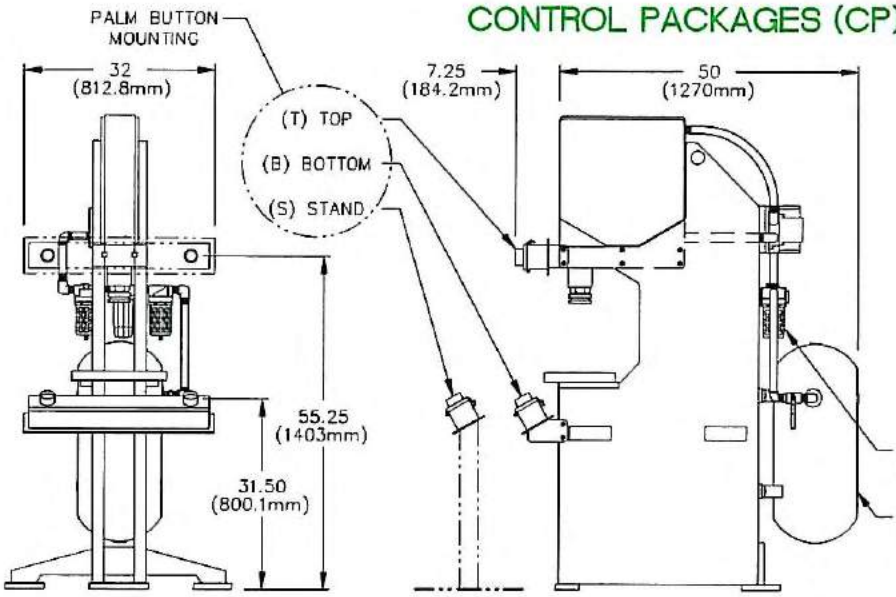
CONTROL PACKAGES (CP)



How to Order Control Packages

CP E S FRL ST

- CP — Control Package
- E — Electric or Pneumatic
- S — Palm Button Mounting
- FRL — * Optoions
- ST — * Optoions

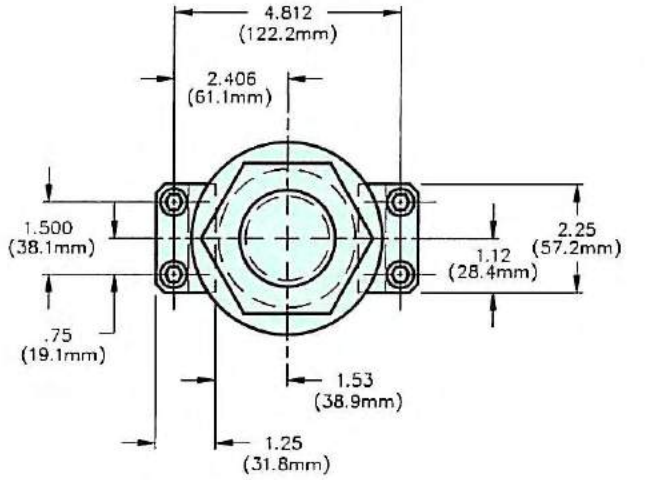
Standard Control Package Logic is 2 hand, anti tie down, anti repeat.

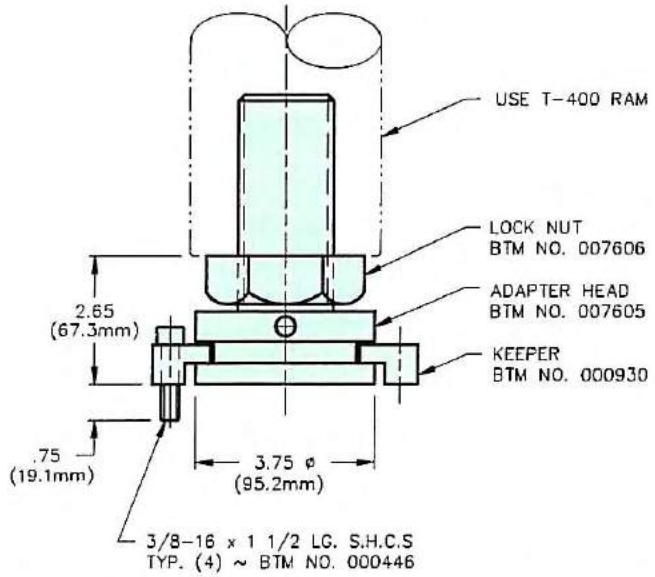
Special Control Packages are available.

(E) Electric – 110 VAC – 60 HZ
(P) Pneumatic – 80 P.S.I. (5.5 bar)

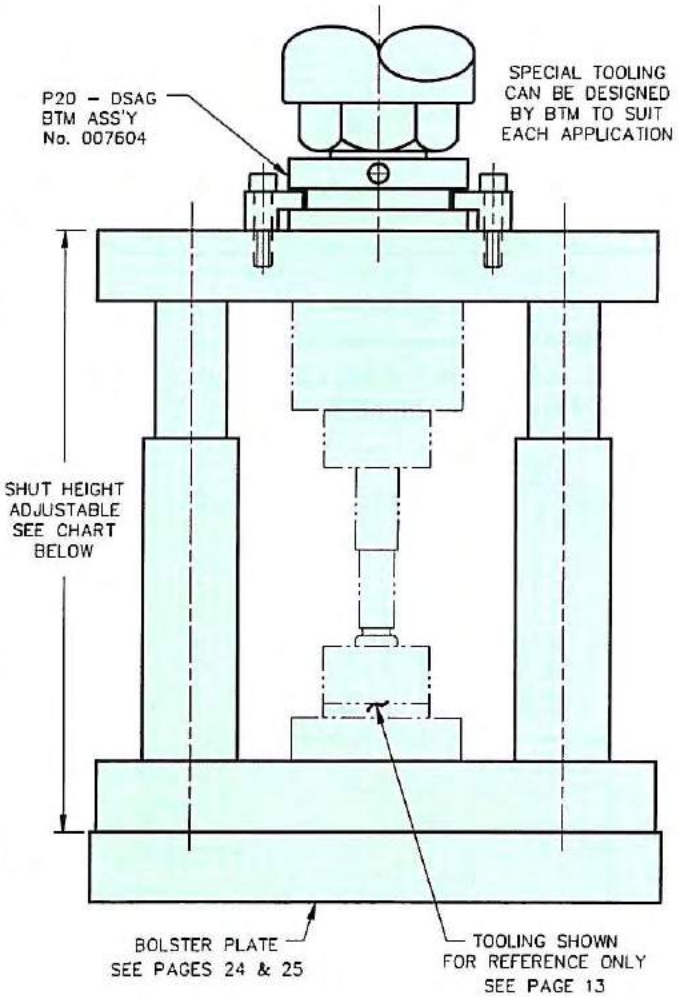
P20 - DSAG

(DIE SET ADAPTER GROUP)
BTM ASS'Y NO. 007604



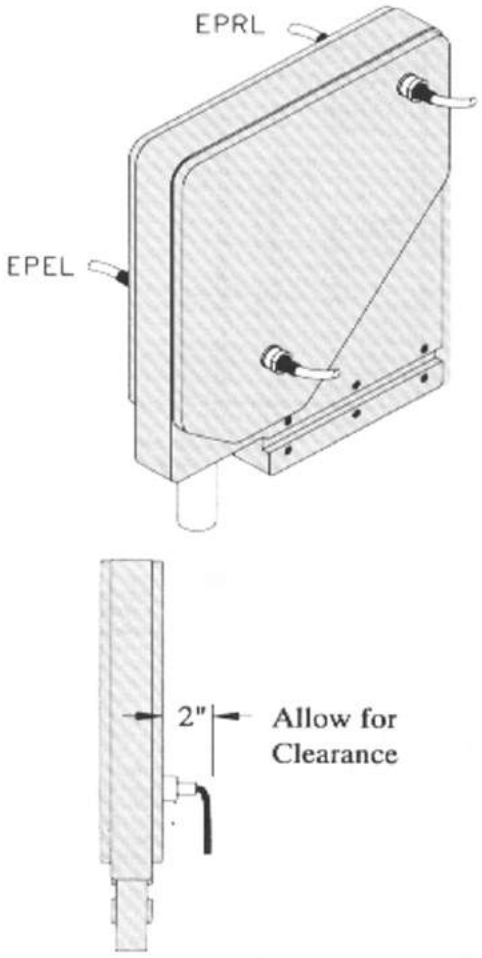


DIE SET INFORMATION

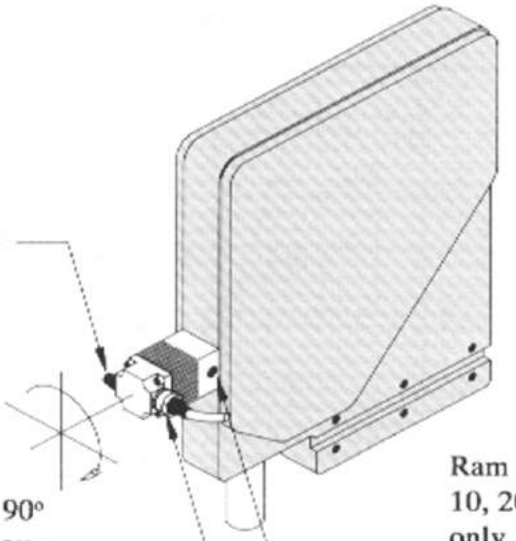


STROKE	SHUT HEIGHT
3.00 STROKE (76.2mm)	12.50 (317.5mm) MAX. 11.50 (292.1mm) MIN.
4.50 STROKE (114.3mm)	11.00 (279.4mm) MAX. 10.00 (254.0mm) MIN.

Electrical Proximity Switches



Ram Latch



Ram Latch available for 5, 10, 20, & 40 ton presses only.
See page 19.

The Ram Latch prevents the ram from drifting down, and is used to facilitate tool changes with the air off.

Ordering Information

How to Order Proximity Switches

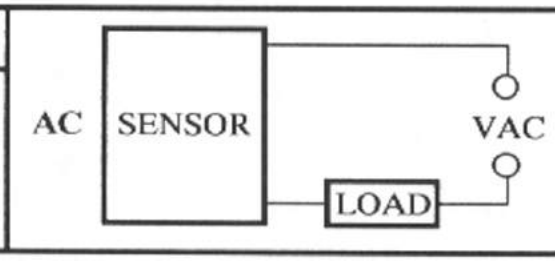
EP	R	L
Electrical Proximity	R = Retracted E = Extended	L = Left Hand R = Right Hand

Components

Proximity Switch

Description	BTM No.
Standard Proximity switch 2 wire, AC / DC Honeywell Microswitch. Others are available. This switch can be used on all press sizes, models and positions EPRL, EPEL, etc.	006266 Includes mounting adapter

Proximity Switch Specifications

AC - Normally Open (DC Available)		
Operating Voltage Range 20-260 VAC	Supplied with 6' cable - 3 wire	
Load Current Maximum 500 mA		

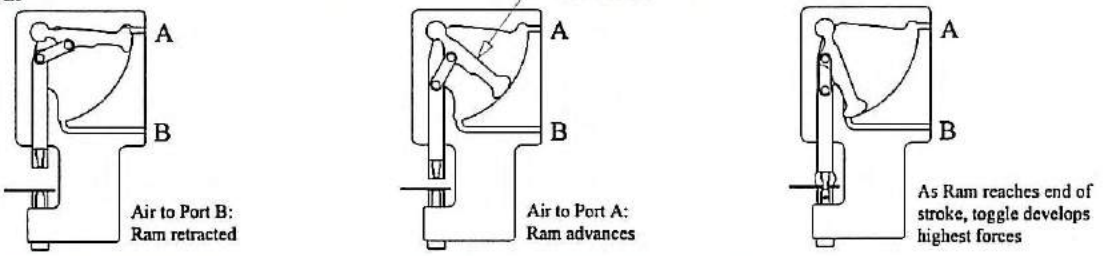
Safety:

User's Responsibility: Each person who is to operate and maintain the unit must be familiar with all safety precautions before attempting to use or service the press equipment. The owner of the machine is responsible to train and supervise all personnel as to safety precautions. The customer must provide proper gaurding to protect personnel from moving machinery.

1.0 How It Works:

The BTM toggle press produces high forces using 80 psi air pressure. The toggle mechanism multiplies the force of the air pressure acting on the piston surface. Force is generated on a curve; as the press ram advances force output increases, with maximum force produced at the end of the stroke. (Figure A.)

Figure A.



1.1 Press Sizing:

Accurate calculation of the *required force* and *work stroke* is necessary in order to perform the work without over-taxing the press. Calculating force for piercing and shearing is relatively straightforward. Calculations for operations such as coining, crimping, clinching and riveting can be more complex, requiring special formulas and/or tryout. BTM's application engineering department offers assistance in press sizing. Call BTM at 810-364-4567 for information. Chart **1.5** shows *calculated* forces at incremental distances from the end of the stroke for each BTM press model. This chart is to be used with your force calculation and work stroke requirement to select the appropriate press model.

1.2 Determining Work Stroke Required:

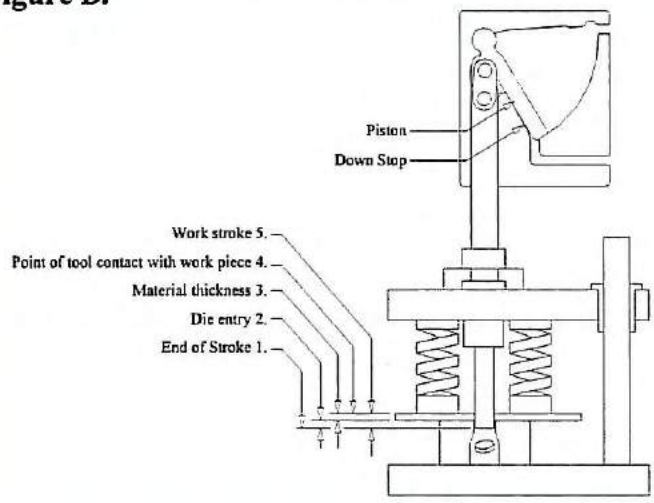
Work Stroke is figured backwards from the fully extended end of the press stroke (piston on down stop). (Figure B.)

1. End of Stroke
2. Entry of the punch into the die beyond the work piece.
3. Material Thickness
4. Point of tool contact with work piece.
5. Distance from point of tool contact with work piece to end of full stroke = work stroke.

Example:

2.	Material Thickness	= .91 mm - .036"
3.	Punch Penetration	+ .76 mm - .030"
4.	Work Stroke	= 1.68 mm-.066"

Figure B.



1.3 Force Calculation:

The example below demonstrates press sizing based on *piercing* force requirements and is useful for other operations as well. Several factors must be considered, including the shear strength and thickness of the material to be pierced, length of cut of the pierced hole, and the amount of punch entry or work stroke. Shear strength values for a variety of materials are provided in chart **1.7** for your convenience. BTM recommends adding a *50% safety factor* to the force requirement calculation to compensate for other variables such as friction, die springs, dull cutting tools, lifting of dies (**3.7**) and operating pressure fluctuations.

A.	Shear strength of material	=
B.	Thickness of material	= _____
C.	Length of cut (circumference)	= _____
		_____
	Multiply AxBxCx1.5 (Safety Factor)	=Force Required

Example: *Force required to pierce a .25" (6.4mm diameter hole in .036" (.9mm) thick mild steel.*

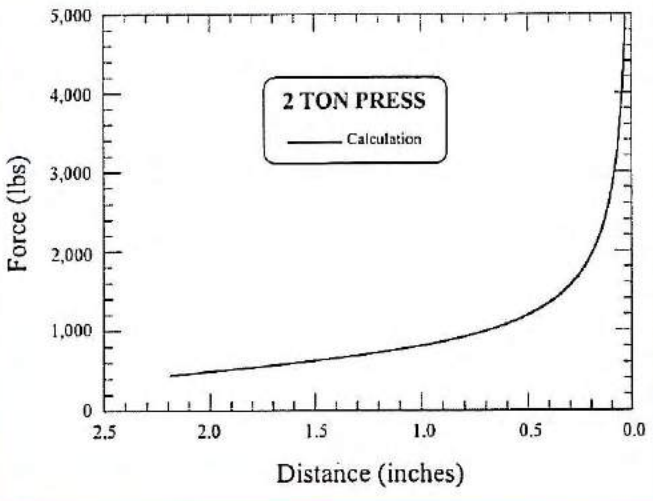
A.	Shear strength (see chart **1.7**)	=50,000 psi	(344.7Nmm²)
B.	Material Thickness	=.036"	(.9mm)
C.	Lencgth of cut (of .25" dia hole)	=.78"	(19.8mm)
	Multiply (AxBxC) & add 50% safety factor (x1.5)	=2106 lbs.	(9215N)

Force required at the point where tooling contacts the work piece. (.066" - 1.68mm in example 1.2)

1.4 Press Selection:

After determining the force required with safety factor, the work stroke must be considered in selecting the appropriate press model. Use chart **1.5** to verify that the press you are considering produces the required force at the distance from the end of the stroke where your tooling will contact the work piece. If it does not, a larger press is required. *In the example provided in* **1.2 & 1.3**, *a two ton BTM press would be an appropriate choice to perform the piercing operation.*

Figure C.



1.5 BTM Toggle Press Force Chart: (On facing page)

This chart lists forces exerted by the press ram at incremental distances from the end of the stroke. Note that the toggle mechanism develops a force curve (Figure C), with force increasing as the ram advances. All forces are rated at 80 psi (5.5 bars) air pressure to the BTM press.

Chart 1.5 Force at Stroke Distance

Distance from Bottom of Stroke	BTM Press Model					
	1 Ton	2 Ton	5 Ton	10 Ton	20 Ton	40 Ton
	Force output in pounds and Newtons at 80 psi (5.5 bar)					
.00" .00mm						
.01" 0.25 mm	4483 19,941	8965 39,878	22526 100,201	45053 200.406	122515 544,974	245031 1,089,952
.02" .05 mm	3161 14,061	6321 28,117	15906 70,753	31812 141,507	86297 383,866	172593 767,737
.03" 0.75 mm	2572 11,441	5145 22,886	12960 57,649	25920 115,298	70255 312,510	150509 625,015
.06" 1.5 mm	1804 8,025	3609 16,054	9113 40,537	18225 81,069	49357 219,551	98714 439,102
.12" 3.0 mm	1261 5,609	2523 11,223	6392 28,433	12785 56,870	34594 153,882	69188 307,763
.24" 6.1 mm	878 3,906	1755 7,807	4466 19,866	8933 39,736	24171 107,518	48341 215,031
.50" 12.7 mm	593 2,638	1186 5,276	3041 13,527	6082 27,054	16457 73,204	32914 146,409
.75" 19.0 mm	474 2,108	949 4,221	2452 10,907	4903 21,810	13268 59,019	26536 118,038
1.00" 25.4 mm	402 1,788	804 3,576	2100 9,341	4200 18,683	11364 50,550	22728 101,099
1.25" 31.75 mm	351 1,561	701 3,118	1859 8,269	3717 16,534	10059 44,745	20118 89,489
1.50" 38.1 mm	310 1,379	621 2,762	1679 7,469	3359 14,942	9089 40,430	18178 80,860
1.75" 44.45 mm	276 1,228	552 2,455	1539 6,846	3077 13,687	8326 37,036	16653 74,076
2.00" 50.8 mm	244 1,085	487 2,166	1423 6,330	2847 12,664	7703 34,265	15406 68,529
2.25" 57.15 mm	—	—	1326 5,898	2652 11,797	7176 31,920	14352 63,841
2.50" 63.5 mm	—	—	1242 5,525	2483 11,045	6719 29,888	13438 59,775
3.00" 76.2 mm	—	—	1099 4,889	2197 9,773	5945 26,445	11890 52,889
3.50" 88.9 mm	—	—	976 4,341	1952 8,683	5282 23,495	10565 46,995
4.00" 101.6 mm	—	—	863 3,839	1725 7,673	4669 20,769	9337 41,533
4.50" 114.3 mm	—	—	749 3,332	1497 6,659	4051 18,020	8103 36,925

Chart 1.6 Force Required to Pierce Holes *Without Safety Factor

Metal Thickness	Hole Diameters							
	.125" 3.0mm	.250" 6.0mm	.375" 9.0mm	.500" 12.0mm	.625" 15.0mm	.750" 21.0mm	.875" 21.0mm	1.000" 25.0mm
	Force In Tons & KiloNewtons Required For Piercing Round Holes In Mild Steel*							
.020" 0.5 mm	.22 2.0	.45 4.0	.7 6.20	.8 7.1	.95 8.5	1.25 11.1	1.5 13.3	1.65 14.7
.030" 0.7 mm	.3 2.7	.6 5.3	.9 8.0	1.2 10.7	1.5 13.3	1.8 16.0	2.1 18.7	2.4 21.4
.040" 1.0 mm	.45 4.0	.82 7.3	1.25 11.1	1.65 14.7	2.1 18.7	2.45 21.8	2.9 25.8	3.2 28.5
.050" 1.2 mm	.52 4.6	1.00 8.9	1.5 13.3	2.0 17.8	2.45 21.8	2.9 25.8	3.4 30.2	3.9 34.7
.060" 1.5 mm	.6 5.3	1.2 10.7	1.8 16.0	2.36 21.0	2.95 26.2	3.54 31.5	4.13 36.7	4.72 42.0
.070" 1.7 mm	.7 6.2	1.45 12.9	2.0 17.8	2.8 24.9	3.5 31.1	4.2 37.4	4.9 43.6	5.5 48.9
.100" 2.5 mm	1.0 8.9	2.0 17.8	3.0 26.7	4.0 35.6	5.0 44.5	6.0 53.4	7.0 62.3	8.0 71.2
.150" 3.7 mm	—	3.0 26.7	4.5 40.0	6.0 53.4	7.5 66.7	9.1 81.0	10.5 93.4	12.2 108.5
.250" 6.0mm	—	4.9 43.6	7.4 65.8	9.8 87.2	12.3 109.4	14.7 130.8	17.2 153.0	19.7 175.3
.500" 12.0 mm	—	—	—	19.7 175.3	24.6 218.8	29.5 262.4	34.4 306.0	39.4 350.5

1.6 Piercing Force Requirements:

This chart shows the force required to pierce round holes (of various diameters) in mild steel (of various thickness.) A 50% safety factor should be added to these numbers when sizing your press.

1.7 Piercing Materials Other Than Mild Steel:

Piercing force required for material other than mild steel can be calculated using the rated shear strength (see chart **1.7**) and the formula given at **1.3.** The chart **1.7** provides shear strength &multiplication factors for other common materials. Multiply the factor for your material by the force shown in chart **1.6.**

Ex: Piercing a .500" (12mm) hole in .050" (1.2mm) mild steel requires 2 Tons. To pierce the same hole in the same thickness of Aluminum 1060-0 multiply 2 Tons x .14 (chart **1.7**) = .28 Ton.

Chart 1.7 Material Strengths

Material	Multiplication Factor	Shear Strength	
Aluminum 1060-0	.14	7,000 psi	48.26 N/mm²
Nylon	.24	12,000 psi	82.74 N/mm²
Copper	.52	26,000 psi	179.26 N/mm²
Aluminum 2011-T3	.64	32,000 psi	220.63 N/mm²
Brass	.72	36,000 psi	248.21 N/mm²
Aluminum 2014-T6	.84	42,000 psi	289.58 N/mm²
Steel Mild Low Carbon	1.00	50,000 psi	344.74 N/mm²
Steel Stainless 409	1.30	65,000 psi	448.16 N/mm²
Steel Stainless 304 L	1.62	81,000 psi	558.47 N/mm²
Steel Stainless 321	1.66	83,000 psi	572.26 N/mm²

2.0 Press Specifications:

BTM Toggle Press bodies are made from 6061-T6 Aluminum (45,000 psi tensile strength) and are hard coat anodized to a Rockwell C70 surface hardness. Pistons, links, pins, and rams are steel. Piston seals are molded V block style.

2.1 Tolerances:

The following are tolerances that can be expected for the dimensions given in this catalog (unless specified otherwise):

2 place decimal (.00).....+/-.010" (+/-0.25m)
3 place decimal (.000)..... +/-.005" (+/-0.13mm)
4 place decimal (.0000)..... +/-.0005" (+/-0.01mm)
Ram rotation..... +/-15'

2.2 Air Consumption
BTM Press Volume Chart:

Volume is shown in cubic inches and cubic centimeters per full cycle.

Amount of Stroke in Use	BTM Press Model					
	1 Ton	2 Ton	5 Ton	10 Ton	20 Ton	40 Ton
.03" 0.75 mm	4.8 78.7	9.6 157.4	18.8 308.1	37.6 616.2	310.0 5080.0	620.0 10160.0
.06" 1.5 mm	6.6 108.2	13.2 216.4	37.4 612.9	74.8 1225.8	378.8 6207.4	757.6 12414.8
.12" 3.0 mm	9.2 150.8	18.4 301.6	56.2 921.0	112.4 1842.0	447.8 7338.1	895.6 14676.2
.24" 6.1 mm	12.2 199.9	24.4 399.8	65.4 1071.7	130.8 2143.4	585.4 9593.0	1170.8 19186.0
.50" 12.7 mm	18.4 301.5	36.8 603.0	84.2 1379.8	168.4 2759.6	723.2 11851.1	1446.4 23702.2
.75" 19.0 mm	22.0 360.5	44.0 721.0	103.0 1687.9	206.0 3375.8	826.6 13545.5	1653.2 27091.0
1.00" 25.4 mm	25.8 422.8	51.6 845.6	121.6 1992.7	243.2 3985.4	929.8 15236.7	1859.6 30473.4
1.25" 31.75 mm	29.0 475.2	58.0 950.4	131.0 2146.7	262.0 4293.0	1033.2 16931.1	2066.4 33862.2
1.50" 38.1 mm	31.8 521.1	63.6 1042.2	149.6 2451.5	299.2 4903.0	1067.6 17494.8	2135.2 3498.6
1.75" 44.45 mm	34.4 563.7	68.8 1127.4	168.4 2759.6	336.8 5519.2	1102.0 18058.5	2204.0 36117.0
2.00" 50.8 mm	37.6 616.2	75.2 1232.4	177.6 2910.3	355.2 5820.6	1171.0 19189.2	2342.0 38378.4
2.25" 57.15 mm	39.8 652.2	79.6 1304.4	187.0 3064.4	374.0 6128.8	1205.4 19753.0	2410.8 39506.0
2.50" 63.5 mm	—	—	196.4 3218.4	392.8 6436.8	1239.8 20316.7	2479.6 40633.4
3.00" 76.2 mm	—	—	205.8 3372.5	411.6 6745.0	1274.2 20880.4	2548.4 41760.8
3.50" 88.9 mm	—	—	215.2 3526.5	430.4 7053.0	1355.2 22207.7	2710.4 44415.4
4.00" 101.6 mm	—	—	224.4 3677.3	488.8 7354.6	1412.0 23138.5	2824.0 46277.0
4.50" 114.3 mm	—	—	261.8 4290.1	523.6 8580.2	1549.8 25396.7	3099.6 50793.4

2.2.1 Calculating Air Consumption:

To determine air consumption in cubic feet or liters per minute use the following formula. Metric versions shown in green.

Formula:

$$CFM = \frac{\text{Press volume x cycles / min}}{1728}$$

$$SCFM = \frac{(14.7 + \text{pressure})}{14.7} \text{ x CFM}$$

Air Volume = press volume x cycles / min

$$\text{Consumption} = \frac{1 + \text{pressure}}{1} \text{ x press volume}$$

Example: 1 ton press with 1.5" (38 mm) stroke
volume = 31.8 in^3 (521.1 cm^3) (See Chart)
60 cycles / minute
at 80 psig (5.5 bar)

Solution:

$$SCFM = \frac{14.7 + 80}{14.7} \text{ x } \frac{31.8 \text{ x } 60 \text{ cycles / min.}}{1728}$$

SCFM = 7.1

$$\text{Litres / Min} = \frac{1 + 5.5}{1} \text{ x } 0.521 \text{ dm}^3 \text{ x } 60 \text{ cycles / min}$$

Litres / Min = 203

Note: BTM Presses may be ordered with stroke limiters to reduce air consumption. See catalog page for your model.

2.3 Air & Valving Requirements:

BTM Toggle Presses are operated by compressed air. The recommended maximum pressure is 80 psi (5.5 bars). Air must be clean and dry. Valving and piping should be greater than or equal to the press ports, or determined by the air requirements of the total number of presses when multiple presses are piped together. A filter and pressure regulator must be incorporated into the air supply line. Light in-line lubrication is also recommended, but not required.

2.4 Surge Tank Sizing:

A surge tank is recommended when operating a 20 or 40 ton press, when piping multiple presses together or when a press is used in an air starved environment. Air supply lines must be adequately sized. **(See 2.3.)** Use the following formula to determine surge tank size:

Formula: $\frac{\text{Press volume in cubic inches (See Chart 2.2)} \times (14.7 + \text{Operating Pressure})}{14.7} \div 231 = \text{Surge Tank volume in Gallons}$

$\frac{\text{PressVolume in cubic centimeters (See Chart 2.2)} \times (1 + \text{Operating Pressure})}{1} \div 1000 = \text{Surge Tank volume in Litres}$

Example:

20 Ton Press x 4.5" (114.3mm) Stroke
Volume = 1549.8 in³ (25396.7c.c) See Chart
Operating Pressure = 80 psi (5.5 bar)

Solution:

$\frac{1549.8 \times (14.7 + 80)}{14.7} \div 231 = 43$ Gallon Surge Tank

$\frac{25396.7 \times (1+5.5)}{1} \div 1000 = 163$ Litre Surge Tank

3.0 Application of BTM Toggle Presses:

Sound engineering principles should be adhered to when tooling and mounting BTM presses. Some guidelines follow.

3.1 Press Set-Up:

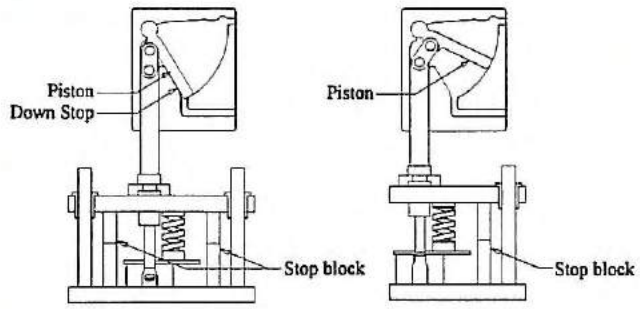
To attain maximum life from an Air Toggle Press, the work must be performed as near the end of the stroke as possible. *In all applications, the press must complete its stroke.* In piercing or shearing applications, the work will be performed above the end of the stroke and the tooling will continue through the work piece to complete the stroke. In other operations such as coining, clinching and riveting, the tooling must be adjusted so that the press reaches the end of the stroke as the work is completed. (Figure D.) *No hesitation of the ram is permissible during the work stroke.*

The recommended method of set-up is to adjust the tooling back so that the press can be fully cycled without contacting the work piece. A series of gradual adjustments are then made using 80 psi supply pressure, until the press completes the work. If the press hesitates or stalls above the bottom of the stroke using this method, it is undersized for the operation.

3.2 Stop Blocks:

When using stop blocks in a die, the press piston must be allowed to reach the internal stop. Stop blocks must be set-up so that the press completes the work and contacts the stop blocks when the piston meets the internal stop. The stop blocks are only required to balance the force being applied to the work piece. If installed incorrectly, the stop blocks and press mechanism will absorb the force meant to be applied to the work piece. (Figure D.)

Figure D.



Correct **Incorrect**