ASME B5.61-2003

Power Presses: General Purpose, Single Action, Straight Side Type

AN AMERICAN NATIONAL STANDARD

The American Society of Mechanical Engineers

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Three Park Avenue • New York, NY 10016

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This Standard will be revised when the Society approves the issuance of a new edition. There will be no addenda or written interpretations of the requirements of this Standard issued to this edition.

The American Society of Mechanical Engineers
Three Park Avenue, New York, NY 10016-5990

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FOREWORD

Recognizing the need for a standard for mechanical power presses, the ASME Committee on Machine Tools and Components (B5) established in December 1973, Technical Committee 30 to develop an American National Standard addressing the interchangeability of bolsters, press tooling, and mounting provisions between general purpose presses of comparable bed size, capacity, and type.

The B5-TC30 membership consists of a balance between manufacturers, users, accessory suppliers and others associated with power presses. The technical committee's work was based on the Joint Industry Conference (JIC) Press Room Standards, once the most widely used document, to develop a standard for mechanical power presses, and basic data submitted by U.S. manufacturers of power presses.

In April 1983, the committee completed the final draft of "Standard for Straight Side Type Presses (Metric)." This draft was not submitted for approval before the committee became inactive.

In 1995, Technical Committee 30 was reestablished to continue the pursuit of the original objectives set forth in 1973. The scope of the Standard was expanded to include hydraulic power presses.

ASME B5.61-2003 was approved by the American National Standards Institute on July 7, 2003.

ASME B5 STANDARDS COMMITTEE
Machine Tools — Components, Elements, Performance, and Equipment

(The following is the roster of the Committee at the time of approval of this Standard.)

CORRESPONDENCE WITH THE B5 COMMITTEE

General. ASME Standards are developed and maintained with the intent to represent the consensus of concerned interests. As such, users of this Standard may interact with the Committee by proposing revisions, and attending Committee meetings. Correspondence should be addressed to:

Secretary, B5 Main Committee
The American Society of Mechanical Engineers
Three Park Avenue
New York, NY 10016-5990

Proposing Revisions. Revisions are made periodically to the Standard to incorporate changes that appear necessary or desirable, as demonstrated by the experience gained from the application of the Standard. Approved revisions will be published periodically.

The Committee welcomes proposals for revisions to this Standard. Such proposals should be as specific as possible, citing the paragraph number(s), the proposed wording, and a detailed description of the reasons for the proposal, including any pertinent documentation.

Attending Committee Meetings. The B5 Main Committee regularly holds meetings, which are open to the public. Persons wishing to attend any meeting should contact the Secretary of the B5 Main Committee.

POWER PRESSES: GENERAL PURPOSE, SINGLE ACTION, STRAIGHT SIDE TYPE

1 SCOPE, PURPOSE, AND APPLICATION

1.1 Scope

This Standard applies to hydraulic and mechanical power presses commonly referred to by the metal-working industry as *General Purpose, Single Action, Straight Side Type Power Presses* that, by means of dies or tooling attached to the slide and bolster, are used to shear, punch, form, or assemble metal or other materials.

The following types of presses are excluded from this Standard:

(a) air (pneumatic)
(b) bench
(c) eyelet machines
(d) forging
(e) four slide machines
(f) gap frame
(g) knuckle joint
(h) multiple action
(i) multiple slide
(j) spotting
(k) transfer feed
(l) turret punching

1.2 Purpose

The purpose of this Standard is to define and describe power presses and their interface, and to permit interchangeability of bolsters, dies, and tooling components between presses of comparable type, size, and capacity.

1.3 Application

Any power press described herein and referred to as an American National Standard Power Press shall comply with the applicable requirements delineated in this Standard.

2 DEFINITIONS AND TERMINOLOGY

Terms used in this Standard are defined in ASME B5.49, Glossary of Power Press Terms.

3 METRIC/U.S. CUSTOMARY RATIONALIZATION

3.1 Metrication

All units of dimension and capacity stated herein are in accordance with ASME B5.51M, Preferred SI Units for Machine Tools. Approximate U.S. Customary units are historical standards and are for reference only. Wherever used in this Standard, the unit *tons* denotes U.S. tons.

Table 1 Standard Capacity Ratings

Single-Point Press		Two-Point Press		Four-Point Press	
kN	tons	kN	tons	kN	tons
250	30	...	...	...	...
500	55	500	55	...	...
1 000	110	1 000	110	...	...
1 600	180	1 600	180	...	...
2 000	225	2 000	225	...	...
2 500	280	2 500	280	2 500	280
4 000	450	4 000	450	4 000	450
6 300	710	6 300	710	6 300	710
10 000	1,125	10 000	1,125	10 000	1,125
...	...	16 000	1,800	16 000	1,800
...	...	20 000	2,250	20 000	2,250
...	...	25 000	2,810	25 000	2,810

3.2 Metric/U.S. Customary Conversion

Nonmandatory Appendix A provides conversion multipliers applicable to this Standard.

4 PRESS CHARACTERISTICS

4.1 Rated Capacity

Standard capacity ratings shall be as specified in Table 1 (see also Fig. 1). See Nonmandatory Appendix B for historical comparison of capacity ratings.

4.2 Rating Points (Mechanical Power Press)

(a) Standard rating points shall be as specified in Table 2.

(b) Drive design shall be based on providing the torque, which produces the rated press capacity at the rating point (see Fig. 2).

(c) Press capacity at points other than the rating point are shown in

(1) Mandatory Appendix I for presses rated at 12.7 mm (½ in.)

(2) Mandatory Appendix II for presses rated at 6.3 mm (¼ in.)

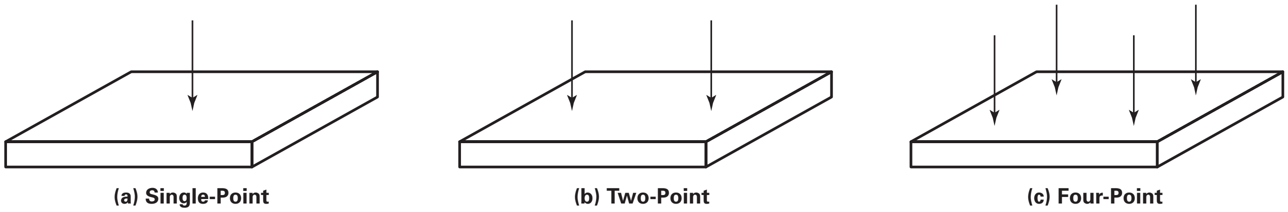


Fig. 1 Slide Connections for Single-Point, Two-Point, and Four-Point Presses

Table 2 Standard Rating Points

Press Type	Rating Point mm	Rating Point in.
Flywheel drive	1.6	1/16
Single end drive Twin end drive blanking press Eccentric gear blanking press	6.3	1/4
Twin end drive Eccentric gear	12.7	1/2

(3) Mandatory Appendix III for presses rated at 1.6 mm (1/16 in.)

4.3 Energy Capacity (Mechanical Power Press)

4.3.1 Function of the Flywheel. The energy required for performing press operations is stored in the flywheel. During the working portion of the press cycle, the flywheel slows down as it supplies the required energy to the drive train.

4.3.2 Function of the Drive Motor. The drive motor restores flywheel energy during the nonworking portion of the press cycle, which may include the interval between press cycles for presses operating in single stroke modes.

4.3.3 Drive Motor Selection. The selection of the drive motor is dependent upon the energy requirements. Factors determining the energy requirements are:

(a) rated capacity
(b) press speed (strokes per minute)
(c) press stroke

Based on the optimum slide velocity for the material being worked, a longer stroke press will be required to operate at a slower speed than a shorter stroke press. The longer the stroke, the deeper the draw that can be made, and the greater the energy required to sustain the press through the depth of the draw. Table 3 specifies typical press speed/drive motor relationships.

4.3.4 Drive Motor/Flywheel Relationship. The usable energy that a flywheel can supply is a function of the ability of the drive motor to tolerate slowdown without overheating. The usable flywheel energy, expressed as a percentage of total flywheel energy, is a function of the motor slowdown. Table 4 specifies the properties of the three types of single speed drive motors that are most commonly used on mechanical power presses. Mandatory Appendix IV provides a method for calculating the usable flywheel energy.

Table 3 Press Speed/Drive Motor Relationship

Press Speed, spm	Type of Motor Required
10 spm or less	Design D, 8% – 13% slip
Between 10 spm and 30 spm	Design D, 5% – 8% slip
30 spm or more	Design B, 3% – 5% slip

4.3.5 Variable Speed Presses. Unless otherwise specified by the purchaser, usable flywheel energy for variable speed presses shall be rated at one-half the maximum speed.

IMPORTANT: The energy range for a variable speed press varies as the square of the speed range. For example, a speed range of 3:1 would provide an energy range of 9:1. For a press with a speed range of 20 spm to 60 spm, the following would be the energies available:

SPM	Energy Available, %
20	45
30	100
60	400

4.4 Structural Capacity

(a) Bed and slide design shall be based on symmetrically distributed loading of the bed and slide over two-thirds of the left-to-right and front-to-back area dimensions of the bed and the slide, respectively. The bed size is normally the bolster area.

NOTE: Tool design should be based on distributing full capacity loading of the press over at least two-thirds of the die space. Dies that do not span the slide connections will result in overload of the bed and slide members at full press capacity.

(b) Bed and slide design shall be based on the following allowable deflection criteria:

(1) for other than progressive die presses, deflection of the bed and slide to be within 0.17 mm/m (0.002 in./ft) of the left-to-right dimension

(2) for progressive die presses

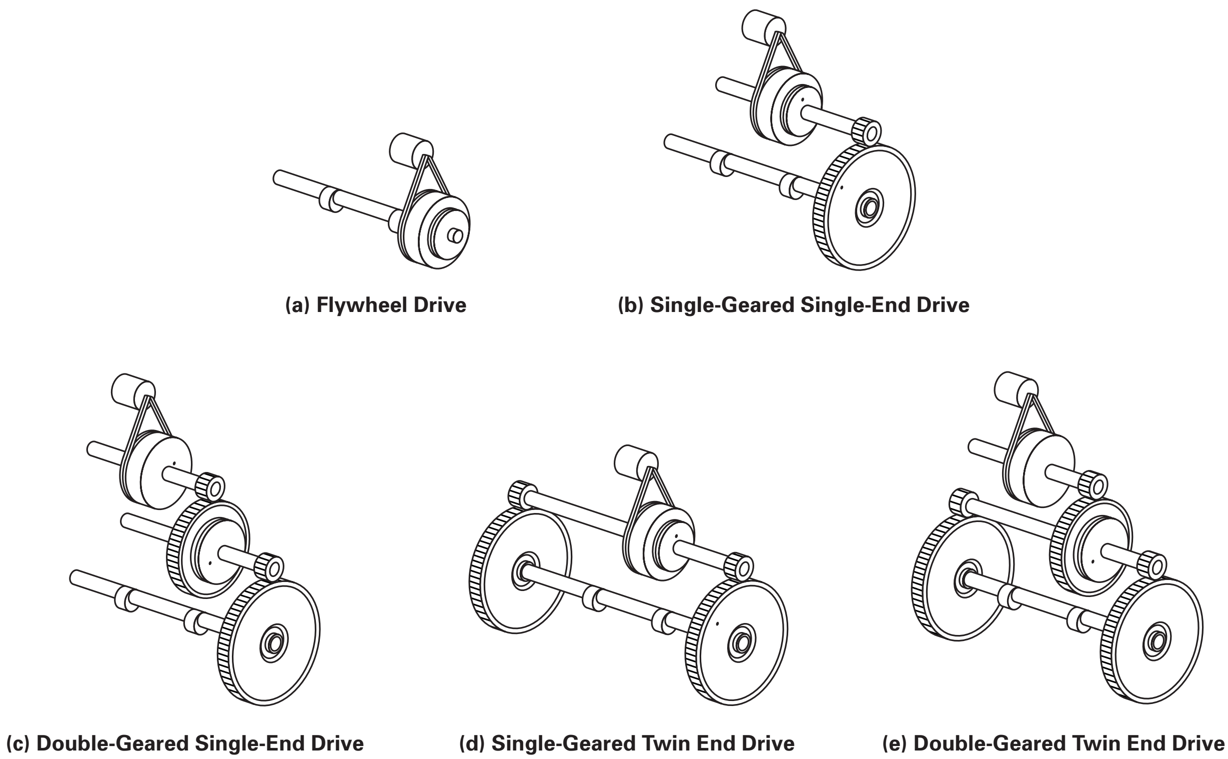


Fig. 2 Drives for Single-Point, Two-Point, and Four-Point Presses

Table 4 Usable Flywheel Energy

Motor Design	Motor Slip, %	Maximum Flywheel Slowdown, %	Usable Flywheel Energy, %
B	3 to 5	10	19
D	5 to 8	15	28
D	8 to 13	20	36

(a) deflection of the bed and slide to be within 0.08 mm/m (0.001 in./ft) of the left-to-right dimension, for dimensions up to 3 000 mm (118 in.)

(b) deflection of the bed and slide to be within 0.12 mm/m (0.0015 in./ft) of the left-to-right dimension, for dimensions greater than 3 000 mm (118 in.)

(3) measurement of deflection with a distributed load cannot be duplicated by testing. Mandatory Appendix V suggests an empirical method of simulating bed and slide loading for testing purposes. This measurement is only done upon the request and agreement of the purchaser.

4.5 Loading of a Press Slide

4.5.1 Mechanical Press. For multiple-point presses, the press slide and its connections shall be designed to withstand offset loading as follows (see Mandatory Appendix VI):

(a) for a two-point mechanical press, 60% of the rated capacity under each connection

(b) for a four-point mechanical press, 35% of the rated capacity under each connection

(c) the total load on the slide shall not exceed the total rated press capacity

EXAMPLE: For a 4 000 kN press two-point press:
(1) 4 000 kN × 0.6 = 2 400 kN maximum force can be applied by one connection
(2) 4 000 kN − 2 400 kN = 1 600 kN maximum force can be applied by the other connection

Mechanical presses shall be provided with hydraulic overloads rated at 110% of press capacity.

4.5.2 Hydraulic Press. Nominal press force (kN) multiplied by 0.075 m equals maximum off-center load (kN·m). Nominal press force (tons) multiplied by 3 in. equals maximum off-center load (in.-tons). Calculation of an off-center force requires consideration.

EXAMPLE: To determine the load that can be applied at 0.5 m off-center for a 4 000 kN press:
(1) 4 000 kN × 0.075 m = 300 kN·m
(2) 300 kN·m/0.5 m = 600 kN

5 TOOLING RELATED CHARACTERISTICS

See Figs. 3 and 4.

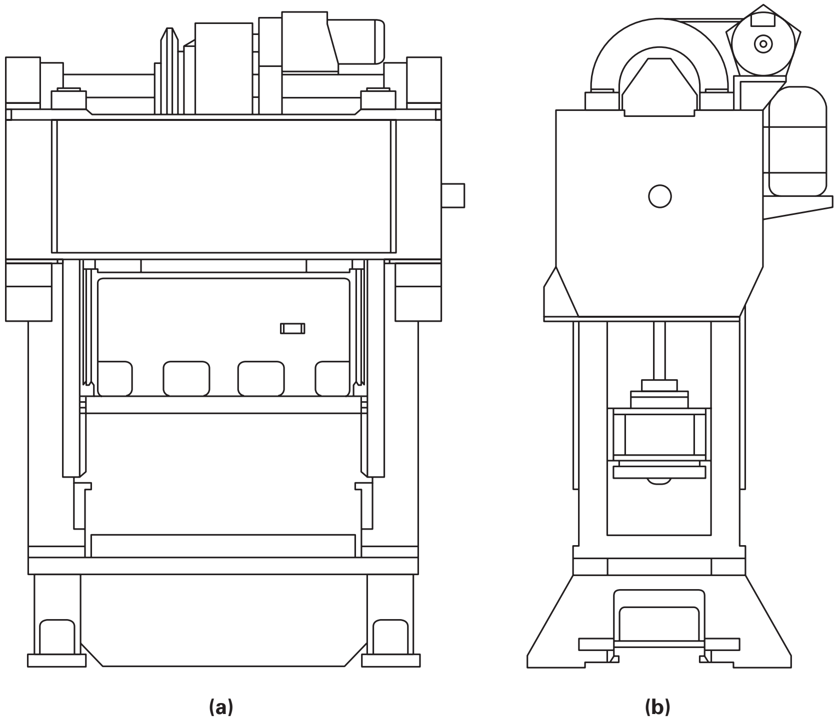


Fig. 3 Typical Construction of a Mechanical Press

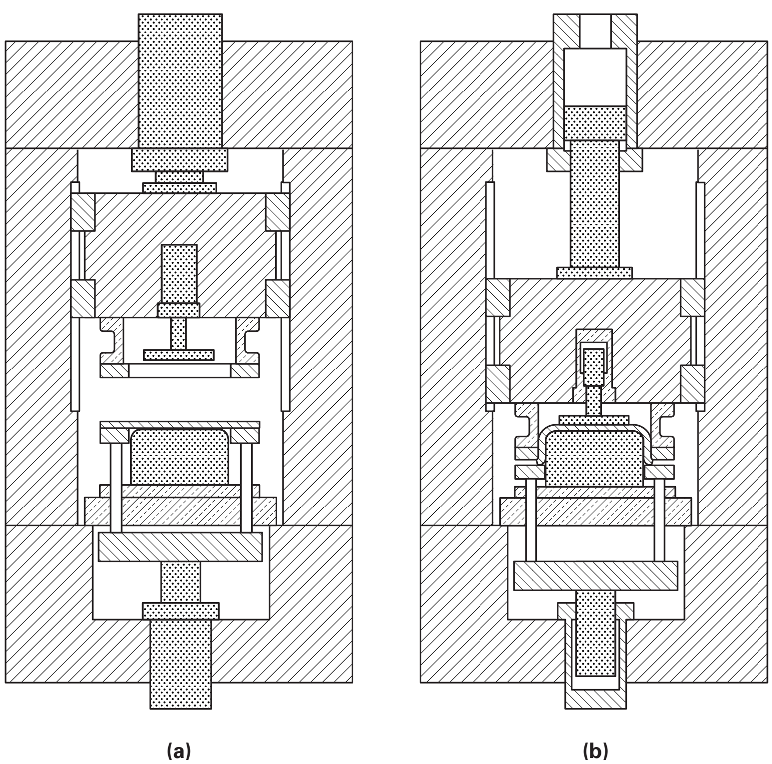


Fig. 4 Typical Construction of a Hydraulic Press

Table 5 Stroke and Die Space Dimensions: Mechanical Power Press

Rated Capacity		Standard Stroke		Maximum Stroke		Nominal Bolster Thickness [Note (1)]		Press Shutheight		Slide Adjustment	
kN	tons	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
250	30	80	3	125	5	75	3	300	11	100	4
500	55	100	4	200	8	100	4	400	16	150	6
1 000	110	160	6	250	10	100	4	400	16	150	6
1 600	180	200	8	315	12	150	6	600	24	200	8
2 000	225	250	10	350	14	175	7	600	24	200	8
2 500	280	250	10	400	16	200	8	700	28	250	10
4 000	450	315	12	450	18	200	8	700	28	250	10
6 300	710	400	16	560	22	250–300 (2)	10–12	800	32	300	12
10 000	1,125	450	18	630	24	275–300 (3)	11–12	900	36	350	14
16 000	1,800	500	20	630	24	300	12	1 000	40	350	14
20 000	2,250	630	24	800	31	300	12	1 000	40	400	16
25 000	2,810	630	24	800	31	350	12	1 200	48	400	16

NOTES:
(1) Bolster thickness is based on steel.
(2) 300 mm for 2 400 mm front-to-back or larger.
(3) 300 mm for 2 200 mm front-to-back or larger.

Table 6 Bed and Slide Dimensions: Single-Point Press

Rated Capacity		Left to Right		Front-to-Back Bed		Front-to-Back Slide	
kN	tons	mm	in.	mm	in.	mm	in.
250	30	630	24	800	32	630	24
500	55						
1 000	110	800	32	1 000	40	800	32
1 600	180						
2 000	225	1 000	40	1 120	42	1 000	40
2 500	280						
4 000	450	1 250	50	1 400	54	1 250	50
6 300	710						
10 000	1,125	1 600	60	1 800	72	1 600	60

5.1 Stroke and Die Space Dimensions

Standard stroke lengths, die space heights, and slide adjustments shall be as specified in Table 5. (For hydraulic presses, no standards apply to stroke length or slide adjustment.)

5.2 Bed and Slide Dimensions

(a) For presses with the slide driven by a single mechanical connection, or a single hydraulic piston, bed and slide dimensions shall be as specified in Table 6.

(b) For presses with the slide driven by multiple mechanical connections, or multiple hydraulic pistons, bed and slide dimensions shall be as specified in Table 7.

5.3 Bed Openings

(a) For all presses, the left-to-right bed opening is 300 mm less than the left-to-right bed size.

(b) For presses from 250 kN up to 4 000 kN, the front-to-back bed opening is 300 mm less than the front-to-back bed size.

(c) For presses from 4 000 kN up to 10 000 kN, the front-to-back bed opening is 450 mm less than the front-to-back bed size.

(d) For presses from 10 000 kN through 25 000 kN, the front-to-back bed opening is 600 mm less than the front-to-back bed size.

5.4 Bolster Locating Pins

(a) Material for locating pins shall be SAE 1020 cold rolled steel, carburized, and hardened.

(b) Locating pin diameter tolerances shall be +0 −0.13 mm (−0.005 in).

(c) Surface finish on locating pins shall be $R_a = 3.2$ μm (125 μin.) on diameters and $R_a = 6.3$ μm (250 μin.) on the ends.

Table 7 Bed and Slide Dimensions: Two-Point and Four-Point Press

Rated Capacity		Left to Right		Front to Back									
				Two-Point Press						Four-Point Press			
kN	tons	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
250	30	800	32	600	24	...	...	...	...	...	...	...	...
500	55	1 250	50	800	32	...	...	...	...	...	...	...	...
1 000	110	1 250	50	800	32	900	36	...	...	...	...	...	...
		1 600	60	900	36	1 000	40	1 120	42	...	...	...	...
1 600	180	1 250	50	800	32	900	36	...	...	...	...	...	...
		1 600	60	900	36	1 000	40	1 120	42	...	...	...	...
2 000	225	1 400	54	900	36	1 000	40	...	...	...	...	...	...
		1 600	60	900	36	1 000	40	1 120	42	...	...	...	...
		1 800	72	1 000	40	1 120	42	1 250	50	...	...	...	...
2 500	280	1 600	60	1 000	40	1 120	42	1 250	50	...	...	...	...
		1 800	72	1 000	40	1 120	42	1 250	50	...	...	...	...
		2 200	84	1 250	50	1 400	54	...	...	1 600	62	...	...
		2 500	96	1 400	54	...	...	...	...	1 600	62	...	...
		2 800	108	...	...	...	...	...	...	1 600	62	1 800	72
		3 100	120	...	...	...	...	...	...	1 800	72	2 000	78
4000	450	1 800	72	1 120	42	1 250	50	...	...	...	...	...	...
		2 200	84	1 250	50	1 400	54	...	...	1 600	62	...	...
		2 500	96	1 400	54	...	...	...	...	1 600	62	1 800	72
		2 800	108	...	...	...	...	...	...	1 600	62	1 800	72
		3 100	120	...	...	...	...	...	...	1 800	72	2 000	78
6 300	710	2 200	84	1 250	50	1 400	54	...	...	1 600	62	...	...
		2 500	96	1 400	54	...	...	...	...	1 600	62	1 800	72
		2 800	108	...	...	...	...	...	...	1 600	62	1 800	72
		3 100	120	...	...	...	...	...	...	1 800	72	2 000	78
		3 400	132	...	...	...	...	...	...	2 000	78	2 200	84
		3 700	144	...	...	...	...	...	...	2 00	84	2 400	96
10 000	1,125	2 800	108	...	...	...	...	...	...	1 800	72	2 200	84
		3 100	120	...	...	...	...	...	...	1 800	72	2 200	84
		3 400	132	...	...	...	...	...	...	2 200	84	2 400	96
		3 700	144	...	...	...	...	...	...	2 200	84	2 400	96
		4 000	156	...	...	...	...	...	...	2 200	84	2 400	96
		4 600	180	...	...	...	...	...	...	2 400	96	2 600	102
		5 200	204	...	...	...	...	...	...	2 800	108	3 000	120
16 000	1,800	3 100	120	...	...	...	...	...	...	2 200	84	...	...
		3 400	132	...	...	...	...	...	...	2 200	84	2 400	96
		3 700	144	...	...	...	...	...	...	2 200	84	2 400	96
		4 000	156	...	...	...	...	...	...	2 400	96	2 600	102
		4 600	180	...	...	...	...	...	...	2 400	96	2 600	102
		5 200	204	...	...	...	...	...	...	2 800	108	3 000	120
20 000	2,250	3 400	132	...	...	...	...	...	...	2 200	84	2 400	96
		3 700	144	...	...	...	...	...	...	2 200	84	2 400	96
		4 000	156	...	...	...	...	...	...	2 400	96	2 600	102
		4 600	180	...	...	...	...	...	...	2 400	96	2 600	102
		5 200	204	...	...	...	...	...	...	2 800	108	3 000	120
25 000	2,810	3 700	144	...	...	...	...	...	...	2 200	84	2 400	96
		4 000	156	...	...	...	...	...	...	2 400	96	2 600	102
		4 600	180	...	...	...	...	...	...	2 400	96	2 600	102
		5 200	204	...	...	...	...	...	...	2 800	108	3 000	120

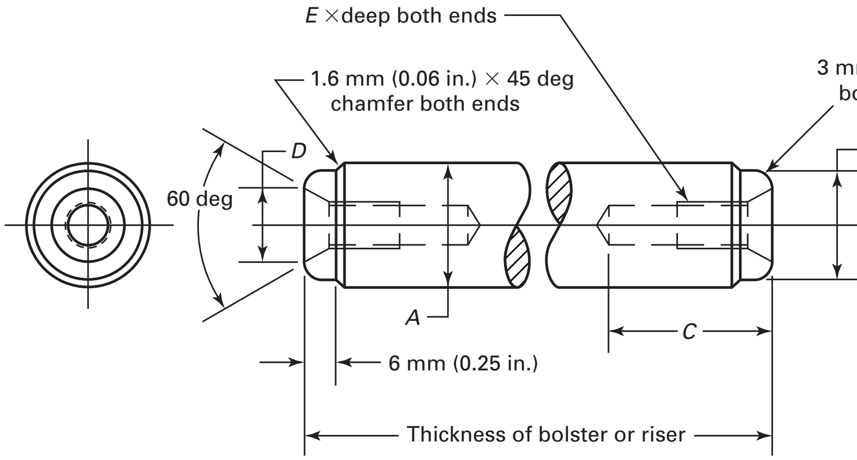


Table 8 Bolster Locating Pin Dimensions

	Rated Capacity			
	Through 1 000 kN (110 T)		Over 1 000 kN (110 T)	
Dimension	mm	in.	mm	in.
A	29	1.13	41	1.63
B	25	1.0	38	1.5
C	32	1.25	44.5	1.75
D	19	0.75	25	1.0
E	M12 × 25 mm deep	$^1/_2$–13 × 1 in. deep	M20 × 38 mm deep	$^3/_4$–10 × 1.5 in. deep

(d) Locating pinhole specifications shall be as follows:

(1) for press capacities through 1 000 kN (110 tons): 30 mm (1.16 in.) diameter

(2) for press capacities over 1 000 kN (110 tons): 43 mm (1.63 in.) diameter

(e) Two holes shall be drilled through, with chamfer at top of 6 mm (0.25 in.) × 45 deg.

(f) Locating pin dimensions shall be as specified in Table 8.

(g) Spacing of locating pinholes for both bed and bolster shall be as specified in Tables 9 and 10.

5.5 Bolster Mounting Slots

(a) Bolster mounting slot dimensions shall be as specified in Table 11.

(b) Spacing of bolster mounting slots shall be as specified in Tables 12 and 13.

5.6 Bolster Mounting Bolts

(a) Bolster mounting bolt specifications shall be as follows:

(1) length, *L*, and finish to be specified by purchaser

(2) medium carbon alloy steel, hardened and tempered

(3) tensile strength 1 000 MPa (150,000 psi) minimum, Brinell hardness 264–353

(b) Bolster mounting bolt dimensions shall be as specified in Table 14.

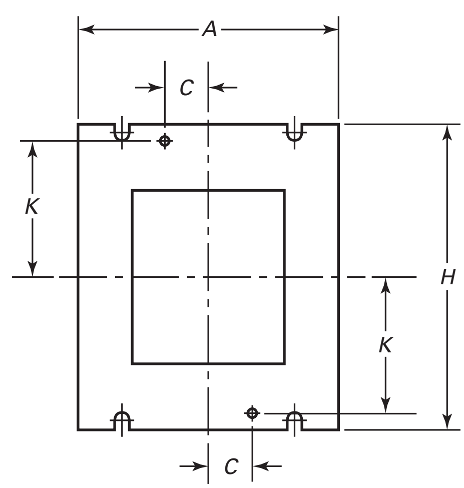


Table 9 Spacing of Bolster Locating Pinholes: Single-Point Press

Left to Right				Front to Back			
A		*C*		*H*		*K*	
mm	in.	mm	in.	mm	in.	mm	in.
630	24	105	4.1	800	32	340	13.4
800	32	105	4.1	1 000	40	440	17.3
1 000	40	230	9	1 120	42	500	19.7
1 250	50	380	15	1 400	54	640	25.2
1 600	60	380	15	1 800	72	840	33

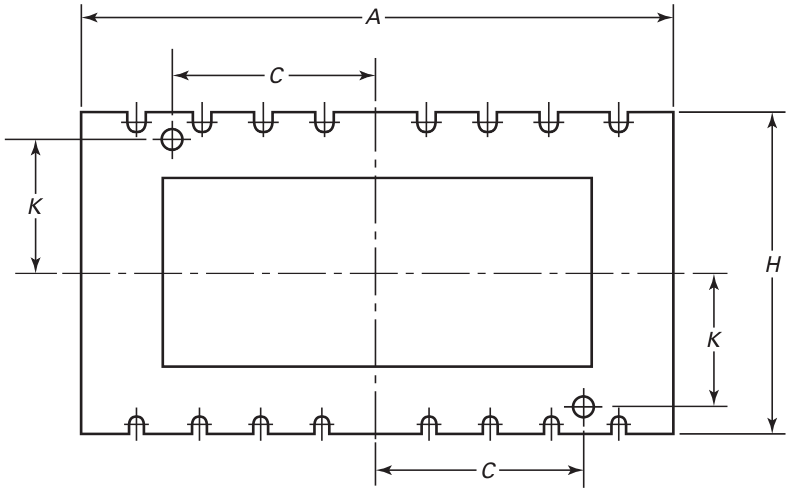


Table 10 Spacing of Bolster Locating Pinholes: Two-Point and Four-Point Press

Left to Right				Suggested Dimension,		Front to Back			
A		C		C		H		K	
mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
800	32	230	9	300	11.8	600	24	240	9.4
1 250	48	230	9	300	11.8	800	32	340	13.4
1 400	54	230	9	300	11.8	900	36	390	15.3
1 600	60	380	15	450	17.7	1 000	40	440	17.3
1 800	72	535	21	600	23.6	1 120	42	500	19.7
2 200	84	685	27	750	29.5	1 250	50	565	22.2
2 500	96	840	33.1	900	35.4	1 400	56	640	25.2
2 800	108	990	39	900	35.4	1 600	60	740	29.1
3 100	120	1 145	45	1 050	41.3	1 800	72	840	33.1
3 400	132	1 295	51	1 350	53.1	2 000	78	940	37
3 700	144	1 450	57	1 500	59	2 200	84	1 040	40.9
4 000	156	1 600	63	1 500	59	2 400	96	1 140	44.1
4 600	180	1 900	74.8	1 800	70.9	2 600	102	1 240	48.8
5 200	204	2 210	87	2 250	88.6	2 800	108	1 340	52.8
. . .	. . .	. . .	. . .	. . .	. . .	3 000	120	1 440	56.7

5.7 Bolster Handling Holes

Bolster handling holes shall be located as specified in Tables 15 and 16.

5.8 Bolster Handling Hooks

(a) Bolster handling hooks shall meet the following requirements:

(1) closed die drop forging: SAE fine grain, heat treated to Brinell hardness 186–241

(2) inspected by ultrasonic and fluorescent magnetic particle method

(3) free from laps, seams, or other surface defects

(4) no permanent set at a proof load of three times the lifting capacity, when loaded vertically

(b) Bolster handling hook dimensions shall be as specified in Table 17.

(c) Bolster handling hook bolts shall meet the following requirements:

(1) medium carbon alloy steel, hardened and tempered

(2) tensile strength 1 000 MPa (150,000 psi) minimum, Brinell hardness 302–352

(d) Bolster handling hook bolt dimensions shall be as specified in Table 18.

5.9 Die Attachment

(a) T-slots, bolts, and nuts shall conform to the requirements of ASME B5.1M, T-Slots — Their Bolts, Nuts, and Tongues. The recommended T-bolt sizes are 20 mm (0.78 in.) for presses up to 1 000 kN (110 ton) and 24 mm (1 in.) for presses above 1 000 kN (110 tons).

(b) T-slots shall be located on 150 mm (6 in.) centers. The middle T-slots are 75 mm (3 in.) to the right and to the left of the front-to-back centerline of the bolster and the slide. See Figs. 5 and 6 for a typical bolster and slide. Number of T-slots are specified in Table 19.

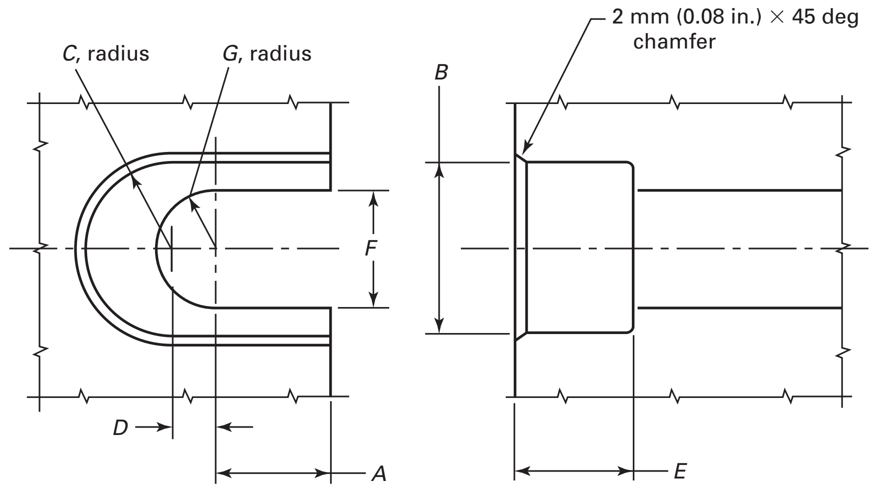


Table 11 Bolster Mounting Slot Dimensions

Bolt Size		Rated Capacity		A		B		C		D		E		F		G	
SI	Customary	kN	tons	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
M20	$^{3}/_{4}$ – 10	250	30	24	0.94	34	1.34	17	0.67	10	0.39	20	0.79	24	0.94	12	0.47
M24	1 – 8	500	55	28	1.10	40	1.57	20	0.79	12	0.47	25	0.98	28	1.1	14	0.56
M30	$1^{1}/_{4}$ – 6	>500	>55	34	1.34	50	1.97	25	0.98	15	0.59	30	1.18	34	1.34	17	0.68

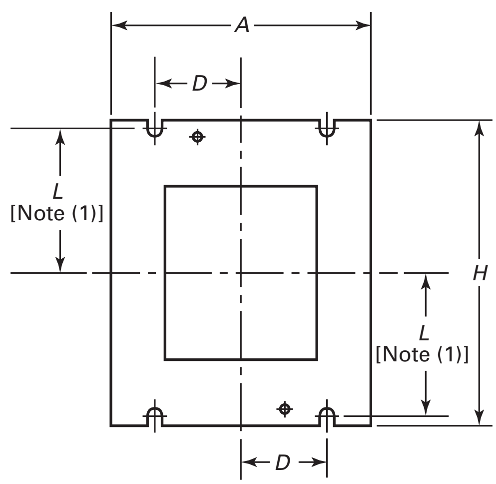


Table 12 Spacing of Bolster Mounting Slots: Single-Point Press

Left to Right				Front to Back, H	
A		D			
mm	in.	mm	in.	mm	in.
630	24	150	5.9	800	32
800	32	350	13.8	1 000	40
1 000	40	450	17.7	1 120	42
1 250	50	450	17.7	1 400	54
1 600	60	600	23.6	1 800	72

GENERAL NOTE: Mounting slots are symmetrical about the centerlines.

NOTE:
(1) Calculate *L* based on dimension *A* in Table 11.

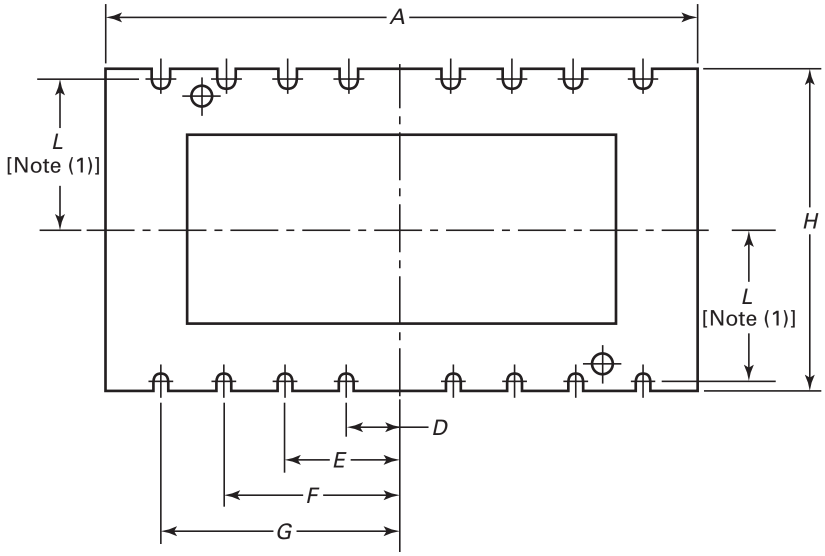


Table 13 Spacing of Bolster Mounting Slots: Two-Point and Four-Point Press

A		D		E		F		G		H	
mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
800	32	350	13.8	. . .	. . .	. . .	. . .	. . .	. . .	600	24
1 250	50	450	17.7	. . .	. . .	. . .	. . .	. . .	. . .	800	32
1 400	54	600	23.6	. . .	. . .	. . .	. . .	. . .	. . .	900	36
1 600	60	600	23.6	. . .	. . .	. . .	. . .	. . .	. . .	1 000	40
1 800	72	300	11.8	750	29.5	. . .	. . .	. . .	. . .	1 120	42
2 200	84	300	11.8	900	35.4	. . .	. . .	. . .	. . .	1 250	50
2 500	96	300	11.8	1 050	41.3	. . .	. . .	. . .	. . .	1 400	54
2 800	108	300	11.8	1 050	41.3	. . .	. . .	. . .	. . .	1 600	60
3 100	120	300	11.8	900	35.4	1 200	47.2	. . .	. . .	1 800	72
3 400	132	300	11.8	900	35.4	1 500	59	. . .	. . .	2 000	78
3 700	144	300	11.8	900	35.4	1 650	65	. . .	. . .	2 200	84
4 000	156	300	11.8	900	35.4	1 650	65	. . .	. . .	2 400	96
4 600	180	300	11.8	900	35.4	1 500	59	2 100	82.7	2 600	102
5 200	204	300	11.8	900	35.4	1 500	59	2 100	82.7	2 800	108
. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	3 000	120

GENERAL NOTE: Mounting slots are symmetrical about the centerlines.

NOTE:

(1) Calculate *L* based on dimension *A* in Table 11.

NOTE: For presses that conform to the historical JIC standards, the middle T-slot is on the front-to-back centerline of the bolster and the slide.

5.10 Pneumatic Die Cushions

Pneumatic die cushions, when provided, shall meet the following requirements:

(a) Die cushion capacity shall be approximately 15% of the rated capacity of the press.

(b) Pneumatic die cushion capacities shall be rated at 700 kPa (100 psi) of air pressure.

(c) Die cushion stroke shall be approximately one third of the press stroke.

(d) The distance between the die cushion pin plate and the top of the bed shall be 12.7 mm (0.50 in.) with tolerances of +0 −0.75 mm (−0.030 in.). Means shall be provided, integral with the die cushion, to positively stop the die cushion stroke at its upper limit. With multiple die cushions within the press bed, measured total variation between die cushion pin plates at the upper limit of stroke shall not exceed 0.25 mm (0.010 in.).

(e) Die cushion pin plate(s) shall be provided with a minimum wear surface Brinell hardness of 300.

(f) Pneumatic die cushion pressure variation shall not exceed 20% during a complete press cycle.

5.11 Hydraulic Die Cushions

(a) Due to the wide variety of applications for hydraulic die cushions, no standards have been developed. Features that have been incorporated include the following:

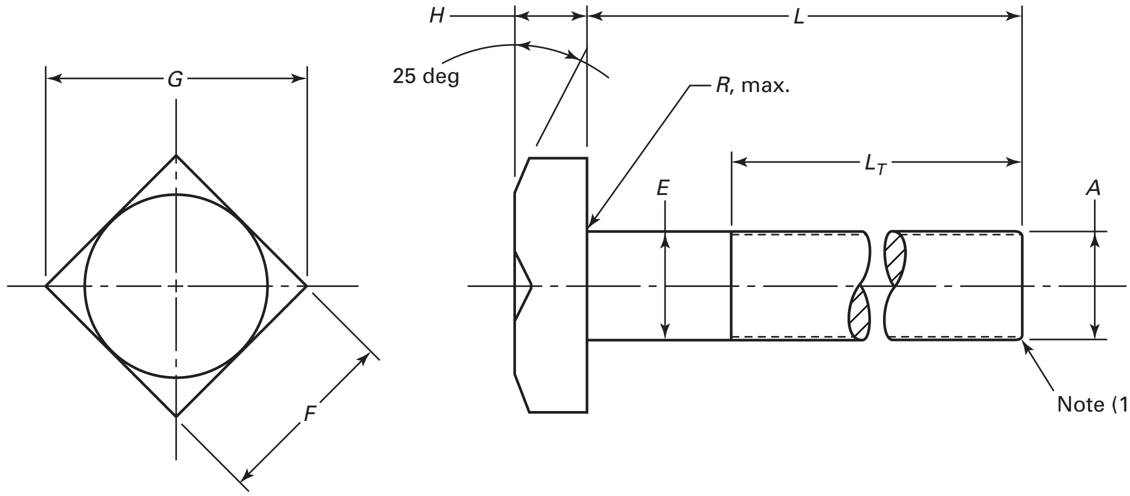


Table 14 Bolster Mounting Bolt Dimensions

Dimension/Description		M20 (3/4 – 10) mm	M20 (3/4 – 10) in.	M24 (1 – 8) mm	M24 (1 – 8) in.	M30 (1 1/4 – 7) mm	M30 (1 1/4 – 7) in.
E	Nominal diameter	20	0.75	24	1.0	30	1.25
F	Nominal head width	30	1.2	36	1.42	46	1.81
	Maximum head thickness	30	1.2	36	1.42	46	1.81
	Maximum head width	29	1.14	34.8	1.37	44.5	1.75
G	Minimum width across corners	39.8	1.57	47.8	1.88	61.1	2.4
H	Nominal head thickness	14	0.55	16	0.63	20	0.79
	Maximum head thickness	14.5	0.57	16.7	0.66	20.8	0.82
	Minimum head thickness	13.4	0.53	15.3	0.6	19.2	0.76
R	Maximum radius	2	0.08	2	0.08	2	0.08
A	Thread data:						
	Pitch	2.5	0.10	3	0.125	3.5	0.143
	Basic major diameter	19.6	0.75	23.95	1.0	29.95	1.25
	Basic pitch diameter	18.38	0.69	22.05	0.92	27.73	1.16
L_T	Minimum full thread length	50	2.0	58	2.3	70	2.8

NOTE:
(1) 45 deg chamfer round point or first thread rolled undersize to facilitate assembly.

(1) programmable force throughout the stroke

(2) programmable ejection function (hold-down feature)

(3) pre-acceleration to reduce slide impact

(b) Die cushion capacity shall be a minimum of 15% of the rated capacity of the press.

(c) Die cushion stroke shall be a minimum of one-third of the press stroke.

(d) The distance between the die cushion pin plate and the top of the bed shall be 12.7 mm (0.50 in.) with tolerances of +0 −0.75 mm (−0.030 in.). Means shall be provided, integral with the die cushion, to positively stop the die cushion stroke at its upper limit. With multiple die cushions within the press bed, measured total variation between die cushion pin plates at the upper limit of stroke shall not exceed 0.25 mm (0.010 in.).

(e) Die cushion pin plate(s) shall be provided with a minimum wear surface Brinell hardness of 300.

5.12 Pressure Pins

(a) Pressure pins shall meet the following requirements:

(1) For normal service, material shall be SAE 1020 cold drawn steel.

(2) For heavy service, the material shall be SAE 1020 cold drawn steel, carburized 1.3 mm (0.05 in.) to 1.5 mm (0.06 in.) deep and hardened to 50–60 Rockwell C Scale.

(3) Tolerance of the diameter shall be +0 −0.13 mm (−0.005 in.).

(4) Ends shall be smooth, flat, and square to the pin.

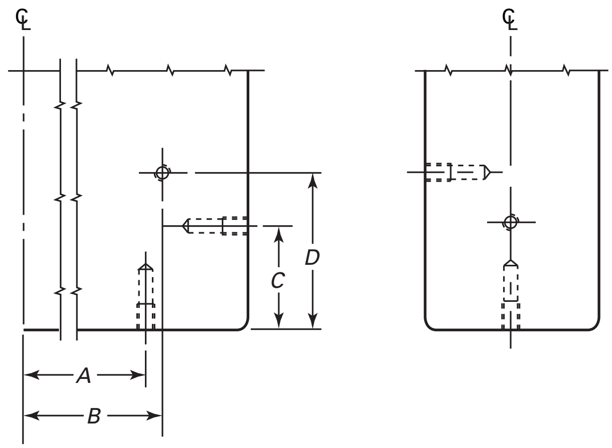


Table 15 Bolster Handling Holes: Single-Point Press

Bed, Left to Right		Tap Size Class 3		Tap Depth		A		B		C		D	
mm	in.	SI	Customary	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
630	24	M20	¾ – 10	38	1.5	280	11	280	11	75	3	190	7.5
800	33	M20	¾ – 10	38	1.5	300	11.8	300	11.8	75	3	190	7.5
1 000	40	M20	¾ – 10	38	1.5	450	17.7	450	17.7	75	3	190	7.5
1 250	50	M20	¾ – 10	38	1.5	450	17.7	450	17.7	75	3	190	7.5
1 600	60	M20	¾ – 10	38	1.5	600	23.6	600	23.6	75	3	190	7.5

(b) Dimensions for plain pressure pins and pressure pinholes shall be as specified in Table 20. Pressure pinhole patterns are specified in Table 21.

(c) Dimensions for headed pressure pins shall be as specified in Fig. 7.

(d) Dimensions of headed pressure pinholes in top surface of bolster shall be as specified in Fig. 8.

(e) Dimensions of pressure pinholes plugs shall be as specified in Table 22.

(f) Pressure Pinhole Location Identification System

(1) Letters and numbers shall be 13 mm (0.5 in.) high.

(2) Letters and numbers shall be used in the manner shown in Fig. 9.

(3) The front of the bolster shall be designated by stamping *FRONT* in letters that are at least 25 mm (1 in.) high.

5.13 Knockouts

(a) Provisions for knockouts are optional. Specifications for the requirements shall be provided by the purchaser.

(b) Knockout bar travel shall be one-third of the length of the slide stroke, but shall not exceed 200 mm (8 in.).

(c) Total knockout capacity should be 10% of the rated capacity of the press.

5.14 Counterbalance

The counterbalance, when provided, shall meet the following requirements:

(a) It shall balance the combined weight of the slide, upper die, and attachments.

(b) The maximum allowable upper die weight is calculated as one-third of the die space in solid steel.

(c) Pneumatic counterbalance pressure variation shall not exceed 20% during a complete press cycle.

5.15 Machining Specifications

5.15.1 Tolerances. The following tolerances shall apply to die space related dimensions:

(a) bolster left-to-right and front-to-back dimensions: ±6 mm (±0.25 in.)

(b) bolster thickness: ±0.4 mm (±0.016 in.)

(c) bolster mounting slots and holes, from bolster centerlines: ±0.4 mm (±0.016 in.)

(d) die mounting holes, from centerlines of slide: ±0.4 mm (±0.016 in.)

(e) T-slot locations, from centerlines of bolster and slide: ±0.4 mm (±0.016 in.)

(f) pressure pinholes, from centerlines of bolster and slide: ±0.4 mm (±0.016 in.)

(g) knockout holes, from front-to-back slide centerline: ±0.8 mm (±0.032 in.)

5.15.2 Surface Finish. The following specifications shall apply to surface finishes:

(a) bed surface and slide face, R_a: 3.2 μm (125 μin.)

(b) top and bottom of bolster, R_a: 3.2 μm (125 μin.)

(c) edges of mounting hole pockets, R_a: 6.3 μm (250 μin.)

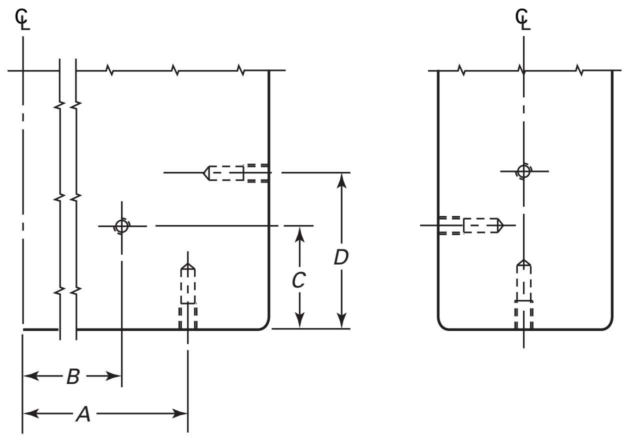


Table 16 Bolster Handling Holes: Two-Point and Four-Point Press

Bed, Left to Right		Tap Size Class 3		Tap Depth		A		B		C		D	
mm	in.	SI	Customary	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.
800	32	M20	3/4 – 10	38	1.5	300	11.8	300	11.8	150	6	230	9
1 250	50	M20	3/4 – 10	38	1.5	450	17.7	450	17.7	150	6	230	9
1 400	54	M20	3/4 – 10	38	1.5	450	17.7	450	17.7	150	6	230	9
1 600	60	M20	3/4 – 10	38	1.5	600	23.6	600	23.6	150	6	230	9
1 800	72	M20	3/4 – 10	38	1.5	750	29.5	750	29.5	150	6	230	9
2 200	84	M24	1 – 8	50	2	900	35.4	900	35.4	150	6	230	9
2 500	96	M24	1 – 8	50	2	1 050	41.3	1 050	41.3	150	6	230	9
2 800	108	M24	1 – 8	50	2	1 200	47.2	1 200	47.2	150	6	230	9
3 100	120	M24	1 – 8	50	2	1 350	53.1	1 350	53.1	150	6	230	9
3 400	132	M30	1 1/4 – 7	57	2.25	1 500	59	1 500	59	150	6	230	9
3 700	144	M30	1 1/4 – 7	57	2.25	1 650	65	1 650	65	150	6	230	9
4 000	156	M30	1 1/4 – 7	57	2.25	1 800	70.9	1 800	70.9	150	6	230	9
4 600	180	M38	1 1/2 – 6	70	2.75	2 100	82.7	2 100	82.7	150	6	230	9
5 200	204	M38	1 1/2 – 6	70	2.75	2 400	94.5	2 400	94.5	150	6	230	9

5.15.3 Chamfers. The following components shall be provided with the specified chamfers:

(a) all bolster edges and shank holes: 6 mm (0.25 in.) × 45 deg

(b) pressure pinholes: 1.5 mm (0.06 in.) × 45 deg

(c) knockout pin ends and knockout holes: 1.5 mm (0.06 in.) × 45 deg

6 ACCEPTANCE CONDITIONS

6.1 Press Accuracy

The press shall be precision leveled in order to prevent cross-corner binding of the slide in the gibs and to ensure a level datum plane on which to base measurements of press accuracy. The validity of the test is dependent on this datum plane being flat and level within accepted limits. The bed shall be established as the datum plane for leveling the press. The bolster (or bed) surface shall be established as the datum plane for slide parallelism and alignment. See Fig. 10.

6.1.1 Acceptance Limits for Level. The datum plane shall be level within 0.04 mm/m (0.0005 in./ft) of die space dimensions, as measured at the centers of the left-to-right and front-to-back dimensions. Measurements shall be made with a 10 second level having a sensitivity of 0.04 mm per graduation per meter (0.0005 in./ft).

6.1.2 Flatness: Bed and Slide Face. Flatness of the tool attachment surface shall be within 0.04 mm/m (0.0005 in./ft) with a maximum total not to exceed 0.25 mm (0.01 in.).

NOTE: The acceptance condition of flatness of bed and slide shall be made at the time of machining by the supplier.

6.1.3 Bolster Flatness and Parallelism. See Fig. 11.

6.1.4 Parallelism Between Slide Face and Bed or Bolster Surface. Parallelism between the slide face and the bed or bolster surface, measured front-to-back and left-to-right, shall be within the following maximum tolerance (see Fig. 12.):

(a) at the end of the slide stroke: 0.08 mm/m (0.001 in./ft)

(b) at mid-stroke (both closing and opening): 0.25 mm/m (0.003 in./ft)

Measurements shall be made:

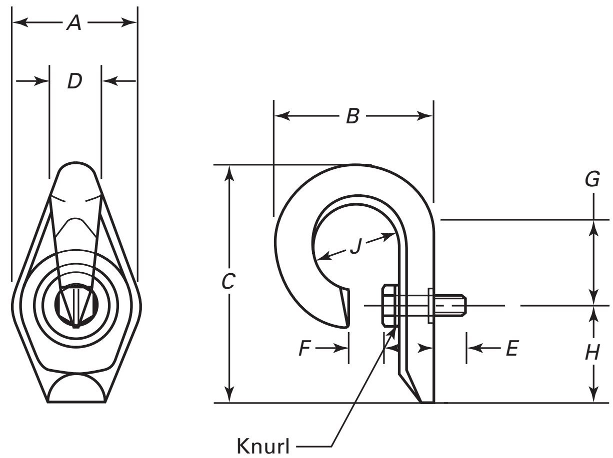


Table 17 Bolster Handling Hook Dimensions

	Rated Capacity							
	27 kN (3 tons)		53 kN (6 tons)		80 kN (9 tons)		134 kN (15 tons)	
Dimension	mm	in.	mm	in.	mm	in.	mm	in.
A	76	3	89	3.5	102	4	114	4.5
B	130	5.13	166	6.63	203	8	241	9.5
C	189	7.44	229	9	268	10.57	308	12.13
D	29	1.13	38	1.5	51	2	64	2.5
E	35	1.38	44	1.75	52	2.06	64	2.5
F	35	1.38	41	1.63	51	2	51	2
G	70	2.75	89	3.5	108	4.25	121	4.75
H	73	2.88	89	3.5	102	4	114	4.5
J	76	3	89	3.5	102	4	114	4.5

Table 18 Bolster Handling Hook Bolt Dimensions

Capacity		Diameter		Thread	
kN	tons	mm	in.	SI	Customary
27	3	20	0.75	M20	10NC – 3
53	6	24	1.0	M24	8NC – 3
80	9	30	1.25	M30	7NC – 3
134	15	38	1.5	M38	6NC – 3

(a) with the adjustment up

(b) under no load and set for normal running conditions (manufacturers will advise)

(c) with sufficient counterbalance force to overcome the cumulative clearances (lost motion) of the press drive

EXAMPLE: The parallelism of a press with a 2 500 mm (100 in.) dimension should be within 0.2 mm (0.008 in.) at the end of the slide stroke and 0.6 mm (0.024 in.) at mid-stroke.

6.1.5 Squareness: Slide Travel. The total runout F.I.M. (full indicator movement) of slide travel shall not exceed 0.1 mm (0.004 in.) for the first 100 mm (4 in.) of travel, and shall not exceed 0.01 mm (0.0004 in.) for each additional 100 mm (4 in.) of travel. See Fig. 13.

Measurements shall be made:

(a) both left-to-right and front-to-back

(b) for the one-third of the slide travel that precedes the end of the stroke

(c) with sufficient counterbalance force to overcome the cumulative clearances (lost motion) of the press drive

6.1.6 Parallelism: Die Cushion Pin Plate. Parallelism between the surface of the die cushion pin plate and the top of the bed shall be parallel within 0.33 mm/m (0.004 in./ft) of die cushion dimensions, both left-to-right and front-to-back, not to exceed 0.75 mm (0.030 in.).

6.2 Bed and Slide Deflection

The allowable deflection of the bed and slide shall comply with the design criteria specified in para. 4.4(b).

6.3 Slide Parallelism Under Load

The following is the procedure for checking parallelism of a mechanical press slide under load (see Fig. 14):

(a) Utilize a matched set of load cells, stanchions and spacers.

(b) Verify that the press slide is at bottom dead center.

(c) Adjust the slide down to make contact with the load cells.

(d) From top dead center, cycle press at full speed and take readings from load cell amplifier.

(e) Adjust the slide down in small increments to increase load to 50% to 70% of rated capacity.

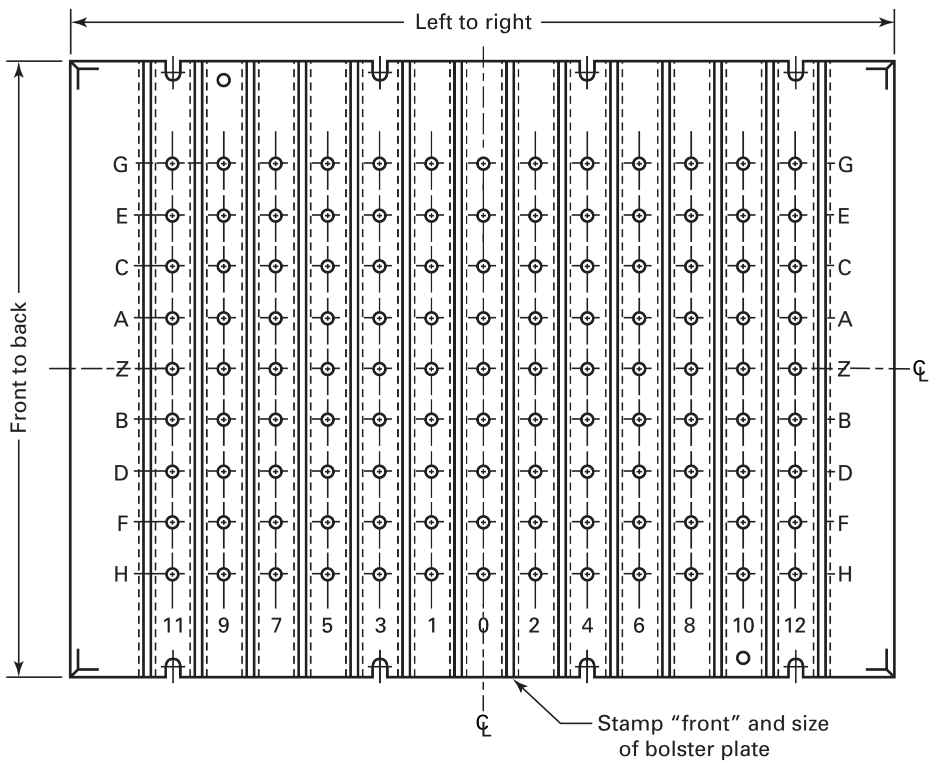


Fig. 5 Typical Bolster

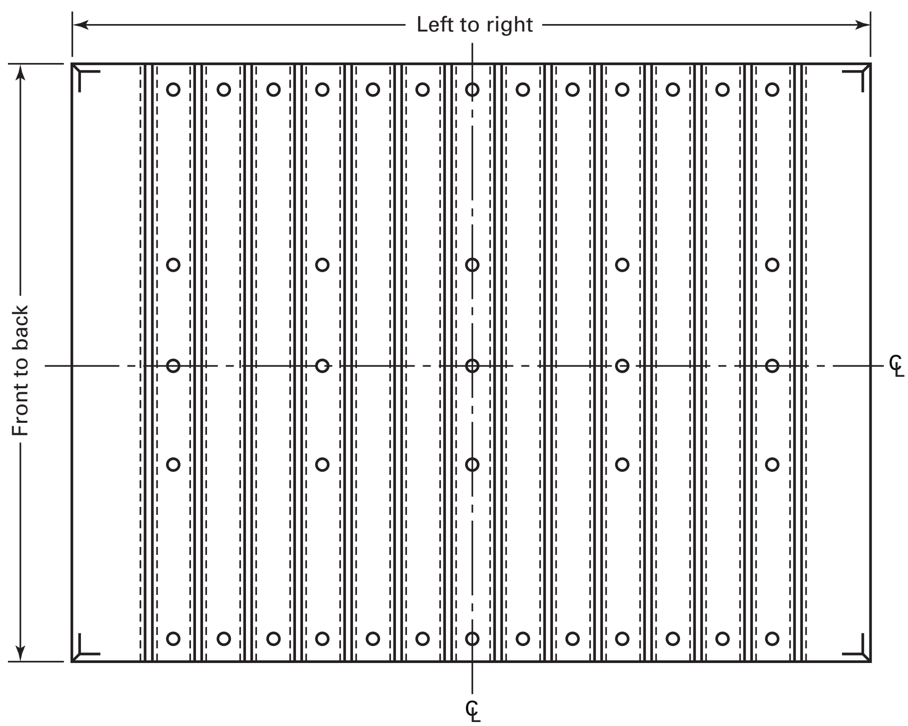


Fig. 6 Typical Slide

Table 19 Number of T-Slots

Bed, Left to Right		Number of T-Slots
mm	in.	
630	24	4
800	32	4
1 000	40	6
1 250	50	8
1 400	54	8
1 600	60	10
1 800	72	10
2 200	84	12
2 500	96	14
2 800	108	16
3 100	120	18
3 400	132	20
3 700	144	22
4 000	156	24
4 600	180	28
5 200	204	32

(f) Record all readings. (Calibrate the load monitor if the press is so equipped.)

An acceptable variance (using load cells) within all corners is 1.5% of the rated press capacity.

EXAMPLE: For 10 000 kN (1,100 ton), a variance of 150 kN (16.5 tons) is acceptable.

7 HEALTH AND SAFETY

7.1 Ergonomics

Ergonomic considerations in the design of power presses are provided in ANSI B11-TR1, Ergonomic Guidelines for the Design, Installation and Use of Machine Tools.

7.2 Safeguarding

Safeguarding requirements in the use of power presses are provided in the following:

(a) Code of Federal Regulations (CFR) (mandated by OSHA)

(1) 29 CFR 1910.147
(2) 29 CFR 1910.212
(3) 29 CFR 1910.217
(4) 29 CFR 1910.219

(b) American National Standards Institute (ANSI)

(1) ANSI B11.1
(2) ANSI B11.2
(3) ANSI B11.19
(4) ASME B15.1
(5) ANSI/NFPA 79

(c) National Safety Council (General Requirements)

(1) Accident Prevention Manual for Business and Industry (Volumes 1 and 2)
(2) Power Press Safety Manual

8 INFORMATION AND INSTRUCTIONS

8.1 Identification

The manufacturer shall provide data plates of durable material, permanently attached, to display information applicable to the press and its accessories. Letters and numbers shall be at least 3 mm (0.12 in.) high.

8.1.1 Press Data Plate. A data plate shall be attached to the front right hand side of the press, its height not to exceed 2 000 mm (80 in.) from floor level. See Figs. 15 and 16 for examples.

8.1.2 Counterbalance Data Plate. A data plate shall be attached adjacent to the counterbalance system pressure control. See Fig. 17 for an example.

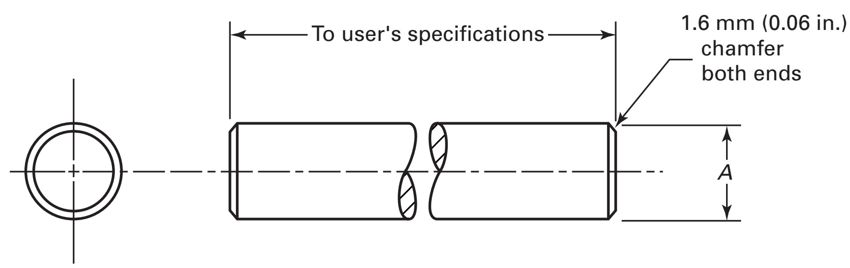


Table 20 Plain Pressure Pin

Press Capacity		A		Pressure Pinhole Diameter	
kN	tons	mm	in.	mm	in.
250–2 000	30–225	25	1.0	27	1.06
2 000–25 000	225–2,810	38	1.5	40	1.6

Table 21 Pressure Pinhole Patterns

Left to Right			Front to Back				
Bed Dimension		Rows of Holes	Bed Dimension		Capacity		Rows of Holes
mm	in.		mm	in.	kN	tons	
630	24	3	600	23.6	. . .	. . .	3
800	32	3	800	31.5	. . .	. . .	3
1 000	40	5	900	35.4	. . .	. . .	5
1 250	50	7	1 000	39.4	. . .	. . .	5
1 400	54	7	1 120	44.1	. . .	. . .	5
1 600	60	9	1 250	49.2	< 4 000	< 450	7
					≥ 4 000	≥ 450	5
1 800	72	9					
2 200	84	11	1 400	55.1	. . .	. . .	7
2 500	96	13	1 600	63	< 4 000	< 450	9
					≥ 4 000	≥ 450	7
2 800	108	15					
3 100	120	17	1 800	70.8	< 4 000	< 450	11
					≥ 4 000	≥ 450	9
3 400	132	19					
3 700	144	21	2 000	78.7	. . .	. . .	11
4 000	156	23	2 200	86.6	. . .	. . .	11
4 600	180	27	2 400	94.5	. . .	. . .	13
5 200	204	31	2 600	102.4	< 10 000	< 1,125	15
					≥ 10 000	≥ 1,125	13
			2 800	110.2	. . .	. . .	15
			3 000	118.1	. . .	. . .	17

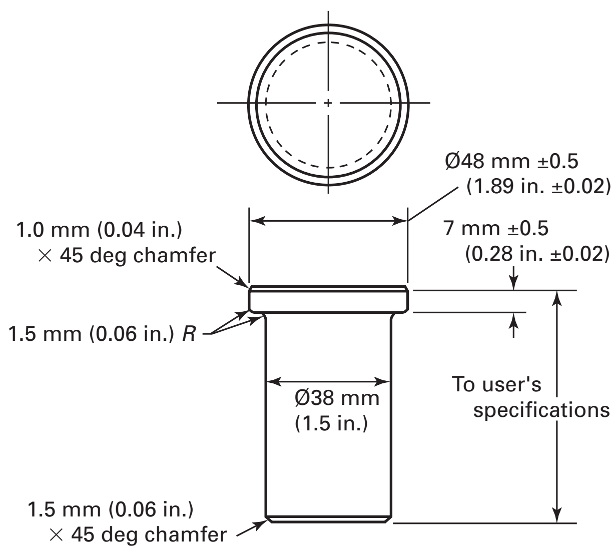


Fig. 7 Headed Pressure Pin

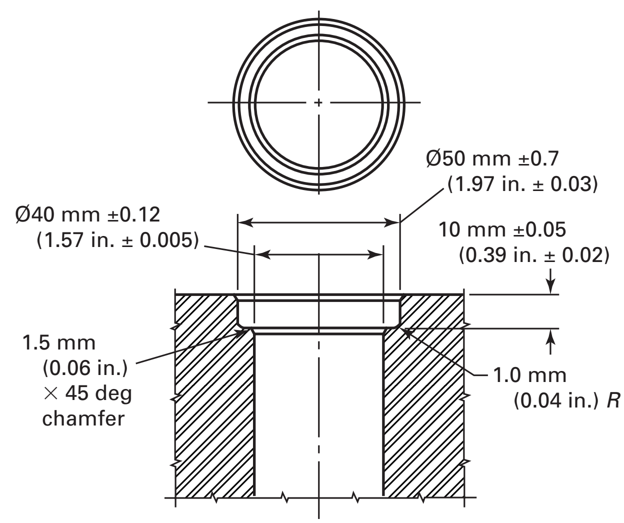


Fig. 8 Headed Pressure Pinhole

8.1.3 Die Cushion Data Plate. When a die cushion is provided, a data plate shall be attached adjacent to the die cushion system pressure control. See Fig. 18 for an example.

8.1.4 Clutch/Brake Data Plate. When a pneumatic clutch/brake is provided, a data plate shall be attached adjacent to the pressure regulator to indicate clutch/brake air pressure for rated capacity.

8.1.5 Lubrication and Operating Fluid Data Plate. Lubrication and operating fluid data plates, when provided, shall be attached near lubricant fill points.

8.1.6 Press Designation. The designation of presses shall be displayed on the front of the press crown and shall be in accordance with the system depicted on Fig. 19.

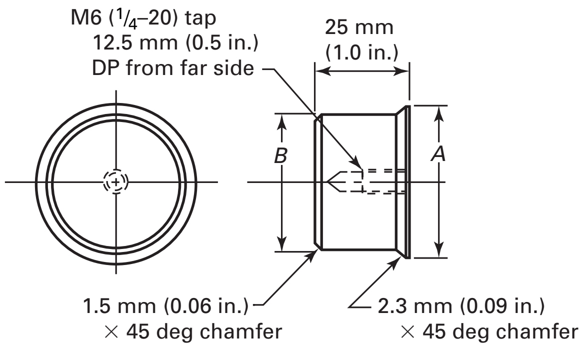


Table 22 Pressure Pinhole Plug

A		B	
mm	in.	mm	in.
29.6	1.14	25	0.98
42.6	1.68	38	1.50

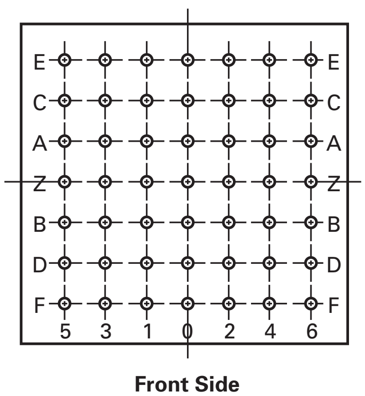


Fig. 9 Pressure Pinhole Location Identification System

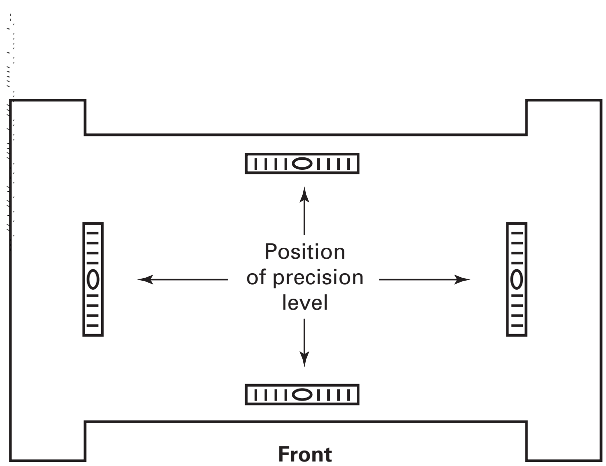


Fig. 10 Establishing the Bed as the Datum Plane

EXAMPLE: SE2 – 4 000 – 2 500 × 1 400 designates a single straight side press with a two-point eccentric gear drive, 4 000 kN capacity, and 2 500 mm × 1 400 mm die space.

8.1.7 Serial Number

(a) The press serial number shall be permanently marked on the left front upright below the gibs, in letters and numbers at least 6 mm (0.25 in.) high.

(b) The press serial number shall also be permanently marked in a readily visible location on the press slide.

(c) For presses with a four-piece tie-rod frame, the press serial number shall also be permanently marked in readily visible locations on the right hand upright, crown, and bed.

8.2 Shipping and Assembly Provisions

(a) Junction boxes and unions shall be located to facilitate press assembly without removing wiring, conduit, piping, or lubrication lines.

(b) Each subassembly (uprights, crown, slide, and bed) shall be clearly and permanently identified with the following information:

(1) press serial number

(2) weight of each major subassembly

(3) the word *FRONT* to designate the front of the press

(c) Utility connections shall be located so that the connections can be readily made after the press is erected.

(d) Properly designed handling holes or hooks shall be provided for safe handling of each major subassembly. Handling holes or hooks shall be located to avoid interference with accessories and mounted on a machined surface.

(e) Safety cables or straps shall be provided to secure major components that are mounted external to the press frame (i.e., motors, surge tanks, etc.).

8.3 Instruction Manual

(a) The manufacturer shall provide a minimum of two instruction manuals on proper:

(1) installation

(2) operation

(3) maintenance

(4) safeguarding

(b) For mechanical power presses, the instruction manual shall include the following information:

(1) rated capacity based on drive torque

(2) press capability based on usable flywheel energy

(3) slide velocity characteristics

This information can be combined into a single press capability graph such as the example shown in Figs. 20 and 21.

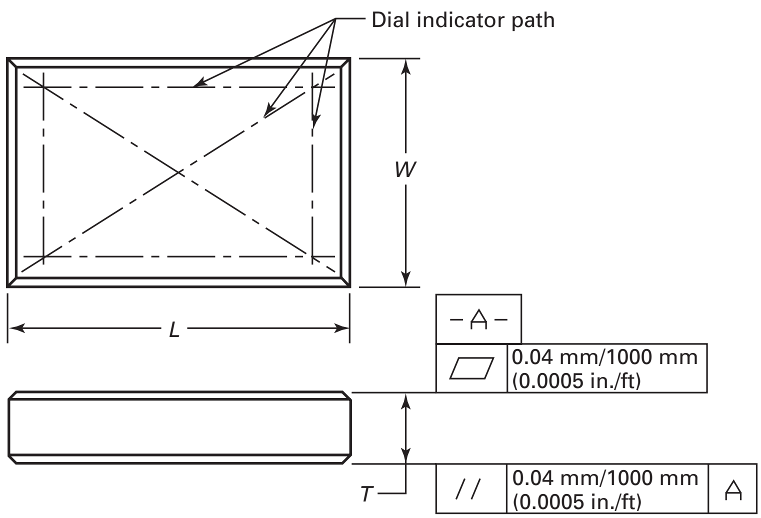


Fig. 11 Bolster Flatness and Parallelism

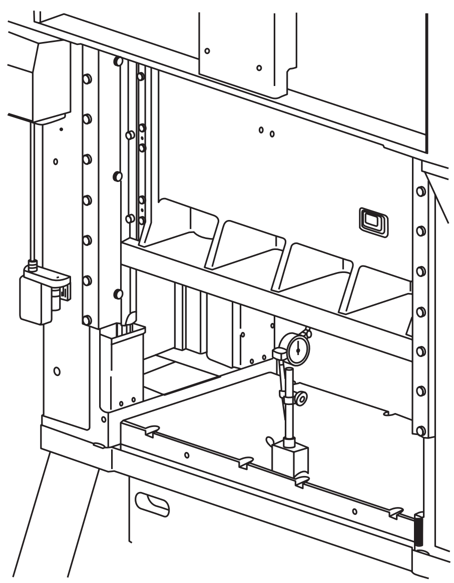


Fig. 12 Checking Parallelism From Slide Face to Bed or Bolster Surface

9 DECLARATION OF MANUFACTURER'S COMPLIANCE

Upon request, the machine manufacturer shall provide a certificate of compliance with this Standard. The certificate, entitled "ASME B5.61 COMPLIANCE," shall include the following information:

(a) manufacturer
(b) press designation
(c) machine model
(d) machine serial number
(e) date

10 REFERENCE STANDARDS

10.1 Normative References

ANSI B11.TR-1-1995, Ergonomic Guidelines for the Design, Installation and Use of Machine Tools
ANSI B11.1-2002, Machine Tools — Mechanical Power Presses — Safety Requirements for Construction, Care, and Use
ANSI B11.2-1995 (R2002), Hydraulic Power Presses
ANSI B11.19-1990 (R1996), Performance Criteria for Safeguarding Machine Tools

Publisher: American National Standards Institute (ANSI), 25 West 43rd Street, New York, NY 10036

ASME B5.1M-1985 (R1998), T-Slots — Their Bolts, Nuts, and Tongues
ASME B5.49-1998, Glossary of Power Press Terms
ASME B5.51M-1979 (R2002), Preferred SI Units for Machine Tools
ASME B15.1-2000, Safety Standard for Mechanical Power Transmission Apparatus

Publisher: The American Society of Mechanical Engineers (ASME International), Three Park Avenue, New York, NY 10016-5990; Order Department: 22 Law Drive, Box 2300, Fairfield, NJ 07007-2300

29 CFR 1910.147, The Control of Hazardous Energy (Lockout/Tagout)
29 CFR 1910.212, General Requirements for All Machines
29 CFR 1910.217, Mechanical Power Presses
29 CFR 1910.219, Mechanical Power-Transmission Apparatus

Publisher: Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402-9325

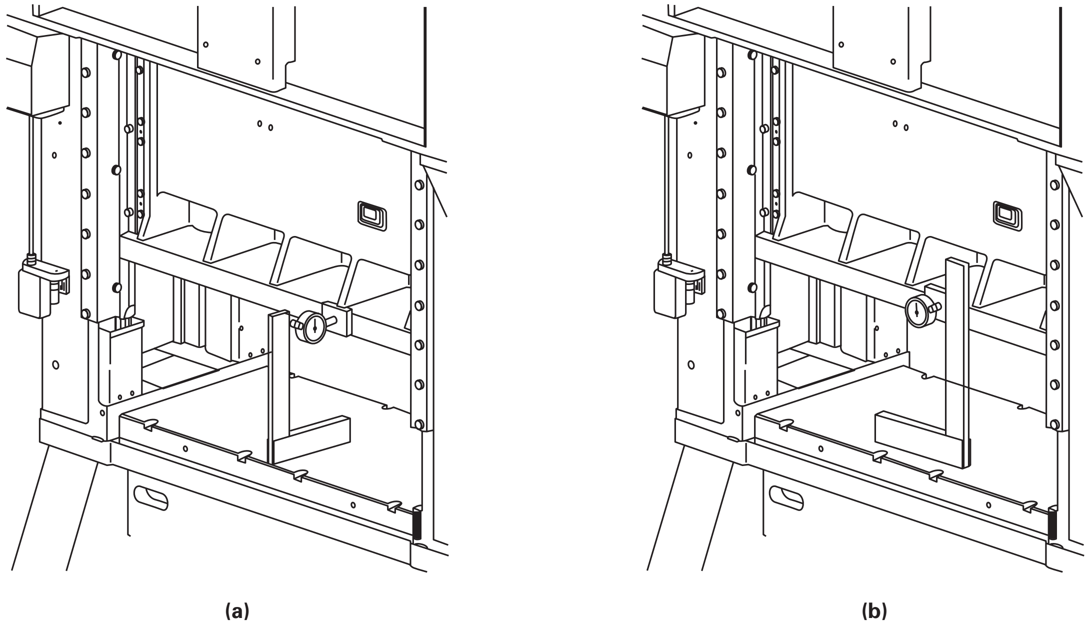


Fig. 13 Checking Squareness of Slide Travel

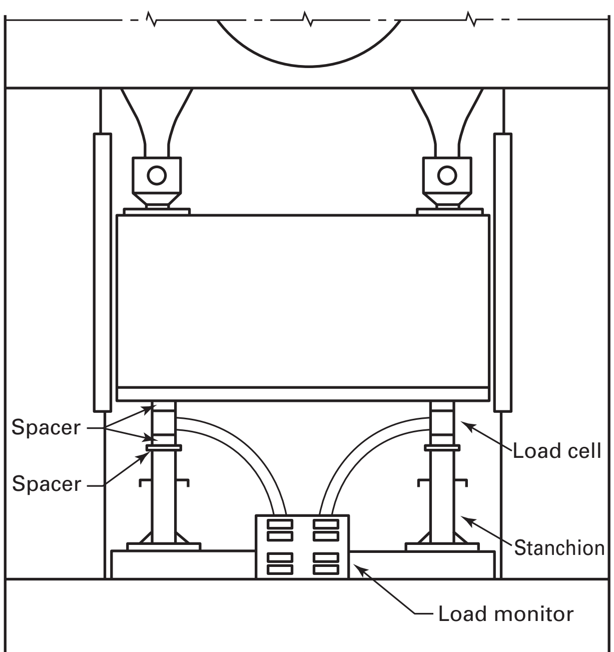


Fig. 14 Leveling the Slide Using Load Cells

NFPA 79-1997, Electrical Standard for Industrial Machinery

Publisher: National Fire Protection Association (NFPA), 1 Batterymarch Park, Quincy, MA 02269-9101

Accident Prevention Manual for Business and Industry (Volumes 1 and 2)
Power Press Safety Manual

Publisher: National Safety Council (NSC), 1121 Spring Lake Drive, Itasca, IL 60143-3201

10.2 Informative References

ANSI B93.114M-1987, Pneumatic Fluid Power — Systems Standard for Industrial Machinery

Publisher: American National Standards Institute (ANSI), 25 West 43rd Street, New York, NY 10036

ASME B5.52-2003, Mechanical Power Presses: General Purpose, Single Point, Gap Type

Publisher: The American Society of Mechanical Engineers (ASME International), Three Park Avenue, New York, NY 10016-5990; Order Department: 22 Law Drive, Box 2300, Fairfield, NJ 07007-2300

ISO 9188:1993, Machine Tools — Straight-sided single-action mechanical power presses from 400 kN up to and including 4 000 kN nominal force — Characteristics and dimensions

PRESS DATA			
SERIAL NUMBER			
MODEL NUMBER			
CAPACITY	kN (tons) at		mm (in.)
USABLE FW ENERGY	kN•m (in.-tons) at		SPM
STROKES PER MINUTE			SPM
SHUTHEIGHT-SLIDE TO BED, SDAU			mm (in.)
ADJUSTMENT OF SLIDE			mm (in.)

Fig. 15 Press Data Plate: Mechanical Press

PRESS DATA		
SERIAL NUMBER		
MODEL NUMBER		
CAPACITY		kN (tons)
SPEED AT FULL CAPACITY		mm/s (IPM)
SHUTHEIGHT-SLIDE TO BED, SDAU		mm (in.)
ADJUSTMENT OF SLIDE		mm (in.)

Fig. 16 Press Data Plate: Hydraulic Press

COUNTERBALANCE PRESSURE SETTING			
UPPER DIE WEIGHT kg (lbs)	AIR PRESSURE kPa (psi)	UPPER DIE WEIGHT kg (lbs)	AIR PRESSURE kPa (psi)
0			
MAX. OPERATING PRESSURE			kPa (psi)

Fig. 17 Counterbalance Data Plate

ISO 9189:1993, Machine Tools — Straight-sided high-speed mechanical power presses from 250 kN up to and including 4 000 kN nominal force — Characteristics and dimensions
Publisher: International Organization for Standardization (ISO), 1 rue de Varembé, Case Postale 56, CH-1211, Genève 20, Switzerland/Suisse

NFPA/T2.24.1 R1-2000, Hydraulic Fluid Power — Systems Standard for Stationary Industrial Machinery — Supplement to ISO 4413:1998, Hydraulic Fluid Power — General Rules Relating to Systems

Publisher: National Fluid Power Association (NFPA), 3333 North Mayfair Road, Milwaukee, WI 53222-3219

DIE CUSHION DATA

SERIAL NUMBER ____________

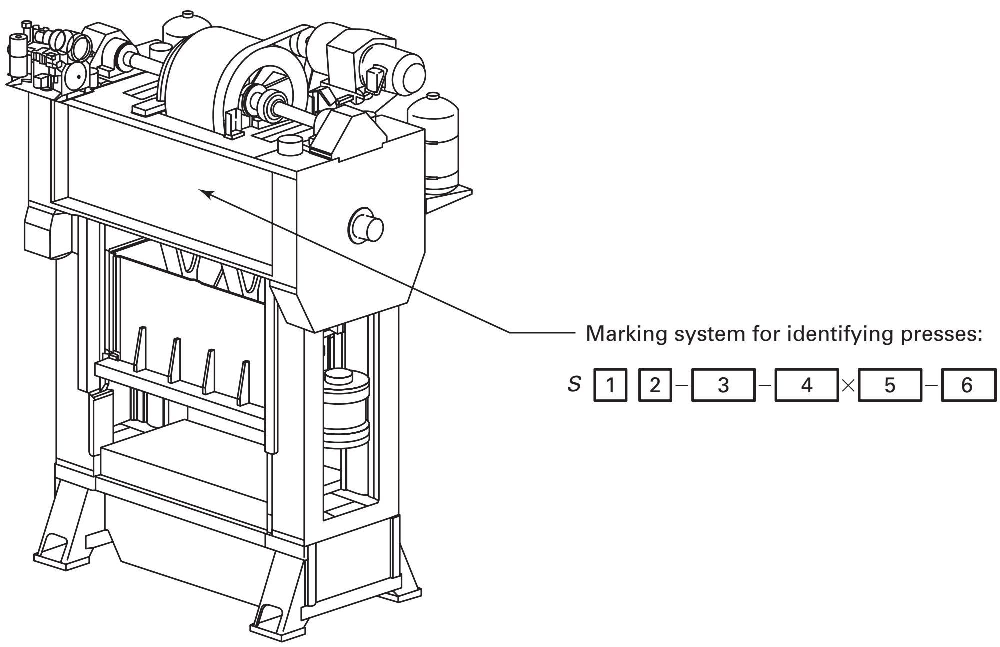
MODEL ____________

STROKE ____________ mm (in.)

CAPACITY ____________ kN (tons) at ____________ kPa (psi)

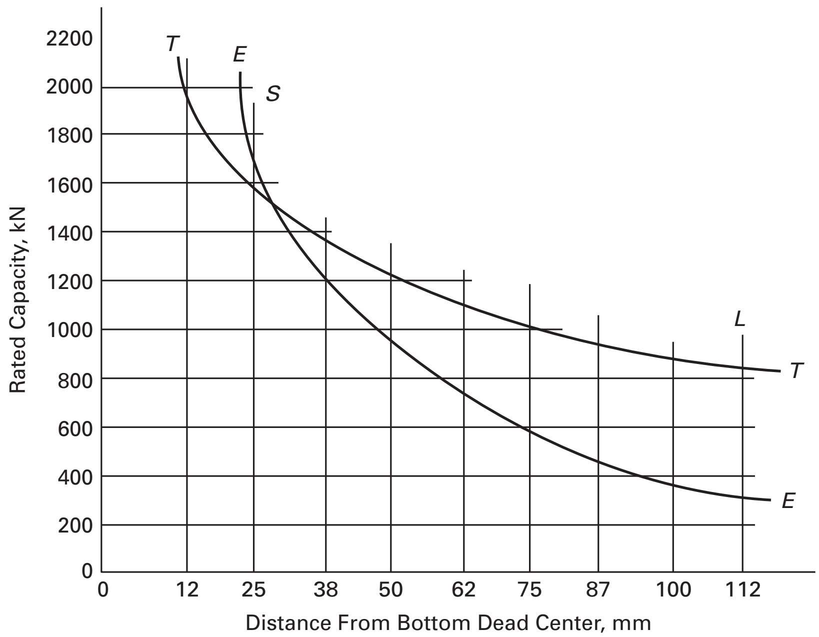
MAX. OPERATING PRESSURE ____________ kPa (psi)

Fig. 18 Die Cushion Data Plate



S = single action straight side press
1 = type of press:
  C = crankshaft or eccentric shaft
  E = eccentric gear
  H = hydraulic
  L = link drive
2 = number of slide connections
3 = rated capacity,kN
4 = left-to-right dimension of bed and bolster, mm
5 = front-to-back dimension of bed and bolster, mm
6 = special manufacturer's designation

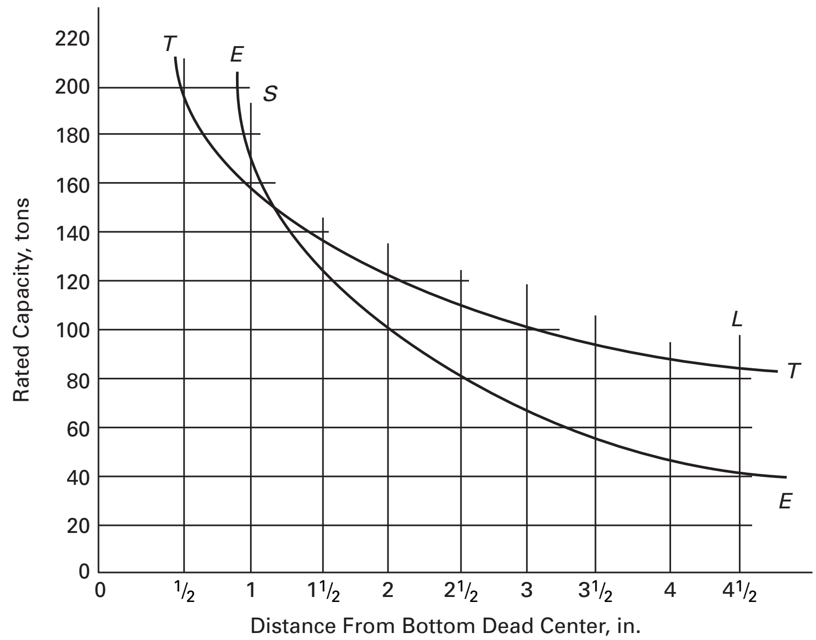
Fig. 19 Press Designation System



E = energy capacity limit
L = stroke length limit
S = structural capacity limit
T = torque capacity limit

GENERAL NOTES:
(a) Capacity = 2 000 kN at 12 mm.
(b) Stroke length = 250 mm.
(c) Usable energy = 40.7 kN·m.

Fig. 20 Press Capability Graph (Metric)



E = energy capacity limit
L = stroke length limit
S = structural capacity limit
T = torque capacity limit

GENERAL NOTES:

(a) Capacity = 225 tons at 1/2 in.

(b) Stroke length = 10 in.

(c) Usable energy = 180 in.-tons.

Fig. 21 Press Capability Graph (U.S. Customary)

MANDATORY APPENDIX I
MECHANICAL POWER PRESS CAPACITY ABOVE RATING POINT OF 12.7 mm (0.5 in.)

Table I-1 Percent of Rated Capacity

Stroke mm	Stroke in.	12.7 (0.5)	19 (0.75)	25 (1)	38 (1.5)	50 (2)	75 (3)	100 (4)	125 (5)	150 (6)	200 (8)	250 (10)	300 (12)
		Distance From Bottom Dead Center, mm (in.)											
80	3	100	87	80	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
100	4	100	86	78	71	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .
125	5	100	85	76	68	65	. . .	. . .	. . .	. . .	. . .	. . .	. . .
150	6	100	84	75	66	61	. . .	. . .	. . .	. . .	. . .	. . .	. . .
200	8	100	83	74	63	58	53	. . .	. . .	. . .	. . .	. . .	. . .
250	10	100	83	73	62	56	50	47	. . .	. . .	. . .	. . .	. . .
300	12	100	83	73	61	55	48	44	43	. . .	. . .	. . .	. . .
400	16	100	83	72	60	53	46	42	39	38	. . .	. . .	. . .
500	20	100	82	72	60	53	45	40	37	36	34	. . .	. . .
600	24	100	82	72	59	52	44	39	36	34	32	31	. . .
800	32	100	82	71	59	52	43	38	35	33	30	28	27

The "slider crank" motion, imparted by a crankshaft, eccentric shaft, or eccentric gear, produces the reciprocating motion of the press slide. The changing mechanical advantage that results from the changing geometry of the crank arm position, relative to the slide connection(s), converts the constant torque of the rotating drive members into a varying linear force when applied by the slide. This force is at its minimum when the crank arm and connection form a right angle (near midstroke). It is at its maximum when the slide approaches the end of its travel.

EXAMPLES:

(1) *Capacity of 4 000 kN press, 400 mm stroke, 50 mm from bottom of stroke.* From Table I-1, the capacity is 53% of rated capacity at 50 mm from bottom dead center (BDC). Capacity: 4 000 kN × 0.53 = 2120 kN

(2) *Capacity of 450 ton, 8 in. stroke, 2 in. from bottom of stroke.* From Table I-1, the capacity is 58% of rated capacity at 2 in. from BDC. Capacity: 450 tons × 0.58 = 238.5 tons

MANDATORY APPENDIX II
MECHANICAL POWER PRESS CAPACITY ABOVE RATING POINT OF 6.3 mm (0.25 in.)

Table II-1 Percent of Rated Capacity

Stroke		Distance From Bottom Dead Center, mm (in.)									
mm	in.	6.3 (0.25)	12.7 (0.50)	19 (0.75)	25 (1)	38 (1.5)	50 (2)	75 (3)	100 (4)	125 (5)	150 (6)
75	3	100	75	64	58	. . .	. . .	. . .	. . .	. . .	. . .
100	4	100	74	63	57	52.5	. . .	. . .	. . .	. . .	. . .
125	5	100	73	62	55.5	49.5	47.5	. . .	. . .	. . .	. . .
150	6	100	72.5	61	54.5	48	44	. . .	. . .	. . .	. . .
200	8	100	72	60	53	45.5	41.5	38	. . .	. . .	. . .
250	10	100	72	60	52.5	44.5	40.5	36	34	. . .	. . .
300	12	100	71.5	59	52	43.5	39.5	34.5	31.5	30.5	. . .
350	14	100	71.5	59	51.5	43.5	38.5	33	31	29.5	28.5
400	16	100	71.5	59	51.5	43	38	33	30	28	27
450	18	100	71.5	58.5	51.5	43	38	32	29	27	26.5
500	20	100	71.5	58.5	51.5	43	38	32	28.5	216.5	26

The "slider crank" motion, imparted by a crankshaft, eccentric shaft, or eccentric gear, produces the reciprocating motion of the press slide. The changing mechanical advantage that results from the changing geometry of the crank arm position, relative to the slide connection(s), converts the constant torque of the rotating drive members into a varying linear force when applied by the slide. This force is at its minimum when the crank arm and connection form a right angle (near midstroke). It is at its maximum when the slide approaches the end of its travel.

EXAMPLES:

(1) *Capacity of 1 600 kN press, 150 mm stroke, 25 mm from bottom of stroke.* From Table II-1, the capacity is 54.5% of rated capacity at 25 mm from BDC. Capacity: 1 600 kN × 0.545 = 872 kN

(2) *Capacity of 180 ton press, 6 in. stroke, $1\frac{1}{2}$ in. from bottom of stroke.* From Table II-1, the capacity is 48% of rated capacity $1\frac{1}{2}$ in. from BDC. Capacity: 180 tons × 0.48 = 86.4 tons

MANDATORY APPENDIX III
MECHANICAL POWER PRESS CAPACITY ABOVE RATING POINT OF 1.6 mm (0.06 in.)

Table III-1 Percent of Rated Capacity

Stroke		Distance From Bottom Dead Center, mm (in.)									
mm	in.	1.6 (0.06)	3.2 (0.12)	6.3 (0.25)	12.7 (0.50)	19 (0.75)	25 (1)	38 (1.5)	50 (2)	75 (3)	100 (4)
75	3	100	72	52	39	34	30	...	...	...	...
100	4	100	71.5	51.5	38	33	29.5	27	...	...	...
125	5	100	71	51.5	37.5	32	28.5	25.5	24	...	...
150	6	100	71	51	37	31	28	24.5	23	...	...
200	8	100	71	51	36.5	30.5	27	23	21.5	19	...
250	10	100	71	50.5	36.5	30	26.5	22.5	20.5	18	17
300	12	100	71	50.5	36	30	26	22	20	17.5	16

The "slider crank" motion, imparted by a crankshaft, eccentric shaft, or eccentric gear, produces the reciprocating motion of the press slide. The changing mechanical advantage that results from the changing geometry of the crank arm position, relative to the slide connection(s), converts the constant torque of the rotating drive members into a varying linear force when applied by the slide. This force is at its minimum when the crank arm and connection form a right angle (near midstroke). It is at its maximum when the slide approaches the end of its travel.

EXAMPLES:

(1) *Capacity of 1 000 kN press, 150 mm stroke, 25 mm from bottom of stroke.* From Table III-1, the capacity is 28% of rated capacity at 25 mm from BDC. Capacity: 1 000 kN × 0.28 = 280 kN

(2) *Capacity of 110 ton press, 4 in. stroke, 1 in. from bottom of stroke.* From Table III-1, the capacity is 29.5% of rated capacity at 1 in. from BDC. Capacity: 110 tons × 0.295 = 32.5 tons

MANDATORY APPENDIX IV USABLE FLYWHEEL ENERGY

IV-1 EXPLANATION

The energy given up by the flywheel, as it slows down under load, will determine the distance through which the rated capacity of a mechanical power press can be sustained. The energy requirement is dependent on the work required to be performed by the tooling during the process (duty factor). The usable flywheel energy is dependent on the amount the flywheel can slow down under load without overloading the motor when restoring the energy (motor factor).

IV-2 CALCULATION IN METRIC UNITS

To calculate the usable flywheel energy in metric units:

$$E = CD_FM_F[(0.04S + 10.2)/1\,000]$$

where
- C = rated capacity, kN
- D_F = duty factor (for variable speed presses, duty factor is based on one-half of maximum speed)
- E = usable flywheel energy, kN·m
- M_F = motor factor
- S = press stroke, mm

EXAMPLE: *2 500 kN press, single-end drive, 250 mm stroke, 5% to 8% slip motor.* From Tables IV-1 and IV-2: duty factor = 2.4; motor factor = 0.28

$E = (2\,500)(2.4)(0.28)[(0.04 \times 250 + 10.2)/1\,000] = 34$ kN·m required

IV-3 CALCULATION IN U.S. CUSTOMARY UNITS

To calculate the usable flywheel energy in U.S. customary units:

$$E = CD_FM_F\,(0.04S + 0.4)$$

where
- C = rated capacity, tons
- D_F = duty factor (for variable speed presses, duty factor is based on one-half of maximum speed)
- E = usable flywheel energy, in.-tons
- M_F = motor factor
- S = press stroke, in.

EXAMPLE: *280 ton press, single end drive, 10 in. stroke, 5% to 8% slip motor.* From Tables IV-1 and IV-2: duty factor = 2.4; motor factor = 0.28

$E = (280)(2.4)(0.28)(0.04 \times 10 + 0.4) = 150.5$ in.-tons required

Table IV-1 Duty Factor Chart

Press Type	Rating Point mm	Rating Point in.	Duty Factor
Flywheel drive	1.6	0.06	0.6
Flywheel drive, progressive die	1.6	0.06	0.8
Geared: single end drive	6.3	0.25	2.4
Geared: blanking press	6.3	0.25	2.4
Geared: twin or eccentric gear	12.7	0.5	3.6
Geared: progressive die	12.7	0.5	4.0

Table IV-2 Motor Factor Chart

Motor Design	Motor Slip, %	Motor Factor
B	3 to 5	0.19
D	5 to 8	0.28
D	8 to 13	0.36

MANDATORY APPENDIX V
BED AND SLIDE DEFLECTION

Bed and slide deflections with distributed loading can be accurately simulated, using hydraulic jacks for mechanical presses or blocks for hydraulic presses. Hydraulic force can be thereby applied to symmetrically distribute loads equal to the rated capacity of the press. The bolster is required if there are bed openings that must be spanned to place the jacks or blocks.

Bed deflection is measured at the center of the bed or bolster, using a straight edge supported on knife edges placed at the ends of the bed or bolster. The measured deflection, divided by distance L_B, should not exceed 0.17 mm/m (0.002 in./ft).

Slide deflection is measured at the center of the slide, using a straight edge supported on knife edges, on the slide flange, placed at the connection centerlines. The measured deflection, divided by distance L_S should not exceed 0.17 mm/m (0.002 in./ft).

See Fig. V-1.

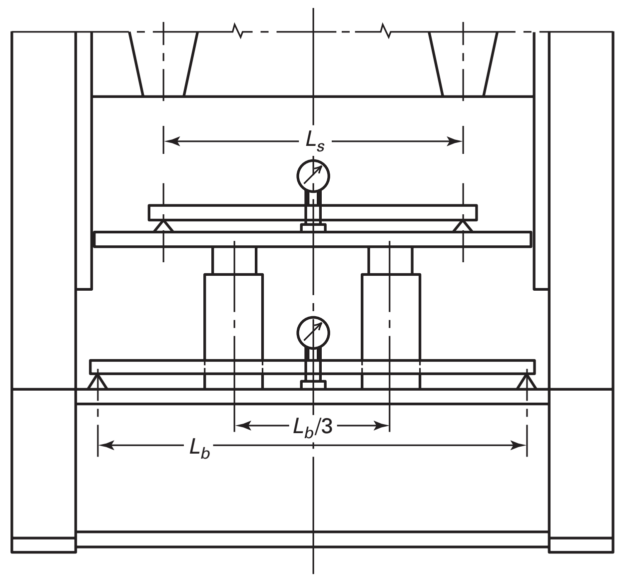


Fig. V-1 Simulation of Bed and Slide Defection

MANDATORY APPENDIX VI
OFFSET LOADING OF A MECHANICAL PRESS SLIDE

The ability of a slide to resist offset loading, without overloading the press, depends on the following:

(a) geometry of the gibbing and bearing area of the gib surfaces

(b) type of lower connection: ball type, saddle type, pin type

(c) orientation of the lower connection: wrist pin, front-to-back or left-to-right

Press gibs are primarily designed to maintain correct alignment through the travel of the slide and the upper dies. They have limited capacity to resist forces imparted by offset loading. Accordingly, offset loading of single-point presses should always be avoided.

Saddle and pin type connections can support significant offset loading, but the direction of the offset must be in line with the wrist pin. The magnitude of the loading and the amount of offset is limited by the proportions of the lower connection(s).

The total load on the slide shall not exceed the total capacity. Where offset loading in excess of these limits is anticipated, the user should consult the manufacturer.

NONMANDATORY APPENDIX A
METRIC/U.S. CUSTOMARY CONVERSION

Quantity	To Convert From	Conversion Formula
Length	Inches to millimeters	1 in. = 25.4 mm
	Millimeters to inches	1 mm = 0.0394 in.
Force	Tons to kilonewtons	1 ton = 8.9 kN
	Kilonewtons to tons	1 kN = 0.1124 ton
Pressure	Pounds per square inch to kilopascals	1 psi = 6.9 kPa
	Kilopascals to pounds per square inch	1 kPa = 0.145 psi (1 bar = 100 kPa = 14.5 psi)
Energy	Inch-tons to kilonewton-meters	1 in.-ton = 0.226 kN·m
	Kilonewton-meters to inch-tons	1 kN·m = 4.425 in.-tons
Power	Horsepower to kilowatts	1 hp = 0.75 kW = 254.4 BTU/hr
	Kilowatts to horsepower	1 kW = 1.341 hp = 3,412 BTU/hr
	BTU per hour to horsepower	1 BTU/hr = 0.000293 kW = 0.000393 hp
Parallelism	Inches per foot to millimeters per meter	1 in./ft = 83.33 mm/m
	Millimeters per meter to inches per foot	1 mm/m = 0.012 in./ft [Note (1)]
Speed	Inches per minute to millimeters per minute	1 in./min = 25.4 mm/min
	Millimeters per minute to inches per minute	1 mm/min = 0.039 in./min
	Feet per minute to meters per second	1 fpm = 0.0051 m/sec
	Meters per second to feet per minute	1 m/sec = 197 fpm
	Feet per minute to meters per minute	1 fpm = 0.306 m/min
	Meters per minute to feet per minute	1 m/min = 3.268 fpm

NOTE:
(1) 1 in./ft = 25.4 mm/304.8 mm = 83.33 mm/m. The reciprocal of 83.33 is 0.012.

NONMANDATORY APPENDIX B
COMPARISON OF CAPACITY RATINGS BETWEEN HISTORICAL JIC AND ISO STANDARDS

Table B1 Comparison of Capacity Ratings Between Historical JIC and ISO Standards

ISO, kN	Historical JIC, tons	ASME B5	
		kN	tons
250	30	250	30
400	. . .	. . .	. . .
. . .	. . .	500	55
630	60	. . .	. . .
1 000	100	1 000	110
1 600	150	1 600	180
2 000 [Note (1)]	200	2 000	225
2 500	300	2 500	280
4 000	400	4 000	450
6 300 [Note (1)]	600	6 300	710
8 000 [Note (1)]	800	. . .	. . .
10 000 [Note (1)]	1,000	10 000	1,125
12 500 [Note (1)]	1,250	. . .	. . .
16 000 [Note (1)]	1,600	16 000	1,800
20 000 [Note (1)]	2,000	20 000	2,250
25 000 [Note (1)]	. . .	25 000	2,810

NOTE:
(1) Non-ISO standard sizes, stated in ISO progression.

Table B2 Standard Rating Points

Press Type	ISO [Note (1)]		ASME B5 (JIC)	
	mm	in.	mm	in.
Flywheel drive	3.5	0.14	1.6	$\frac{1}{16}$
Single end drive, Twin end drive blanking press Eccentric gear blanking press	7.0	0.28	6.3	$\frac{1}{4}$
Twin end drive Eccentric gear	12.5	0.49	12.7	$\frac{1}{2}$

NOTE:
(1) From ISO 9188 and 9189.

ASME B5.61-2003

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