



SuperBrute®

MANIFOLD SYSTEMS AND PRESS CUSHIONS



Go Forward With Us



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

TABLE OF CONTENTS

INTRODUCTION.....	2
APPLICATIONS.....	4
NITROGEN SYSTEMS.....	6
NITROGEN MANIFOLD CYLINDERS.....	8
HALF TON MINI MODELS.....	10
BASIC MODELS.....	12
BASIC STUB MODELS.....	14
FLANGE MODELS.....	16
LOW PROFILE (PANCAKE) MODELS.....	17
BIG BRUTE® MODELS.....	18
MODULAR PRESS CUSHION.....	19
MANIFOLD DESIGN.....	20
FLANGE SYSTEM DESIGN.....	24
RESERVOIR TANKS.....	25
STANDARD CONTROL CONSOLES.....	26
HIGH PRESSURE CONTROL CONSOLES.....	27
MULTI-CONTROL CONSOLES.....	28
ACCESSORIES.....	29
FITTINGS.....	30

COMPARE OUR NITROGEN GAS MANIFOLDS TO OTHER SYSTEMS:

Greater Press Versatility

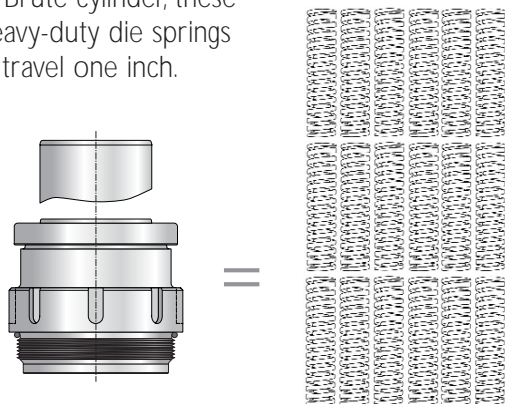
SuperBrute manifold systems are an integral part of the die, so the die can be moved from one press to another easily, with minimal set-up.

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.

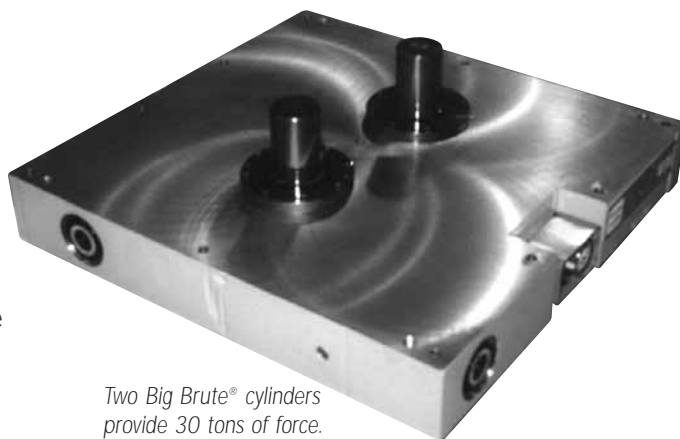
Space Savings

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.



Two Big Brute® cylinders provide 30 tons of force.

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

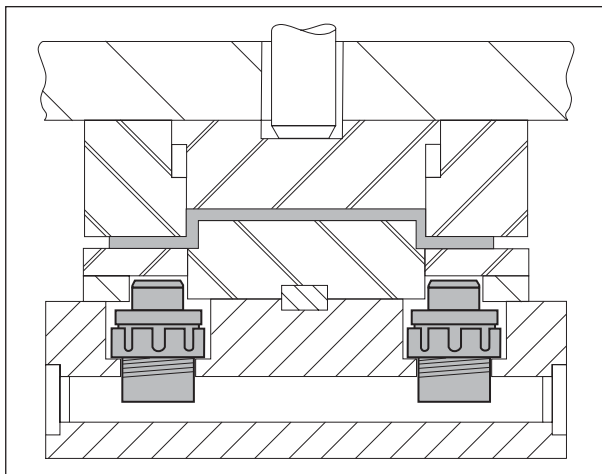
The self-contained SuperBrute nitrogen system simplifies maintenance. The ability to add or release nitrogen gas from the system without shutting down during production allows maintenance to be done at a convenient time in the factory schedule.

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.

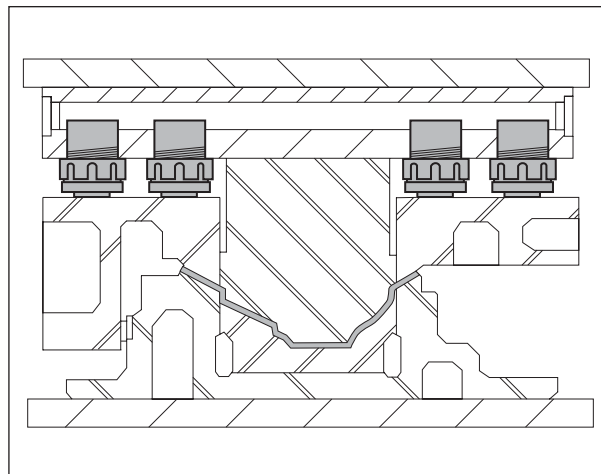
APPLICATIONS

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



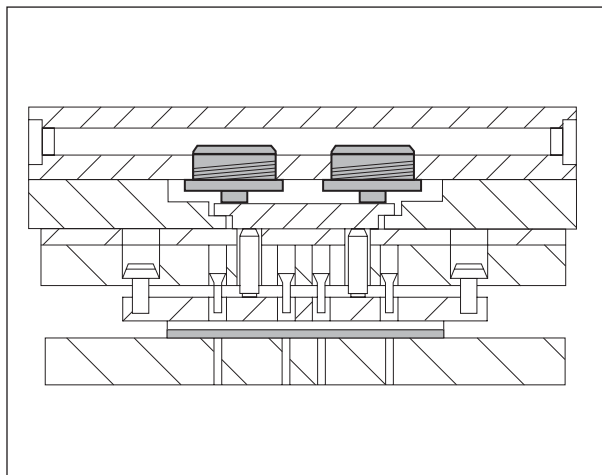
CONVENTIONAL DRAW

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



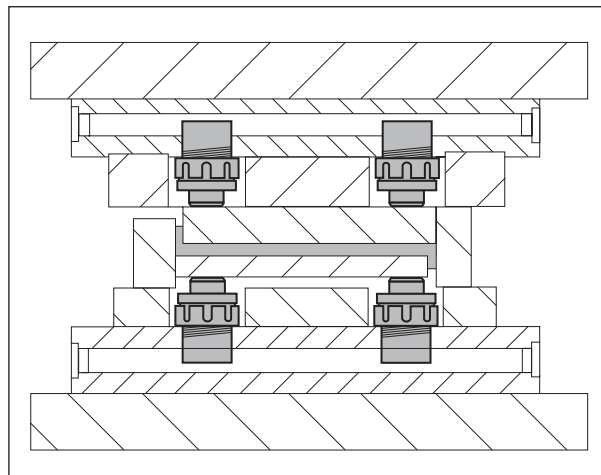
INVERTED DRAW

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



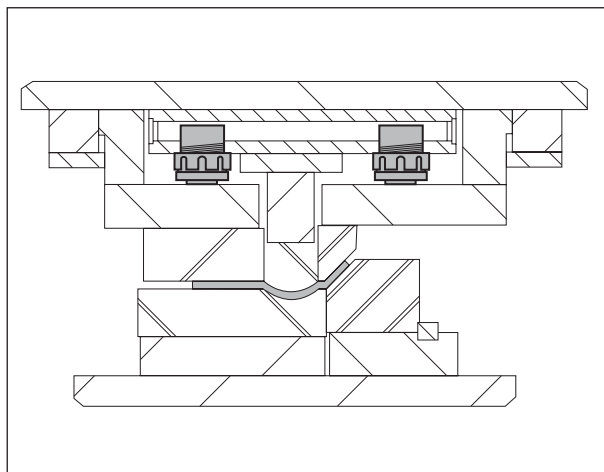
STRIP PUNCHES

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



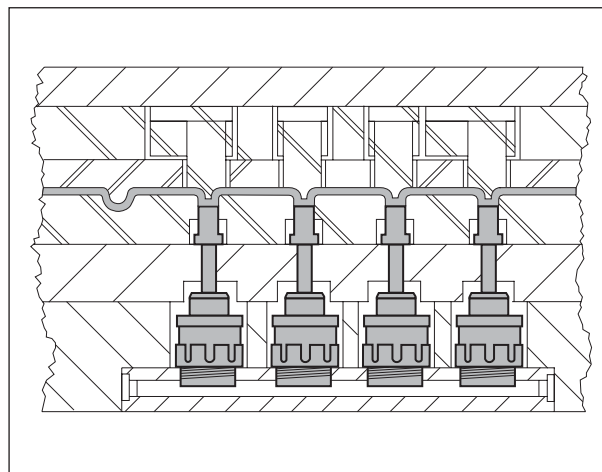
FORM UP AND DOWN

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.



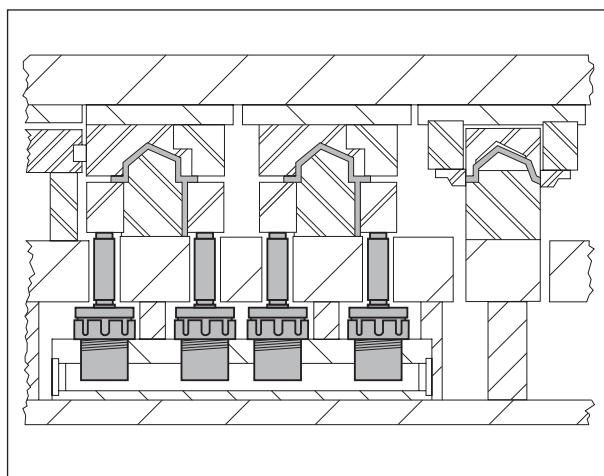
COMBINED OPERATIONS

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.



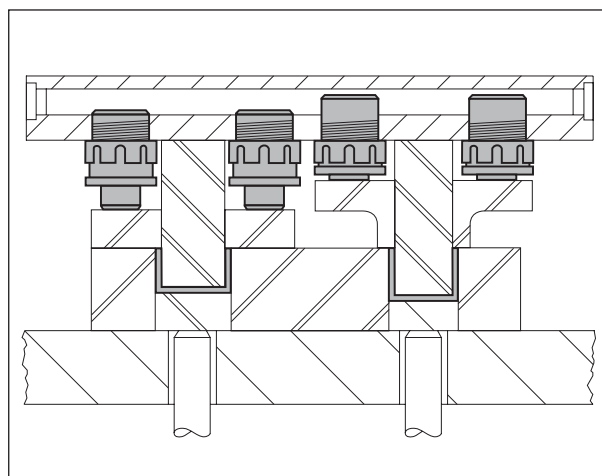
CLOSE STATION CENTERS

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

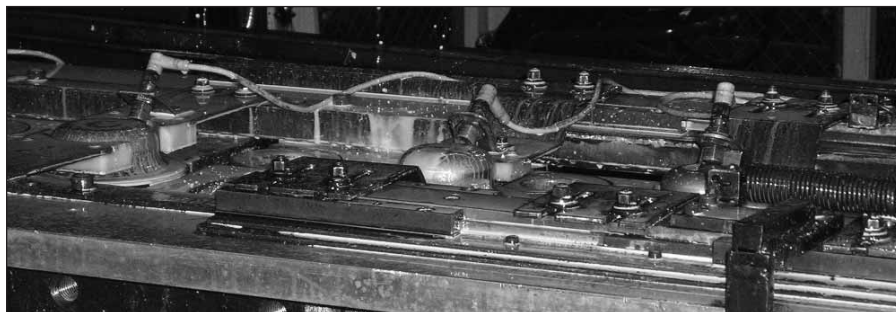
Nitrogen cylinders react quickly and precisely, making them ideal for high speed production runs.

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.

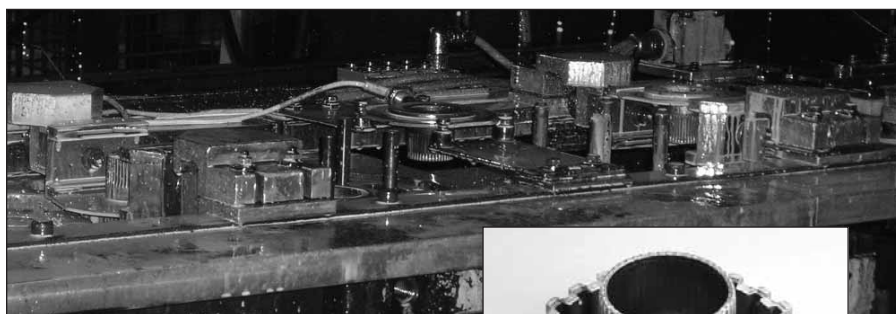
Transform Automotive in Sterling Heights, Michigan, produces transmission parts with the help of a SuperBrute manifold system. They value the benefits of the low pressure rise including less heat build-up, longer seal life, and less maintenance and downtime for this deep draw operation.



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 specifica-

tions 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 hoses together for a common pressure.

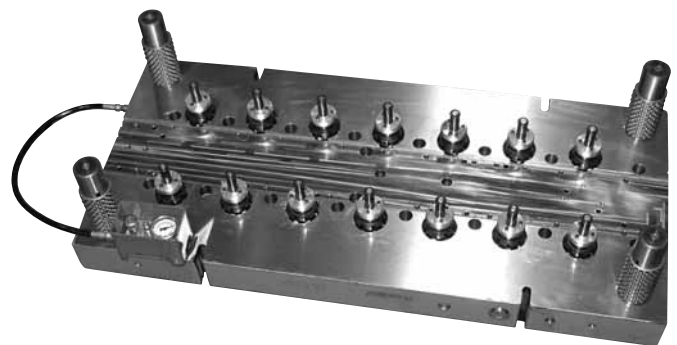
SuperBrute Modular Press Cushions

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.



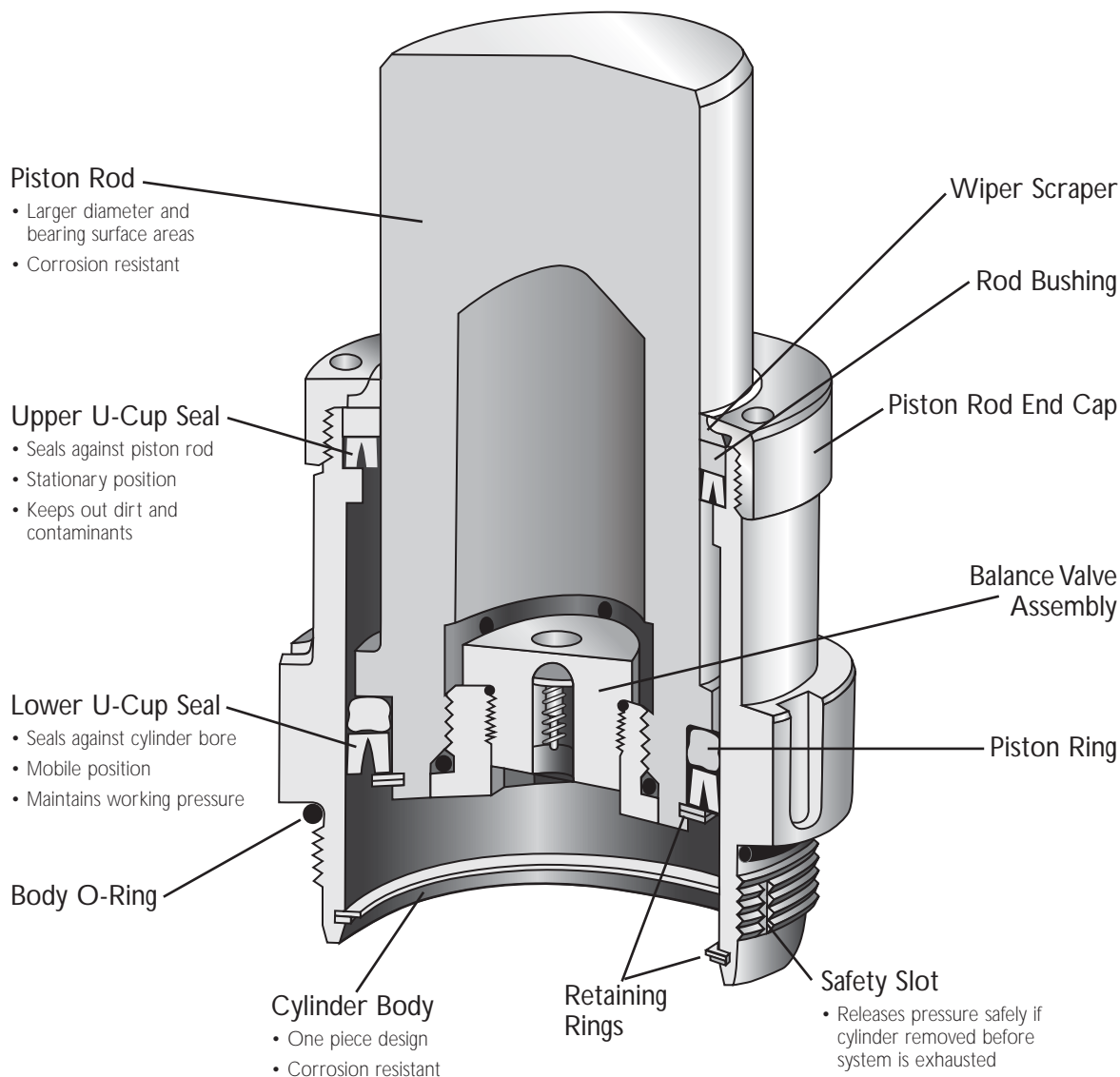
Manifold incorporated into a die set saves costs and space.

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

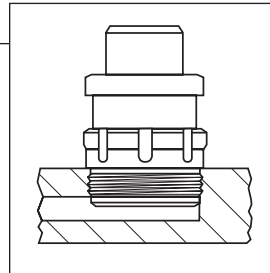
There is a SuperBrute manifold cylinder for virtually every stamping operation.



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:

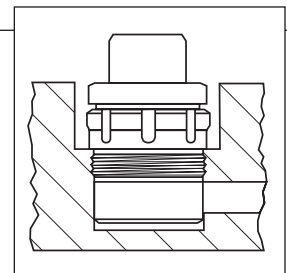
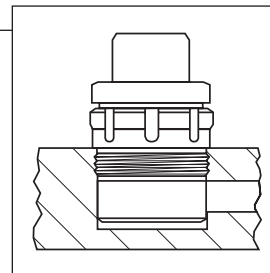
- Thinner manifold plates.
- Drain slots machined into the manifold plate are not usually required.
- Elimination of machining recessed holes for the cylinders.
- Easy accessibility to cylinders for maintenance.



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:

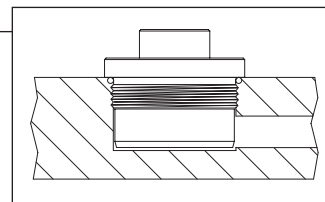
- Useful when die space or press shut height is limited.
- Mounting in a recessed cavity saves additional space.



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:

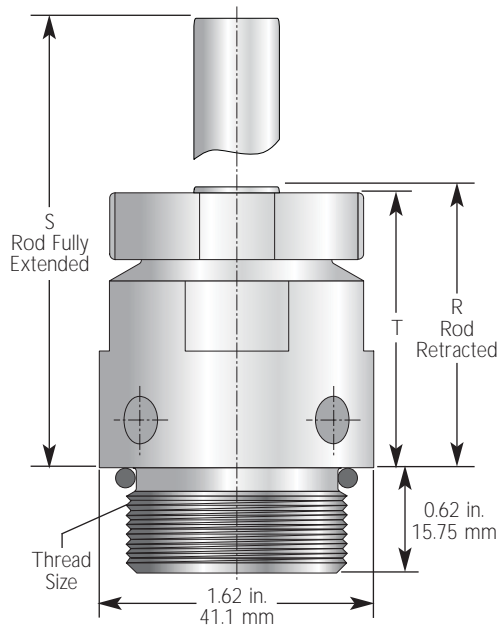
- High force in applications where die space or press shut height is very limited.



HALF TON MINI MODELS

PRODUCT SPECIFICATIONS

Maximum Force at 1500 psi/103 bar	1035 lbs./470 kg
Effective Piston Area	0.69 in. ²
Rod Diameter	0.50 in./ 12.7 mm
English Thread Size	1-5/16-12
Seal Kit Order Number	0500-0013

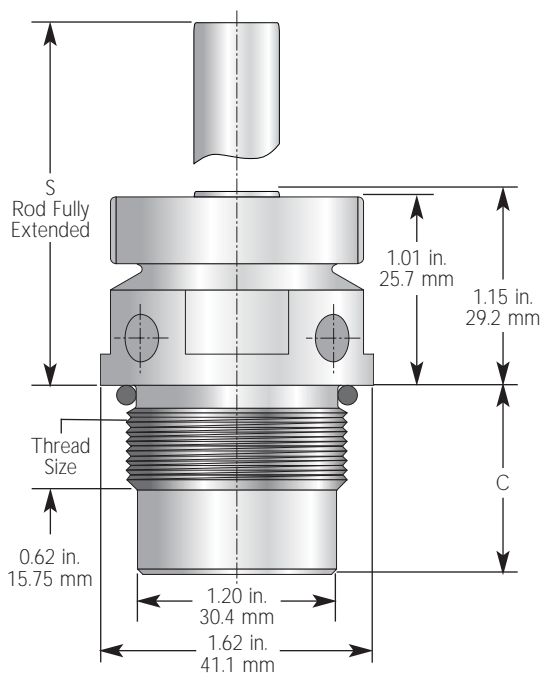


SUPBFM: Basic models for manifold mounting.

DIMENSIONS

SUPBFM

Max. Working Stroke		R		S		T	
in.	mm	in.	mm	in.	mm	in.	mm
0.50	12.7	1.15	29.2	1.65	41.9	1.01	25.6
1.00	25.4	1.65	41.9	2.65	67.3	1.51	38.3
1.50	38.1	2.15	54.6	3.65	92.7	2.01	51.0
2.00	50.8	2.65	67.3	4.65	118.1	2.51	63.7
2.50	63.5	3.15	80.0	5.65	143.5	3.01	76.4
3.00	76.2	3.65	92.7	6.65	168.9	3.51	89.1

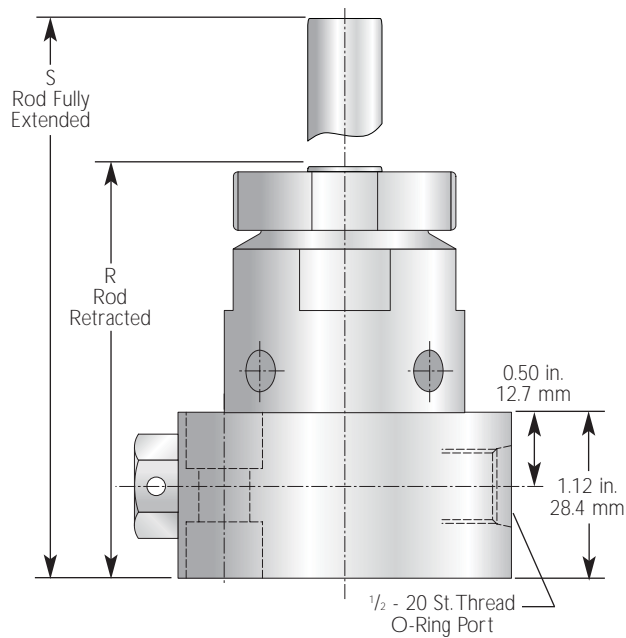


SUPSFM: Stub models for applications where shut height is limited.

DIMENSIONS

SUPSFM

Max. Working Stroke		C		S	
in.	mm	in.	mm	in.	mm
0.50	12.7	0.62	15.7	1.65	41.9
1.00	25.4	1.12	28.4	2.15	54.6
1.50	38.1	1.62	41.1	2.65	67.3
2.00	50.8	2.12	53.8	3.15	80.0
2.50	63.5	2.62	66.5	3.65	92.7
3.00	76.2	3.12	79.2	4.15	105.4

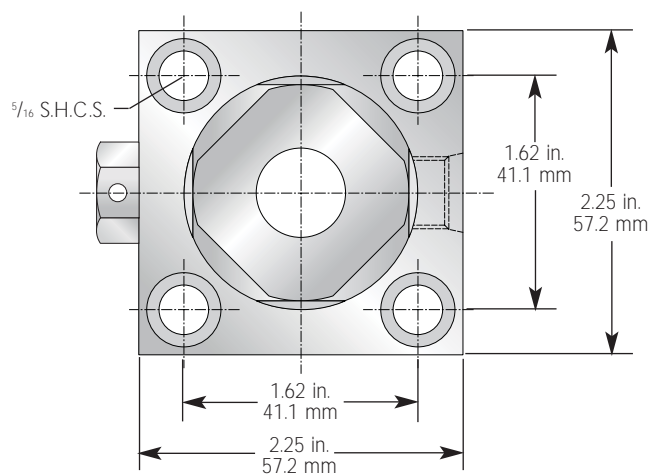


SUPBFFM: Hose flange-mounted models to a reservoir tank.

DIMENSIONS

SUPBFFM

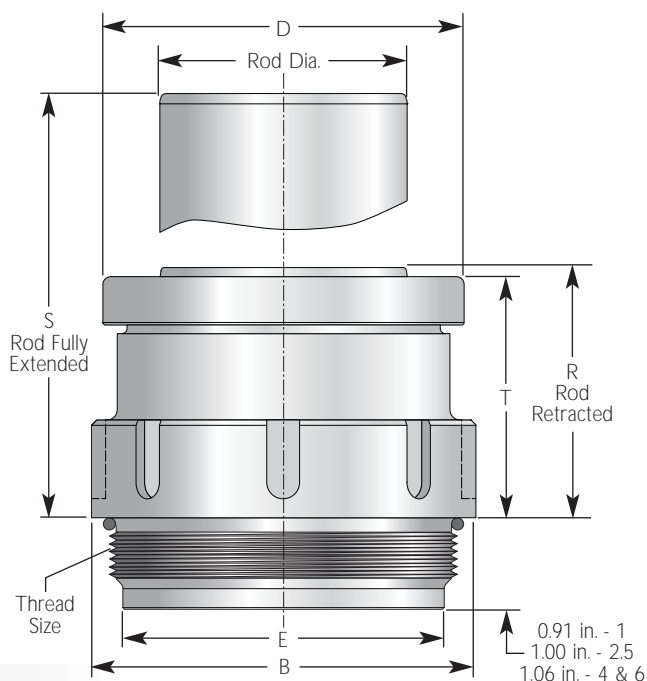
Max. Working Stroke		R		S	
in.	mm	in.	mm	in.	mm
0.50	12.7	2.28	57.9	2.77	70.6
1.00	25.4	2.78	70.6	3.77	96.0
1.50	38.1	3.28	83.3	4.77	121.4
2.00	50.8	3.78	96.0	5.77	146.8
2.50	63.5	4.28	108.7	6.77	172.2
3.00	76.2	4.78	121.4	7.77	197.6



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

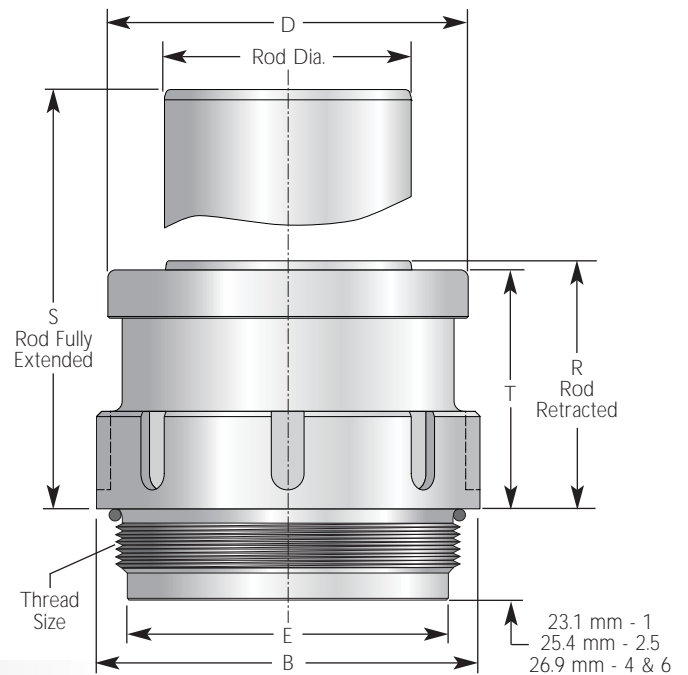
DIMENSIONS

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

METRIC BASIC & HIGH PRESSURE MODELS

The SUPBGM 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® Metric Basic & High Pressure Models

Model	Max. Force @ 103 bar/1500 psi	High Pressure @ 138 bar/2000 psi	Effective Piston Area	Rod Diameter	Diameter B	Diameter D	Diameter E	Metric Thread Size	Std. Seal Kit Order Number
SUPBGM09	1008 kg	1345 kg	9.55 cm ²	28.7mm	60.5mm	53.8mm	43.6mm	M47x2mm	0500-1005
SUPBGM23	2416 kg	3223 kg	22.9 cm ²	47.7mm	74.9mm	69.6mm	59.4mm	M63x2mm	0500-2506
SUPBGM36	3682 kg	4912 kg	34.9 cm ²	57.2mm	93.7mm	86.4mm	77.7mm	M82x2mm	0500-4202
SUPBGM51	5190 kg	6924 kg	49.2 cm ²	73.2mm	113.0mm	106.5mm	94.5mm	M100x2mm	0500-6202

DIMENSIONS

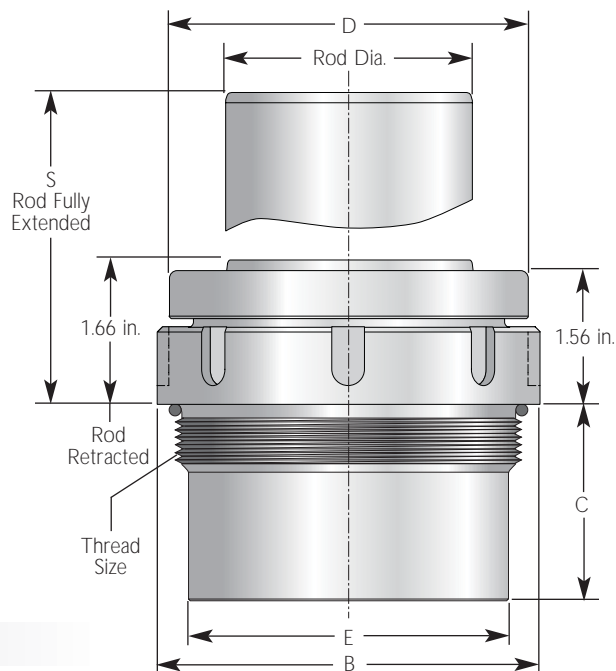
SuperBrute® Metric Basic and High Pressure Models

Max. Working Stroke	R mm	S mm	T mm
25	48	73.3	45.5
50	73	123.3	70.5
75	98	173.3	95.5
100	123	223.3	120.5
125	148	273.3	145.5
150	173	323.3	170.5
175	198	373.3	195.5
200	223	423.3	220.5

All dimensions are nominal unless tolerance is stated.

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

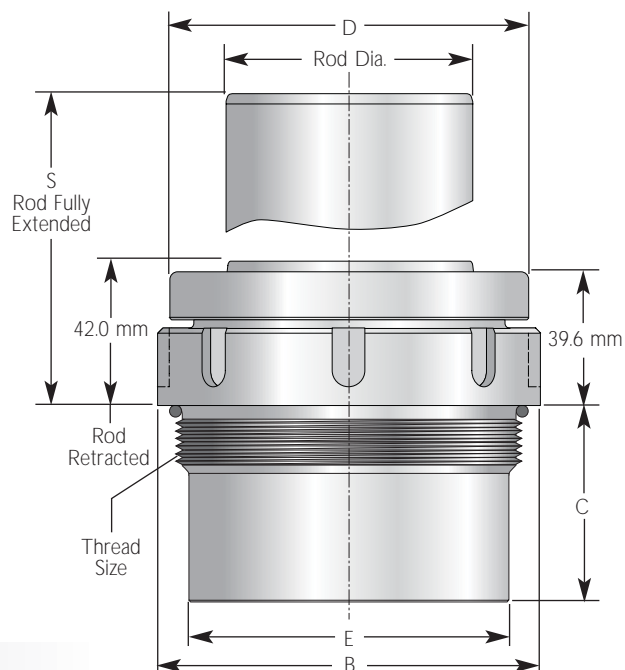
SUPS 4 & 6

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.

METRIC BASIC & HIGH PRESSURE STUB MODELS

The SUPSGM 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 counter-bored hole 1/4-inch over the cylinder diameter.



PRODUCT SPECIFICATIONS

SuperBrute® Metric 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
SUPSGM09	1008 kg	1345 kg	9.55 cm ²	28.7mm	60.5mm	53.8mm	43.6mm	M47x2mm	0500-1005
SUPSGM23	2416 kg	3223 kg	22.9 cm ²	47.7mm	74.9mm	69.6mm	59.4mm	M63x2mm	0500-2506
SUPSGM36	3682 kg	4912 kg	34.9 cm ²	57.2mm	93.7mm	86.4mm	77.7mm	M82x2mm	0500-4202
SUPSGM51	5190 kg	6924 kg	49.2 cm ²	73.2mm	113.0mm	106.5mm	94.5mm	M100x2mm	0500-6202

DIMENSIONS

SuperBrute® Metric and High Pressure Stub Models SUPSGM 09

Max. Working Stroke	S mm	C* mm
25	67	29
50	92	54
75	117	79
100	142	104
125	167	129
150	192	154
175	217	179
200	242	204

SUPSGM 23

Max. Working Stroke	S mm	C* mm
25	67	31.3
50	92	56.3
75	117	81.3
100	142	106.3
125	167	131.3
150	192	156.3
175	217	181.3
200	242	206.3

SUPSGM 36 & 51

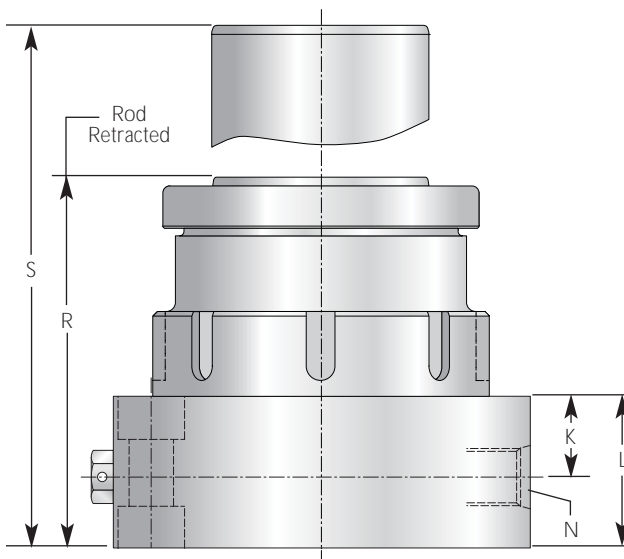
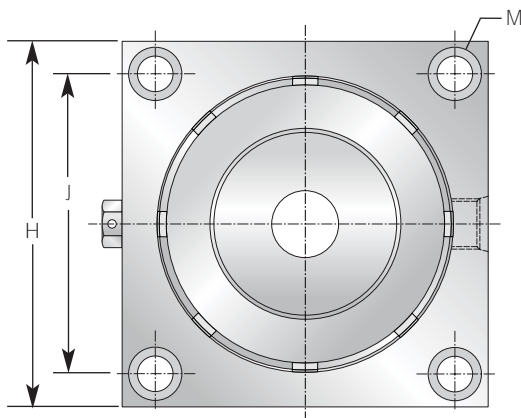
Max. Working Stroke	S mm	C* mm
25	67	32.9
50	92	57.9
75	117	82.9
100	142	107.9
125	167	132.9
150	192	157.9
175	217	182.9
200	242	207.9

*Manifold cavity depth is C plus 3.2 mm.

All dimensions are nominal unless tolerance is stated.

ENGLISH FLANGE MODELS

The SUPF flange-mounted cylinders are hoses 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 hoses 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	1.38	0.88	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	1.50	0.75	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	2.00	1.06	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	2.00	1.06	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

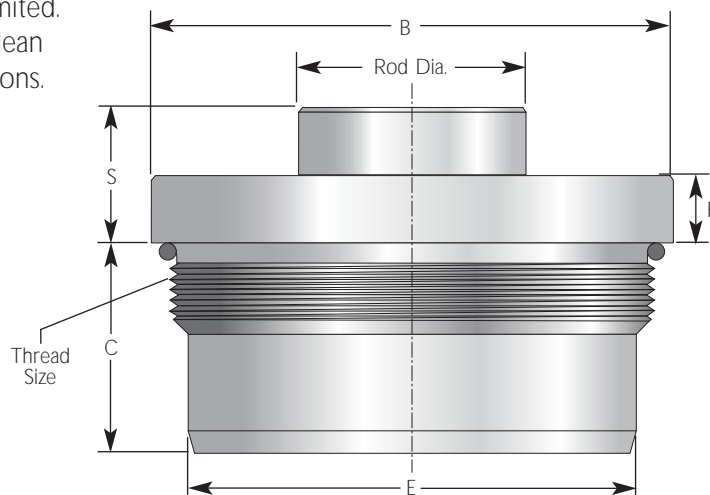
Max. Working Stroke	R in.	S in.
1.00	3.41	4.41
1.50	3.91	5.41
2.00	4.41	6.41
2.50	4.91	7.41
3.00	5.41	8.41
3.50	5.91	9.41
4.00	6.41	10.41
4.50	6.91	11.41
5.00	7.41	12.41
5.50	7.91	13.41
6.00	8.41	14.41
6.50	8.91	15.41
7.00	9.41	16.41
7.50	9.91	17.41
8.00	10.41	18.41

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

LOW PROFILE (PANCAKE) MODELS

The RFP 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

SuperBrute® 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 cm ²	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 cm ²	1.25 in./31.8mm	2.75 in./70.0mm	2.34 in./59.1mm	2.12 in./53.9mm	2-1/2-12	0500-2503
RFP4S	8118 lbs./3582 kg	5.41 in. ² /34.9 cm ²	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
RFP6S	11505 lbs./5190 kg	7.67 in. ² /49.2 cm ²	1.75 in./44.5mm	4.38 in./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

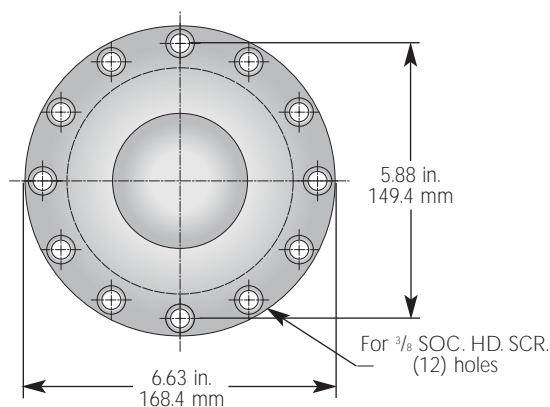
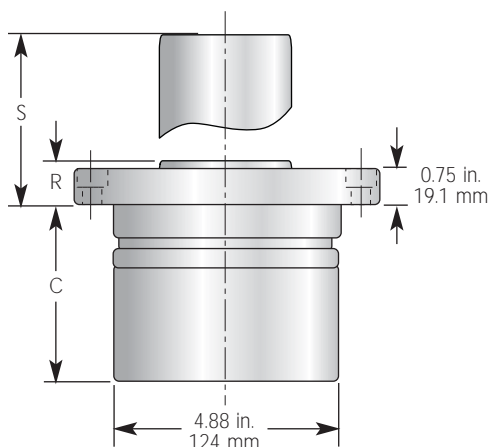
Max. Working Stroke		C		S		P*		F	
in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
0.25	6.3	1.47	37.3	0.87	22.1	1.63	41.1	0.56	14.2
0.38	9.5	1.59	40.4	1.00	25.4	1.65	41.9	0.56	14.2
0.50	12.7	1.72	43.7	1.12	28.4	1.78	45.2	0.56	14.2
0.75	19.0	1.97	50.0	1.37	34.8	2.03	51.6	0.56	14.2

*Minimum cavity depth.

All dimensions are nominal unless tolerance is stated.

BIG BRUTE ENGLISH, METRIC & HIGH PRESSURE MODELS

Big Brute cylinders are the choice for heavy tonnage, each offering 15 tons of force.



PRODUCT SPECIFICATIONS

Maximum Force at 1500 psi/103 bar	22,500 lbs./10,227 kg
Maximum Force at 2000 psi/138 bar	30,000 lbs./13,636 kg
Effective Piston Area	15.03 in. ²
Rod Diameter	2.87 in./ 72.9 mm
Seal Kit Order Number	0500-0028

DIMENSIONS

BB English

Max. Working Stroke	C in.	S in.	R in.
1.00	2.04	2.11	1.11
1.50	2.54	2.61	1.11
2.00	3.04	3.11	1.11
2.50	3.54	3.61	1.11
3.00	4.04	4.11	1.11

BB Metric

Max. Working Stroke	C mm	S mm	R mm
25	46.9	53.3	28.3
38	59.9	66.3	28.3
50	71.9	78.3	28.3
63	84.9	91.3	28.3
75	96.9	103.3	28.3

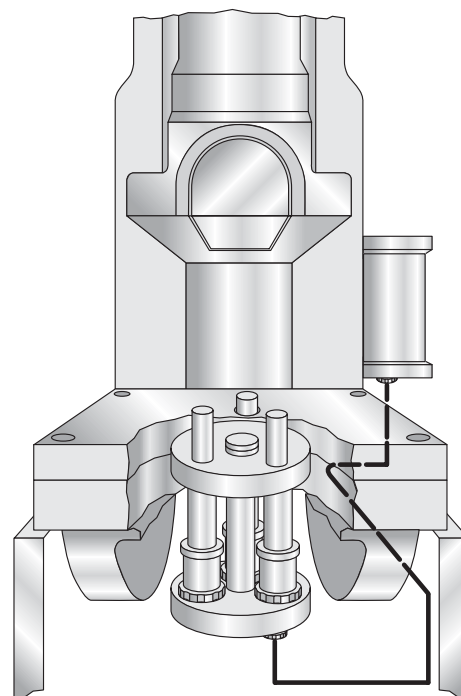
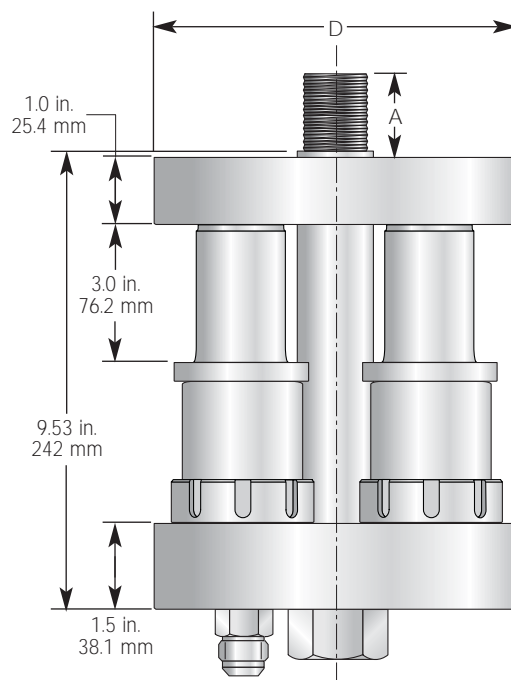
MODULAR PRESS CUSHION

The PC model incorporates three or four nitrogen cylinders into a powerful and compact cushion that installs easily into any press, no matter how limited the space under the bolster plate. The cushion height with die open is 9.53 in./242 mm and the maximum working travel is 3.0 in./76.2mm. Only one threaded hole on the underside of the bolster is required. Each modular press cushion comes complete with 10 feet of hose, a reservoir tank, control console, cushion assembly and fittings.

PRODUCT SPECIFICATIONS

SuperBrute® Metric Basic & High Pressure Stub Models

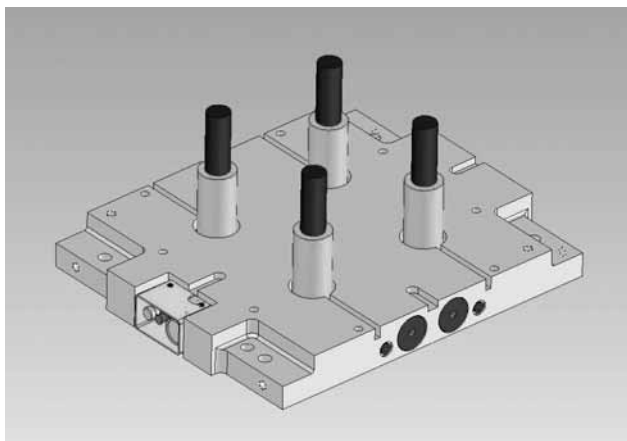
Model	Cylinder Model	Max. Force	A Stud Length	D Plate Dia.	Std. Thread Size
PC-3	SUPB1-3	6600 lbs. 3000 kg	1.50 in. 38.1mm	6.50 in. 165.1mm	1-8
PC-4	SUPB1-3	8800 lbs. 4000 kg	1.88 in. 47.7mm	6.75 in. 172mm	1-1/4-7
PC-7.5	SUPB2.5-3	15480 lbs. 7020 kg	1.88 in. 47.7 in.	7.88 in. 200.2mm	1-1/4-7
PC-10	SUPB2.5-3	20640 lbs. 9360 kg	2.25 in. 57.2mm	8.12 in. 206.2mm	1-1/2-6



The PC is ideal for small OBI, gap and straight-sided presses with limited shut height and small bed areas.

All dimensions are nominal unless tolerance is stated.

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.

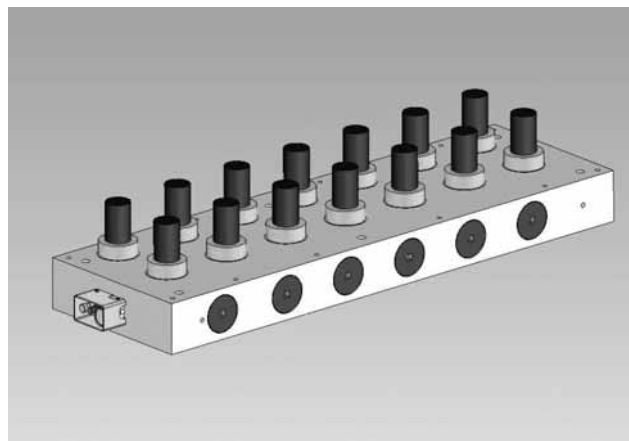
The most compact system uses the manifold plate as a die shoe. However when more space is available, the system can be designed with the manifold plate separate from the die shoe. Having a separate manifold allows independent service to either the die or the cylinders.

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.

$$\text{Force} = \frac{\text{Psi Nitrogen}}{\text{Effective Piston Area}} \times$$

Force Distribution

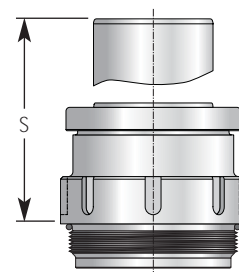
Distribute the force over the area as required. Our wide range of cylinder tonnage selections allows this to be done in a variety of ways.

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 10-18.

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:

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

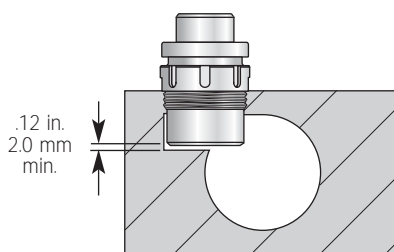
Now convert Manifold Volume into lineal inches of drilled reservoir holes by using the Hole Volume chart (page 22) and the following formula:

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

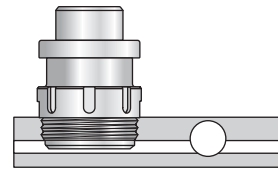
To reduce machining, large diameter holes are preferred over a larger quantity of smaller diameter holes.

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.

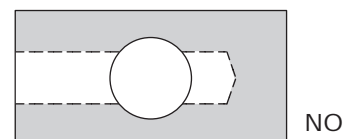
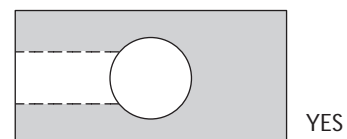
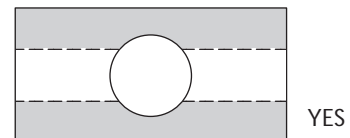
- A. Reservoir holes may intersect cylinder cavities but should not interfere with the threaded portion of the cylinder cavity.



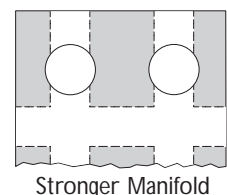
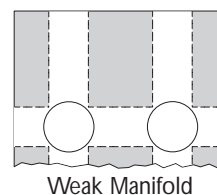
- B. If reservoir holes cannot be located to intersect the cylinder cavities, feeder holes must be used. Drill feeder holes from the outside edge of the plate. Use one-quarter-inch holes for cylinders up to 2.5 tons, and three-eighth-inch holes for cylinders over 2.5 tons.



- 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.

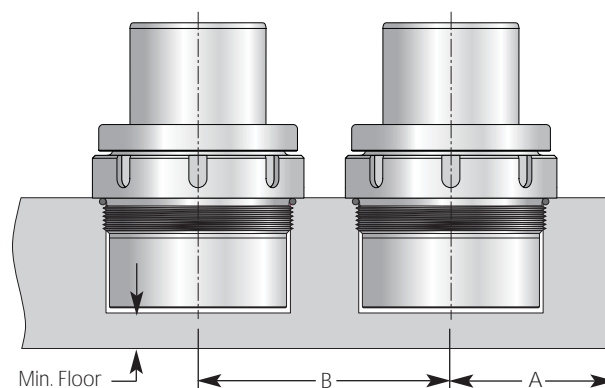


MANIFOLD DESIGN (CONTINUED)

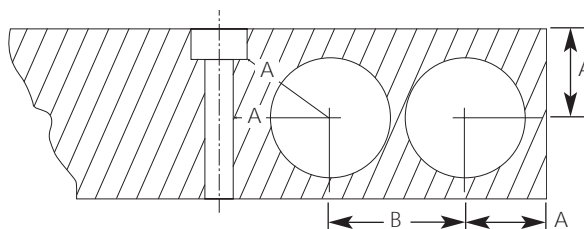
E. Allow a minimum clearance:

- between reservoir holes,
- from the edge of the hole to the edge of the plate,
- from the reservoir holes to the top and bottom surface of the plate,
- 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	
Metric Thread	N/A		M47 X 2		M63 X 2		M82 - 2 mm		M100 - 2 mm	



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

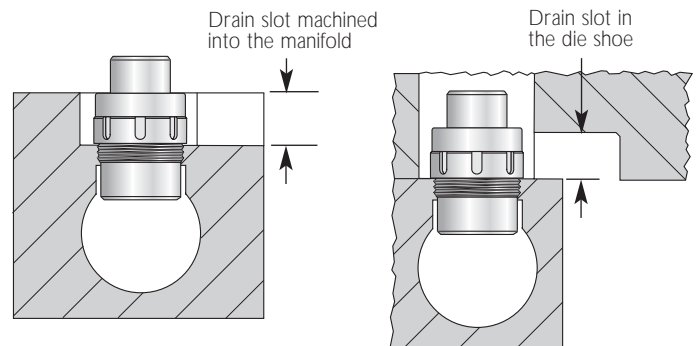
Each independent system is equipped with one rupture plug located in the control console. It is designed to safely release nitrogen if the maximum operating pressure is exceeded. Rupture plugs prevent damage to the system as well as personal injury resulting from accidental overcharging, press overstroking, 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.

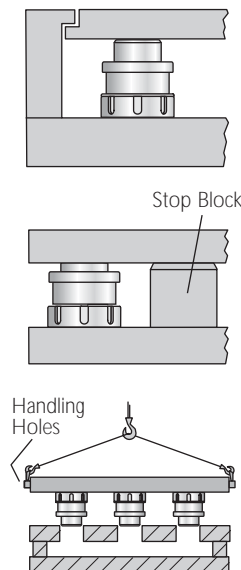


Die Open Clearance

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.

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

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

After determining the required tank volume, select the appropriate reservoir tank. (See page 25 for more information on reservoir tanks).

Example

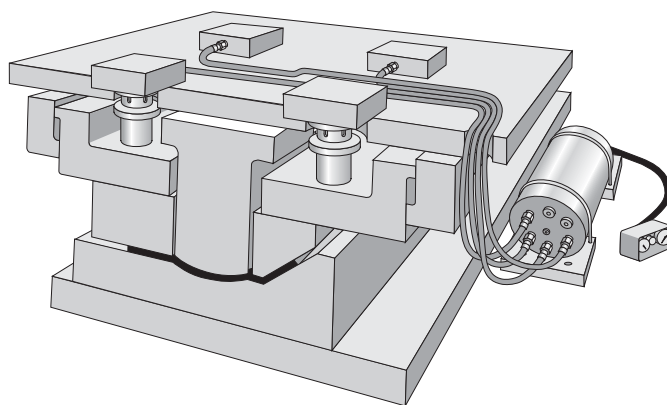
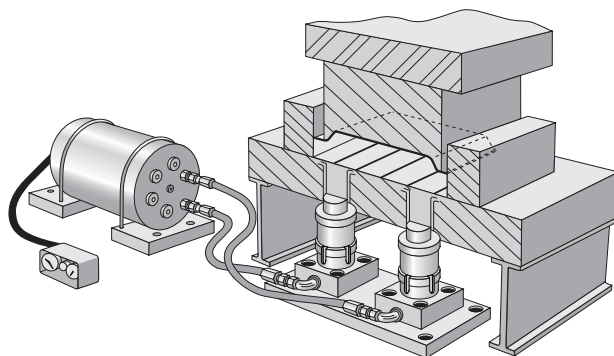
Eight (8) SUPB 2.5X3 nitrogen die cylinders using 2-3/4 in. of stroke at a pressure rise of 10%.

Piston Area = 3.55 sq. in.

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

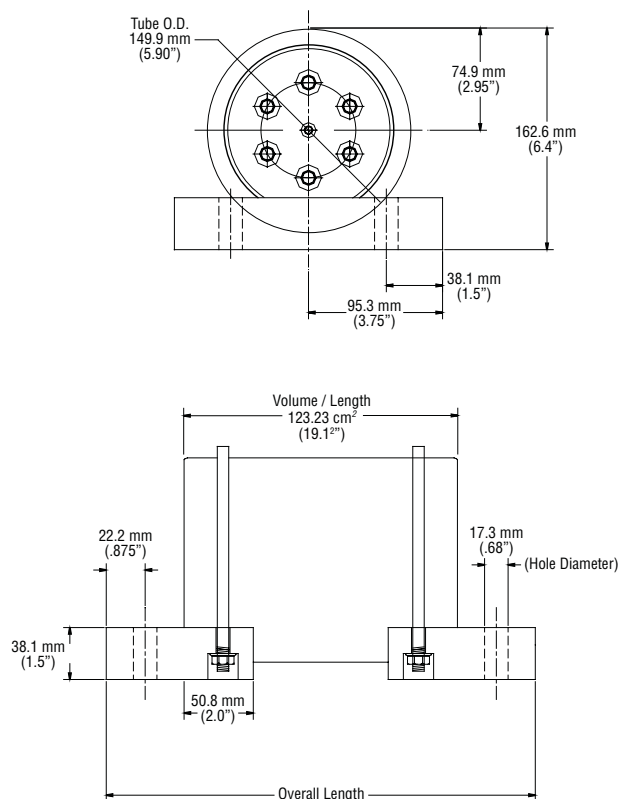
Required Tank Volume = $78.1 \times \frac{100\%}{10\%} = 781 \text{ cu. in.}$

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

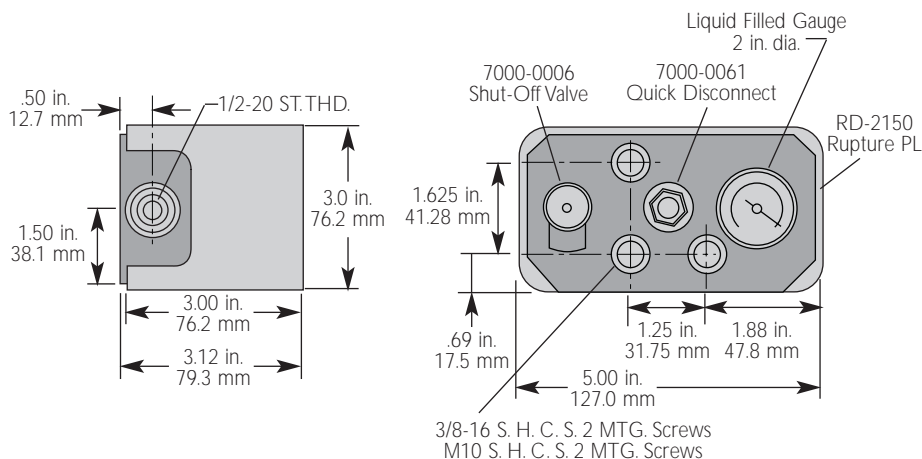
Model	Standard Volume		Standard Overall Length		Number of Ports on Each Face
	cm ³	in. ³	mm	in.	
ST-50-HP	819	50	244	9.61	6 each 3/4-16 1 face 7/16-20 1 face 7/16-14
ST-100-HP	1639	100	311	12.23	
ST-160-HP	2622	160	390	15.36	
ST-200-HP	3278	200	443	17.46	
ST-320-HP	5244	320	603	23.73	
ST-460-HP	7540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

All dimensions are nominal unless tolerance is stated.

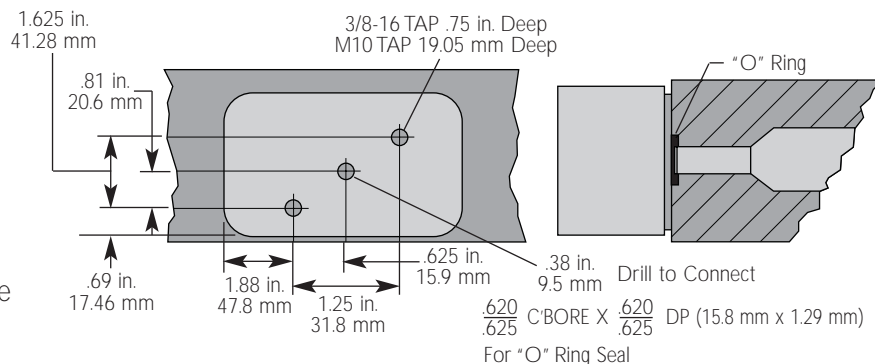
STANDARD CONTROL CONSOLES



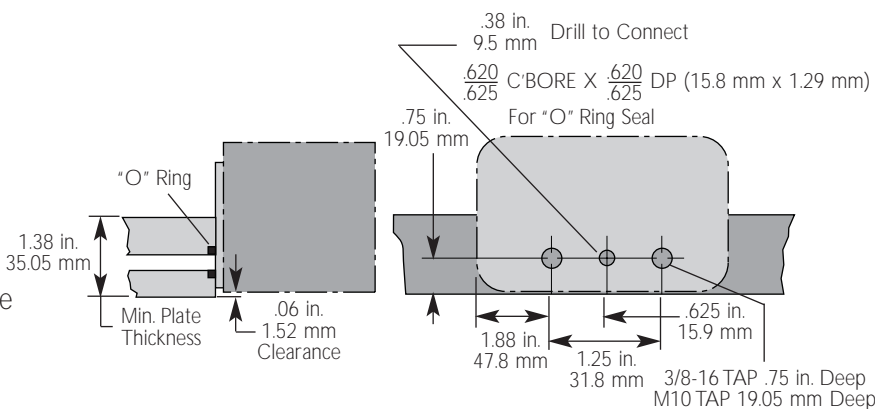
For Hose Connection
CCH1510A-English, CCHGM1510A-Metric
Using a hose connection, this control console can be installed in any accessible location.



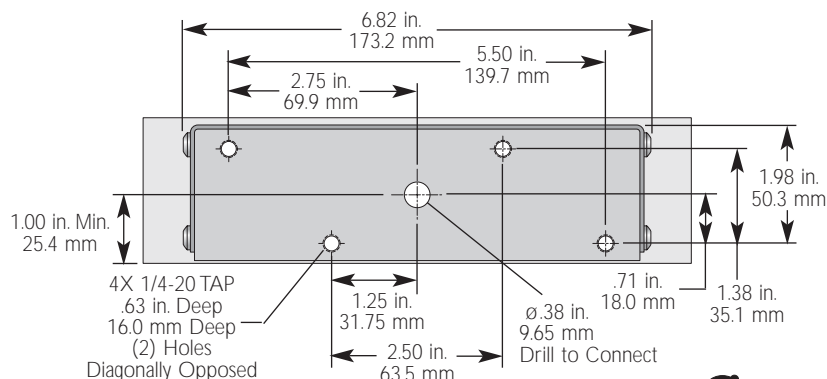
For Manifold Mounting
CCH1510B-English, CCHGM1510B-Metric
For manifolds with a minimum thickness of 3 inches, this console mounts directly to the manifold plate with an o-ring seal.



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.



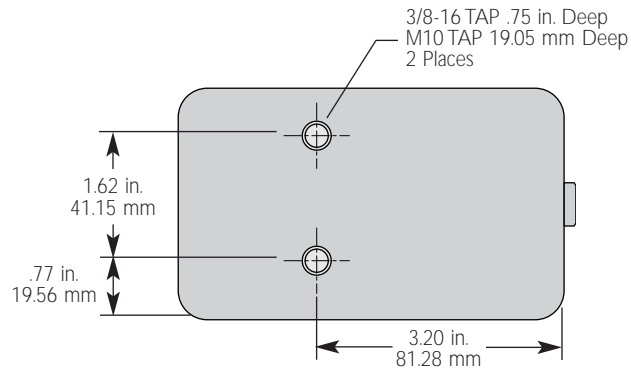
LowBoy Control Console
LBLP-0001
Compatible with all standard charging systems, the LowBoy control console features an ultra-low profile of less than two inches.



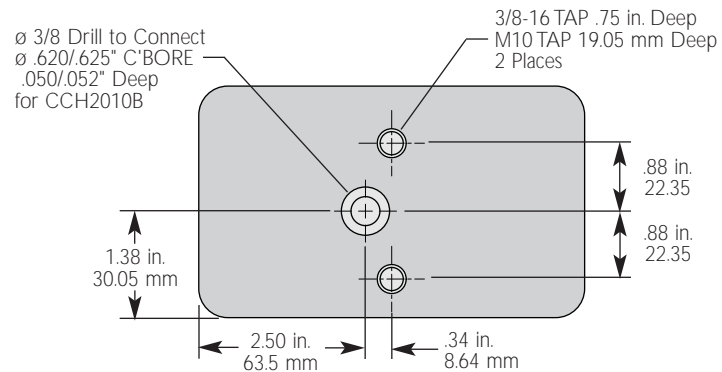
HIGH PRESSURE CONTROL CONSOLES



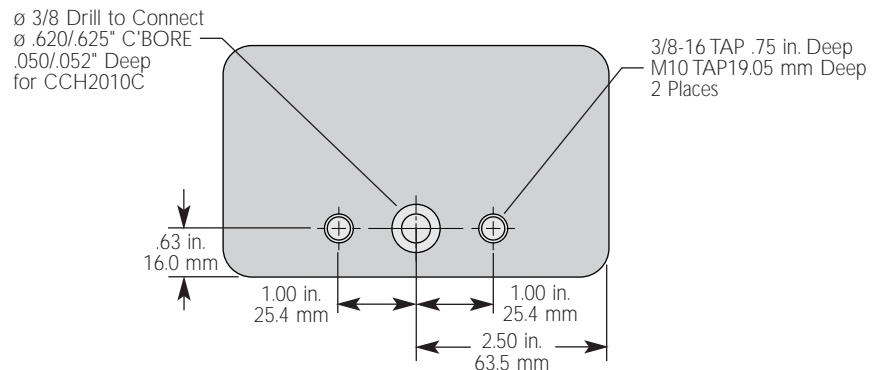
For Hose Connection
CCH2010Z-English, CCHGM2010Z-Metric
Using a hose connection, this control console can be installed in any accessible location.



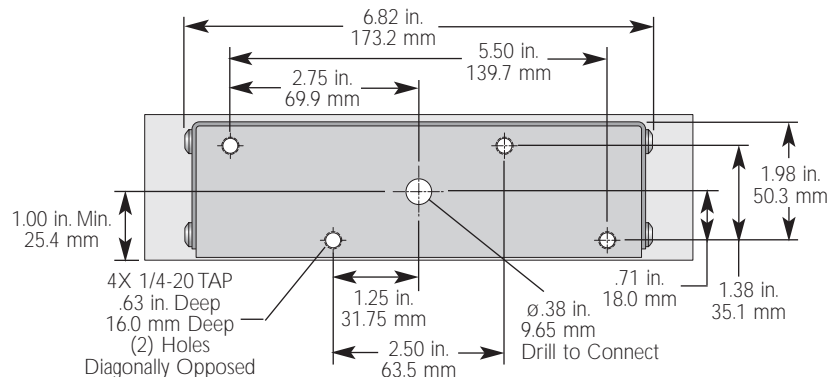
For Manifold Mounting
CCH2010B-English, CCHGM2010B-Metric
For manifolds with a minimum thickness of 3 inches, this console mounts directly to the manifold plate with an o-ring seal.



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

7000-0006

Male Quick Disconnect

7000-0061

Female Quick Disconnect

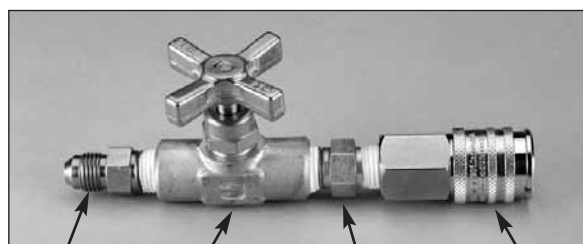
(Female connect to straight-through shut-off valve and then to hose).

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

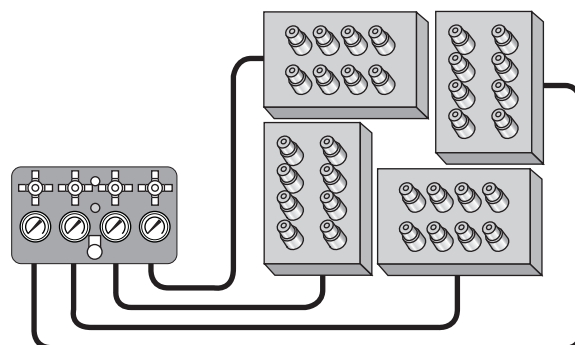


450036 7000-0067 8000-0004 7000-0052

MULTI-CONTROL CONSOLES

For regulating pressure in up to six nitrogen gas systems in the same press. Stretch draw dies usually require charging the system with all valves open to provide common pressure throughout. Transfer and progressive dies often require different pressures at the various stations, and the CCM-6 allows each system to be charged separately by closing the control valves on the remaining systems.

In addition to separate pressure control, the CCM-6 makes servicing easier since each system can be isolated and removed without losing gas in the remaining systems.



Common Pressures

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.

- 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



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)
4400-1001 (3000 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.**

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

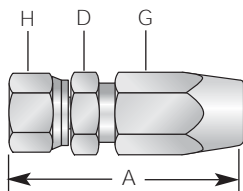
For models SUPB and SUPS

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
SUPBSFM	TOAS-0016

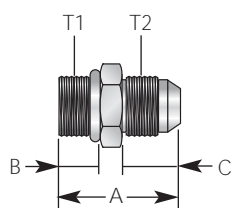
FITTINGS



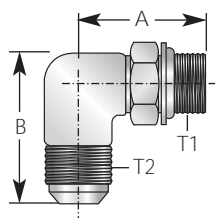
JIC 37° Swivel

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

Male JIC 37°

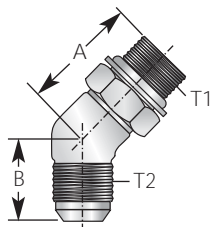


Part No.	For Hose Part No.	T1 Thread	T2 Thread	A	B	C	Hex
0800-0106	0800-1007	7/16-20	1/2-20	1.23 in.	31.2 mm	0.36 in.	9.1 mm
0800-0018	0800-1007	7/16-20	7/16-20	1.23 in.	31.2 mm	0.36 in.	9.1 mm
0800-1001	0800-1007	1/2-20	1/2-20	1.23 in.	31.2 mm	0.36 in.	9.1 mm
0800-3001	0800-3007	3/4-16	3/4-16	1.48 in.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



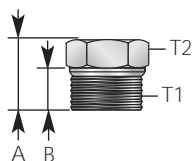
90° Elbow

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
0800-1002	0800-1007	1/2-20	1/2-20	1.09 in.	27.7 mm
0800-3002	0800-3007	3/4-16	3/4-16	1.45 in.	36.8 mm
0800-4002	0800-4007	7/8-14	7/8-14	1.70 in.	43.2 mm



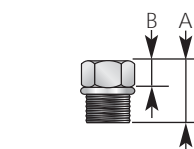
45° Elbow

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
0800-3003	0800-3007	3/4-16	3/4-16	1.30 in.	33.0 mm
0800-4003	0800-4007	7/8-14	7/8-14	1.52 in.	38.6 mm



Reducer

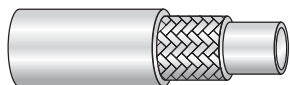
Part No.	T1 External Thread	T2 Internal Thread	A	B	Hex
0800-0042	7/8-14	3/4-16	1.31 in.	33.27 mm	0.50 in.
0800-0053	3/4-16	1/2-20	0.75 in.	19.1 mm	0.43 in.



Rupture Plug

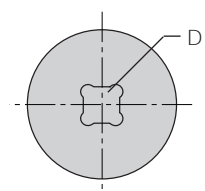
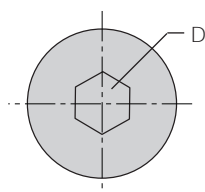
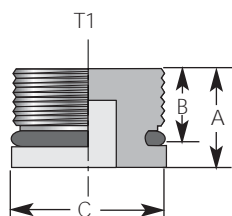
Part No.	Thread	A	B	Hex	Max. Pressure
4400-1002	7/16-20	0.62 in.	15.7 mm	0.28 in.	7.16 mm
4400-1001	3/8-24	0.62 in.	15.7 mm	0.28 in.	7.16 mm

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	

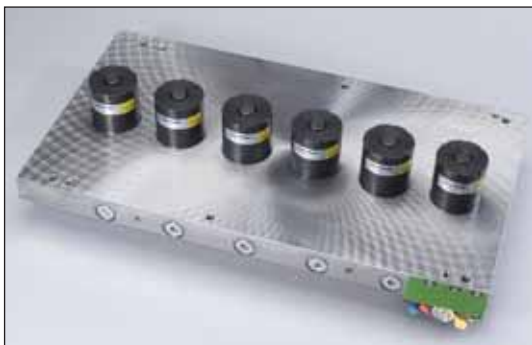


English & Metric Port Plugs

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.

OTHER PRODUCTS FROM FORWARD INDUSTRIES



Crossover Nitrogen System™



Kaller Nitrogen Gas Springs



Di-Dro Advanced Forming System



Cam Systems



Francis Company Inc

137 Naumkeag St No - Shakopee, MN 55379

952-496-3335 800-333-9645 FAX 952-496-2725

sales@franciscompany.com

