THIN Air Powered Toggle Presses

TOG-L-LOC® (CLINCHING)

PIERCING

RIVETING

STAMPING

BENDING
How it Works

Air pressure at port “B” holds the piston and ram in the return position.

Air pressure at port “A” swings the piston through an arc, driving the ram and the toggle linkage.

Maximum force is achieved as the linkage “Toggles” or goes to center.

Advantages & Features

BTM's patented “THIN” air powered toggle presses produce high forces using 80 psi (5.5 bars) air pressure! The “THIN” profile allows for close stacking. These extremely simple and rugged presses have only three moving parts. A unique, pivoting, rectangular, piston drives the non rotating ram through a force multiplying toggle linkage. This quick acting mechanism drastically reduces air consumption as compared with conventional pneumatic cylinders doing the same work. BTM press bodies are constructed of light weight, aircraft aluminum, hardcoated to a Rockwell C-70 for excellent wear characteristics.

Air consumption of BTM Toggle press compared with conventional pneumatic cylinders.

<table>
<thead>
<tr>
<th>Air Supply</th>
<th>Required Force</th>
<th>Stroke</th>
<th>Device</th>
<th>Air used per complete cycle</th>
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<tbody>
<tr>
<td>80 psi</td>
<td>2000 lbs.</td>
<td>2.25&quot;</td>
<td>1 Ton BTM Press</td>
<td>256 in.(^3) (652 cm(^3))</td>
</tr>
<tr>
<td>(5.5 bar)</td>
<td>(8896N)</td>
<td>(57.15mm)</td>
<td></td>
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<tr>
<td>80 psi</td>
<td>2000 lbs.</td>
<td>2.25&quot;</td>
<td>Cylinder</td>
<td>798 in.(^3) (2084 cm(^3))</td>
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<tr>
<td>(5.5 bar)</td>
<td>(8896N)</td>
<td>(57.15mm)</td>
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</table>

The BTM Press uses 68% less air than the cylinder requires in the example. Stroke limiters are available to further reduce air consumption.

For formula and chart see page 32
BTM Air Toggle Presses may be mounted on close centers for simplified automation and special machine building.

BTM air powered toggle presses can perform all the typical operations of other presses, but within a smaller space and using only a small amount of air. Presses can be quickly tooled and easily mounted in any position.

Self-equalizing models facilitate access over flanges or channels. Bench, floor and tooling models can be equipped with die set tooling to quickly accommodate a multitude of applications.

Various options and accessories are available to help you build machines quickly and cost effectively. These include; special rams, modified press bodies, control packages, and stroke limiters for improved cycle time with less air consumption. Special presses for unusual applications may also be developed.

For over 25 years BTM Corporation has offered complete design and build services to help you solve your production problems. Call our sales engineering department and let us help you apply our presses to your next application.

A BTM 20 ton floor press is shown with optional die set tooling and control package.

Self-Equalizing Toggle Presses allow easy load and unload of parts with flanges or channels.
## Contents

1 & 2 Ton Presses

- PB (Punch & Button)
- PB6 (Punch & Button)
- FM (Front Mount)
- H (Head)
- EU & REU (Equalizing)
- EU & REU (Reverse Equalizing)

5 & 10 Ton Presses

- H (Head)
- FM (Front Mount)
- EU & REU (Equalizing)
- EU & REU (Reverse Equalizing)

20 & 40 Ton Presses

- H (Head)

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<th>Page</th>
</tr>
</thead>
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<td>Proximity Switches</td>
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**Set-Up & Maintenance Guide**

- Press Sizing & Work Stroke
- Force Calculation & Press Selection
- Piercing Force Requirements
- Tolerances, Air Consumption
- Surge Tanks, Press Setup
- Mounting, Guides, Shut Height
- Equalizing & Reverse Equalizing
- EU & REU Set-Up
- Lubrication, Seal Replacement

-4- BTM Corporation • 300 Davis Road, Marysville, Michigan 48040 U.S.A. • Phone 810-364-4567 • Fax 810-364-6178
Contents & Specials

2 Ton

5 & 10 Ton

T (Tooling)

B (Bench)

T (Tooling)

B (Bench)

F (Floor)

20 & 40 Ton

Page

Specials

T (Tooling)

F (Floor)

Special presses and modifications to standard presses are available. BTM can also supply completely tooled presses. Contact our Sales Engineering Department for assistance with your special press requirements.

TM (TopMount)

Long Stroke
Up to 10” on 4 & 8 Ton Models

P5 EU (Equalizing)
Complete with Tooling
1 & 2 Ton PB Presses

PB Models
(Punch and Button)

** Models**

PIP B x 1.5 (38.1mm) Stroke 001406 - 15 lbs. (6.8 kg)

PIP B x 2.25 (57.2mm) Stroke 001408 - 15 lbs. (6.8 kg)

P2PB x 1.5 (38.1mm) Stroke 001407 - 25 lbs. (11.4 kg)

P2PB x 2.25 (57.2mm) Stroke 001500 - 25 lbs. (11.4 kg)

** Optional**

** Optional 1 Ton**

(Std. 2 Ton)

** Cod Templates Available**

60 Strokes Per Minute
(1 and 2 Ton Presses)

Components

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How to Order Presses

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How to Order Components

2 P2 Link 000120

** Qty. **

** Description **

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* Denotes Options

Note: Use "O" Ring No. 000821 in P2PB & P6. Use No. 000150 in P2H & FM.
**1 & 2 Ton PB6, FM & H Presses**

**PB6 Models**  
(6 inch Throat)  
For components and dimensions not shown, see P1PB and P2PB on page 6.

**FM Models**  
(Front Mount)  
For components and dimensions not shown, see P1PB and P2PB on page 6.

**H Models**  
(Head)  
For components and dimensions not shown, see P1PB and P2PB on page 6.

---

**Options**

**Electrical Proximity Sensors**  
See Page 28

**Stroke Limiter**  
Limits upstroke to suit your requirements  
See Page 6

Cushions on up and downstrokes are available with metric threads

Special, Tooling Call for quote

---

BTM Corporation • 300 Davis Road, Marysville, Michigan 48040 U.S.A. • Phone 810-364-4567 • Fax 810-364-6178
2 Ton Equalizing (2 Position) Presses

EU Models
(Equalizing Unit)

P2EU x 1.50 (38.1mm) Stroke 012878 - 30 lbs. (13.6 kg)
P2EU x 2.25 (57.2mm) Stroke 006210 - 30 lbs. (13.6 kg)

How Equalizing Works
(Standard - Punch on Ram)

1. Open Position - Part load and unload.
2. Equalize Position - Die advanced to part.
3. Closed Position - Ram extended to perform work.

How to Order Presses

<table>
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<th>Models</th>
<th>Simple</th>
<th>Special</th>
<th>1/2&quot; 2-1/4 or Special</th>
<th>Ram Style</th>
<th>See Page 10</th>
<th>Footer</th>
<th>See Page 28</th>
<th>See Page 11</th>
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Contact BTM's Sales Department for equalize strokes greater than 1.00 (25.4 mm)

For further information, see pages 33-35 in the technical section.
2 Ton Reverse Equalizing (2 Position) Presses

REU Models
(Reverse Equalizing Unit)

REU100 RAM
STANDARD FOR P2REU

1.000 Dia.
(25.4mm)

1.240
(31.5mm)

75 (19.1mm)

1/4-28
SET SCREW

A = 7.38
(187.4mm)

SPECIAL RAMS AVAILABLE

EQUALIZE MOVEMENT

Cad Templates Available

For dimensions and items not shown, see P2EU, page 8.

How to Order Presses

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<td>1/16 Dia. x 1/4 Roll Pin</td>
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<td>Ram Stop</td>
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How to Order Components

1 Piston 000117

* Denotes Options

Contact BTM’s Sales Department for equalize strokes greater than 1.00 (25.4 mm)

For further information, see pages 33-35 in the technical section.
# 75 & 100 Series Rams

### PT - 75
- **DIA:** .750 (19.1mm DIA)
- **Tool:** 1 TON PRESSES

### PTA - 75
- **DIA:** 1.000 (25.4mm DIA)
- **Tool:** 2 TON PRESSES

### TE - 75
- **DIA:** 1.420 (36.07mm)
- **Tool:** 2 TON PRESSES

### S - 75
- **DIA:** 1.75 (44.4mm)
- **Tool:** 2 TON PRESSES

---

<table>
<thead>
<tr>
<th>SERIES</th>
<th>PRESS MODEL</th>
<th>RAM STYLE</th>
<th>STROKE</th>
<th>A DIM.</th>
<th>BTM NO.</th>
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<td>1.50 (38.1mm)</td>
<td>7.88 (200.2mm)</td>
<td>000145</td>
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</tbody>
</table>

---

See page 11 for punches and strippers that can be used with this ram.

**Note:** A punch length of 2.150 (63.5mm) is required.
Standard Pierce Tooling

Examples of Tooling Set-Ups

PB Press
Piercing

FM Press
Riveting

Altered BTM Press
Stamping
Nutsetting

Pierce Tooling
See items below

Special Tooling
Call BTM for quote

Standard Strippers, Punches and Dies

SS-1 STRIPPER
BTM ASS'Y NO. 000157

SS-1 PIERCE PUNCH
BTM ASS'Y No. 013137 (2.50 LG.)
013729 (2.25 LG.)

.25
(6.4mm)
.3748 DIA. +.0000
(9.5mm)
- .0001

.75
(19.1mm)

.138
(35.0mm)

.33 FLAT
(.8mm)

.33 FLAT
(.8mm)

TO CLEAR
SPRING I.D.

.25
(6.4mm)

PIERCED SHAPE MUST
FIT MIN. .31 (7.9mm)
DIAMETER

1 TON PIERCE DIE
BTM No. 013138

.7497 DIA. +.0004
(19.1mm)
- .0001

.94
(23.9mm)

.03 FLAT
(.8mm)

.03 FLAT
(.8mm)

Matched Punch & Die Sets - Fax Pierce
Punch Shape For Quote To Punch Tech, Inc.
(Division of BTM) Fax: 810-364-6030

SS-3 STRIPPER
BTM ASS'Y NO. 000168

SS-3 PIERCE PUNCH
BTM ASS'Y No. 013135 (2.50 LG.)
013730 (2.25 LG.)

.25
(6.4mm)
.3748 DIA. +.0000
(9.5mm)
- .0001

.75
(19.1mm)

.25
(6.4mm)

2.50
(63.5mm)
OR

2.25
(57.2mm)

PIERCED SHAPE MUST
FIT MIN. .31 (7.9mm)
DIAMETER

2 TON PIERCE DIE
BTM No. 013140

.94
(23.9mm)

.12
(3.0mm)

.03 FLAT
(.8mm)

.03 FLAT
(.8mm)

Matched Punch & Die Sets - Fax Pierce
Punch Shape For Quote To Punch Tech, Inc.
(Division of BTM) Fax: 810-364-6030

BTM Corporation • 300 Davis Road, Marysville, Michigan 48040 U.S.A. • Phone 810-364-4567 • Fax 810-364-6178 - 11 -
P2 - DSAG
(DIE SET ADAPTER GROUP)
BTM ASS'Y NO. 000923
(USED TO ADJUST SHUT HEIGHT)

USE TE-100 RAM
SEE PAGE 10

LOCK NUT
BTM NO. 000925

ADJ. NUT
BTM NO. 000924

KEEPER
BTM NO. 000930

3/8-16 x 1 1/2 LG. S.H.C.S
Typ. (4) ~ BTM NO. 000446

STROKE
1.50 (38.1mm)
2.25 (57.2mm)

SHUT HEIGHT
9.25 (235mm) MAX.
8.25 (209.5mm) MIN.
6.50 (216mm) MAX.
7.50 (190.5mm) MIN.

PUNCH HOLDER ASS'Y.
BTM No. 013426 W/SS-1
BTM No. 013427 W/SS-3
BALL LOCK RETAINERS AVAILABLE

PUNCH HOLDER
BTM No. 002161

C'BORE FOR
3/8 S.H.C.S.

P.F. FOR
5/16 DOWEL

1/4-28 SET SCREW

SLUG CLEARANCE
HOLE TO BE DETERMINED
BY CUSTOMER.

RETAINER ASSEMBLY
(RETAINER AND BACKING PLATE)
BALL LOCK RETAINERS AVAILABLE

BTM No.
013142
013143

D. DIA.
.7499
.9999

L
1.88
2.25

E
.5525
.7500

1/4-28 SET SCREW

Punch Holder Assembly and Retainers may be used in any size press
See "DIE SET INFORMATION" above for example.
150 Series Rams For P4 & P8 Presses

P-150

19.0

TE-150

21.5

S-150

PER
CUSTOMER

TRU-ARC
Snap Ring
(#160-150)
Supplied
With Ram

1.25
[31.8]

.75
[19.0]

1.25 Ref.
[31.8]

3.00
[76.2]


5/16-18 Set
Screw No.
037928
1.500 Dia.
[38.1]

.09 Flat
[2.3]

.7499 [19.1] Dia.

BTM No. 000276

BTM No. 000285

1 1/2-12 UNF-2A Thread

Special Ram
Customer To Provide
Ram End Configuration
For BTM Price & Delivery

TO BE
ASSIGNED

See Pages 21-23 For Options & Accessories
5 & 10 Ton FM Presses

FM Models
(Front Mount)

P5FM x 3.00 (76.2mm) Stroke 001549 - 90 lbs. (41 kg)
P5FM x 4.50 (114.3mm) Stroke 001550 - 90 lbs. (41 kg)

P10FM x 3.00 (76.2mm) Stroke 001551 - 155 lbs. (70 kg)
P10FM x 4.50 (114.3mm) Stroke 001552 - 155 lbs. (70 kg)

---

*Options*

Ram Latch – See page 19

Electrical Proximity Switches – See page 28

Stroke Limiter –
Limit upstroke to suit your requirements.

Presses are available with metric threads.
5 & 10 Ton Reverse Equalizing (2 Position) Presses

REU Models
(Reverse Equalizing Unit)

PSREU x 3.00 (76.2mm) Stroke 013200 - 135 lbs. (61 kg)
P10EU x 3.00 (76.2mm) Stroke 013202 - 225 lbs. (102 kg)

How Equalizing Works
(Reverse - Die on Ram)

1. Open Position - Port load and unload.
2. Equalize Position - Die advanced to port.
3. Closed Position - Ram extended to perform work.

Cad Templates Available

How to Order Components
1. Mount Block 006368

How to Order Presses

Components
P5REU

<table>
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<tr>
<th>Description</th>
<th>No. Req'd</th>
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<td>Mount Block</td>
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<td>Stop Collar (Fixed Pos.)</td>
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<tr>
<td>Ram Step</td>
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<tr>
<td>R.H. Equalize Side Plate</td>
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<tr>
<td>LH. Equalize Side Plate</td>
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<tr>
<td>Key 3/8 x 3/8 x 3/4</td>
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<tr>
<td>Key 1/2 x 1/2 x 8</td>
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<td>Air Cylinder</td>
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Components
P10REU

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<td>Ram Step</td>
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<td>R.H. Equalize Side Plate</td>
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<td>LH. Equalize Side Plate</td>
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<td>Key 3/8 x 3/8 x 3/4</td>
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<td>Key 1/2 x 1/2 x 8</td>
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For dimensions and components not shown, see PSEU & P10EU on page 16.
See pages 33-35 in the Technical Section for further information.

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19-
# BTM 150 & 175 Series Rams

## PA - 150
## PA - 175

1.500 DIA. (38.1mm)
150 SERRATED 5 TON PRESSES
1.750 DIA. (44.4mm)
175 SERRATED 10 TON PRESSES

± .02 (3mm) ADJUSTMENT

.88 SLOT (22.4mm)
5/16 - 18 x 1 ADJUSTMENT SCREW NO. 00117

1.75 (44.4mm)
5/16 - 18 SET SCREW NO. 001038

.50 (12.7mm)
15° TYPICAL

.25 (6.4mm)
SLOT CENT.

SLOT (2.2mm)

.7499 (19.1mm) DIA.

## P - 150*
## P - 175

1.500 DIA. (38.1mm)
150 SERRATED 5 TON PRESSES
1.750 DIA. (44.4mm)
175 SERRATED 10 TON PRESSES

± .02 (3mm) ADJUSTMENT

.88 SLOT (22.4mm)
5/16 - 18 x 1 ADJUSTMENT SCREW NO. 00117

1.75 (44.4mm)
5/16 - 18 SET SCREW NO. 001038

.50 (12.7mm)
15° TYPICAL

.25 (6.4mm)
SLOT CENT.

SLOT (2.2mm)

.7499 (19.1mm) DIA.

## TE - 150
## TE - 175

1.500 DIA. (38.1mm)

.125 FLAT (3.1mm)

3.50 (88.9mm)
1 1/2 - 12 UNF-2A THD.

## S - 150
## S - 175

SPECIAL RAM CUSTOMER TO PROVIDE RAM ENQ. CONFIGURATION FOR BTM PRICE AND DELIVERY

---

<table>
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<tr>
<th>SERIES</th>
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<th>RAM STYLE</th>
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<th>A DIM. (mm)</th>
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<td>4.50 (114.3mm)</td>
<td>14.80 (375.9mm)</td>
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* P-150 RAMS USE A SNAP RING TO BACK UP STRIPPER.

---

- USE TRUARC SNAP RING #5160-150 (SUPPLIED W/RAM)
Ram Latch with Proximity Switch

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

Available on 5, 10, 20 and 40 Ton Presses
Models: H, FM, EU, REU, T, B or F.

(H Shown)

NOTE: 2 Ram Latches are required for 40 Ton Presses. Located on center-line of rams.

Retract port, and prox. switch location positioned by customer. See page 28.
CONTROL PACKAGES (CP)

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

Palm Button Mounting

(T) Top
(B) Bottom
(S) Stand

Filter-Regulator-Lubricator (FRL) *

Surge Tank (ST) *

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

Special Control Packages are available.

P5 - DSAG
(Die Set Adapter Group)
BTM Assy No. 000927

Die Set Information

P5 - DSAG
BTM Assy No. 000927

Special Tooling can be designed by BTM to suit application

Tooling shown for ref. only see pg. 13 & 19

Bolster Plate see pg. 20

<table>
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<tr>
<th>StroK</th>
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<tr>
<td>3.00</td>
<td>11.50 (292.1mm) MAX.</td>
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<td>10.50</td>
<td>266.7mm MIN.</td>
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<td>4.50</td>
<td>10.00 (254.0mm) MAX.</td>
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<td>9.00</td>
<td>228.6mm MIN.</td>
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BTM Corporation • 300 Davis Road, Marysville, Michigan 48040 U.S.A. • Phone 810-364-4567 • Fax 810-364-6178
20 Ton H Presses

P20H x 3.00 (76.2mm) Stroke 001556 - 345 lbs. (157 kg)
P20H x 4.50 (114.3mm) Stroke 001557 - 345 lbs. (157 kg)

Components

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<th>BTM No.</th>
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<td>P20H x 3.00 (76.2mm) Body</td>
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<td>000422</td>
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<td>P20H x 4.50 (114.3mm) Body</td>
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<td>000423</td>
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<td>Piston</td>
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<td>Link Pin</td>
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<td>000426</td>
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<td>Ram - 400 Series</td>
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<td>R.H. Cover</td>
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<td>L.H. Cover</td>
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<tr>
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How to Order Presses

Quantity | Model | Stroke | Ram Style | Sealed Stroke | Proximity Scale | Ram Load | Ram Set Adapter | Tooling Notes | BTM No. |
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<td>6</td>
<td>P20H</td>
<td>4.50</td>
<td>See Page 78</td>
<td>See Page 28</td>
<td>See Page 28</td>
<td>See Page 78</td>
<td>See Page 27</td>
<td>See Figs 11,19, &amp; 22</td>
<td>000425</td>
</tr>
</tbody>
</table>

How to Order Components

| Qty. | P20 Link | 000425 |

* Denotes Options
**40 Ton H Presses**

**H Models**
(Head)

P40H x 3.00 (76.2mm) Stroke 003899 - 660 lbs. (300 kg)
P40H x 4.50 (114.3mm) Stroke 003900 - 660 lbs. (300 kg)

**NOTE:**
Dimensions are identical to P20H except as shown.

1" N.P.T. ~ 4 PLACES

1/2-13 TAP
26 PLACES

Cad Templates Available

40 Strokes Per Minute
(40 Ton Presses)

---

**Components P40H**

<table>
<thead>
<tr>
<th>Description</th>
<th>No. Req'd</th>
<th>BTM No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>P40H x 3.00 (76.2mm) Body</td>
<td>1</td>
<td>013144</td>
</tr>
<tr>
<td>P40H x 4.50 (114.3mm) Body</td>
<td>1</td>
<td>013145</td>
</tr>
<tr>
<td>Piston Set</td>
<td>1</td>
<td>004615</td>
</tr>
<tr>
<td>Piston Seal</td>
<td>4</td>
<td>000433</td>
</tr>
<tr>
<td>Link</td>
<td>1</td>
<td>004514</td>
</tr>
<tr>
<td>Link Pin</td>
<td>2</td>
<td>004616</td>
</tr>
<tr>
<td>Link Pin Retainer</td>
<td>2</td>
<td>000432</td>
</tr>
<tr>
<td>Rom - 400 Series</td>
<td>2</td>
<td>See Pg. 26</td>
</tr>
<tr>
<td>R.H. Cover</td>
<td>1</td>
<td>000429</td>
</tr>
<tr>
<td>L.H. Cover</td>
<td>1</td>
<td>000430</td>
</tr>
<tr>
<td>Cover Screw</td>
<td>17</td>
<td>004618</td>
</tr>
<tr>
<td>Cover Nut</td>
<td>17</td>
<td>000433</td>
</tr>
<tr>
<td>Rom Wiper</td>
<td>2</td>
<td>000433</td>
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<tr>
<td>Rom &quot;O&quot; Ring</td>
<td>2</td>
<td>000450</td>
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<td>Grease Filling</td>
<td>6</td>
<td>000273</td>
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<tr>
<td>Sealant - Cover</td>
<td>1</td>
<td>004617</td>
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**How to Order Presses**

How to Order Components

<table>
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<tr>
<th>Qty</th>
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<th>BTM No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>P40 Link</td>
<td>004614</td>
</tr>
</tbody>
</table>

* Denotes Options
# 20 Ton Floor & Tooling Presses

**F and T Models**  
(Floor and Tooling)

- **P20F x 3.00 (76.2mm) Stroke**: 000862 - 2600 lba. (1182 kg)
- **P20F x 4.50 (114.3mm) Stroke**: 000863 - 2600 lba. (1182 kg)
- **P20T x 3.00 (76.2mm) Stroke**: 000860 - 1550 lba. (705 kg)
- **P20T x 4.50 (114.3mm) Stroke**: 000861 - 1550 lba. (705 kg)

**See page 27 for Control Packages**

---

### How to Order Presses

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Model</th>
<th>Stroke</th>
<th>Ram Style</th>
<th>DSAG</th>
<th>RB</th>
<th>EPL</th>
<th>EPL</th>
<th>CP</th>
<th>E</th>
<th>S</th>
<th>F</th>
<th>FL</th>
<th>Tooling</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P20F</td>
<td>4.50</td>
<td>T-460</td>
<td>DSAG</td>
<td>RL</td>
<td>EPL</td>
<td>EPL</td>
<td>CP</td>
<td>E</td>
<td>S</td>
<td>F</td>
<td>FL</td>
<td>Tooling</td>
</tr>
</tbody>
</table>

* Denotes Options

---

**STROKE**  
**SHUT HEIGHT**

<table>
<thead>
<tr>
<th>STROKE</th>
<th>SHUT HEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>3.00 STROKE</strong></td>
<td>12.50 (317.5mm) MAX.</td>
</tr>
<tr>
<td>(76.2mm)</td>
<td>11.50 (292.1mm) MIN.</td>
</tr>
<tr>
<td><strong>4.50 STROKE</strong></td>
<td>11.00 (279.4mm) MAX.</td>
</tr>
<tr>
<td>(114.3mm)</td>
<td>10.00 (254.0mm) MIN.</td>
</tr>
</tbody>
</table>
40 Ton Floor & Tooling Presses

F and T Models
(Floor and Tooling)

P40F x 3.00 (76.2mm) Stroke 003905 - 2850 lbs. (1338 kg)
P40F x 4.50 (114.3mm) Stroke 003906 - 2950 lbs. (1338 kg)
P40T x 3.00 (76.2mm) Stroke 003903 - 1895 lbs. (860 kg)
P40T x 4.50 (114.3mm) Stroke 003904 - 1895 lbs. (860 kg)

See page 27 for Control Packages

NOTE: DIMENSIONS ARE IDENTICAL TO 20 TON VERSIONS EXCEPT AS SHOWN.

How to Order Presses

* Denotes Options

BTM Corporation • 300 Davis Road, Marysville, Michigan 48040 U.S.A. • Phone 810-364-4567 • Fax 810-364-6178
### 400 Series Rams

#### T - 400

- 4.000 Dia. (101.6mm)
- 400 Series 20 & 40 Ton Presses
- 2" - 12 UNF-2B Tap

#### S - 400

- Special Ram
  - Customer to provide ram end configuration for BTM price and delivery

<table>
<thead>
<tr>
<th>SERIES</th>
<th>PRESS MODEL</th>
<th>RAM STYLE</th>
<th>STROKE</th>
<th>A DIM.</th>
<th>BTM NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>400 SERIES RAMS FOR 20 &amp; 40 TON PRESSES</td>
<td>ALL</td>
<td>T</td>
<td>3.00 (76.2mm)</td>
<td>16.00 (406.4mm)</td>
<td>007607</td>
</tr>
<tr>
<td></td>
<td></td>
<td>S</td>
<td>3.00 (76.2mm)</td>
<td>PER CUSTOMER</td>
<td>TO BE ASSIGNED</td>
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<tr>
<td></td>
<td></td>
<td>T</td>
<td>4.50 (114.3mm)</td>
<td>17.50 (444.5mm)</td>
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<td></td>
<td></td>
<td>S</td>
<td>4.50 (114.3mm)</td>
<td>PER CUSTOMER</td>
<td>TO BE ASSIGNED</td>
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</tbody>
</table>
**Electrical Proximity Switches**

Mountable on 90° increments. Proximity switch independant of port A.

Proximity switch senses unlock position.

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

**Ordering Information**

<table>
<thead>
<tr>
<th>Components</th>
<th>Proximity Switch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td></td>
</tr>
<tr>
<td>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.</td>
<td></td>
</tr>
<tr>
<td>BTM No.</td>
<td>006266</td>
</tr>
<tr>
<td>Includes mounting adapter</td>
<td></td>
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</tbody>
</table>

**Proximity Switch Specifications**

<table>
<thead>
<tr>
<th>AC - Normally Open</th>
<th>(DC Available)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Voltage Range 20-260 VAC</td>
<td>Supplied with 6' cable - 3 wire</td>
</tr>
</tbody>
</table>
| 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 guarding 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.)

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”
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)

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

A. Shear strength (see chart 1.7)
B. Material Thickness
C. Length of cut (of .25" dia hole)

Multiply (AxBxC) & add 50% safety factor (x1.5)

= 
= 
= 

=Force Required

=50,000 psi (344.7N/mm²)
= .036" (.9mm)
= .78" (19.8mm)
=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.

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.
1.6 Piercing Force Requirements:
This chart shows the force required to pierce round holes (of various diameters) in mild steel (of various thicknesses.) 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 .500" (.12mm) 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

<table>
<thead>
<tr>
<th>Material</th>
<th>Multiplication Factor</th>
<th>Shear Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aluminum 1060-0</td>
<td>.14</td>
<td>7,000 psi</td>
</tr>
<tr>
<td>Nylon</td>
<td>.24</td>
<td>12,000 psi</td>
</tr>
<tr>
<td>Copper</td>
<td>.52</td>
<td>26,000 psi</td>
</tr>
<tr>
<td>Aluminum 2011-T3</td>
<td>.64</td>
<td>32,000 psi</td>
</tr>
<tr>
<td>Brass</td>
<td>.72</td>
<td>36,000 psi</td>
</tr>
<tr>
<td>Aluminum 2014-T6</td>
<td>.84</td>
<td>42,000 psi</td>
</tr>
<tr>
<td>Steel Mild Low Carbon</td>
<td>1.00</td>
<td>50,000 psi</td>
</tr>
<tr>
<td>Steel Stainless 409</td>
<td>1.30</td>
<td>65,000 psi</td>
</tr>
<tr>
<td>Steel Stainless 304 L</td>
<td>1.62</td>
<td>81,000 psi</td>
</tr>
<tr>
<td>Steel Stainless 321</td>
<td>1.66</td>
<td>83,000 psi</td>
</tr>
</tbody>
</table>

BTM Corporation • 300 Davis Road Marysville, Michigan U.S.A. 48040 • Phone 810-364-4567 • Fax 810-364-6178
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)...........+/-0.010" (+/-0.25mm)
3 place decimal (.000)...........+/-0.005" (+/-0.13mm)
4 place decimal (.0000)...........+/-0.0005" (+/-0.01mm)
Ram rotation........................+/-15'

2.2 Air Consumption
BTM Press Volume Chart:

<table>
<thead>
<tr>
<th>Volume is shown in cubic inches and cubic centimeters per full cycle.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Amount in Use</strong></td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td>.06&quot; 0.75 mm</td>
</tr>
<tr>
<td>.12&quot; 2.0 mm</td>
</tr>
<tr>
<td>.12&quot; 3.0 mm</td>
</tr>
<tr>
<td>.12&quot; 4.4 mm</td>
</tr>
<tr>
<td>.12&quot; 6.0 mm</td>
</tr>
<tr>
<td>.12&quot; 9.0 mm</td>
</tr>
</tbody>
</table>

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.

Formulas:

\[
\text{CFM} = \frac{\text{Press volume} \times \text{cycles} \text{/ min}}{1728}
\]

\[
\text{SCFM} = \frac{(14.7 + \text{pressure})}{14.7} \times \text{CFM}
\]

Air Volume = press volume \times \text{cycles} \text{/ min}

Consumption = \frac{1}{\text{1 + pressure}} \times \text{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:

\[
\text{SCFM} = \frac{14.7 + 80}{14.7} \times \frac{31.8 \times 60 \text{ cycles} \text{/ min.}}{1728}
\]

\[
\text{SCFM} = 7.1
\]

\[
\text{Litres / Min} = \frac{1 + 5.5}{1} \times \frac{0.521 \text{ dm}^3 \times 60 \text{ cycles} \text{ / min.}}{203}
\]

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: \[
\frac{\text{Press volume} \times (14.7 + \text{Operating Pressure})}{\text{(in cubic inches)}} \div 231 = \text{Surge Tank volume in Gallons}
\]

\[
\frac{\text{Press Volume} \times (1 + \text{Operating Pressure})}{\text{(in cubic centimeters)}} \div 1000 = \text{Surge Tank volume in Litres}
\]

Example:
20 Ton Press x 4.5" (114.3mm) Stroke
Volume = 1549.8 in\(^3\) (25396.7 c.c) (See Chart)
Operating Pressure = 80 psi (5.5 bar)

Solution:
\[
\frac{1549.8 \times (14.7 + 80)}{14.7} = 231 = 43 \text{ Gallon Surge Tank}
\]

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

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.](image-url)
3.3 Press Mounting:
The BTM Air Toggle Press produces high forces which must be contained by the press mounting to ensure maximum life. When constructing force frames for press mounting, rigidity is essential to minimize deflection of the press ram.

Head model (H) presses must be mounted so that both keyways are in direct shear and directly tied to an integral rear support and frame. (Figure E.)

Equalizing (EU & REU) presses have dowel pin holes to be used for precise location. Piping and clearance must allow for movement of the unit. (Figure F.)

3.4 Throat Depth:
Designs incorporating deep throats must have sufficient force frames to inhibit deflection at the tooling. It is recommended that the tooling be mounted in a separate block affixed to the frame to provide final alignment. (Figure G.)

3.5 Anti-Rotation & Guides:
BTM Toggle Presses feature a ± 15° non-rotating ram. The method of mounting tooling to the ram can affect the life and performance of the press and tooling. Alignment of the tooling and containment of the deflection are imperative. In critical appli-

3.6 Shut Height Adjustment:
Various methods of shut height adjustment are provided with standard BTM components. Ramps with built-in adjusting screws (PA&PTA), adjustable die button support (PB models) and die set adapter groups (DSAG) are listed in catalog 98P.

3.7 Lifting With The Toggle Press:
Force produced when retracting the toggle press is reverse of the force curve. However, certain long stroke presses will not perform in accordance with the force curve near the retracted position. Consult BTM when considering the lifting of large tools with the retract stroke.
4.0 Equalizing Presses:
Equalizing presses are useful in applications where both the punch and die must move clear of the part for loading and unloading. Two types are available; Equalizing Units (EU) and Reverse Equalizing Units (REU). Both types provide two motions, for die positioning and punch entry.

4.1 EU Models:
EU models are used where the tooling mounted on the press anvil is the "first" motion (generally die positioning) and the tooling mounted on the ram is the "second" motion (generally punch entry).

How it works:
1. Press is mounted to a machine base, both die and ram tooling are retracted to allow loading of the part onto stationary gauging. The open position stop collar is used to adjust the die position away from the part. (Figure H.)
2. Air pressure at 40 psi (2.7 bar) is applied to port AA of the equalize cylinder, advancing the die to the part. The closed position stop collar is used to adjust the die position to the part.
3. Air pressure at 80 psi (5.5 bar) is applied to port A of the press, advancing the ram and punch to the work.
4. Air pressure is switched to port B, retracting the ram.
5. Air pressure is switched to port BB, retracting the die.

4.2 REU Models:
REU models are used where the tooling mounted on the press ram is the "first" motion (generally die positioning) and the tooling mounted on the anvil is the "second" motion (generally punch entry).

How it works:
1. Press is mounted to a machine base, both die and ram tooling are retracted to allow loading of the part onto stationary gauging. The open position stop collar is used to adjust the tooling position away from the part. The equalize cylinder acts as an air spring, with constant pressure at port BB. This pressure should be regulated to the minimum required to retract the tooling. Port AA is vented to atmosphere. (Figure I.)
2. Air pressure at port A advances the ram tooling (die) to the part. The closed position stop collar is used to adjust the die position relative to the part.
3. The remainder of the stroke is used to pull the (punch) tooling to the part, completing the work and compressing the air spring.
4. Air pressure is switched to port B, retracting the press ram. The first portion of this travel allows the air spring to extend, retracting the (punch) tooling.
5. The remaining ram travel retracts the (die) tooling from the part.
4.3 Design & Set Up:
EU Model (Figure H)
1. Designing an EU model into a machine and setting up the unit after installation are both performed with the unit in the closed position (air on port AA), and the open position stop collar threaded away from the mount block to its stop.
2. The closed position stop collar is then turned against the mount block until the open position collar is one inch from the mount block. This sets the unit to the position shown in the catalog drawings.
3. Tooling is designed in this position relative to the press keyway and the part position. The two stop collars may be used to fine tune the open and closed press positions.

REU Model (Figure I)
1. Designing an REU model into a machine and setting up the unit after installation are both performed with the unit in the closed position (air on port A), and the open position stop collar threaded away from the mount block to its stop.
2. The closed position stop collar is then turned against the stop block until the open position collar is one inch from the mount block. This sets the unit to the position shown in the catalog drawings.
3. Tooling is designed in this position relative to the press keyway and the part position. The two stop collars may be used to fine tune the open and closed press positions.

5.0 Maintenance:
Properly sized and applied, BTM Toggle Presses will provide a long service life. They require only regular lubrication and a clean, dry air supply. After extended service, seal replacement may be necessary. This is a relatively simple procedure and is outlined in 5.2.

5.1 Lubrication:
The BTM Air Toggle Press is a mechanical device using air as its power source and therefore requires clean, dry air. A filter and pressure regulator must be incorporated into the air supply line. Light in-line lubrication is also recommended, but not required, as press seals are lubed for life at assembly. When incorporating in-line lubrication, use a light spindle oil in the lubricator (a reclassifier is also recommended). Lubrication is required every 20,000 cycles at grease fittings only. See lube tags on front of press assembly for specific lubrication instructions. Grease fittings are provided to lubricate the bearing and link pin areas on most presses. Use Chevron Rykotac Grease EP or equivalent at grease fittings. Note: Not all greases are compatible. If other grease will be used, you must verify its compatibility. Failure to follow recommended lubrication procedures will void warranty. A video is available upon request detailing general press maintenance and seal replacement procedures.

5.2 Seal Replacement:
Refer to the catalog page showing your press model to order seal kit.

5.2.1 Loosen all the cover plate nuts by two threads only. Apply air to either port (80 psi maximum). This will separate one of the cover plates from the press body.

5.2.2 Remove all the cover plates screws & nuts, and the cover plate. The opposite cover plate will usually remain sealed to the body, and may be tapped loose using a wood block and a mallet. Remove the second cover plate.

5.2.3 Position the press body with the ram horizontal to prevent the ram from falling out when the link pin is removed. Remove the retainer ring from the ram link pin. The link pins on P-1 models are pressed into one side of the link and do not have retaining rings. Tap the link pin out and slide the ram out of the body.

5.2.4 Remove the piston and link from the body, and remove the old seals from the piston.

5.2.5 Remove the ram O-Ring from the body.
The O-Ring on PB models is located on the ram.

5.2.6 Clean all parts. Inspect all parts for signs of wear or damage.
5.2.7 Check the cover plates to see if a "pencil" outline of the press cavity is visible. (Figure J.) If it is not, align the cover plates with the body and outline the contour with a pencil. Repeat procedure on second cover plate.

Figure K. Cover Screw Size & Torque

<table>
<thead>
<tr>
<th>Sail Size</th>
<th>1 &amp; 2 Ton</th>
<th>5 &amp; 10 Ton</th>
<th>20 &amp; 40 Ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>Torque in Ft / Lbs</td>
<td>1/4</td>
<td>5/16</td>
<td>3/8</td>
</tr>
<tr>
<td>Torque in N • m</td>
<td>12.2</td>
<td>31.2</td>
<td>67.8</td>
</tr>
</tbody>
</table>

5.3 Replacing Components:
Worn or damaged component parts may be replaced following the same procedure described at 5.2. Components are listed on the catalog 02P pages for each model. Presses may be returned to BTM for factory repair.

5.2.8 Install new piston seals with "V" grooves facing the powered surfaces of the piston. (Figure J.) (opposite each other)

5.2.9 Install new ram O-Ring.

5.2.10 Grease and re-assemble the piston, link and ram into the press body.

5.2.11 Apply a thin layer of grease to the area of the cover plates inside the "pencil" line. Apply a thin layer of Accuflex® Sealant to the area outside the "pencil" line. (Figure J.) Do not apply sealant inside the line.

5.2.12 Assemble the cover plates to the press and torque screws according to the chart in (Figure K). Make sure all threads are free of sealant. A slight bypass of air is normal due to the rectangular seals.

* Note Regarding Sealant
BTM Air Toggle Presses manufactured after August 2001 use polyurethane sealant to seal the side cover plates. A tube of SIKAFLEX 221 is included with each BTM Seal Kit. Presses manufactured before August 2001 were sealed with RTV-108 silicone sealant. Silicone is no longer provided with BTM Seal Kits. Presses that were originally sealed with silicone can be re-sealed with SIKAFLEX 221.