in./91.9mm	3.06 in./77.7mm	2.63 in./66.6mm	3-1/4-12	0500-4002
RPF6S	11505 lbs./5190 kg	7.67 in.²/49.2 cm²	1.75 in./44.5mm	4.38in./111.3mm	3.70 in./93.9mm	3.12 in./79.3mm	4.0-12	0500-6103

DIMENSIONS

RFP 1S & 2.5S

Max. Working Stroke		C		S		P*		F	
in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
0.25	6.3	1.19	30.2	0.69	17.4	1.25	31.8	0.38	9.7
0.38	9.5	1.32	33.5	0.81	20.6	1.38	34.9	0.38	9.7
0.50	12.7	1.44	36.5	0.94	23.8	1.50	38.1	0.38	9.7
0.75	19.0	1.69	42.9	1.19	30.2	1.75	44.4	0.38	9.7

RFP 4S & 6S

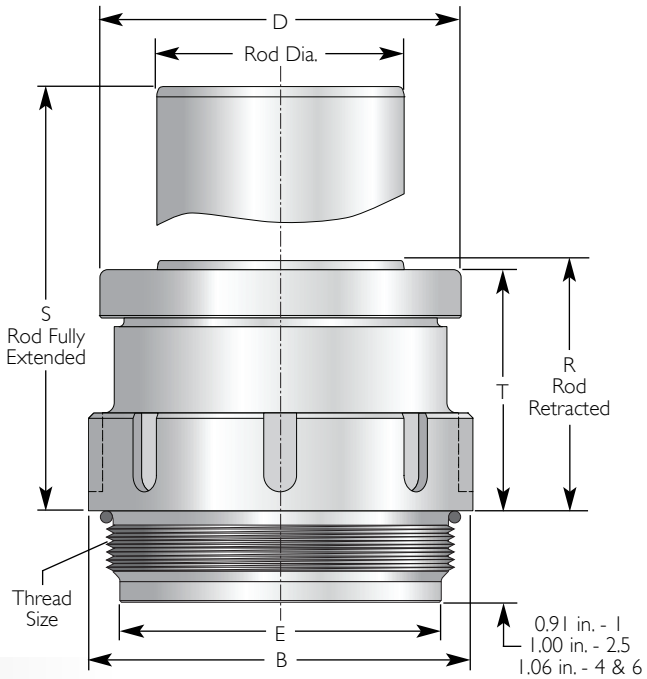
Max. Working Stroke		C		S		P*		F	
in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
0.25	6.3	1.47	37.3	0.87	22.1	1.63	41.1	0.56	14.2
0.38	9.5	1.59	40.4	1.00	25.4	1.65	41.9	0.56	14.2
0.50	12.7	1.72	43.7	1.12	28.4	1.78	45.2	0.56	14.2
0.75	19.0	1.97	50.0	1.37	34.8	2.03	51.6	0.56	14.2

*Minimum cavity depth.

All dimensions are nominal unless tolerance is stated.

ENGLISH BASIC & HIGH PRESSURE MODELS

The SUPB basic models mount directly into the threaded ports of the manifold plate. Use of SAE straight threads assures cylinder interchangeability and simple machining, as well as positive, leak free connections.



PRODUCT SPECIFICATIONS

SuperBrute® English Basic & High Pressure Models

Model	Max. Force @ 1500 psi/103 bar	High Pressure @ 2000 psi/138 bar	Effective Piston Area	Rod Diameter	Diameter B	Diameter D	Diameter E	English Thread Size	Std. Seal Kit Order Number	Viton Seal Kit Order Number
SUPB 1	2220 lbs.	2960 lbs.	1.48 in.^{2}	1.13 in.	2.38 in.	2.12 in.	1.72 in.	1-7/8-12	0500-1005	0510-1005
SUPB 2.5	5325 lbs.	7100 lbs.	3.55 in.^{2}	1.88 in.	2.95 in.	2.74 in.	2.34 in.	2-1/2-12	0500-2506	0510-2506
SUPB 4	8118 lbs.	10820 lbs.	5.41 in.^{2}	2.25 in.	3.69 in.	3.40 in.	3.06 in.	3-1/4-12	0500-4202	0510-4202
SUPB 6	11505 lbs.	15340 lbs.	7.67 in.^{2}	2.88 in.	4.45 in.	4.19 in.	3.72 in.	4.0-12	0500-6202	0510-6202

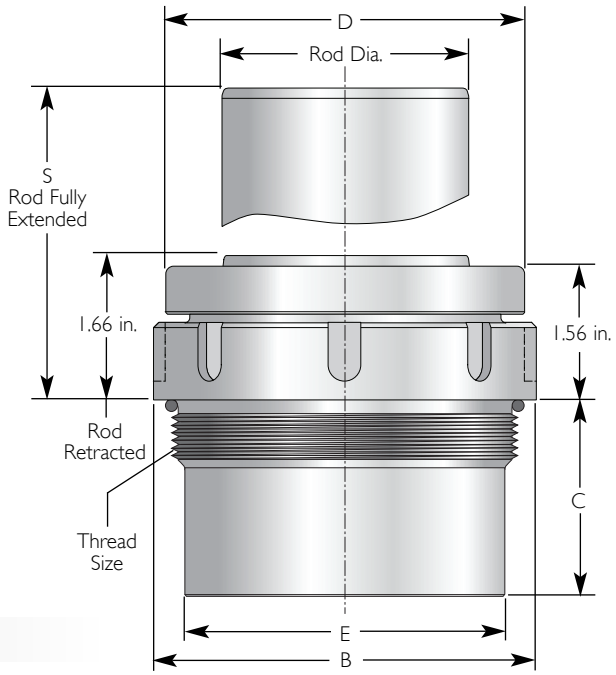
DIMENSIONS

SuperBrute® English Basic and High Pressure Models

Max. Working Stroke	R in.	S in.	T in.
1.00	1.91	2.91	1.81
1.50	2.41	3.91	2.31
2.00	2.91	4.91	2.81
2.50	3.41	5.91	3.31
3.00	3.91	6.91	3.81
3.50	4.41	7.91	4.31
4.00	4.91	8.91	4.81
4.50	5.41	9.91	5.31
5.00	5.91	10.91	5.81
5.50	6.41	11.91	6.31
6.00	6.91	12.91	6.81
6.50	7.41	13.91	7.31
7.00	7.91	14.91	7.81
7.50	8.41	15.91	8.31
8.00	8.91	16.91	8.81

ENGLISH BASIC & HIGH PRESSURE STUB MODELS

The SUPS stub models are ideal for presses with limited shut height because they feature the minimum height above the manifold plate. They are designed for thicker manifolds in which the piston can travel deep into the plate. Stub models are threaded into the manifold plate using a tube wrench that fits over the outer housing. The only requirement is a counterbored hole 1/4-inch over the cylinder diameter.



PRODUCT SPECIFICATIONS

SuperBrute® English Basic & High Pressure Stub Models

Model	Max. Force @ 1500 psi/103 bar	High Pressure @ 2000 psi/138 bar	Effective Piston Area	Rod Diameter	Diameter B	Diameter D	Diameter E	English Thread Size	Std. Seal Kit Order Number	Viton Seal Kit Order Number
SUPS 1	2220 lbs.	2960 lbs.	1.48 in.^{2}	1.13 in.	2.38 in.	2.12 in.	1.72 in.	1-7/8-12	0500-1005	0510-1005
SUPS 2.5	5325 lbs.	7100 lbs.	3.55 in.^{2}	1.88 in.	2.95 in.	2.74 in.	2.34 in.	2-1/2-12	0500-2506	0510-2506
SUPS 4	8118 lbs.	10820 lbs.	5.41 in.^{2}	2.25 in.	3.69 in.	3.40 in.	3.06 in.	3-1/4-12	0500-4202	0510-4202
SUPS 6	11505 lbs.	15340 lbs.	7.67 in.^{2}	2.88 in.	4.45 in.	4.19 in.	3.72 in.	4.0-12	0500-6202	0510-6202

DIMENSIONS

SuperBrute® English and High Pressure Stub Models

SUPS 1

Max. Working Stroke	S in.	C* in.
1.00	2.66	1.16
1.50	3.16	1.66
2.00	3.66	2.16
2.50	4.16	2.66
3.00	4.66	3.16
3.50	5.16	3.66
4.00	5.66	4.16
4.50	6.16	4.66
5.00	6.66	5.16
5.50	7.16	5.66
6.00	7.66	6.16
6.50	8.16	6.66
7.00	8.66	7.16
7.50	9.16	7.66
8.00	9.66	8.16

SUPS 2.5

Max. Working Stroke	S in.	C* in.
1.00	2.66	1.26
1.50	3.16	1.76
2.00	3.66	2.26
2.50	4.16	2.76
3.00	4.66	3.26
3.50	5.16	3.76
4.00	5.66	4.26
4.50	6.16	4.76
5.00	6.66	5.26
5.50	7.16	5.76
6.00	7.66	6.26
6.50	8.16	6.76
7.00	8.66	7.26
7.50	9.16	7.76
8.00	9.66	8.26

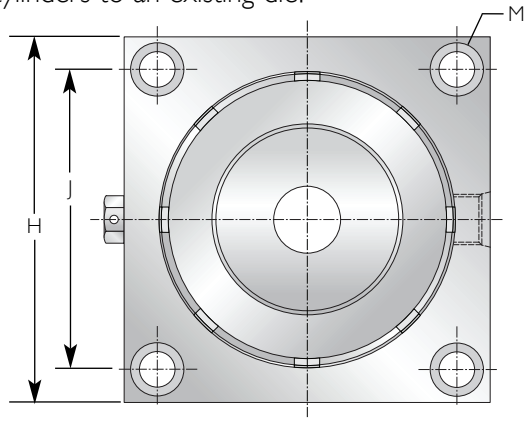
SUPS 4 & 6

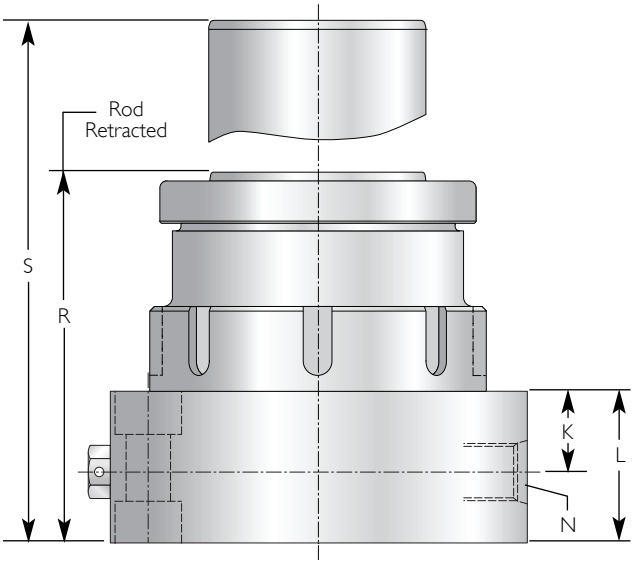
Max. Working Stroke	S in.	C* in.
1.00	2.66	1.31
1.50	3.16	1.81
2.00	3.66	2.31
2.50	4.16	2.81
3.00	4.66	3.31
3.50	5.16	3.81
4.00	5.66	4.31
4.50	6.16	4.81
5.00	6.66	5.31
5.50	7.16	5.81
6.00	7.66	6.31
6.50	8.16	6.81
7.00	8.66	7.31
7.50	9.16	7.81
8.00	9.66	8.31

*Manifold cavity depth is C + 1/8 in.

ENGLISH FLANGE MODELS

The SUPF flange-mounted cylinders feature a double seal technology and are hosed and connected to a reservoir tank. They are designed for interchangeable use with multiple dies and presses, and can also be used to add nitrogen cylinders to an existing die.





Alternate Second Port: a second port can be furnished in the bottom center of the flange. Each cylinder must be hosed separately to the reservoir tank, not in a series. Contact Forward Industries for more information.

PRODUCT SPECIFICATIONS

SuperBrute® English Flange Models

Model	Max. Force @ 1500 psi/103 bar	Effective Piston Area	Rod Dia. in.	H in.	J in.	K in.	L in.	M S.H.C.S.	N St. Thd. O Ring Port	English Thread Size	Hose Order Number	Std. Seal Kit Order Number	Viton Seal Kit Order Number
SUPF 1	2220 lbs.	1.48 in.^{2}	1.13	3.00	2.25	0.88	1.38	3/8	1/2-20	1-7/8-12	0800-1007	0500-1005	0510-1005
SUPF 2.5	5325 lbs.	3.55 in.^{2}	1.88	3.50	2.75	0.75	1.50	3/8	1/2-20	2-1/2-12	0800-1007	0500-2506	0510-2506
SUPF 4	8118 lbs.	5.41 in.^{2}	2.25	5.00	3.50	1.06	2.00	1/2	3/4-16	3-1/4-12	0800-3007	0500-4202	0510-4202
SUPF 6	11505 lbs.	7.67 in.^{2}	2.88	5.50	4.50	1.06	2.00	1/2	3/4-16	4.0-12	0800-3007	0500-6202	0510-6202

DIMENSIONS

SuperBrute® English Flange Models

SUPF 1

Max. Working Stroke	R in.	S in.
1.00	3.29	4.29
1.50	3.79	5.29
2.00	4.29	6.29
2.50	4.79	7.29
3.00	5.29	8.29
3.50	5.79	9.29
4.00	6.29	10.29
4.50	6.79	11.29
5.00	7.29	12.29
5.50	7.79	13.29
6.00	8.29	14.29
6.50	8.79	15.29
7.00	9.29	16.29
7.50	9.79	17.29
8.00	10.29	18.29

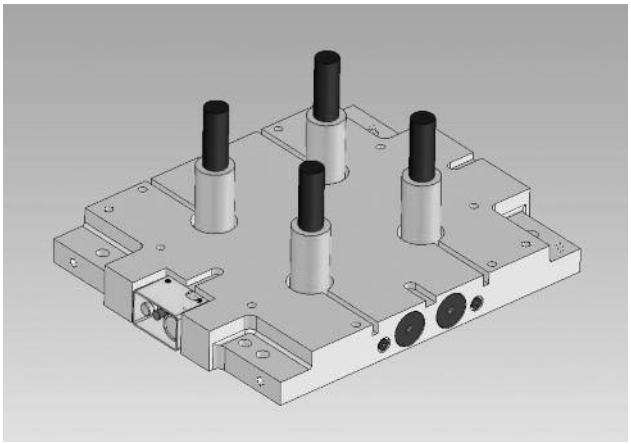
SUPF 2.5

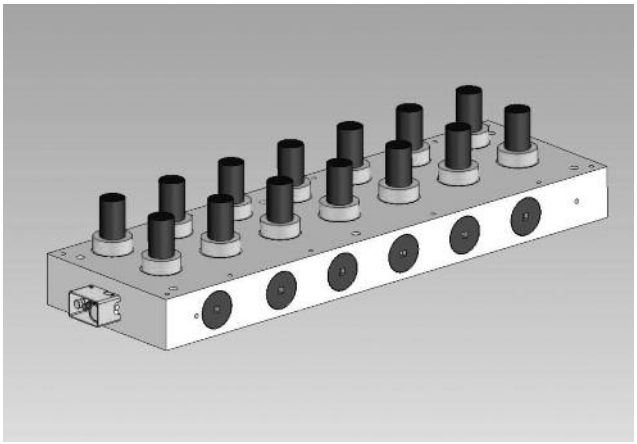
Max. Working Stroke	R in.	S in.
1.00	3.41	4.41
1.50	3.91	5.41
2.00	4.41	6.41
2.50	4.91	7.41
3.00	5.41	8.41
3.50	5.91	9.41
4.00	6.41	10.41
4.50	6.91	11.41
5.00	7.41	12.41
5.50	7.91	13.41
6.00	8.41	14.41
6.50	8.91	15.41
7.00	9.41	16.41
7.50	9.91	17.41
8.00	10.41	18.41

SUPF 4 & 6

Max. Working Stroke	R in.	S in.
1.00	3.91	4.91
1.50	4.41	5.91
2.00	4.91	6.91
2.50	5.41	7.91
3.00	5.91	8.91
3.50	6.41	9.91
4.00	6.91	10.91
4.50	7.41	11.91
5.00	7.91	12.91
5.50	8.41	13.91
6.00	8.91	14.91
6.50	9.41	15.91
7.00	9.91	16.91
7.50	10.41	17.91
8.00	10.91	18.91

MANIFOLD DESIGN





Forward Industries offers two types of manifold system: the standard 1500 psi manifold and the high pressure 2000 psi manifold. You can choose to design the system yourself or to have the engineers at Forward Industries design a system for you. We work with a wide variety of 2D and 3D CAD files, and can have a design and quotation returned to you quickly, often within 48 hours.

A typical manifold system consists of a metal plate with cavities into which cylinders are threaded. The cavities are connected by passages or reservoir holes drilled into the plate through which the nitrogen gas is forced. The size depends on the amount of pressure required to perform the stamping or forming operation. All cylinders are designed for leak free mounting.

The most compact system uses the manifold plate as a die shoe. However when more space is available, the system can be designed with the manifold plate separate from the die shoe. Having a separate manifold allows independent service to either the die or the cylinders.

DESIGN FACTORS

There are seven basic factors to consider in order to design an efficient manifold system:

- Force
- Force Distribution
- Stroke
- Cylinder Model
- Reservoir Holes
- Pressure Control
- Safety

Note: This information is for designing a 1500 psi manifold. For 2000 psi manifolds, contact Forward Industries.

Force

Calculate the amount of force required in the application, always allowing a margin for an adjustment upwards. If more force is required than originally planned, this margin will be valuable.

Force = Psi Nitrogen X Effective Piston Area

Force Distribution

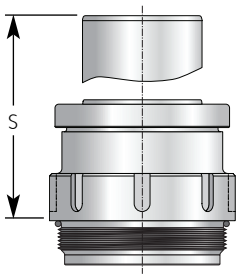
Distribute the force over the area as required. Our wide range of cylinder tonnage selections allows this to be done in a variety of ways.

Ten tons or more:

- 20-1/2 ton cylinders
- 10-1 ton cylinders
- 4-2.5 ton cylinders
- 3-4 ton cylinders
- 2-6 ton cylinders
- 2-5.4 high pressure cylinders

Stroke

The configuration of the part will dictate the working stroke of the cylinders. Most SuperBrute cylinders are available in stroke increments of one-half inch. If the exact stroke required is not available, choose the next longest.



Cylinder Model

Choose the correct cylinders from the selection on pages 8-12.

Reservoir Holes

When the press closes, nitrogen gas is forced from the cylinders into the reservoir holes. This is referred to as "swept volume". When this occurs, the pressure in the system rises. In draw and form operations, a rise of 10% is generally acceptable. When uniform pressure is not required, a greater rise is permissible.

Use the following formulas to determine the diameter and length of the reservoir holes that will result in the desired pressure rise.

First calculate Swept Volume:

$$\text{Swept Volume (SV)} = \text{Piston Area} \times \text{Work Stroke} \times \text{Number of Cylinders}$$

Next calculate Manifold Volume:

$$\text{Manifold Volume (MV)} = \text{SV} \times \frac{100\%}{\%\ \text{Pressure Rise}}$$

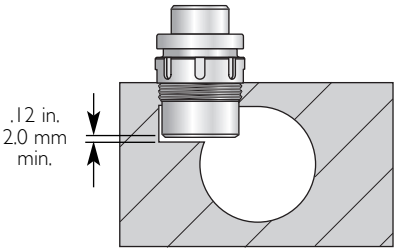
Now convert Manifold Volume into lineal inches of drilled reservoir holes by using the Hole Volume chart (page 20) and the following formula:

$$\text{LI} = \frac{\text{MV}}{\text{Volume Per Lineal Inch of Hole}}$$

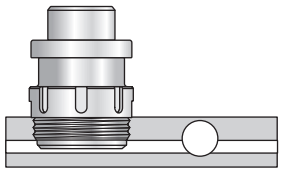
To reduce machining, large diameter holes are preferred over a larger quantity of smaller diameter holes.

Caution: when calculating lineal inches of drilled holes, make sure to count the intersection of reservoir holes only once. If reservoir holes intersect cavities for stub cylinders, do not include the diameter of the cavity in lineal inches drilled.

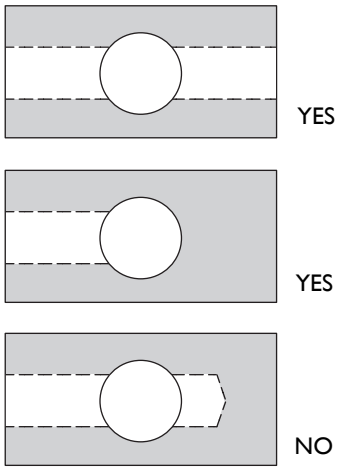
A. Reservoir holes may intersect cylinder cavities but should not interfere with the threaded portion of the cylinder cavity.



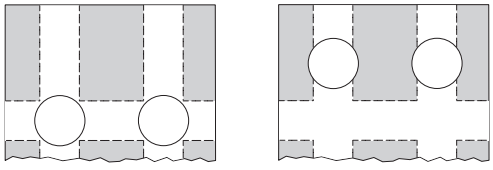
B. If reservoir holes cannot be located to intersect the cylinder cavities, feeder holes must be used. Drill feeder holes from the outside edge of the plate. Use one-quarter-inch holes for cylinders up to 2.5 tons, and three-eighth-inch holes for cylinders over 2.5 tons.



C. Drilled passages should extend through the plate, ending in a cross-drilled hole or in a cylinder cavity. This allows thorough cleaning of burrs and chips after machining. Avoid blind drilled holes.



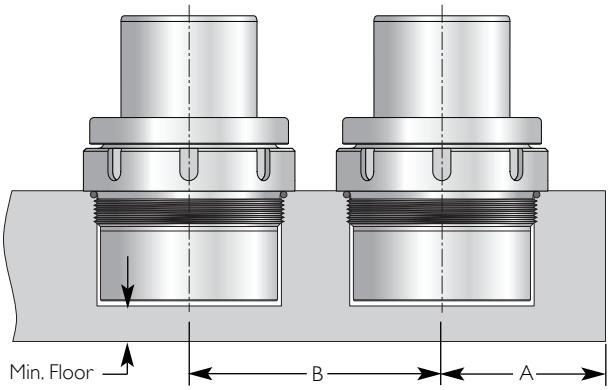
D. When interconnecting reservoir holes with cross tie holes, be sure to provide enough metal around the cylinder cavities to prevent weakening the manifold plate.



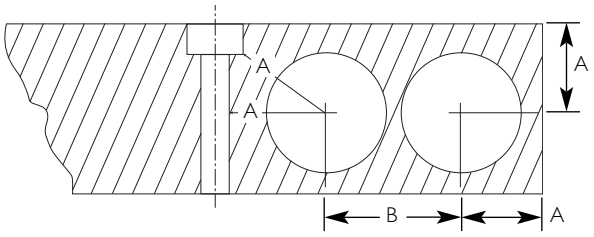
MANIFOLD DESIGN *(CONTINUED)*

E. Allow a minimum clearance:
   a. between reservoir holes,
   b. from the edge of the hole to the edge of the plate,
   c. from the reservoir holes to the top and bottom surface of the plate,
   d. between cylinders.

Note. Make sure that fastening holes, keyways, dowels, etc., do not interfere with reservoir holes.



Cylinder	.5 Ton Cyl.		1 Ton Cyl.		2.5 Ton Cyl.		4 Ton Cyl.		6 Ton Cyl.	
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
Min. Edge Dist. A	.94	23.88	1.25	31.75	1.56	39.62	2.12	53.85	2.50	63.50
Min. Edge Dist. B	1.87	47.50	2.50	63.50	3.25	82.55	4.00	101.60	4.75	120.65
Min. Floor	.44	11.18	.44	11.18	.44	11.18	.56	14.22	.62	15.75
English Thread	1-5/16-12		1-7/8-12		2-1/2-12		3-1/4-12		4-12	



Standard Manifold Volume Hole Drilling Chart

Plugs	Thread Size	Area/ Linear Inch		Hole Diameter	A	B	Suggested Plate Thickness*	Max. Drilling Depth (1 Way)
0800-0026	7/16-20	.71 cm^2	mm	9.53	9.53	18.75	51	584
		.110 $in.^2$	in.	0.375	0.375	0.738	2.00	23
0800-0027	1/2-20	.97 cm^2	mm	11.13	10.31	22.22	51	584
		.151 $in.^2$	in.	0.438	0.406	0.875	2.00	23
0800-0028	3/4-16	2.18 cm^2	mm	16.60	14.30	30.96	51	483
		.338 cm^2	in.	0.656	0.563	1.219	2.00	19
0800-0029	7/8-14	2.85 cm^2	mm	19.05	15.88	34.93	51	1092
		.442 $in.^2$	in.	0.750	0.625	1.375	2.00	43
0800-0030	1-1/16-12	4.46 cm^2	mm	23.83	19.05	42.06	51	1092
		.691 $in.^2$	in.	0.938	0.750	1.656	2.00	43
0800-0031	1-3/16-12	5.71 cm^2	mm	26.97	22.45	46.05	51	1092
		.886 $in.^2$	in.	1.062	0.884	1.813	2.00	43
0800-0032	1-5/16-12	7.15 cm^2	mm	30.18	23.83	50.80	57	1092
		1.108 $in.^2$	in.	1.188	0.938	2.000	2.25	43
0810-0017	1-5/8-12	11.40 cm^2	mm	38.10	26.97	58.75	64	1143
		1.767 $in.^2$	in.	1.500	1.062	2.313	2.50	45
081M-0020 and	M47-2	15.52 cm^2	mm	44.45	31.75	60.33	70	1194
0810-0020	1-7/8-12	2.405 $in.^2$	in.	1.750	1.250	2.375	2.75	47
081M-0023	M63-2	27.75 cm^2	mm	59.44	39.70	76.20	89	1829
		4.301 $in.^2$	in.	2.340	1.563	3.000	3.50	72
0810-0023	2-1/2-12	28.58 cm^2	mm	60.33	39.70	76.20	89	1829
		4.430 $in.^2$	in.	2.375	1.563	3.000	3.50	72
081M-0075	M82-2	48.51 cm^2	mm	78.59	53.98	95.25	114	1524
		7.518 $in.^2$	in.	3.094	2.125	3.750	4.50	60
081M-0057	M100-2	71.26 cm^2	mm	95.25	63.50	111.25	133	1829
		11.045 $in.^2$	in.	3.750	2.500	4.380	5.25	72

* Drilling patterns can affect plate thickness.
Note: For volume hole information on high pressure manifolds, contact Forward Industries.

Pressure Control

Each pressure system must include a control console, located where it is readily accessible and observable by the press operator. When possible, protect the console by mounting it in a milled recess machined into the manifold plate.

Safety

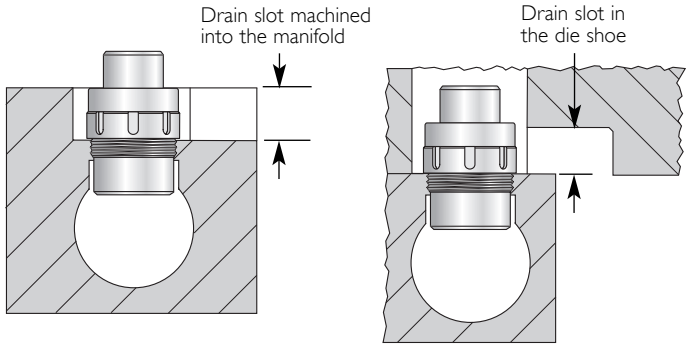
Each independent system is equipped with one rupture plug located in the control console. It is designed to safely release nitrogen if the maximum operating pressure is exceeded. Rupture plugs prevent damage to the system as well as personal injury resulting from accidental overcharging, press overstroking, crimped hoses or blocked reservoir holes. **Note: Once ruptured, plugs must be replaced. Never replace with a solid plug.**

The Automatic Pressure Control, 7000-0032, automatically monitors high press nitrogen systems. If there is any deviation from the selected pressure, the control will electronically signal the press to stop. A warning light on the control indicates the problem to the press operator. It ensures part quality in operations where accurate pressure is critical. It protects dies and presses from damage resulting from loss of pressure. Pressure range is 200-3000 psi.

Additional Design Information

Drain Slots

Nitrogen gas cylinders must not be submerged in die fluids. The grinding dust and metal chips suspended in these fluids can cause cylinder failure. Drain slots must be provided when cylinders are mounted in a recessed cavity or when a die shoe creates a pocket around cylinders. Drain slots should be a minimum of one-inch by one-inch.

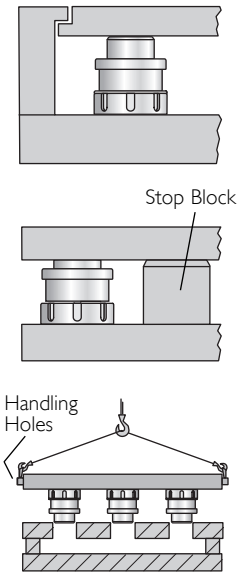


Die Open Clearance

When the die is open, the cylinders should be fully extended with a clearance of 0.015 in. maximum. This allows the manifold and pressure pad to be more easily installed or removed for servicing.

Designing in stop blocks prevents overstroking of the press. Stop blocks also allow manifolds to be stacked for storage.

Locate handling holes so that the manifold plate can be installed without rolling it over and possibly damaging the cylinders.

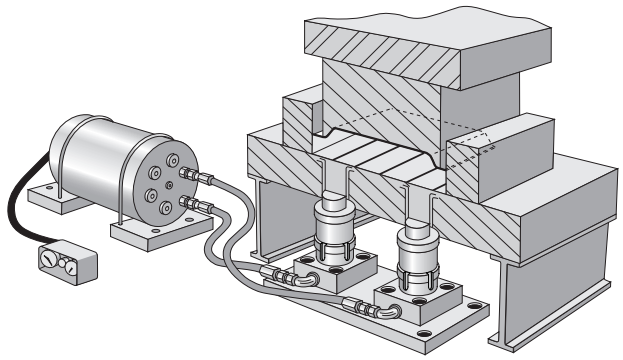


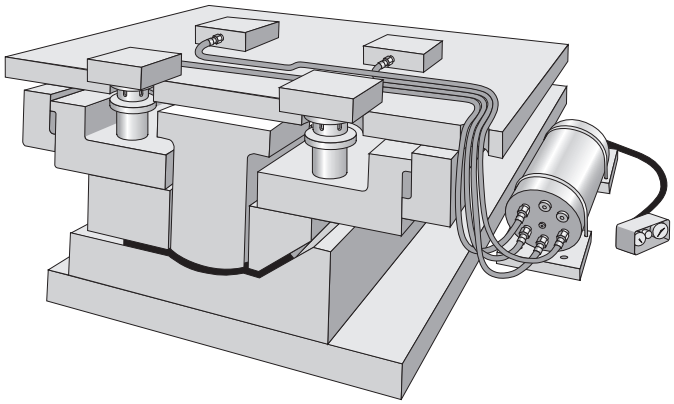
FLANGE SYSTEM DESIGN

A Versatile System Ideal for Prototype Operations

Nitrogen Gas Storage

In a typical system, nitrogen die cylinders are threaded into flange bases that are then connected with high pressure hoses to a reservoir tank. As press closes, the nitrogen gas is forced from the cylinders into the reservoir tank. The tank serves as the storage place for the "swept volume" of nitrogen gas. Forward Industries offers seven tanks of varying sizes to provide the volume of gas required.





Determining Tank Size

First, determine the volume of nitrogen needed, taking into consideration the pressure rise caused by the closing action of the press and die. Pressure rise is 15% or less for cushions, 20% or less for stripping.

Swept Volume (SV) = Piston Area X Work Stroke X Number of Cylinders

Required Tank Volume =

$$\text{Swept Volume} = \frac{100\%}{\%\ \text{Pressure Rise}}$$

After determining the required tank volume, select the appropriate reservoir tank. (See page 23 for more information on reservoir tanks).

Example

Eight (8) SUPB 2.5X3 nitrogen die cylinders using 2-3/4 in. of stroke at a pressure rise of 10%.

Piston Area = 3.55 sq. in.

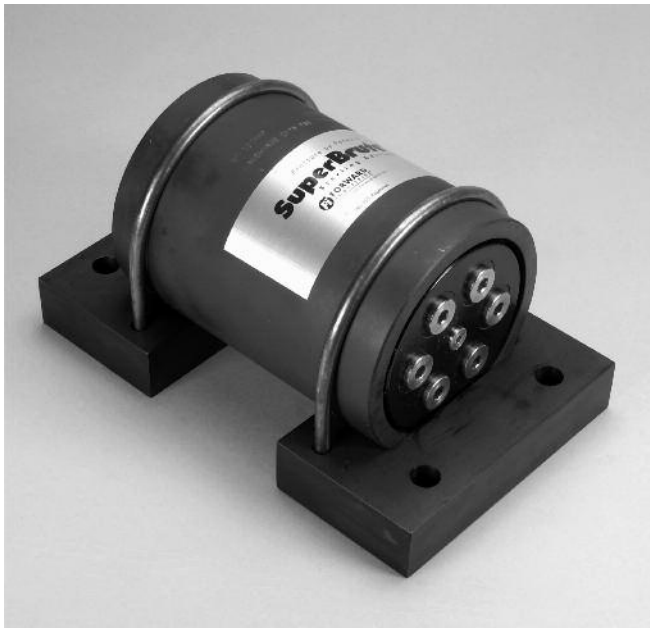
Swept Volume = 3.55 sq. in. X 2.75 in. X 8 = 78.1 cu. in.

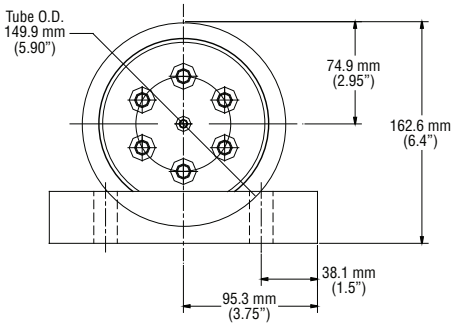
$$\text{Required Tank Volume} = 78.1 \times \frac{100\%}{10\%} = 781 \text{ cu. in.}$$

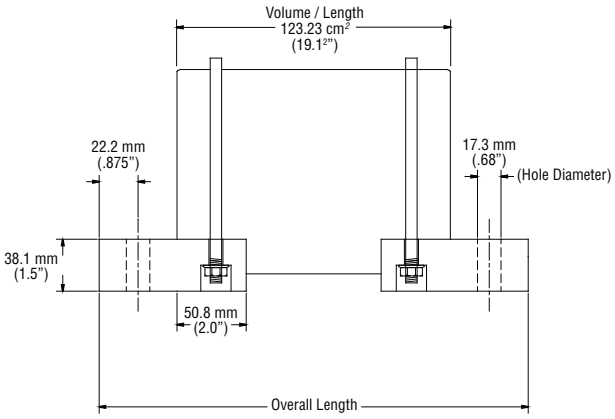
Select ST-730-HP with 730 cu. in. of available volume. If 1/2-20 fittings are required, order #0800-0053 for each line required.

RESERVOIR TANKS

The ST compression tank is designed for pressure to 150 bar/2175 psi. This compact, modular tank features a rupture disc plug for added safety. Multiple ports on each end offer increased flexibility.







DIMENSIONS

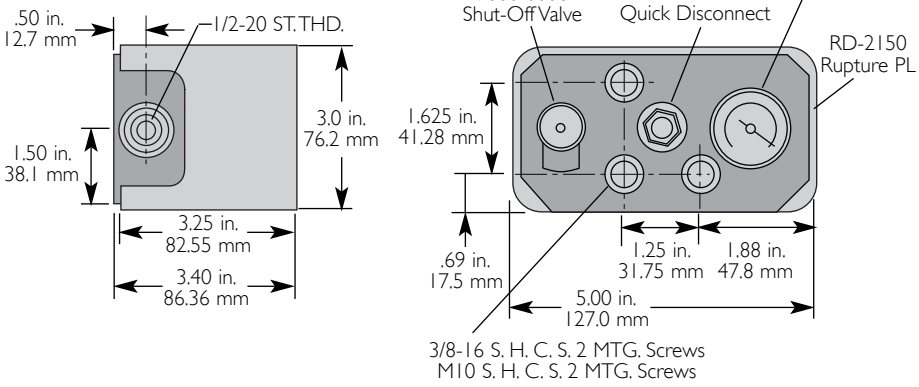
Model	Standard Volume		Standard Overall Length		Number of Ports on Each Face
	cm³	in.³	mm	in.	
ST-50-HP	819	50	244	9.61	6 each 3/4-16 1 face 7/16-20 1 face 7/16-14
ST-100-HP	1639	100	311	12.23	
ST-160-HP	2622	160	390	15.36	
ST-200-HP	3278	200	443	17.46	
ST-320-HP	5244	320	603	23.73	
ST-460-HP	7540	460	789	31.06	
ST-730-HP	11963	730	1149	45.25	

All dimensions are nominal unless tolerance is stated.

1500 PSI
STANDARD CONTROL CONSOLES

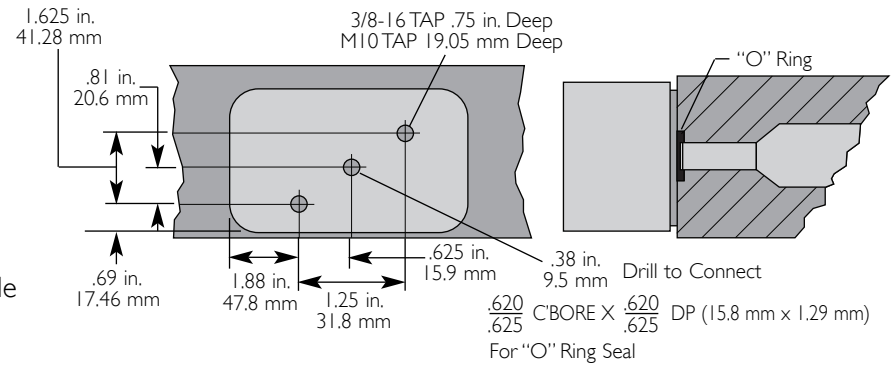
For Hose Connection
CCH1510A-English, CCHGM1510A-Metric

Using a hose connection, this control console can be installed in any accessible location.



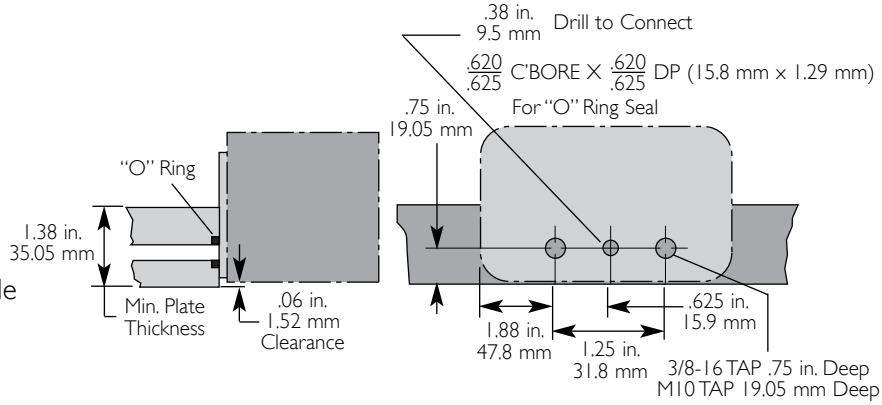
For Manifold Mounting
CCH1510B-English, CCHGM1510B-Metric

For manifolds with a minimum thickness of 3 inches, this console mounts directly to the manifold plate with an o-ring seal.



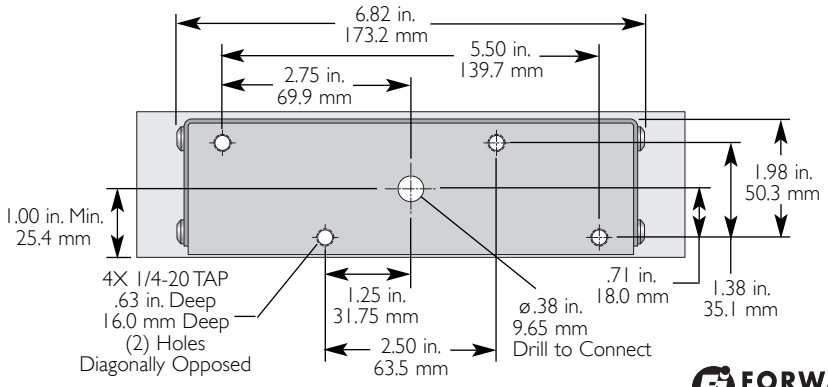
For Manifold Mounting
CCH1510C-English, CCHGM1510C-Metric

For manifolds with a maximum thickness of 3 inches, this console mounts directly to the manifold plate with an o-ring seal.

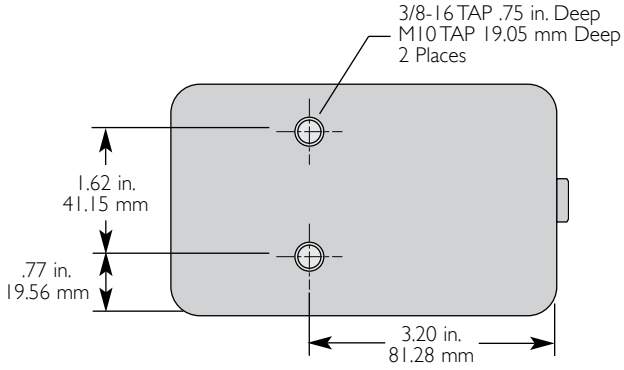


LowBoy Control Console
LBLP-0001

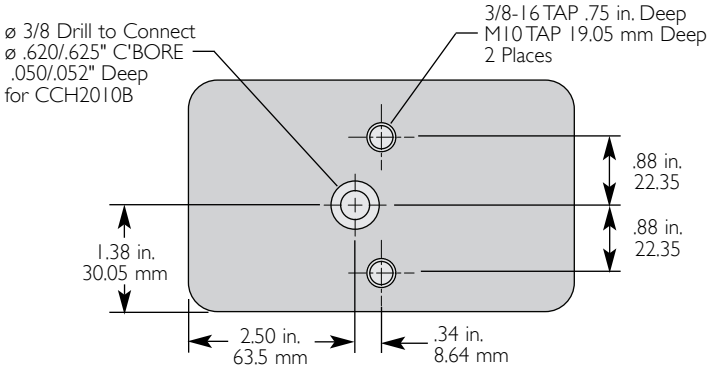
Compatible with all standard charging systems, the LowBoy control console features an ultra-low profile of less than two inches.



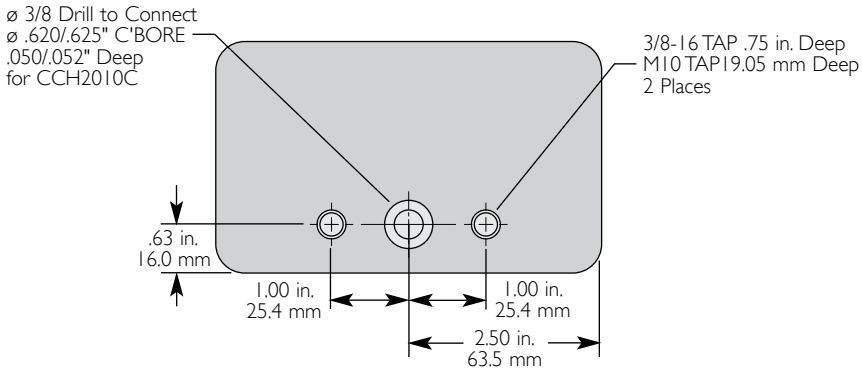
2000 PSI
HIGH PRESSURE CONTROL CONSOLES



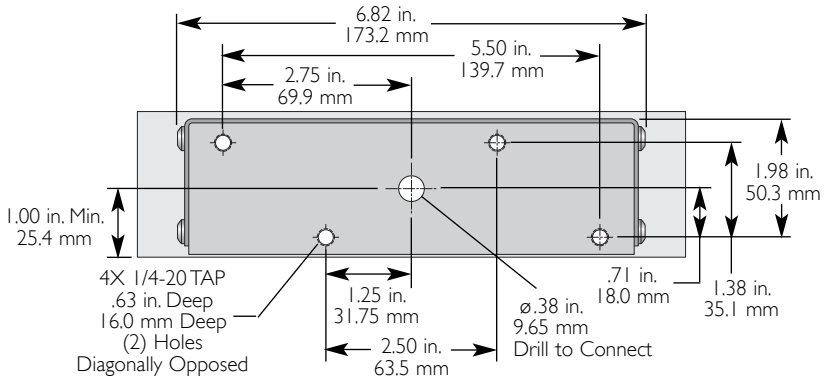
For Hose Connection
CCH2010Z-English, CCHGM2010Z-Metric
Using a hose connection, this control console can be installed in any accessible location.



For Manifold Mounting
CCH2010B-English, CCHGM2010B-Metric
For manifolds with a minimum thickness of 3 inches, this console mounts directly to the manifold plate with an o-ring seal.



CCH2010C-English, CCHGM2010C-Metric
For manifolds with a maximum thickness of 3 inches, this console mounts directly to the manifold plate with an o-ring seal.



LowBoy Control Console
LBHP-0001
Compatible with all standard charging systems, the LowBoy control console features an ultra-low profile of less than two inches.

QUICK DISCONNECT CONSOLES

Two-inch Diameter Liquid-Filled Gauge

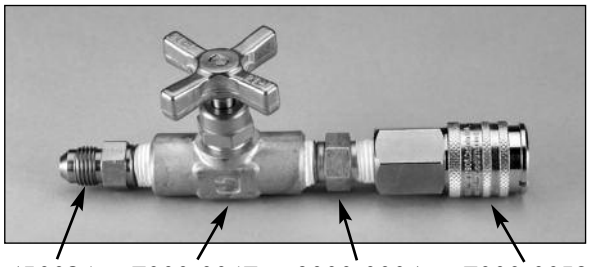
460836 5000 psi 1/4 NPT
460835 3000 psi 1/4 NPT
460222 5000 psi 1/8 NPT
460221 3000 psi 1/8 NPT

Bleed Valve
Previous 7000-0006 1/4 NPT
Current 11-700-9900-HF G-1/4 BSPP Port

Male Quick Disconnect
7000-0061

Female Quick Disconnect
(Female connect to straight-through shut-off valve and then to hose).
7000-0052

Complete Quick Disconnect Assembly
8000-0042
Includes: 450036 7/16-1/4 nipple
7000-0052 Female quick disconnect
7000-0067 Shut off valve
8000-0004 1/4-1/4 nipple



ACCESSORIES

CYLINDER SERVICE TOOLS

Face Spanner
For models SUPB, SUPS, and RFPS

Model	Order Number
1 & 2.5 ton	0700-1015
4 & 6 ton	0700-1017

Hook Spanner
For models SUPB and SUPS

Model	Order Number
1 & 2.5 ton	0700-1001
4 & 6 ton	0700-1006

Tube Wrenches
For models SUPB and SUPS

Model	Order Number
1 ton	0700-1009
2.5 ton	0700-1010
4 ton	0700-1011
6 ton	0700-1012

For models SUPBFM and SUPBSFM

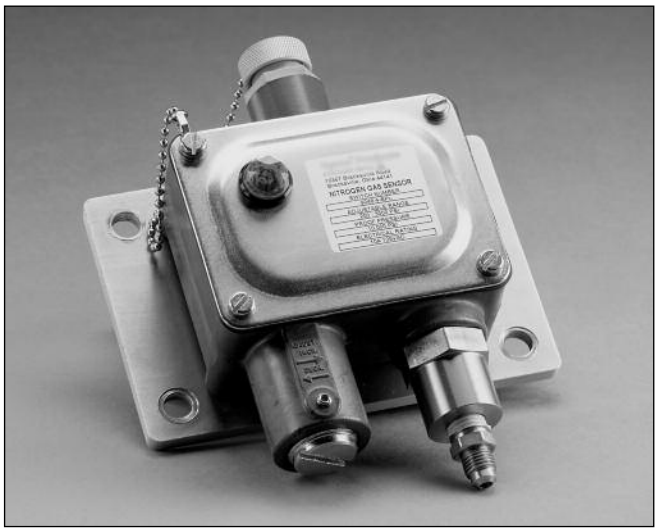
Model	Order Number
SUPBFM	TOAS-0016
SUPSFM	TOAS-0016

ACCESSORIES

The Automatic Pressure Control monitors high-pressure nitrogen systems. If there is any deviation from the selected pressure, the control will electronically signal the press to stop. A warning light on the control indicates the problem to the press operator. The Automatic Pressure Control ensures part quality in operations where accurate pressure is critical. It protects dies and presses from damage resulting from loss of pressure.

7000-0032

- Pressure range is 200-3000 psi.
- Supplied with 15 foot hose and female quick disconnect.
- Electrical connector: Brad Harrison mini-charge receptacle connector with 10 amp output.
- 125V AC signal (minimum current 100mA).
- Approved by Underwriter's Laboratories and CSA Testing Laboratories.



Automatic Pressure Control 7000-0032

APM-5800

- Use with 11-770-2700 quick disconnect to connect to inlet valve on Forward control panel. Available with 1/4 NPT thread (APM-5800) or G1/4 thread (APM-5800-G1/4).
- Pressure Range: 0-5800 psi (0-400 bar).
- Supplied with: Cable and protective cover
- Connection: 4-wire connection

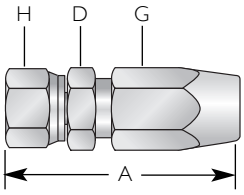
Charging Assembly
CUH-2010-A (Complete)
CUH-2010-C (Hose & Connector)

Charge Forward nitrogen gas systems using the CUH-2010-A Charging Assembly. The unit incorporates a regulator to limit the out-flow of gas, a tank pressure gauge, 10 feet of hose and a quick connector.

Rupture Plug
4400-1002 (2150 psi)

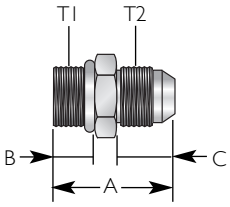
Rupture plugs protect the system against over-charging. When the internal pressure of the system exceeds the rupture plug rating, it will rupture and safely release pressure. **Once ruptured, the plug must be replaced.**

FITTINGS



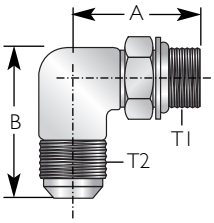
JIC 37° Swivel

Part No.		For Hose Part No.	Thread	A		D	Hex G	H
0800-1006 0800-1005	Perm. Renu.	0800-1007	1/2-20	2.39 in.	60.7 mm	5/8	5/8	5/8
0800-3006 0800-3005	Perm. Renu.	0800-3007	3/4-16	2.88 in.	73.2 mm	7/8	13/16	7/8
0800-4006	Perm.	0800-4007	7/8-14	3.29 in.	83.6 mm	1	1	1



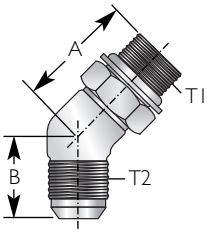
Male JIC 37°

Part No.	For Hose Part No.	T1 Thread	T2 Thread	A		B		C		Hex
0800-0106	0800-1007	7/16-20	1/2-20	1.23 in.	31.2 mm	0.36 in.	9.1 mm	0.55 in.	14 mm	9/16
0800-0018	0800-1007	7/16-20	7/16-20	1.23 in.	31.2 mm	0.36 in.	9.1 mm	0.55 in.	14 mm	9/16
0800-1001	0800-1007	1/2-20	1/2-20	1.23 in.	31.2 mm	0.36 in.	9.1 mm	0.55 in.	14 mm	5/8
0800-3001	0800-3007	3/4-16	3/4-16	1.48 in.	37.6 mm	0.44 in.	11.2 mm	0.66 in.	16.8 mm	7/8
0800-0039	0800-1007	7/8-14	1/2-20	1.50 in.	38.1 mm	0.50 in.	12.7 mm	0.74 in.	18.7 mm	1
0800-0041	0800-3007	7/8-14	3/4-16	1.50 in.	38.1 mm	0.50 in.	12.7 mm	0.74 in.	18.7 mm	1
0800-4001	0800-4007	7/8-14	7/8-14	1.70 in.	43.2 mm	0.50 in.	12.7 mm	0.76 in.	19.3 mm	1



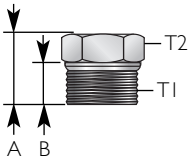
90° Elbow

Part No.	For Hose Part No.	T1 Thread	T2 Thread	A		B	
0800-0093	0800-1007	7/16-20	1/2-20	1.13 in.	28.7 mm	0.95 in.	24.1 mm
0800-1002	0800-1007	1/2-20	1/2-20	1.09 in	27.7 mm	0.95 in.	24.1 mm
0800-3002	0800-3007	3/4-16	3/4-16	1.45 in.	36.8 mm	1.25 in	31.8 mm
0800-4002	0800-4007	7/8-14	7/8-14	1.70 in.	43.2 mm	1.45 in.	36.8 mm



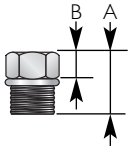
45° Elbow

Part No.	For Hose Part No.	T1 Thread	T2 Thread	A		B	
0800-1003	0800-1007	1/2-20	1/2-20	1.05 in.	26.7 mm	0.77 in.	19.6 mm
0800-3003	0800-3007	3/4-16	3/4-16	1.30 in.	33.0 mm	0.98 in.	24.9 mm
0800-4003	0800-4007	7/8-14	7/8-14	1.52 in.	38.6 mm	1.11 in.	28.2 mm



Reducer

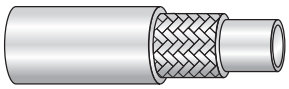
Part No.	T1 External Thread	T2 Internal Thread	A		B		Hex
0800-0042	7/8-14	3/4-16	1.31 in.	33.27 mm	0.50 in.	12.7 mm	1
0800-0053	3/4-16	1/2-20	0.75 in.	19.1 mm	0.43 in.	12.0 mm	0.88



Rupture Plug

Part No.	Thread	A		B		Hex	Max. Pressure
4400-1002	7/16-20	0.62 in.	15.7 mm	0.28 in.	7.16 mm	9/16	2150 psi/148 bar
4400-1001	3/8-24	0.62 in.	15.7 mm	0.28 in.	7.16 mm	1/2	3000 psi/207 bar

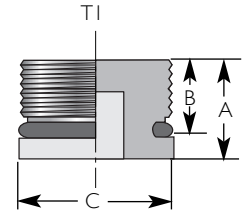
FITTINGS

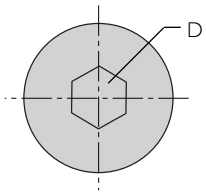


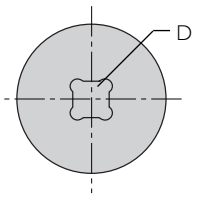
High Pressure Hose

Part No.	I.D	I.D.	O.D.	O.D.	Min. Bend Radius	Min. Bend Radius	For Cylinders
0800-1007	.250 in.	6.4 mm	.498 in.	12.6 mm	2.75 in.	69.8 mm	SUPF 1 & 2.5
0800-3007	.375 in.	9.5 mm	.642 in.	16.3 mm	4.50 in.	114.3 in.	SUPF 4 & 6
0800-4007	.500 in.	12.7 mm	.800 in.	20.3 mm	5.50 in.	139.6 mm	

*Note: For other fitting and hose options, contact customer service at 888-200-7190.







English & Metric Port Plugs

Part No.	Machined for Rupture Plug*	Rupture Plug	With 1/2-20 Thread	Thread Size	A	B	C	D
0800-0026	–	–	–	7/16-20	.45 in.	.36 in.	.56 in.	3/16 H
0800-0027	–	–	–	1/2-20	.45 in.	.36 in.	.63 in.	3/16 H
0800-0028	–	–	–	3/4-16	.56 in.	.44 in.	.88 in.	5/16 H
0800-0029	–	–	–	7/8-14	.63 in.	.50 in.	1.00 in.	3/8 H
0800-0030	–	–	–	1-1/16-12	.75 in.	.59 in.	1.25 in.	9/16 H
0800-0031	–	–	–	1-3/16-12	.75 in.	.59 in.	1.38 in.	9/16 H
0800-0032	–	–	–	1-5/16-12	.75 in.	.59 in.	1.50 in.	5/8 H
0810-0017	0810-0018	4400-1002	0810-0019	1-5/8-12	,75 in.	.59 in.	1.88 in.	3/4 H
0810-0020	0810-0021	4400-1002	0810-0022	1-7/8-12	.75 in.	.59 in.	2.12 in.	1/2 S
0810-0023	0810-0024	4400-1002	0810-0025	2-1/2-12	.75 in.	.59 in.	2.75 in.	1/2 S
081M-0020	081M-0021	4400-1002	081M-0022	M47 X 2mm	19 mm	15 mm	53.3 mm	1/2 S
081M-0023	081M-0024	4400-1002	081M-0025	M63 X 2mm	19 mm	15 mm	69.3 mm	1/2 S
081M-0075	081M-0077	4400-1002	081M-0078	M82 X 2mm	25 mm	19 mm	88.9 mm	3/4 S
081M-0057	081M-0059	4400-1002	081M-0062	M100 X 2mm	25 mm	19 mm	108 mm	3/4 S

*Specify rupture plug shown when ordering machined port plugs.

Notes

Forward Industries supplies a wide range of nitrogen manifold systems, gas springs and cams for the metal stamping industry, all manufactured in an ISO 9001:2008 certified facility.

We made our name engineering top quality manifolds but today we offer much more than that, including the Crossover Nitrogen System™ and the Flex Form Advanced Forming System. Choose from a full line of KALLER® gas springs as well, from minis and subcompacts to stock lifters and those that meet automotive standards. Hydraulic and roller cams round out the product line.

With sales and service offices in the United States, Canada and Mexico, and a network of sales representatives and distributors, we are ready to serve you.

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