ME3281
MACHINE DRAWING PRACTICE

ASSIGNMENT BOOKLET

(for private circulation only)

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&

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ME3281 – Machine Drawing Practice

***L T E P O C 1 0 0 3 3 7**

Objective: 1. To understand the basics of Machine Drawing representation, important conventions and standards, geometric dimensioning and tolerance. 2. To create and understand assembly and manufacturing drawings and. 3. Exposure to 3D modeling packages.

Course content: Sectional views of machine components – various techniques and conventions (10 hours). Fastening and connecting methods for assembly – representation of screw threads, keys, fasteners, riveting and welding (12 hours). Introduction to 3D modeling of machine components - creating assembly drawings and bill of materials (16 hours). Dimensions, limits, fits and tolerances, surface finish and machining symbols, production drawings (12 hours).

Text books:

1. Narayana K.L., Kannaiah.P& Venkata Reddy.K., "**Machine Drawing**", New Age International, 2009

2. Bhatt N. D., "**Machine Drawing**", Charotar Publishing House, 2014.

Reference books:

1. Luzadder. J. W & Duff M Jon, "**Fundamentals of Engineering Drawing**", PHI Learning, 2008

2. French &Vierk., "**Fundamentals of Engineering Drawing**", McGraw Hill, 1996.

Prerequisite: ME1480 - Engineering Drawing

Schedule of Exercises

S. No	Description	Page No.	No. of Classes
1	Sectional views	2	3
2	Fasteners (Bolted Joints, Keyed Joints, Riveted Joints and Welded Joints)	6	3
3	Assembly drawings	23	4
4	Production drawings	29	3
	Total		13
5	Conventional representations needs to be carried out outside the class hours (O Category)		

Weightage:

Assignment – 25% (based on the assignments carried out in the Laboratory)

Project – 15% (based on the Individual Project done beyond the class hours)

Mid Semester Exam – 20%

End Semester Exam – 40%

**L – Lecture; T – Tutorial; E – Extended Tutorial; P – Practical; O – Hours spent outside class; C- Credits*

1. SECTIONAL VIEWS

1.1 Fig. 1.1 shows a **Vertical Support Bracket.**
Draw a sectional elevation, plan and half sectional left side view.

1.2 Fig. 1.2 shows elevation and left side view of the **Bracket**.
Draw the views given below to full size.
a) Plan
b) A sectional side view on plane C-C

1.3 Fig 1.3 shows the orthographic views of a **Machine Cover.**
Draw the following views.
a) Sectional elevation at D-D
b) Plan

1.4 Fig 1.4 shows an orthographic views of a **Terminal Block.**
Draw the following views.
a) Sectional elevation at A-A
b) Half Sectional right-hand side view, the section being taken as the Plane B-B

1.5 Fig. 1.5 shows the orthographic views of a **Rocker Arm.**
Draw the following views.
a) A sectional elevation at A-A
b) Side view

1.6 Fig 1.6 shows a **Machine Cap.**
Draw the following views.
a) A full sectional elevation taking the sectional plane A-A passing through the centre of the rib and cutting the ribs longitudinally.
b) A sectional side view at B-B

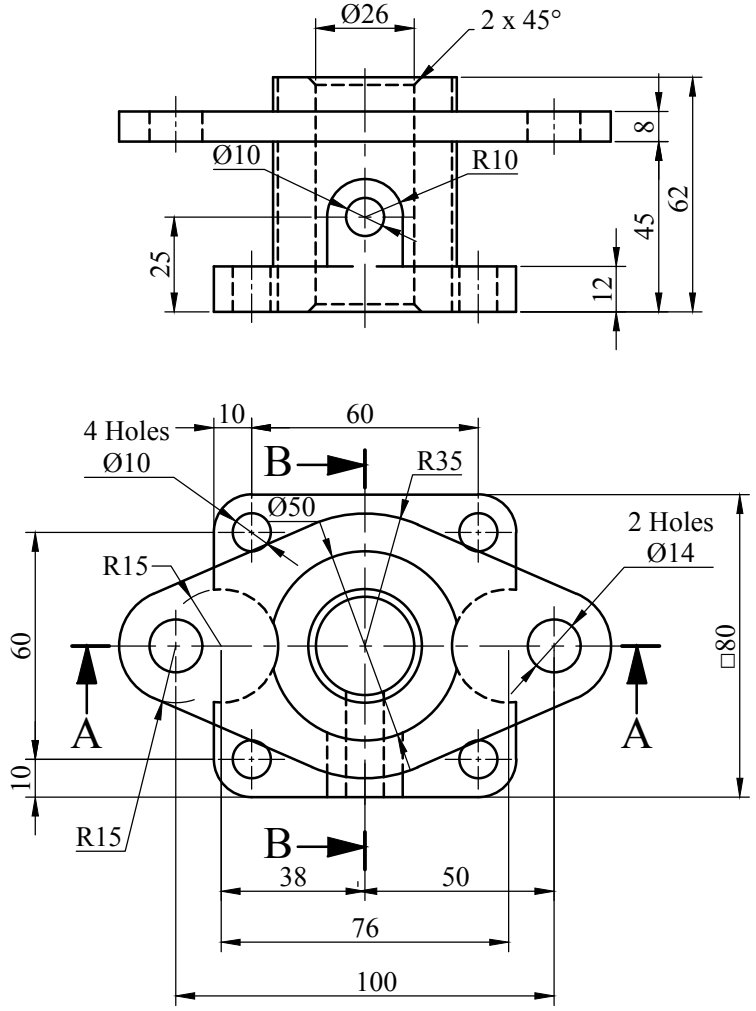


Fig. 1.1 Vertical Support Bracket

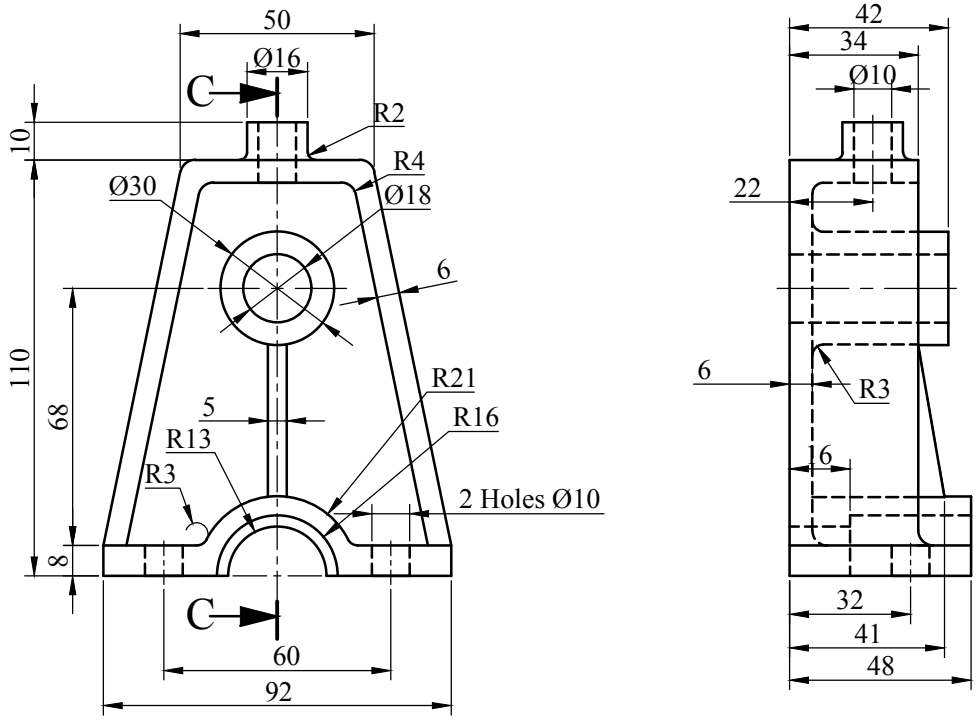


Fig. 1.2 Bracket

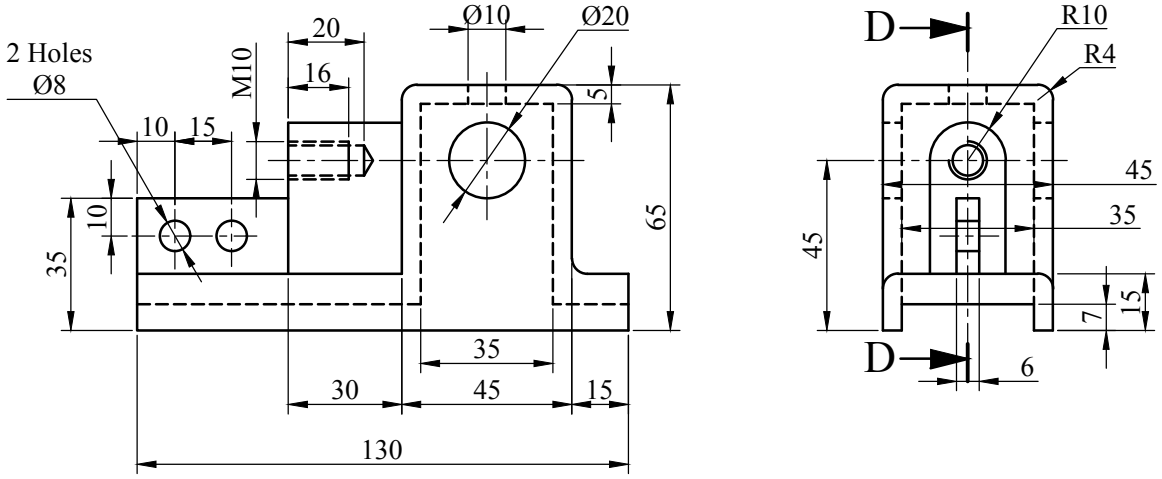


Fig. 1.3 Machine Cover

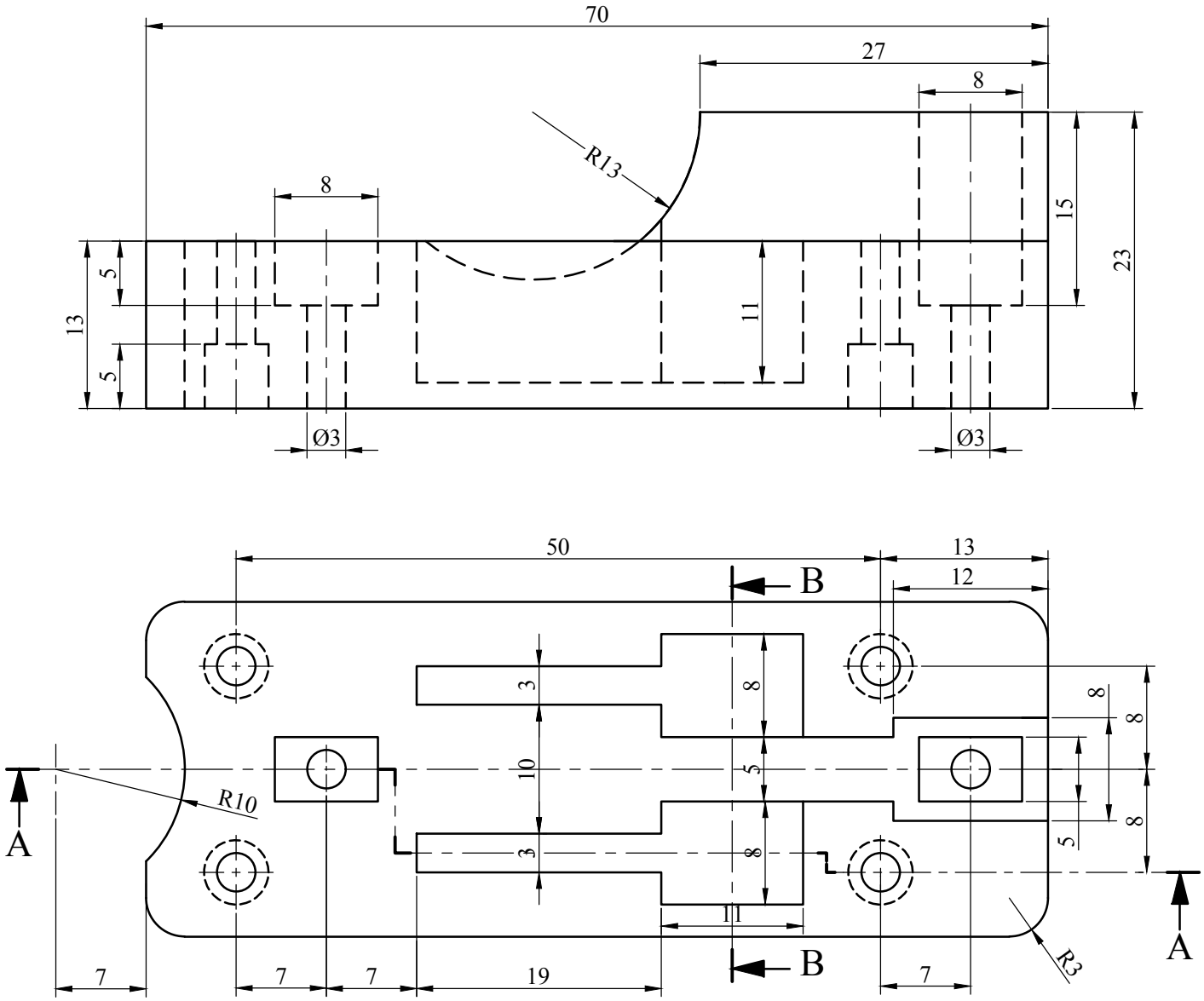


Fig. 1.4 Terminal Block

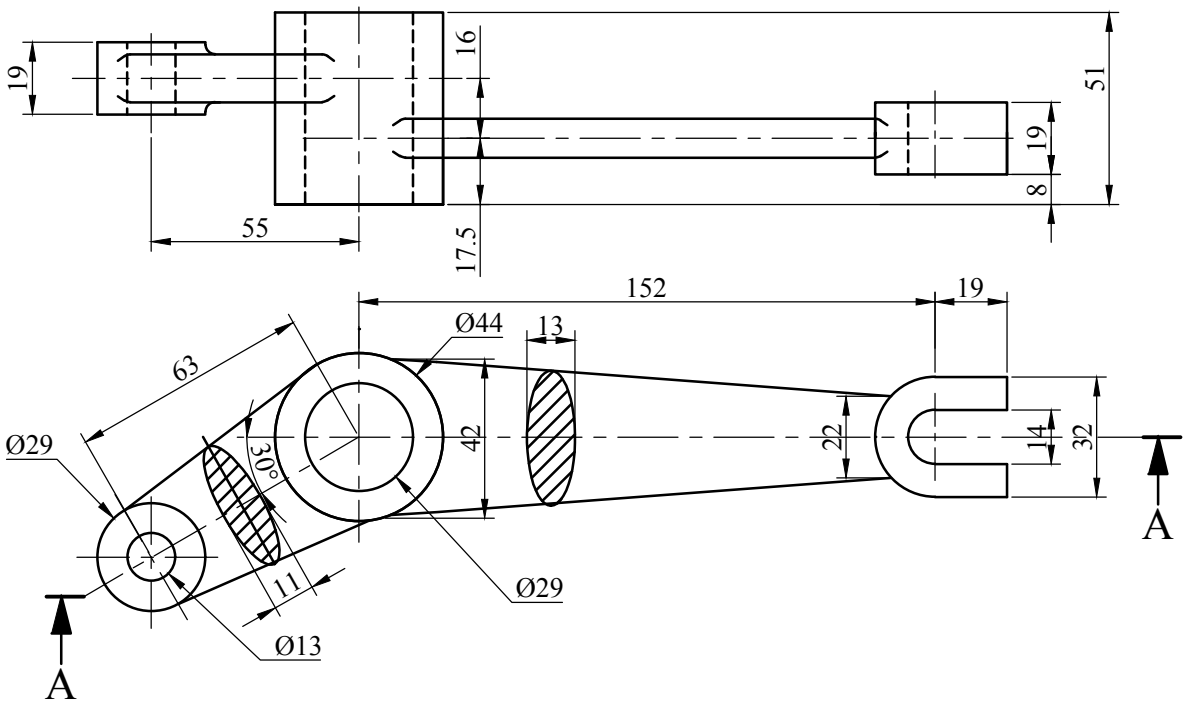


Fig. 1.5 Rocker Arm

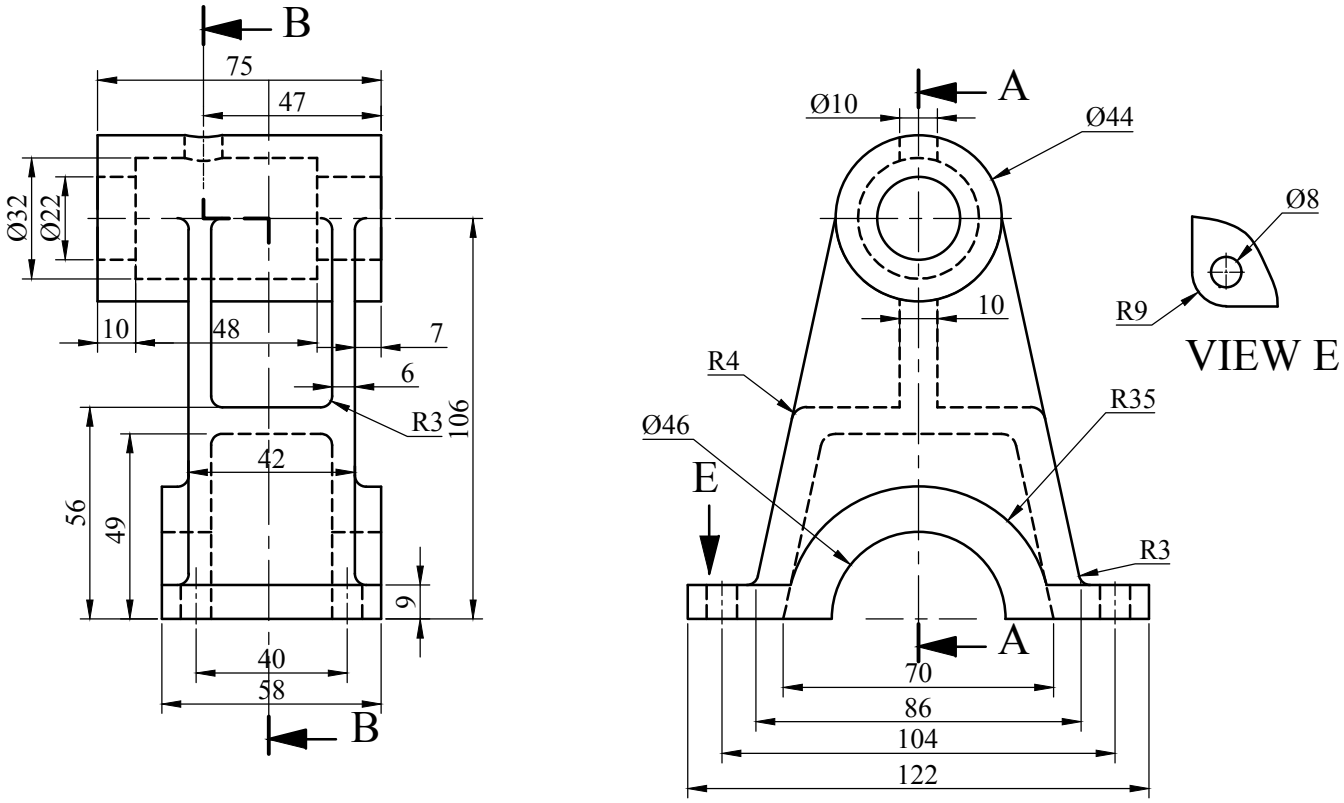


Fig. 1.6 Machine Cap

2.FASTENERS

a) BOLTED JOINTS

2.1 a) Draw a M18 bolt of length 75 with a hexagonal nut in two views. (Refer Table 2.1 IS:1363)

b) Draw a blind threaded hole of M20 in a plate of thickness 60 mm with a thread depth as 36 mm.

c) Fig 2.1 shows a **Clamp.** Use M16 hexagonal bolt and nut to tighten the clamp. Draw the plan and sectional elevation.

2.2 Fig 2.2 shows part of a **Fixture.** Use a M20 stud and lock nut. Draw the sectional elevation and plan.

2.3 Fig 2.3 shows the details of the screw joint to be fixed by M16 screws. For the left side use the cheese head screw and part of the head will go into the counterbore provided in the plate. On the right side a taper countersunk hole is provided to accommodate countersunk screw. Draw the plan and the sectional elevation.

b) KEYED JOINTS

A general arrangement of a shaft, flange and a key are shown in Fig. 2.4 (a). Tapered key, Parallel key and Gib headed key are shown in Fig. 2.4. The proportional dimensions of these keys are given in the tables 2.2, 2.3 and 2.4.

2.4 Draw the sectional elevation and end view of the keyed joint using a tapered key (taper 1:100) for the following dimensions.

Shaft diameter - 40, Hub OD - 60, Flange OD - 120, Flange thickness - 10 and Hub Length – 50.

2.5 Draw the sectional elevation and end view of a keyed joint using Gib headed key with the dimension given in the problem 2.4.

c) RIVETED JOINTS

The nomenclature of the rivet is shown in Fig 2.5. Various important types of rivet heads used in engineering are shown in Fig. 2.6. Proportions for different rivet heads are given in the form of the nominal diameter (D) of the rivet. Fig 2.7 shows a lap joint, Fig 2.8 and Fig 2.9 shows single cover and double cover butt joints and Fig 2.10 and Fig 2.11 shows double riveted double covered butt joint (Chain) and double riveted double covered butt joint (zig zag) respectively.

2.6 Draw the sectional elevation of a double riveted lap joint to join plates of thickness 12 mm. Use snap head for rivets. Indicate all the dimensions.

2.7 Draw a sectional elevation of a single riveted single strap butt joint to connect two plates of thickness 9 mm each. The strap (cover plate) thickness is 1.125 times (Round off to nearest standard value) of the main plate thickness. The diameter of the rivet is $6\sqrt{t}$ (where t is thickness of the main plate, round off to nearest standard value.) Draw the plan assuming a chain riveting with pitch of 3 times the diameter of the rivet.

d) WELDED JOINTS

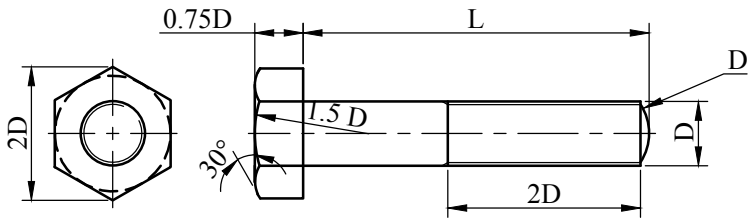
2.8 a) Two square plates of 70x70x10 thickness are welded by a lap joint. Show the joint by a 7 mm fillet weld.

b) A butt joint is made of 60x60x10 plates. The edge preparation is made to "Single U Butt" shape. Show the weld by convention.

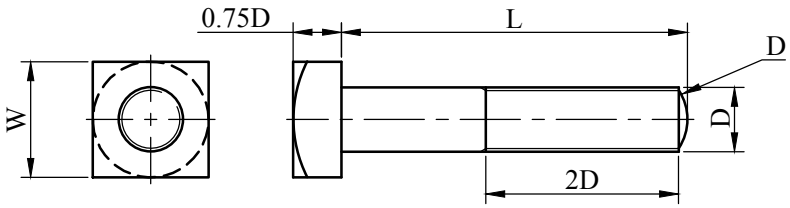
c) A Tee joint made with 50x50x8 thick plates. There are to be welded on both sides of the "T" at site with a 6 mm fillet weld. Show the joint by convention.

d) Prototype of a bracket is to be fabricated by all welded construction.
Component drawings are shown in Fig 2.12. Prepare an assembly drawing indicating the welding by appropriate symbols.

2.9 Components to be fabricated using welding are shown in Fig. 2.13, Draw the orthographic projection indicating welding symbols.

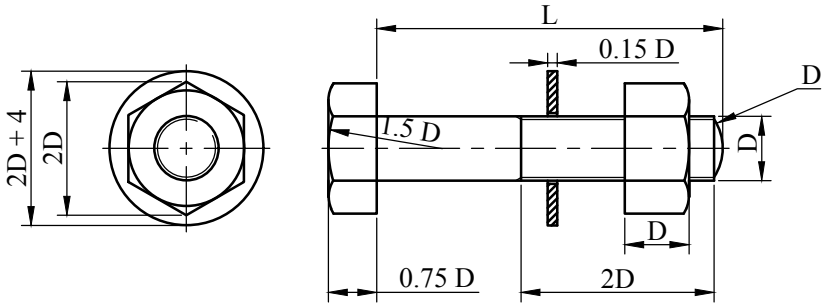


(a) Hexagonal headed bolt

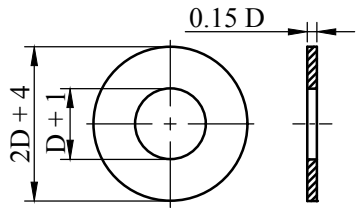


(b) Square headed bolt

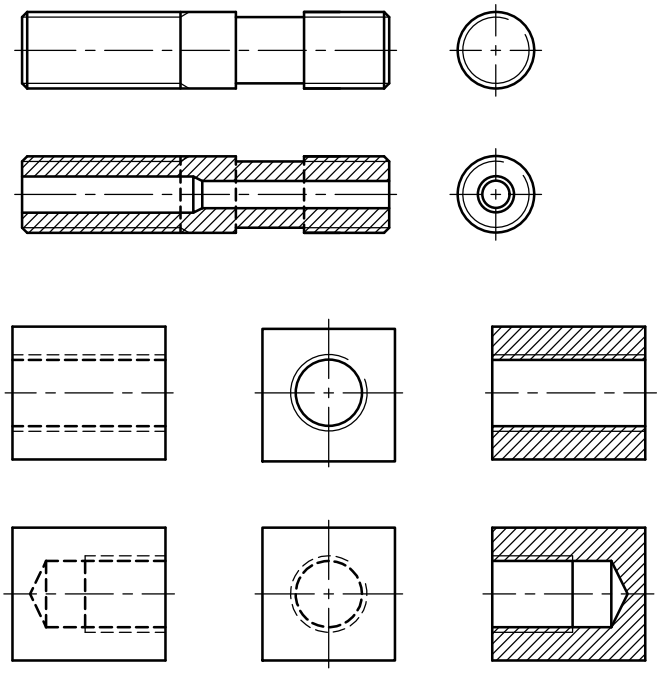
Where D - Nominal diameter



(c) Bolt & Nut Joint

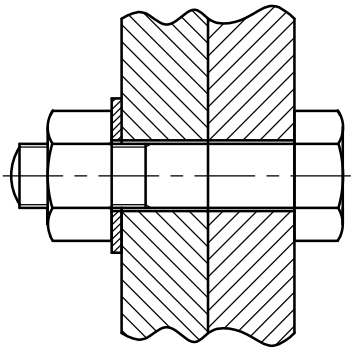


(d) Washer

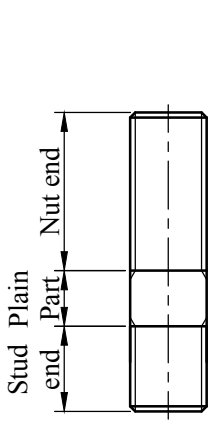


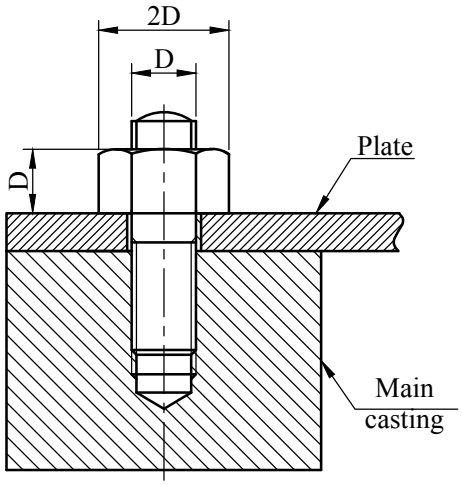
(e) Conventional representation of threads

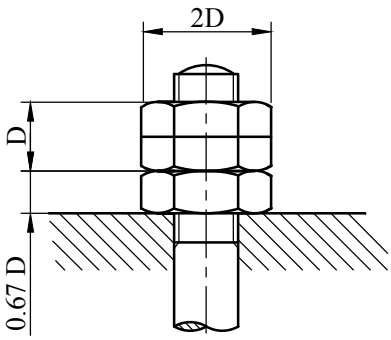
Fig 2 (i) BOLT , NUT & WASHER CONVENTIONS



(a) Bolted Joint



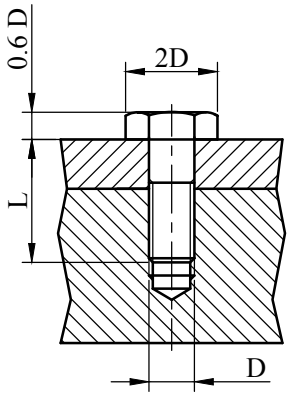




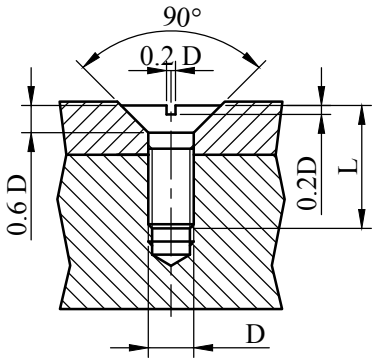
Where D - Nominal diameter

(b) Stud Joint

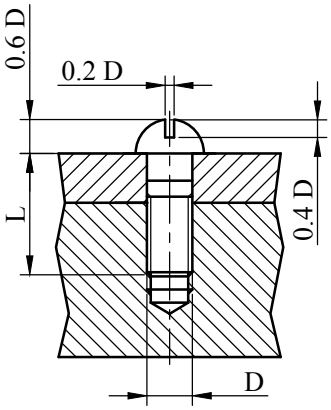
(c) Lock Nut



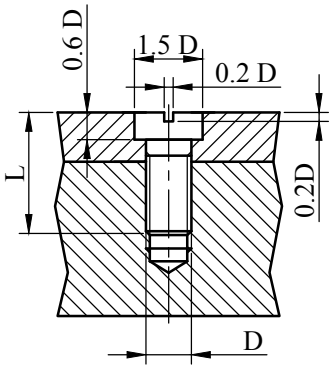
Hexagonal head



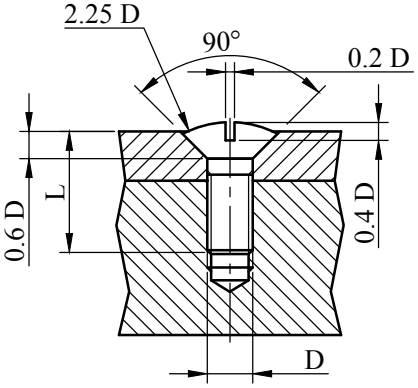
Countersunk head



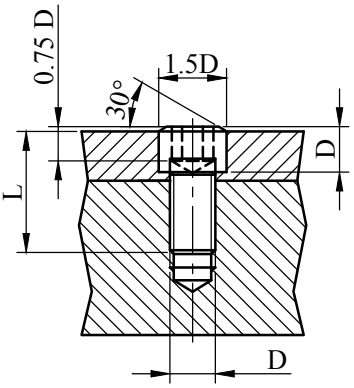
Snap head



Pan head



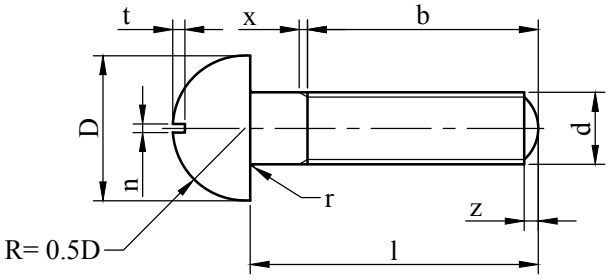
Round Countersunk head



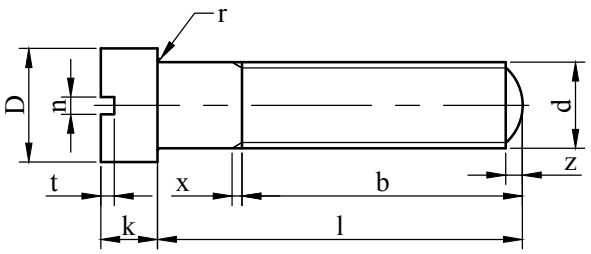
Allen head

(d) Shapes of Screw head

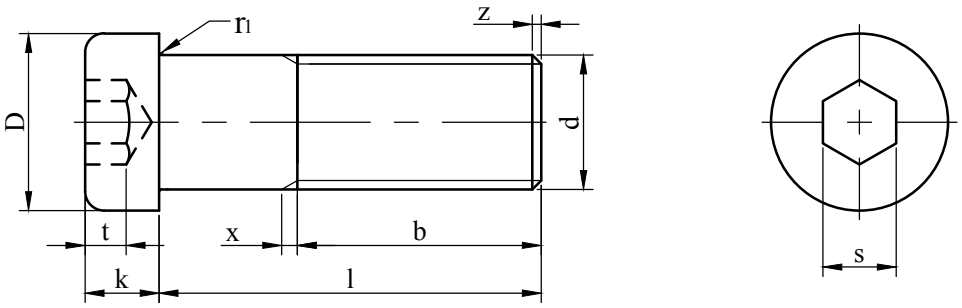
Fig 2 (ii) FIXING DEVICES



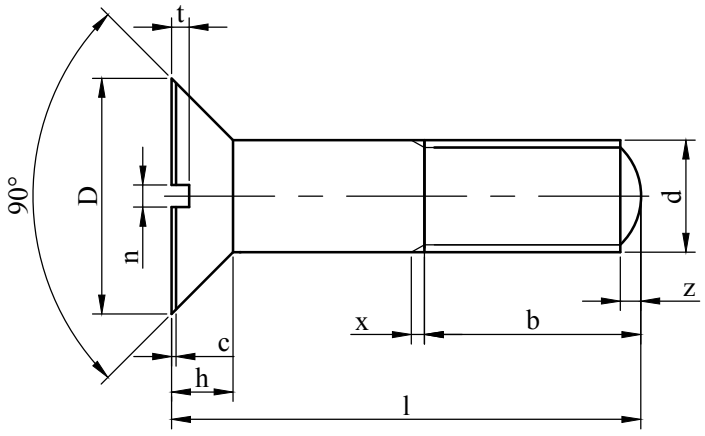
Slotted Round Head Machine Screw : IS 1366



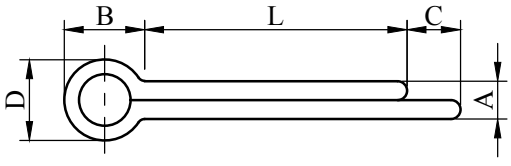
Slotted Cheese Head Machine Screw : IS 1366



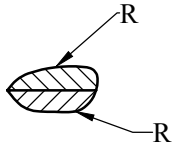
Hexagon Socket Head Cap Screw : IS 2269



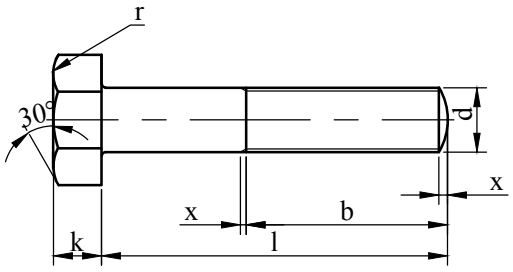
Slotted Countersunk Head Machine Screw : IS 1365



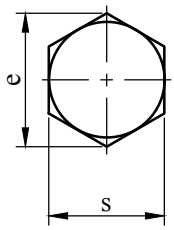
Split Cotter Pin : IS 549

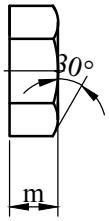


Enlarged Section

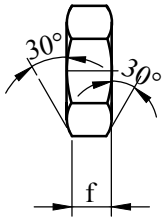


Hexagonal bolt IS : 1363

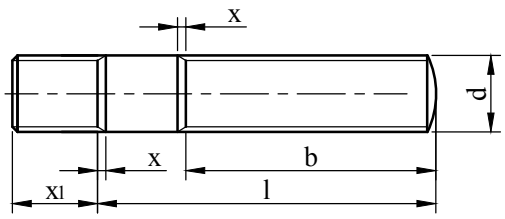




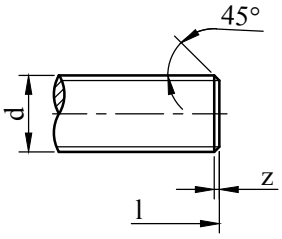
Hex. Nut



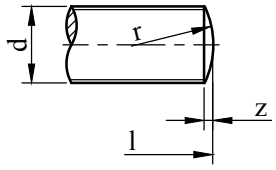
Lock Nut



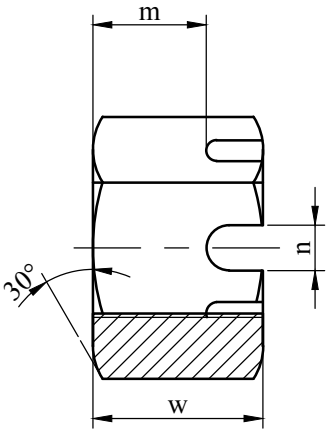
Stud IS : 1862



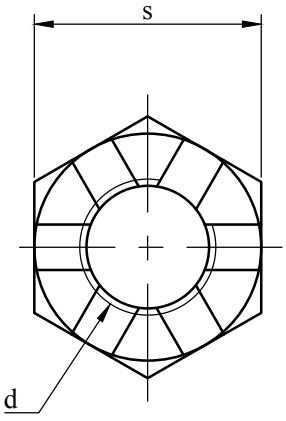
Chamfer End IS : 1368

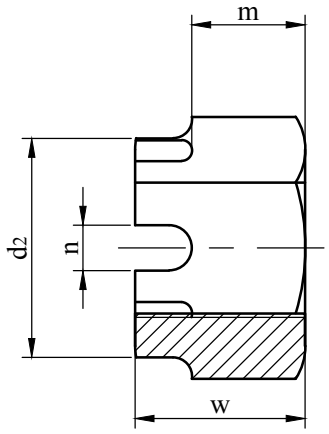


Radioused end IS : 1368

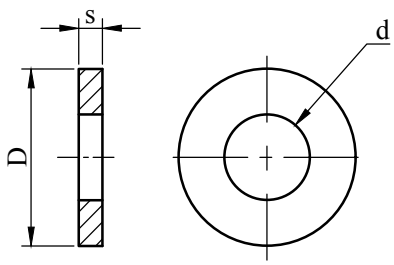


Slotted Nut IS : 2232

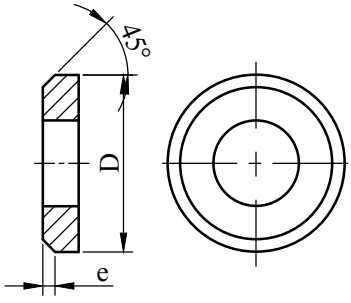




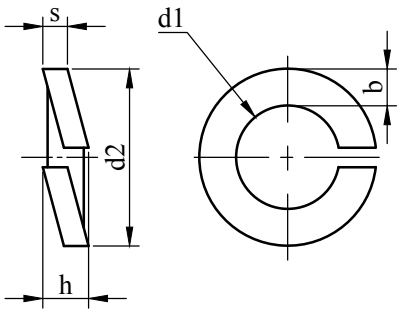
Castle Nut IS : 2232



Punched Plain Washer IS : 2016



Punched Machined Washer IS : 2016



Spring Washer IS : 3063

Table 2.1 STANDARD TABLES FOR BOLTS, NUTS, ETC.,

Hexagonal Bolts, Nuts and Lock Nuts: IS 1363

d	M6	M8	M10	M12	M16	M18	M20	M24	M30	M36
b1	17	21	25	29	37	41	45	53	65	.....
b2	22	26	30	34	42	46	50	58	70	82
b3	...	...	...	44	52	56	60	68	80	92
s	10	13	17	19	24	27	30	36	46	55
e	11.5	15	19.6	21.9	27.7	31.2	34.6	41.6	53.1	63.5
k	4	5.5	7	8	10	12	13	15	19	23
r	0.3	0.5	0.5	1	1.2	1.2	1.2	1.6	1.6	1.8
m	5	6.5	8	10	13	15	16	19	24	29
f	3	4	5	7	8	9	9	10	12	14
x	1	1.4	1.4	2	2.5	3	3	3.5	4	4.5

Bolts and Screw ends: IS 1368

z	1	1.25	1.5	1.75	2	2.5	2.5	3	3.5	4

r_1 for sizes up to 6 mm 0.6d to 0.8d: from 6 mm 1d to 1.2d

IS 1862 STUDS:

d	M6	M8	M10	M12	M16	M18	M20	M24	M30	M36
b_1	17	21	25	29	37	41	45	53	65	...
b_2	22	26	30	34	42	46	50	58	70	82
b_3	...	...	...	44	52	56	60	68	80	92
k_1	6	8	10	12	16	18	20	24	30	36
x	1	1.4	1.4	2	2.5	3	3	3.5	4	4.5

$x_1 \approx$ d to d+2 for type A and 1.5d to 1.5d+4 for type B

b_1 for lengths 0 to 80 b2 for lengths 80 to 200 b3 for lengths above 200

Hexagonal Socket head cap screw IS 2269

d	M3	M4	M5	M6	M8	M10	M12	M14	M16	M18	M20	M22	M24
b_1	11	13	15	17	21	25	29	33	37	41	45	49	53
b_2	..	..	20	22	26	30	34	38	42	46	50	54	58
b_3	..	..	..	..	..	..	44	48	52	56	60	64	68
D	5.5	7	9	10	13	16	18	22	24	27	30	33	36
s	2.5	3	4	5	7	8	10	12	14	14	17	17	19
K	3	4	5	6	8	10	12	14	16	18	20	22	24
r_1 max	0.2	0.2	0.2	0.3	0.6	0.6	1.2	1.2	1.2	1.2	1.2	1.2	1.8
$r_1$min	..	..	..	..	0.5	0.5	1	1	1	1	1	1	1.5
t	1.5	2.5	3	4	5	6	8	9	10	11	12	14	15

For lengths up to and including 80mm – b_1

For lengths above 80 mm and up to 200 mm – b_2

For length above 200 mm – b_3

z according to IS: 1368

x according to IS: 1369

Slotted round headed and cheese headed screws; IS 1366

d	M1.6	M2	M2.5	M3	M4	M5	M6	M8	M10	M12	M16	M20
D	3.2	3.5	4.5	5	7	9	10	13	16	18	24	30
b_1	8	9	10	11	13	15	17	21	25	29	37	45
b	..	..	..	..	..	20	22	26	30	34	42	50
n	0.6	0.6	1	1	1.4	1.4	1.8	1.8	2.8	2.8	3.2	4.3
t	0.5	0.6	0.8	0.9	1.2	1.5	1.8	2	2.5	3	3.5	4

Slotted Countersunk head machine screws: IS 1365

D	3.2	4	5	6	8	10	12	15	18	21	27	33
h	1	1.2	1.4	1.7	2.3	2.8	3.3	3.9	4.5	5	6	7
b_1	8	9	10	11	13	15	17	21	25	29	37	45
b_2	..	..	..	..	..	20	22	26	30	34	42	50
c	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.5	0.5	0.5	0.5
n_{min}	0.5	0.5	0.8	0.8	1.2	1.2	1.6	1.6	2.5	2.5	3	4
n_{max}	0.6	0.6	1	1	1.4	1.4	1.8	1.8	2.8	2.8	3.2	4.3
t	0.5	0.6	0.8	0.9	1.2	1.5	1.8	2	2.5	3	3.5	4

For lengths up to and including 80mm – b_1

For lengths above 80 mm and up to 200 mm – b_2

z according to IS: 1368

x according to IS: 1369

Slotted nuts and castle nuts: IS 2232

d2	7.5	-		17	22	25	28	34	42	50
w	7.5	9.5	12	15	19	21	22	27	33	38
m	5	6.5	8	10	13	15	16	19	24	26
n	2.25	2.7	3	3.8	4.8	4.8	4.8	5.8	7.3	5.4
s	10	13	17	19	24	27	30	36	46	55

Cotter pin sizes

	1.6	2	2.5	3.2	4	4	4	5	6.3	6.3

Plain Washers: IS 2016

d	**6.6**	**9**	**11**	**14**	**18**	**20**	**22**	**26**	**33**	**39**
D	12	16	22	25	30	34	36	45	56	67
s	1.6	2	2.5	3		4	4	4	5	6
e	0.5	0.5	0.5	0.5	0.5	1	1	1	1	1.5

Split Cotter pin IS 549

size	**1.6**	**2.5**	**3.2**	**4**	**6.3**
A	1.2	2	2.7	3.5	5.6
B	4	5	6.3	8	13
C	2.5	2.5	4	4	4
D	3.2	5	6.3	8	13
R	0.1	0.2	0.2	0.3	0.4
L	20	32	40	56	112

Spring Washers IS 3063

d	M2	M2.5	M3	M3.5	M4	M5	M6	M8	M10	M12	M16	M18	M20	M24	M30
d1	2.4	2.9	3.4	3.9	3.5	5.5	6.6	9	11	14	18	20	22	26	33
d2	4.2	4.9	6	6.5	7.5	9.1	11.6	15	18	22	28	30	34	40	49
b	0.1	1	1.3	1.3	1.5	1.8	2.5	3	3.5	4	55	5	6	7	8
s	0.5	0.6	0.8	0.8	0.9	1.8	1.6	2	2.2	2.5	3.5	3.5	4	5	6

h= 2s

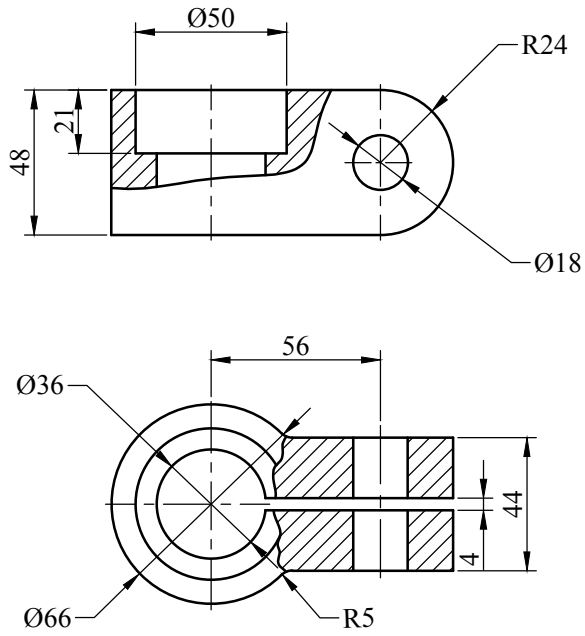


Fig 2.1 Clamp

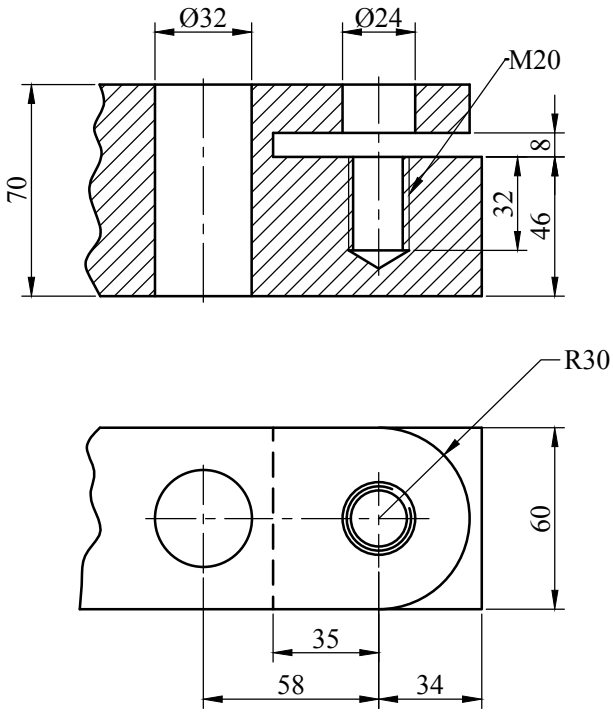


Fig 2.2 Fixture

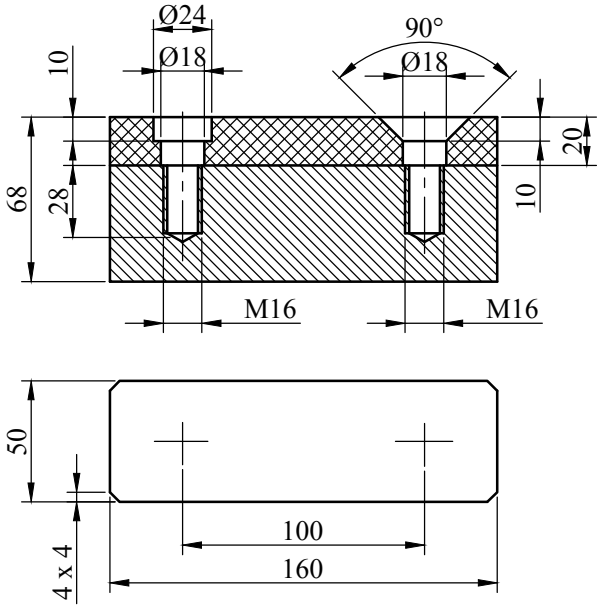
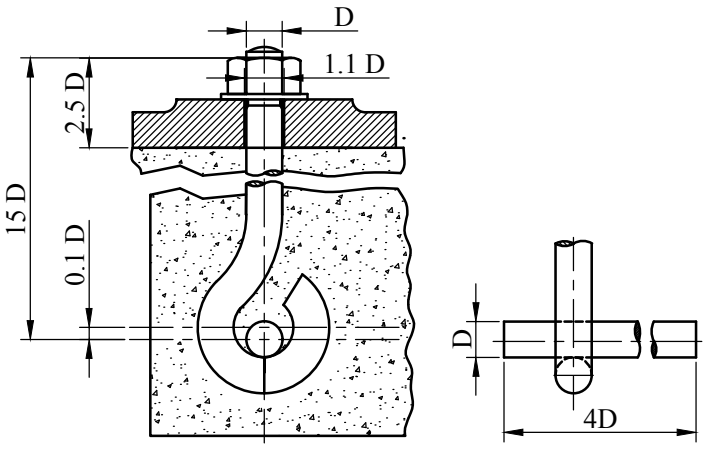
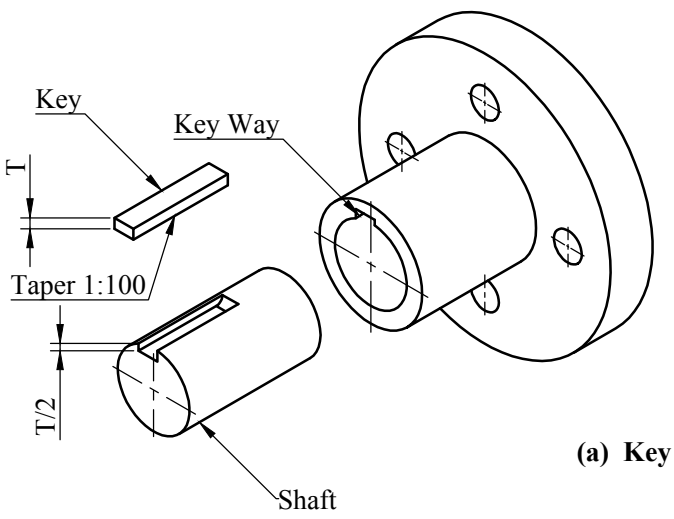
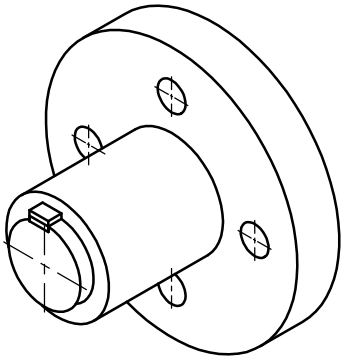


Fig 2.3 Screw Joint

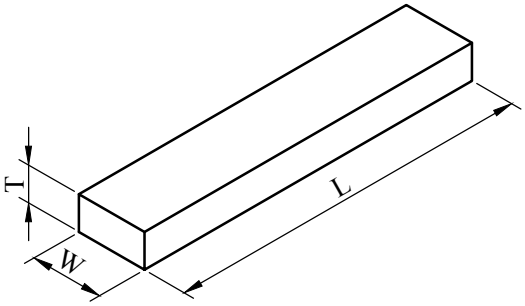


Eye Foundation Bolt

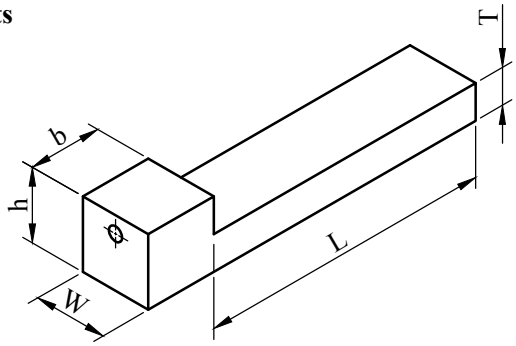




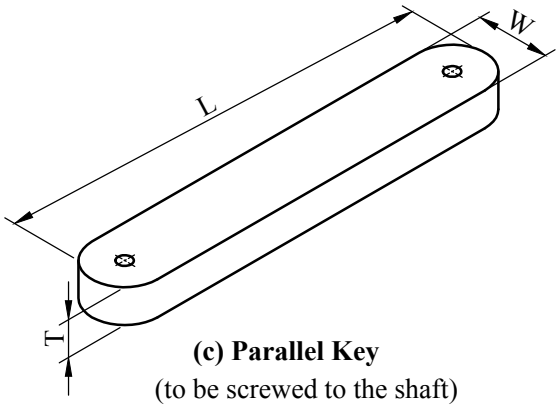
(a) Key Joints



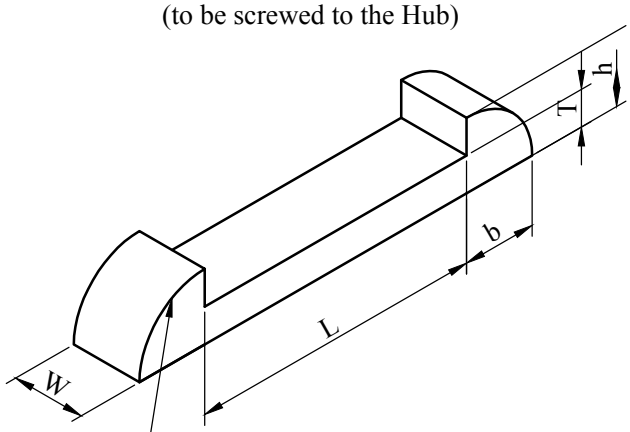
(b) Taper sunk Key



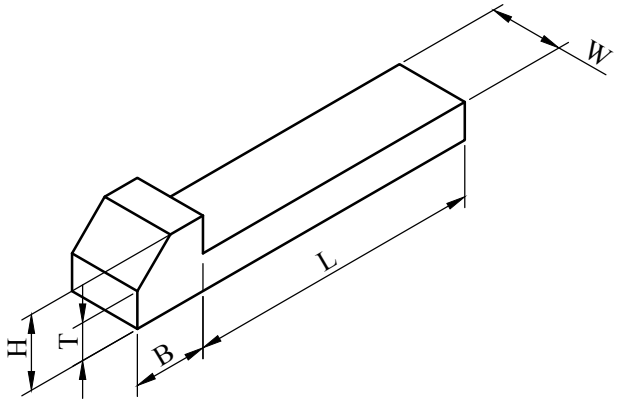
(d) Parallel Key
(to be screwed to the Hub)



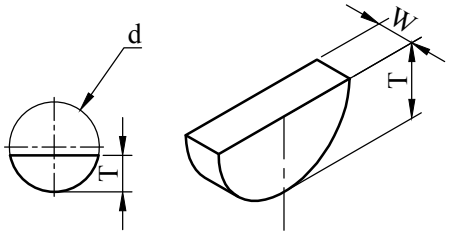
(c) Parallel Key
(to be screwed to the shaft)



(e) Feather Key
This Projections prevent
the axial movement in the Hub



(f) Gib Headed Key



(g) Woodruff Key

Fig 2.4 KEYS AND KEYWAYS

Table 2.2

Designation of taper key: The taper key is designated by specifying the width, thickness and length. For example a taper key of 12mm width , 8mm thickness and 50 mm length is designated as : TAPER KEY 12x8x50 (BIS : 2293-1963)

The usual proportions of the taper key are given below: d=diameter of the shaft

Type of key	Width of key	Thickness of key at thick end 't'
Rectangular taper key	0.25 d	0.66W=d/6
Square taper key	0.25 d	0.25 d

The key has a taper of 1 in 100 on the top side only.

Table 2.3

***Designation of parallel key*:** The parallel key is designated by specifying the width, thickness and length. For example a parallel key of 12mm width , 8mm thickness and 50 mm length is designated as : PARALLEL KEY 12x8x50 (BIS : 2048-1963)

The usual proportions of the parallel key are given below: d=diameter of the shaft

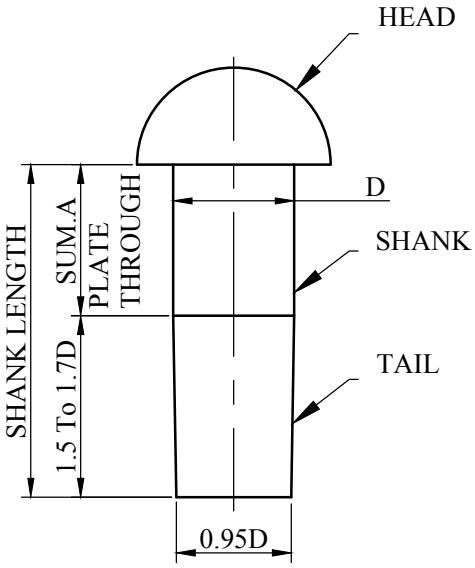
Type of key	Width of key	Thickness of key at thick end 't'
Rectangular parallel key	0.25 d	0.66W=d/6
Square parallel key	0.25 d	0.25 d

Table 2.4

Designation of Gib-headed key: The Gib-headed key is designated by specifying the width, thickness and length. For example a Gib-headed key of 12mm width, 8mm thickness and 50 mm length is designated as : GIB-HEADED KEY 12x8x50 (BIS: 2048-1963)

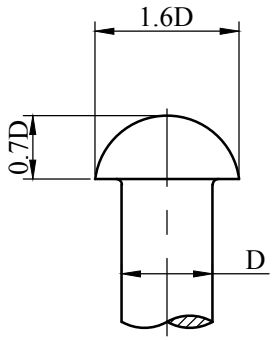
The usual proportions of the Gib-headed key are given below: d=diameter of the shaft

Width of key	W= 0.25d+2mm
Thickness of key at thick end	T = 0.67W
Standard taper	1 in 100
Height of head	H = 1.75T
Width of head	B = 1.5T

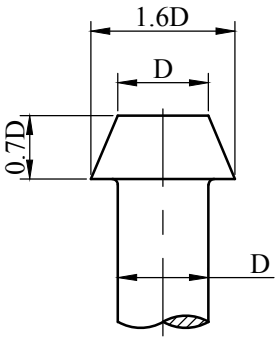


Where D - Nominal diameter

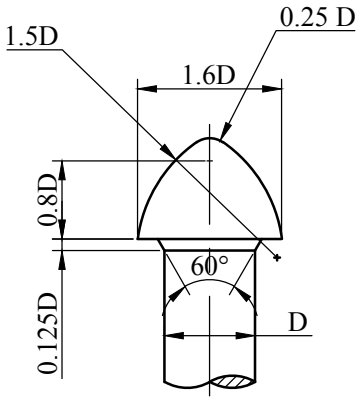
Fig. 2.5 RIVET



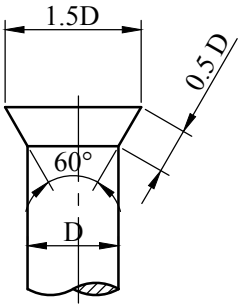
(i) SNAP OR CUP



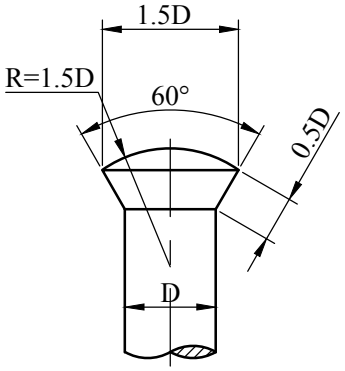
(ii) PAN



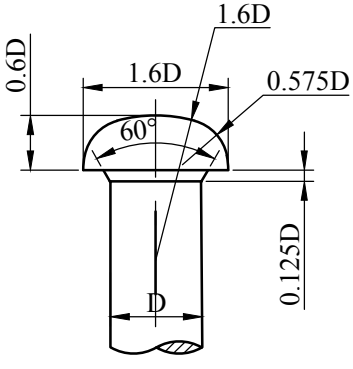
(iii) CONICAL



(iv) COUNTERSUNK



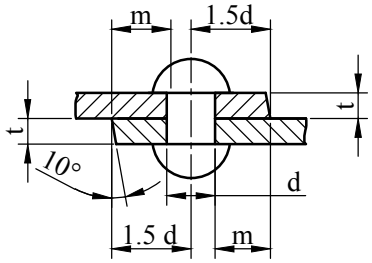
(v) ROUNDED COUNTERSUNK



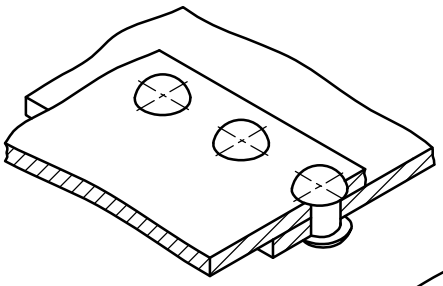
(vi) ELLIPSOID

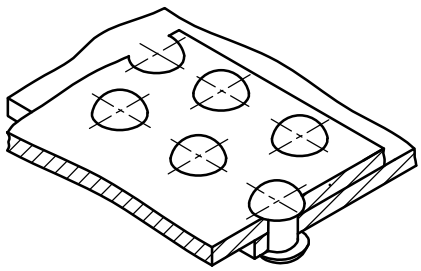
Forms and Proportions of Rivet-Heads

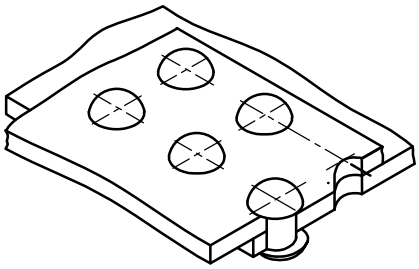
Fig. 2.6 TYPES OF RIVET HEADS

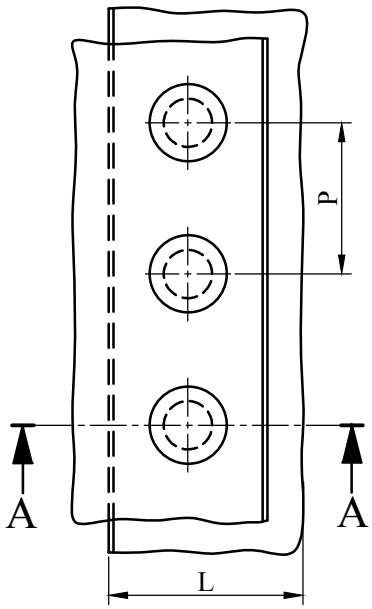


Section A-A



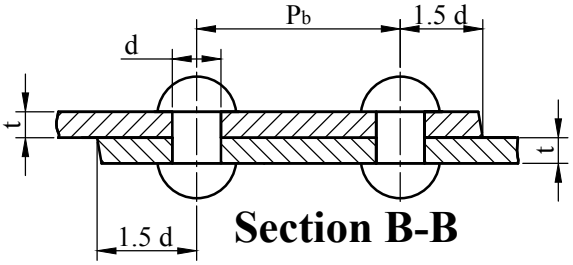




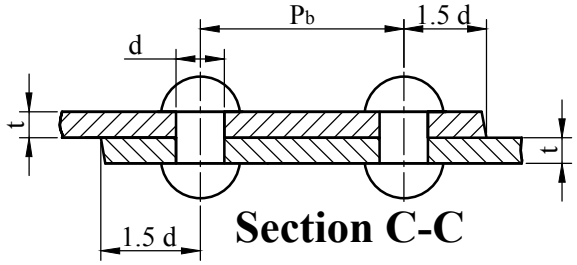


Single-Riveted Lap Joint

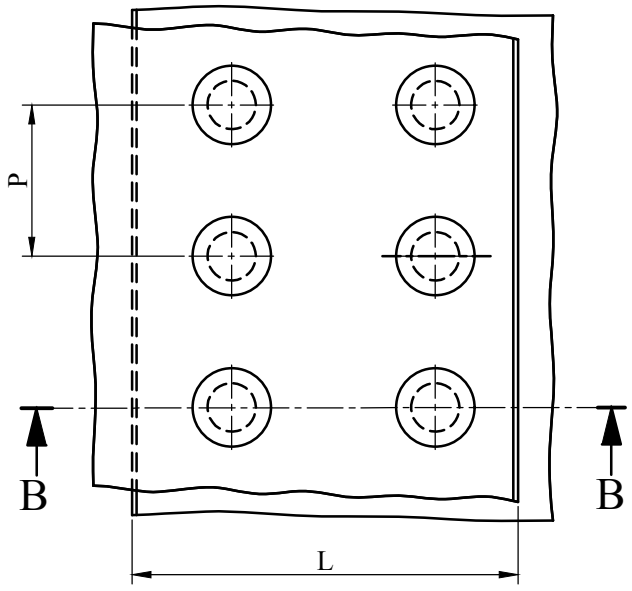
t = Thickness of the plate
d = Diameter of the rivet = $6\sqrt{t}$
m = Margin = d
P = Pitch = 3d
P_b = Back pitch = 2d+6
P_d = Diagonal pitch



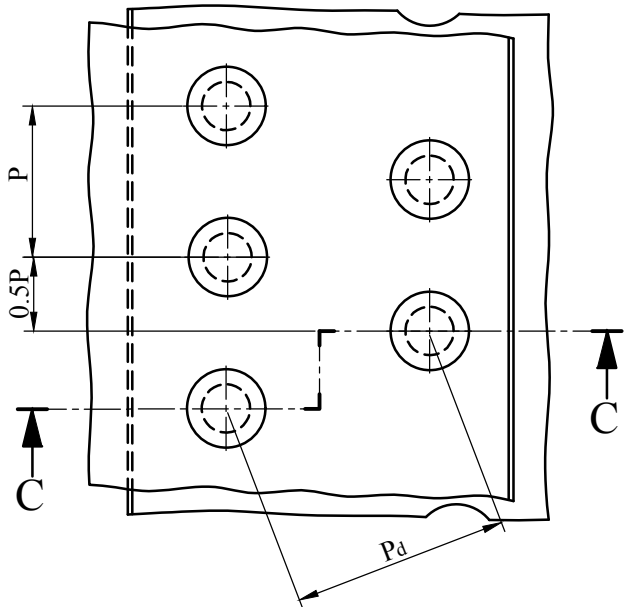
Section B-B



Section C-C



Double-Riveted (Chain) Lap Joint



Double-Riveted (Zig-Zag) Lap Joint

Fig. 2.7 TYPES OF LAP JOINTS

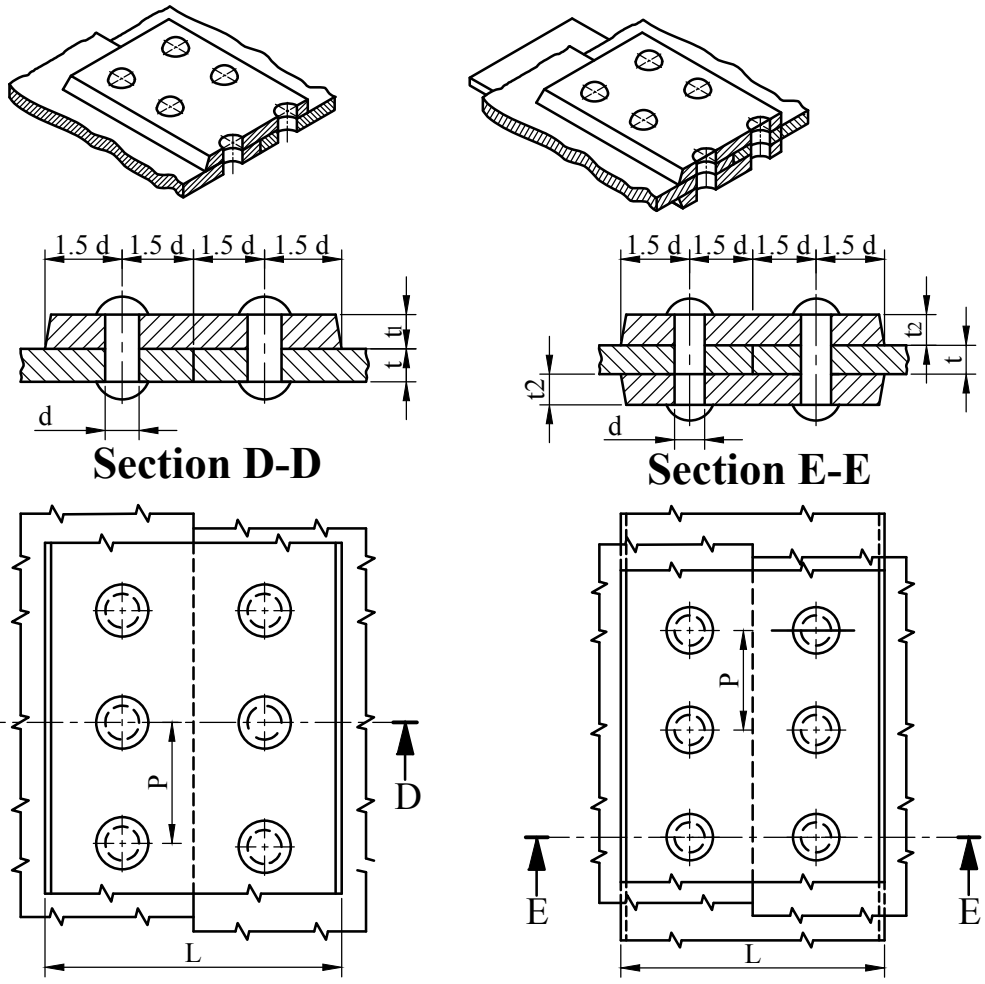


Fig 2.8 Single - Riveted (Single strap) Butt joint

Fig 2.9 Single - Riveted (Double strap) Butt joint

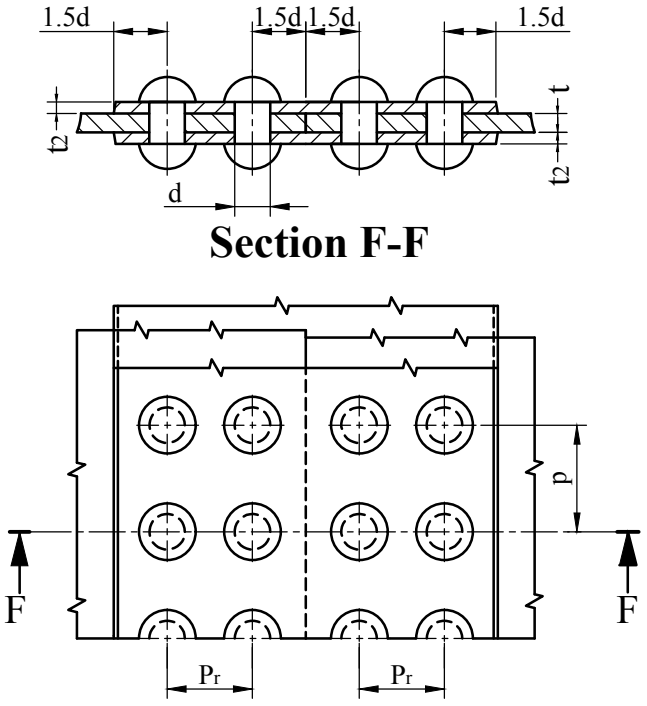


Fig 2.10 Double riveted double strap chain butt Joint

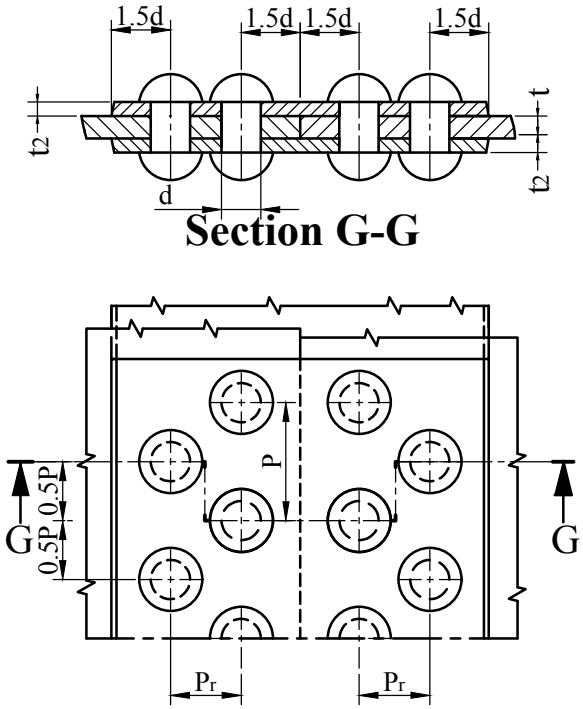


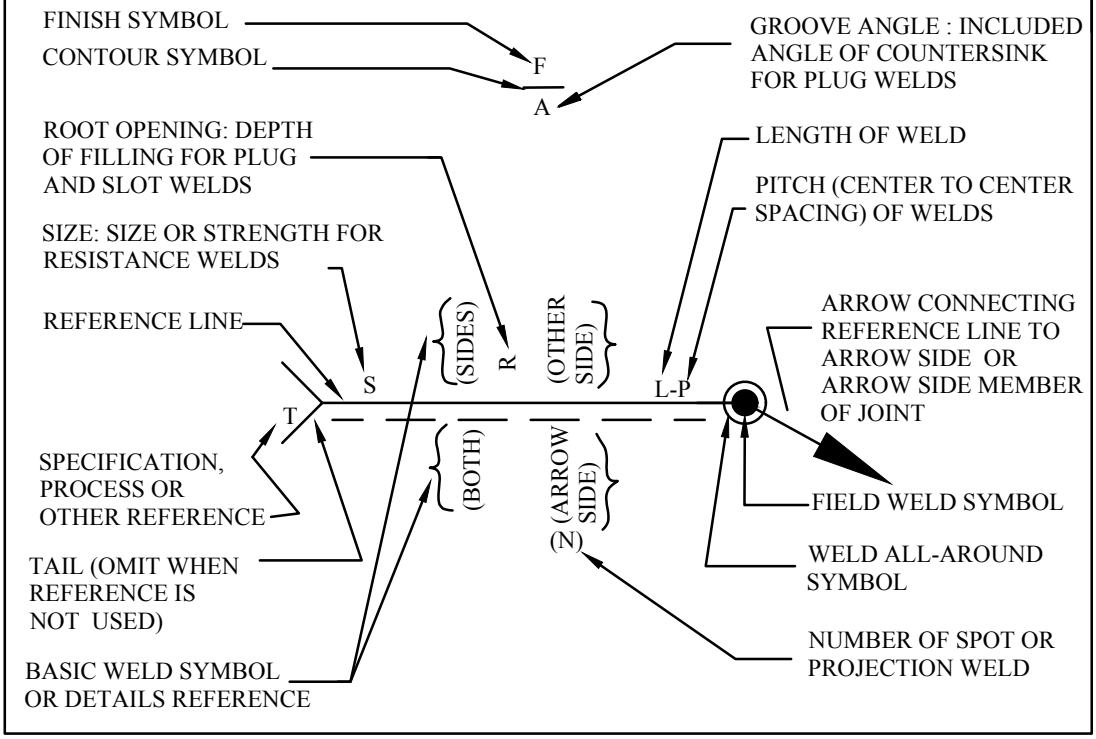
Fig 2.11 Double riveted double strap zig zag butt joint

Thickness of cover plate(Butt joint)
t_1 = 1.125t (Single cover)
t_2 = 0.625t (Double cover)

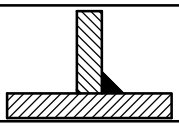
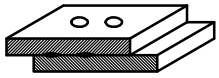
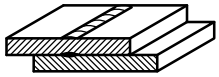
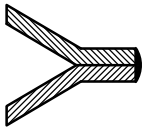
P_r = Row Pitch
= 0.6 P for Zig Zag Riveting
= 0.8 P for Chain Riveting

TABLE 2.5 WELDING SYMBOLS & CONVENTIONS

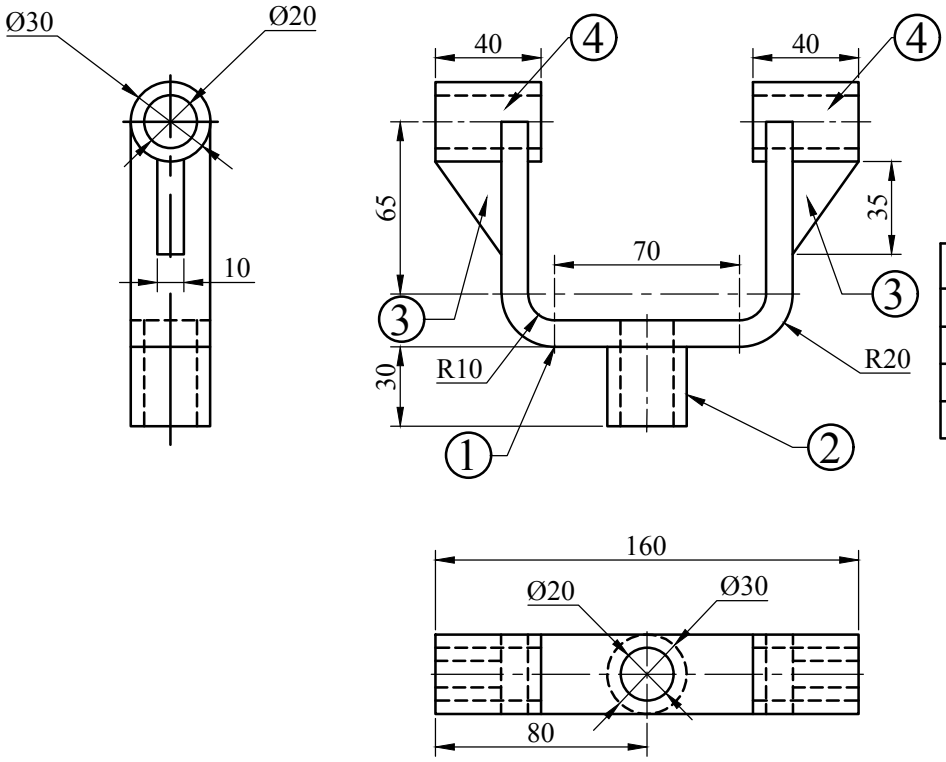
LOCATION OF ELEMENTS OF A WELDING SYMBOL



BASIC WELDING SYMBOL

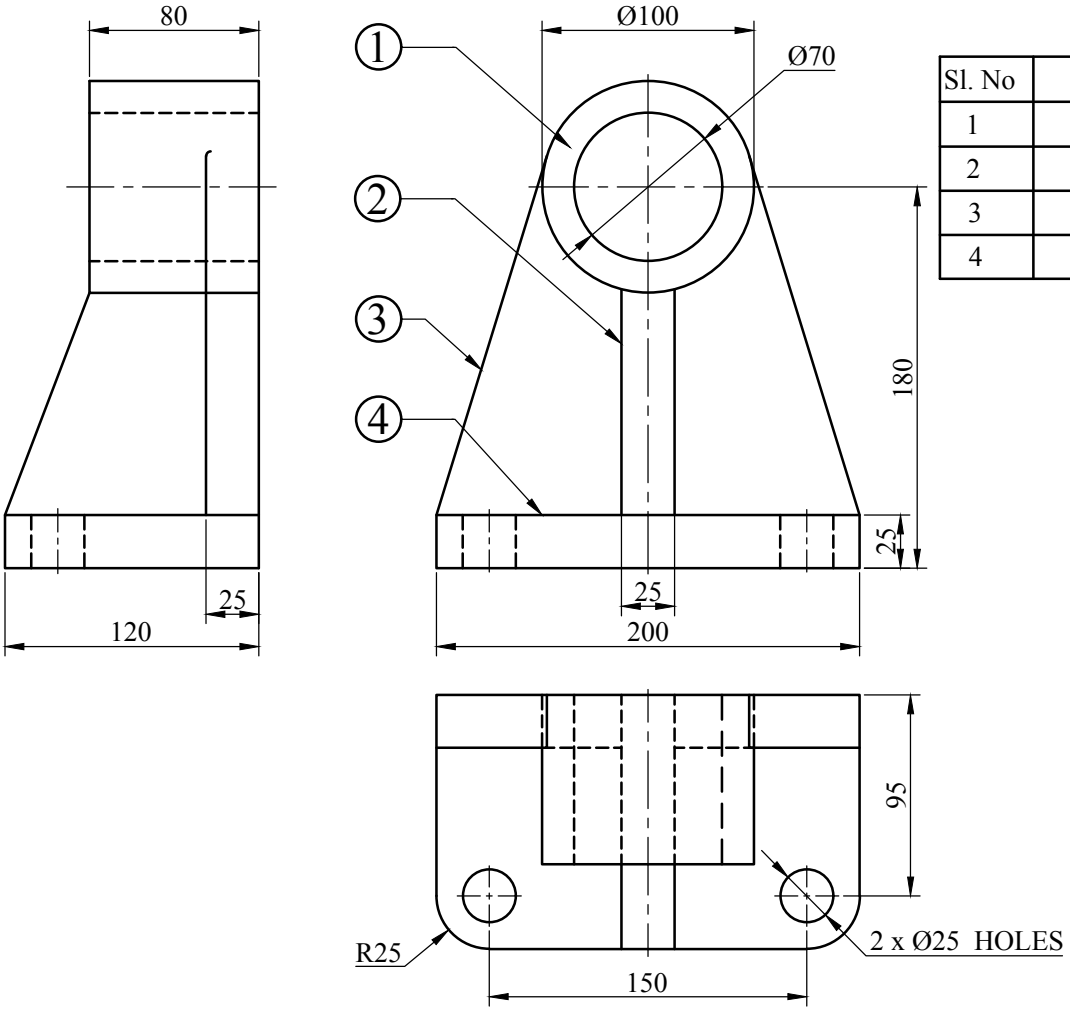
No.	FORM OF WELD	ILLUSTRATION	SYMBOL	No.	FORM OF WELD	ILLUSTRATION	SYMBOL
(i)	FILLET			(viii)	SINGLE-BEVEL BUTT		
(ii)	SQUARE BUTT			(xi)	SINGLE-BEVEL BUTT WELD WITH BROAD ROOT FACE		
(iii)	SINGLE-V BUTT			(x)	DOUBLE-BEVEL BUTT		
(iv)	DOUBLE-V BUTT			(xi)	DOUBLE-BEVEL BUTT WELD WITH BROAD ROOT FACE		
(v)	SINGLE-U BUTT			(xii)	SPOT		
(vi)	DOUBLE-U BUTT			(xiii)	SEAM		
(vii)	SINGLE-J BUTT			(xiv)	EDGE		

TYPE OF WELDED JOINTS AND THE CORRESPONDING STANDARD SYMBOLS



Sl. No	Component	Qty
1	Bracket	1
2	Bush	1
3	Rib	2
4	Bush	2

Fig. 2.12



Sl. No	Component	Qty
1	Housing	1
2	Rib	1
3	Rib	2
4	Base Plate	1

Fig. 2.13

3. ASSEMBLY DRAWINGS

3.1 The details of parts of a ***Screw Jack*** are shown in Fig. 3.1. A threaded spindle (2) with square threads is inserted to the body (1). At the end of the screw, a tommy bar (6) is inserted in order to rotate the spindle. The portion of the tommy bar that has to be held in hand is knurled for better gripping. A cap (3) is loosely fitted on the cylindrical projection at the top of the spindle and can rotate freely. A set screw (4) and a washer (5) are used for fitting the cap. Assemble the given parts in proper sequence and create the following views:

(a) Half sectional front view (b) Top view (c) Full sectional side view and (d) Isometric view

Show the major dimensions, itemize the parts and prepare the BOM.

3.2 Fig. 3.2 shows the part detail of a ***C-clamp***. Draw the following assembled views with necessary dimensions to suitable scale:

(a) Elevation in section (b) Right view and (c) Isometric view

Itemize the parts in the drawing views. Prepare the BOM.

The assembly consists of a c-shaped frame (1) and a screw rod (2) with handle (4). The pad (3) fitted to the end of the screw rod presses the workpiece against the fixed jaw on the c-frame, as the screw tightened. Note that the cap screw (7) inside the movable pad is tightly screwed to the end of the screw rod using the diameter step, but keeping the jaw free to rotate about it. This arrangement permits the jaw to be stationary on the workpiece while the screw rod is rotated during clamping. Collar (5) and pin (6) are fitted to end of the handle to prevent it falling out of screw rod during use.

3.3 Fig 3.3 details different parts of a ***Machine vice***. Draw the following assembled views with necessary dimensions to suitable scale:

(a) Sectional elevation (b) Plan (c) End view and (d) Isometric view

Show the major dimensions and itemize the parts in the drawing views. Prepare the BOM.

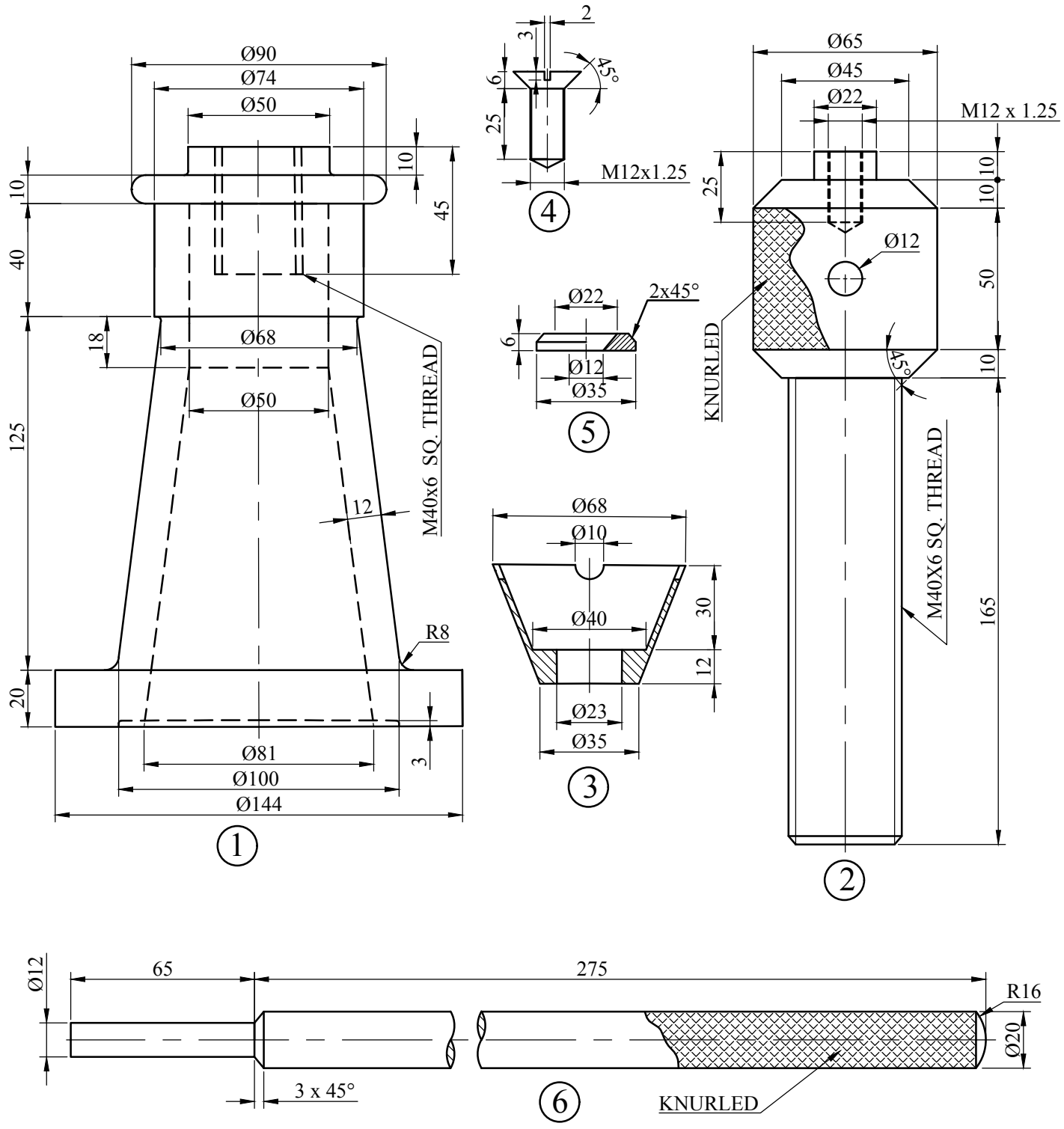
The fixed jaw is an integral part of the base (1). Sliding jaw holder (3) is inserted from the bottom of the base and sliding jaw (2) is mounted to it from top and fastened using nut (5). The clamp screw (4) is inserted through the hole from right side of the base, also passes through the threaded hole in the sliding jaw holder. The other end of the clamp screw is fastened with washer and nuts after it passes through the hole below the fixed jaw end.

3.4 From the details given in Fig 3.4, assemble the parts and draw the following views of *the* ***Non-return valve***:

(a) Sectional elevation taking the section at YY (b) Sectional plan taking the section at XX (c) Isometric view

Show the major dimensions and itemize the parts in the drawing views. Prepare the BOM.

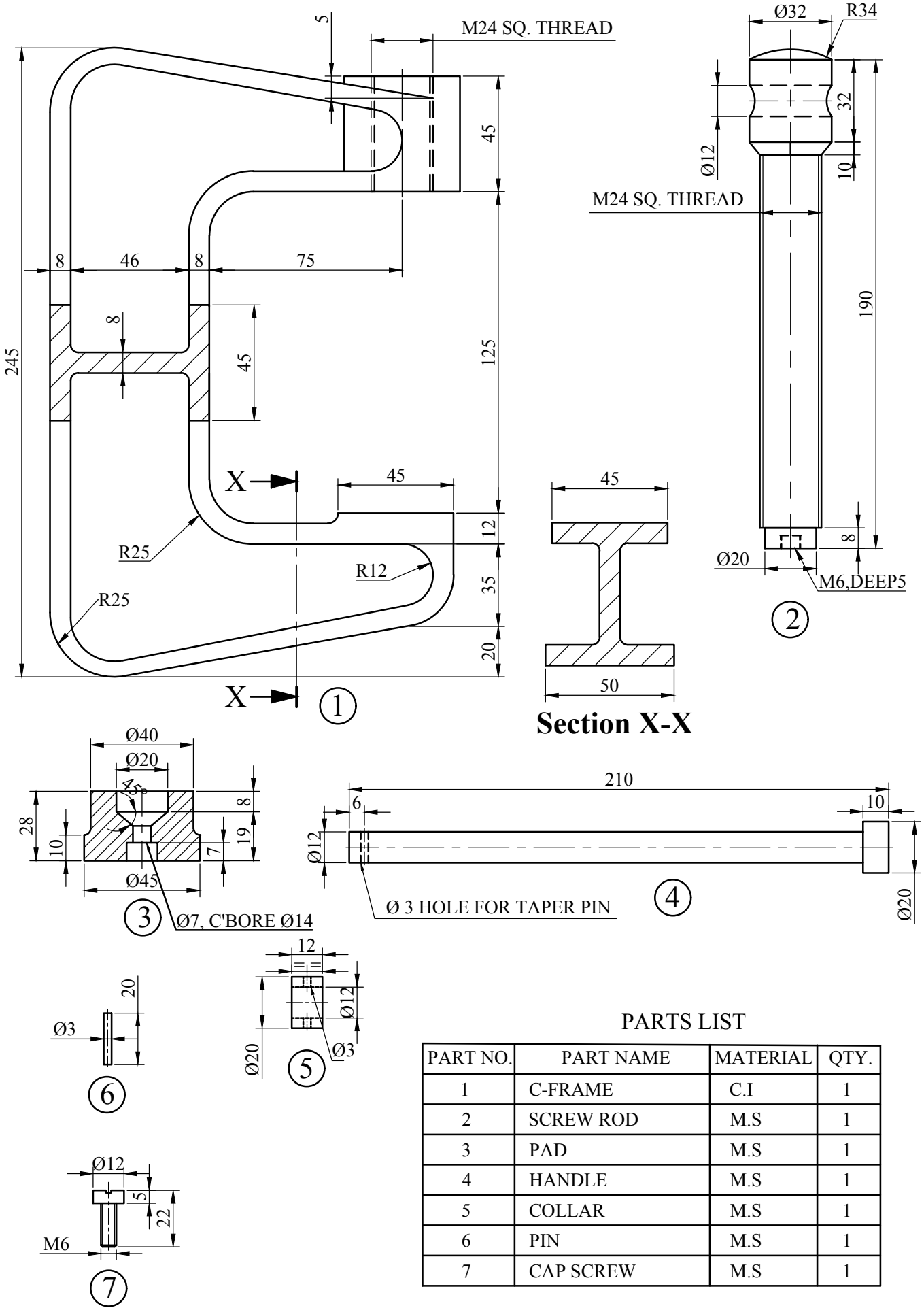
Fluid flow enters the valve at A (inlet) and leaves the valve at B (outlet). The gland bush (3) and the gland (4) are first assembled and screwed onto the spindle (2) and then assembled into the valve body (1) at C. By operating the spindle, the fluid outlet B is either closed or kept open. The valve (5) is positioned in the body through the passage D and it is kept floating. The valve stop (6) is screwed into the body at D and is used to control the amount of lift of the valve. The fluid inlet connection to the valve is made at A. When the spindle is operated and the outlet is open; due to the pressure of the inlet fluid, valve is lifted and passage is established from A through B. When the pressure of the incoming fluid is reduced, the valve automatically shuts-off the inlet passage, ensuring non-return of the fluid in the opposite direction.



PARTS LIST

PART NO.	PART NAME	MATERIAL	QTY.
1	BODY	C.I	1
2	SPINDLE	M.S	1
3	CAP	C.I	1
4	SCREW	M.S	1
5	WASHER	M.S	1
6	TOMMY BAR	M.S	1

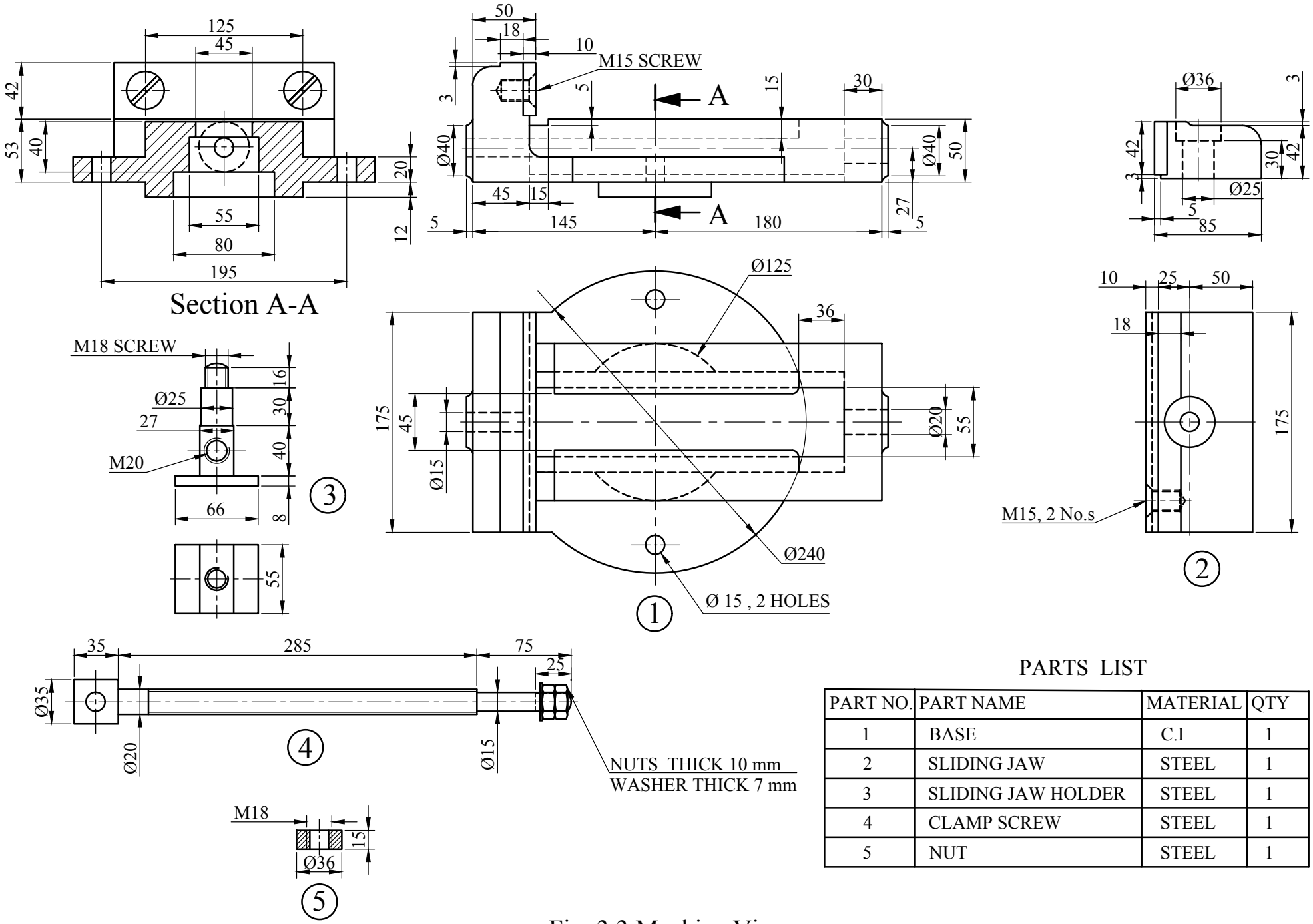
Fig 3.1 Screw Jack



PARTS LIST

PART NO.	PART NAME	MATERIAL	QTY.
1	C-FRAME	C.I	1
2	SCREW ROD	M.S	1
3	PAD	M.S	1
4	HANDLE	M.S	1
5	COLLAR	M.S	1
6	PIN	M.S	1
7	CAP SCREW	M.S	1

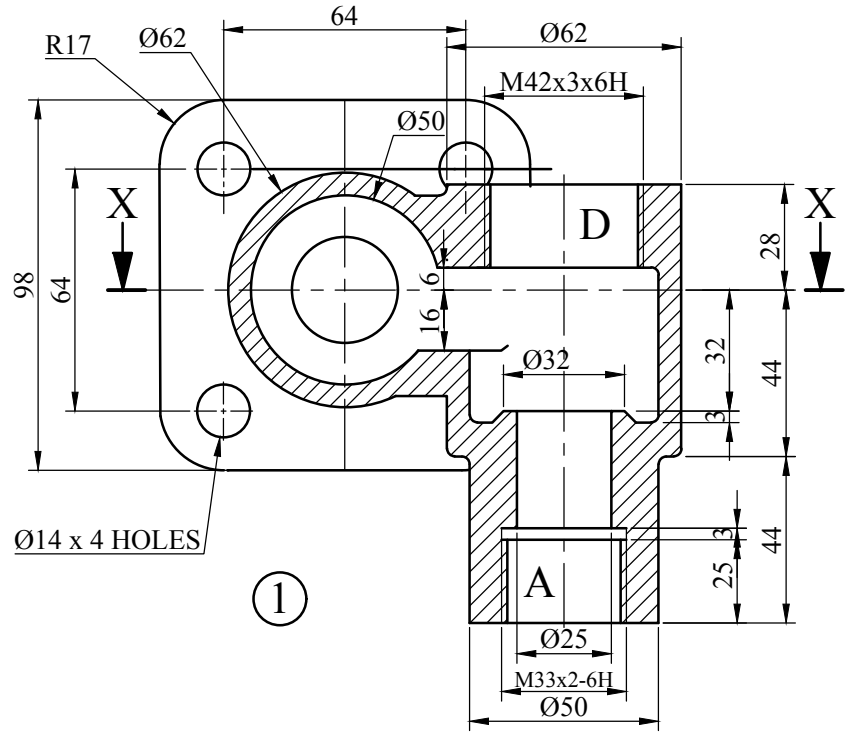
Fig 3.2 C-clamp



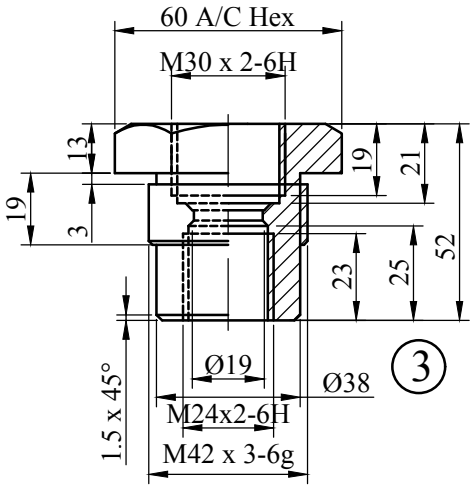
PARTS LIST

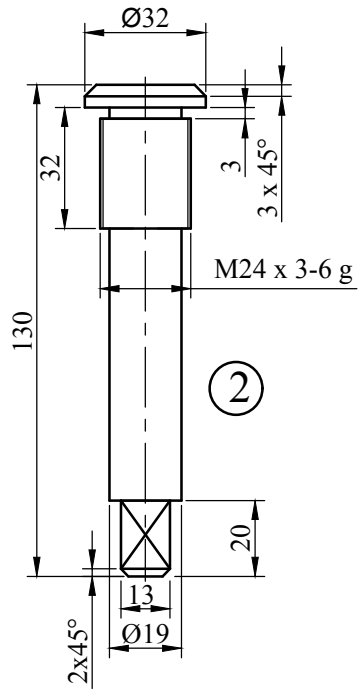
PART NO.	PART NAME	MATERIAL	QTY
1	BASE	C.I	1
2	SLIDING JAW	STEEL	1
3	SLIDING JAW HOLDER	STEEL	1
4	CLAMP SCREW	STEEL	1
5	NUT	STEEL	1

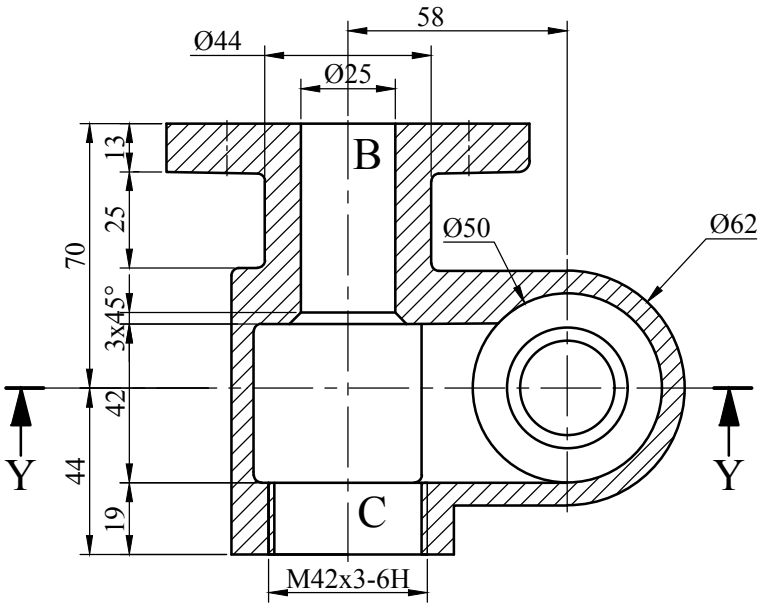
Fig. 3.3 Machine Vice



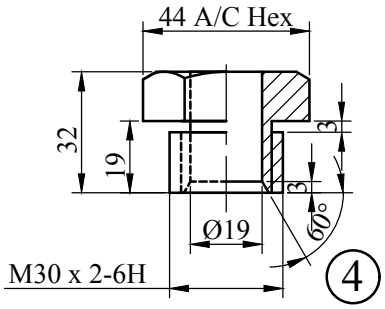
Section Y-Y

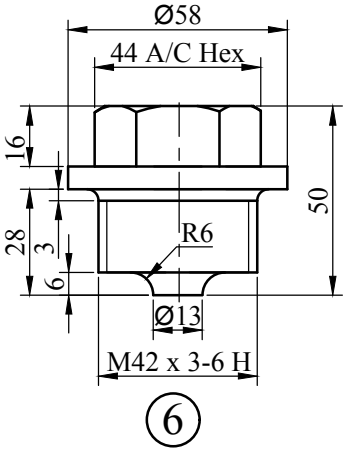


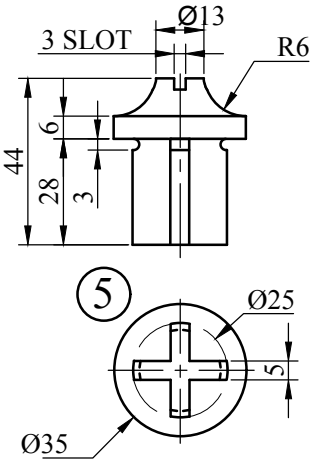




Section X-X







PARTS LIST

PART NO.	PART NAME	MATERIAL	QTY
1	VALVE BODY	C.I	1
2	SPINDLE	BRASS	1
3	GLAND BUSH	BRASS	1
4	GLAND	BRASS	1
5	VALVE	BRASS	1
6	VALVE STOP	BRASS	1

Fig. 3.4 Non-return valve

4. PRODUCTION DRAWINGS

4.1 Prepare the production drawings of the components of the ***Journal Bearing*** shown in Fig. 4.1 Indicate the suitable fits and dimensional, geometric tolerances (GD&T) wherever necessary for the following parts. Also show the machining and surface finish symbols at required locations.

a) Body

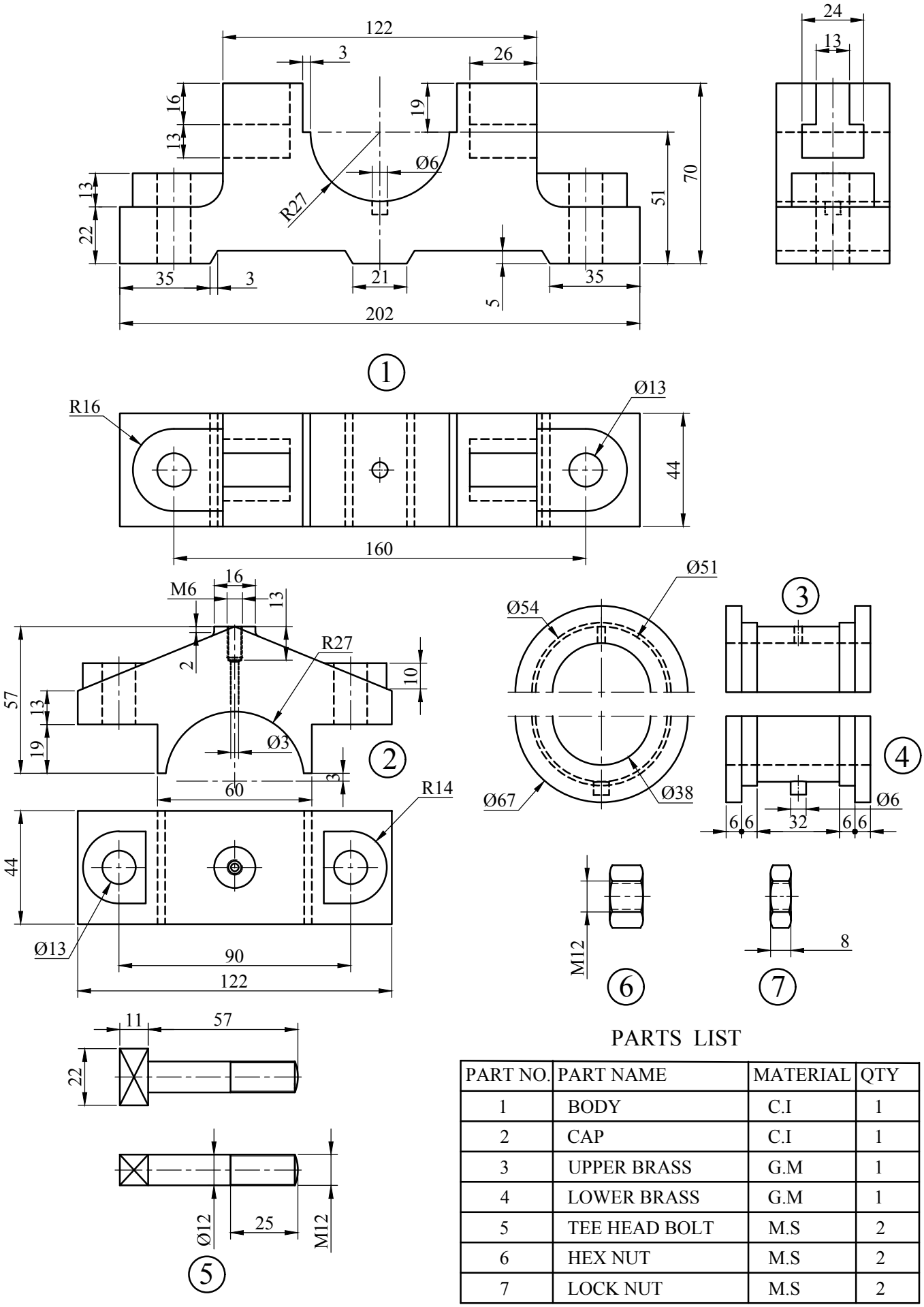
b) Cap

c) Lower brass

4.2 Prepare the working drawings of the components of the ***Spring-Loaded Safety Valve*** shown in Fig. 4.2 Include all the relevant details necessary for manufacturing the components (GD&T, Surface finish, Suitable fits etc.)

a) Valve Body

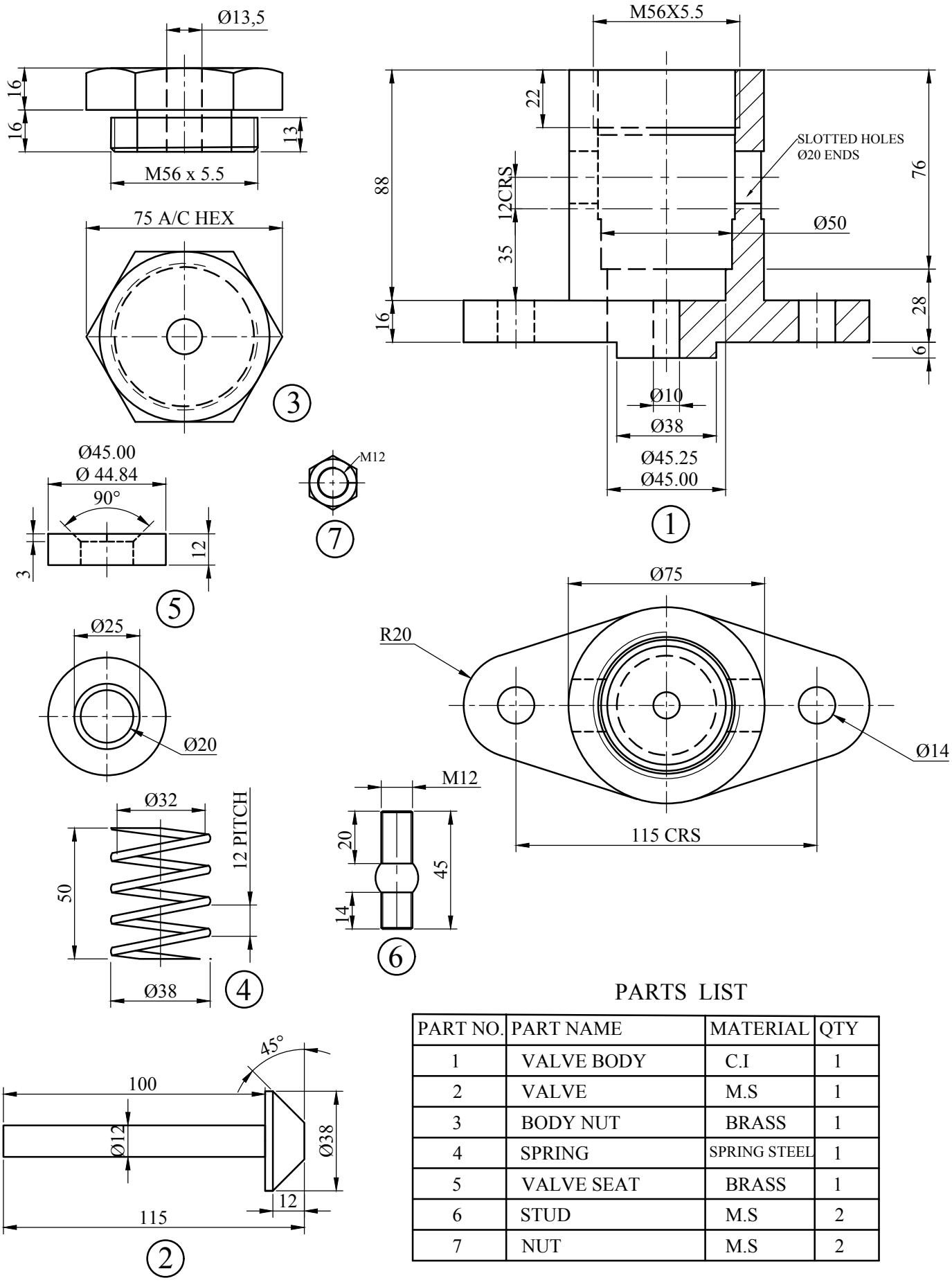
b) Valve



PARTS LIST

PART NO.	PART NAME	MATERIAL	QTY
1	BODY	C.I	1
2	CAP	C.I	1
3	UPPER BRASS	G.M	1
4	LOWER BRASS	G.M	1
5	TEE HEAD BOLT	M.S	2
6	HEX NUT	M.S	2
7	LOCK NUT	M.S	2

Fig. 4.1 Journal bearing



PARTS LIST

PART NO.	PART NAME	MATERIAL	QTY
1	VALVE BODY	C.I	1
2	VALVE	M.S	1
3	BODY NUT	BRASS	1
4	SPRING	SPRING STEEL	1
5	VALVE SEAT	BRASS	1
6	STUD	M.S	2
7	NUT	M.S	2

Fig. 4.2 Spring Loaded Safety Valve

5. CONVENTIONAL REPRESENTATION

Conventional representation of various mechanical symbols are shown in the tables 5.1 – 5.6.

5.1 Draw the conventional representations for the following machine elements.

a) Conical Helical Spring with Rectangular Section
b) Helical Torsion Spring
c) Rack and Pinion
d) Worm and Worm wheel
e) Ball Bearing
f) Leaf spring without eyes and with center band
g) Square end of a Shaft
h) Splined Shaft
i) Ratchet and Pinion
j) Straight Knurling.

5.2 Draw the conventional representation of Steel, Wood, Concrete, Asbetos, Marble and Glass.

Table 5.1 CONVENTIONAL REPRESENTATION OF COMMON FEATURES

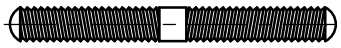
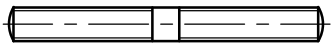
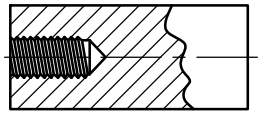
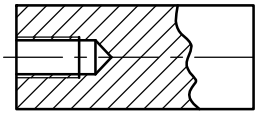
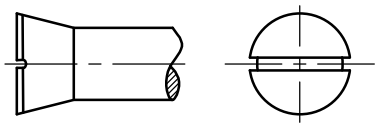
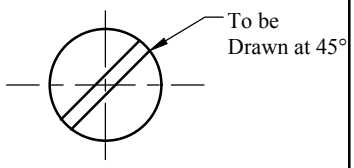
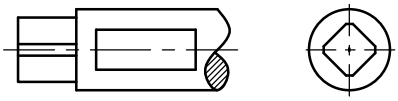
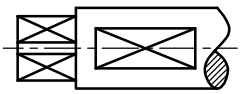
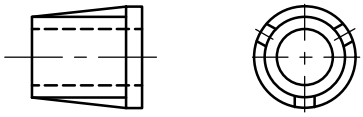
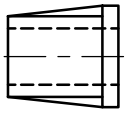
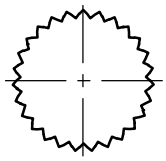
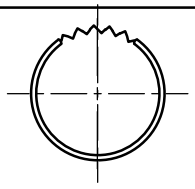
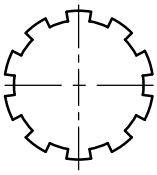
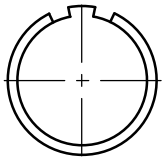
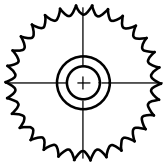
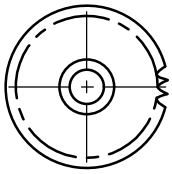
TITLE	ACTUAL PROJECTION / SECTION	CONVENTION
EXTERNAL THREADS		
INTERNAL THREADS		
SLOTTED HEAD		
SQUARE END AND FLAT		
RADIAL RIBS		
SERRATED SHAFT		
SPLINED SHAFT		
CHAIN WHEEL		

Table 5.2 CONVENTIONAL REPRESENTATION OF COMMON FEATURES - Contd

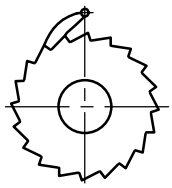
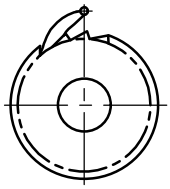
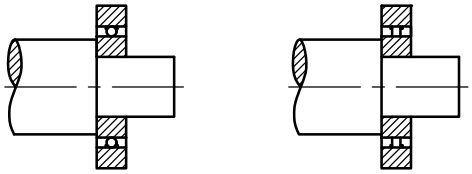
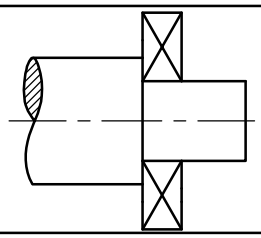
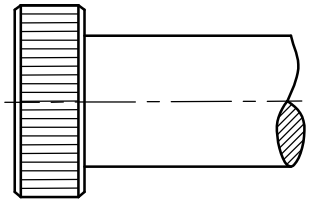
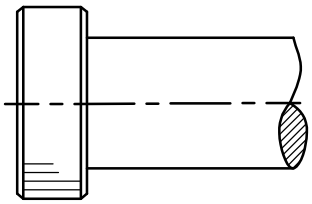
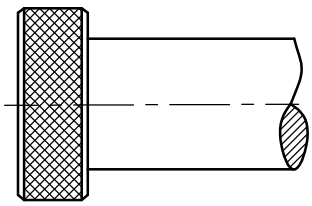
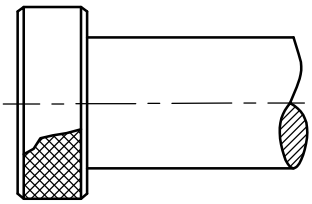
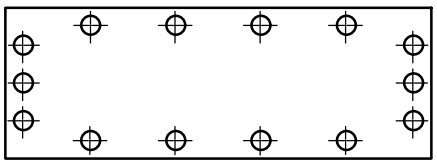
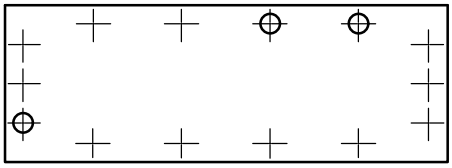
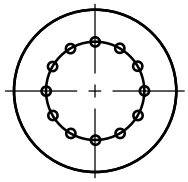
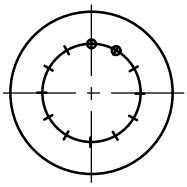
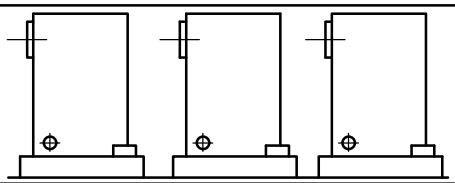
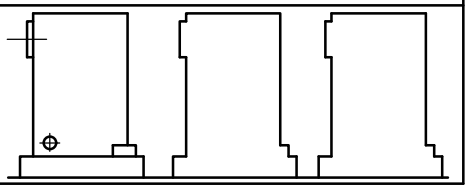
TITLE	ACTUAL PROJECTION / SECTION	CONVENTION
RATCHET AND PINION		
BEARINGS		
STRAIGHT KNURLING		
DIAMOND KNURLING		
HOLES ON A LINEAR PITCH		
HOLES ON A CIRCULAR PITCH		
REPEATED PARTS		

Table 5.3 CONVENTIONAL REPRESENTATION OF SPRINGS

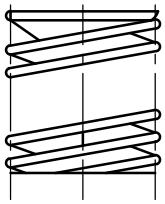
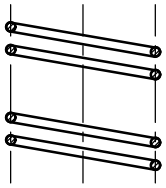
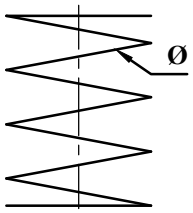
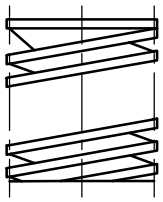
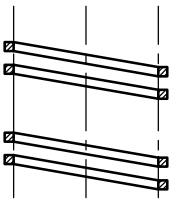
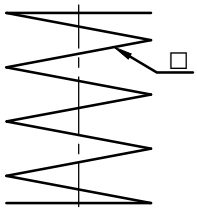
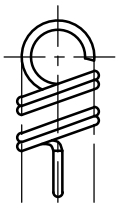
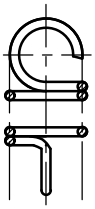
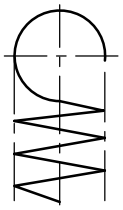
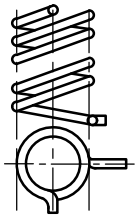
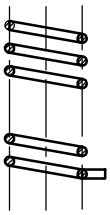
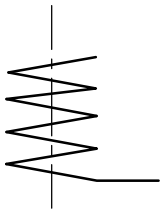
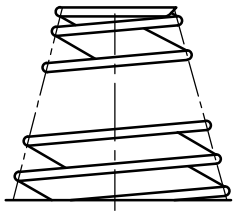
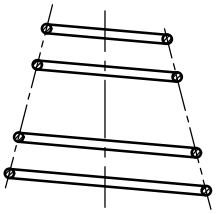
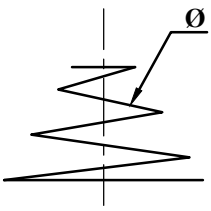
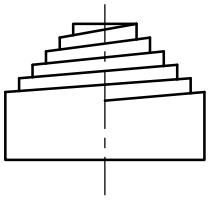
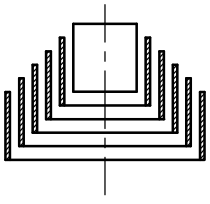
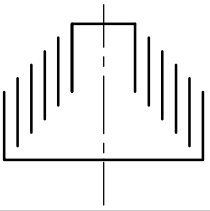
DESCRIPTION		ACTUAL PROJECTION		CONVENTION
		VIEW	SECTION	
HELICAL SPRINGS	COMPRESSION SPRING WITH CIRCULAR SECTION			
	COMPRESSION SPRING WITH SQUARE SECTION			
	TENSION SPRING			
	HELICAL TORSION SPRING			
CONICAL HELICAL SPRINGS	WITH CIRCULAR SECTION			
	WITH RECTANGULAR SECTION			

Table 5.4 CONVENTIONAL REPRESENTATION OF SPRINGS - Contd.

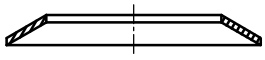
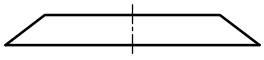
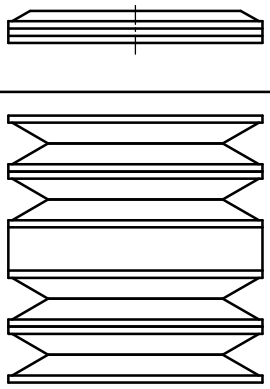
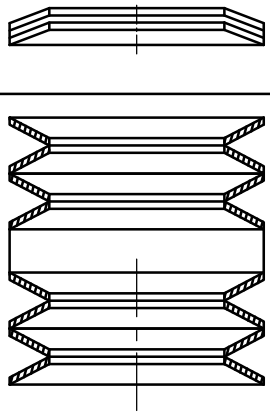
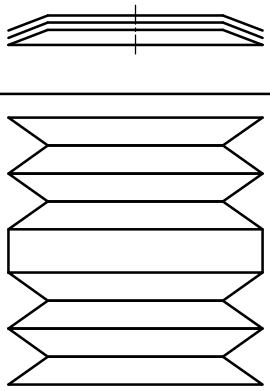
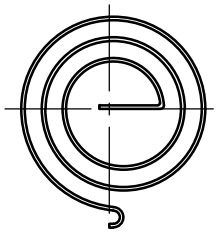
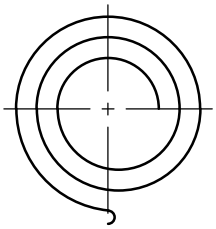
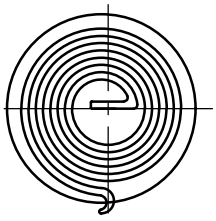
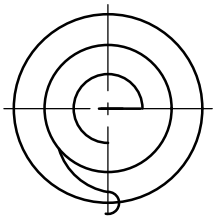
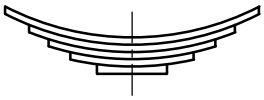
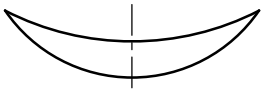
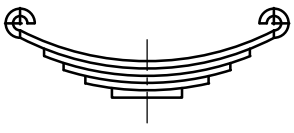
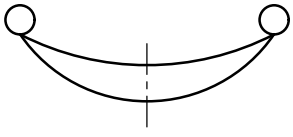
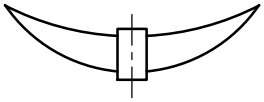
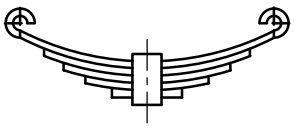
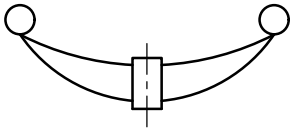
DESCRIPTION		ACTUAL PROJECTION		CONVENTION
		VIEW	SECTION	
DISC SPRINGS	SPRING			
	SPRING ASSEMBLY			
SPIRAL SPRINGS	SPIRAL SPRING, UNWOUND		—	
	SPIRAL SPRING, WITH WOUND BARREL		—	
LEAF SPRINGS	WITHOUT EYES		—	
	WITH EYES		—	
	WITHOUT EYES, WITH CENTRE BAND		—	
	WITH EYES AND CENTRE BAND		—	

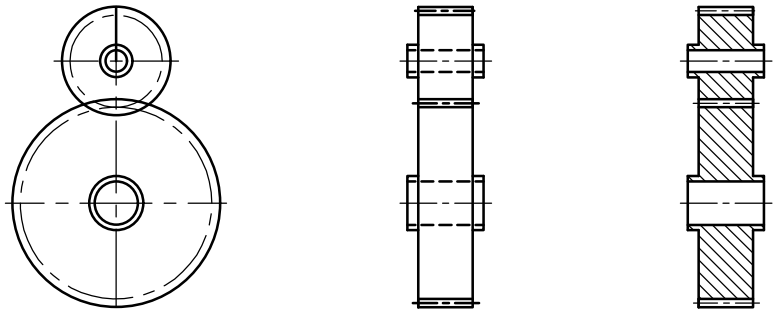
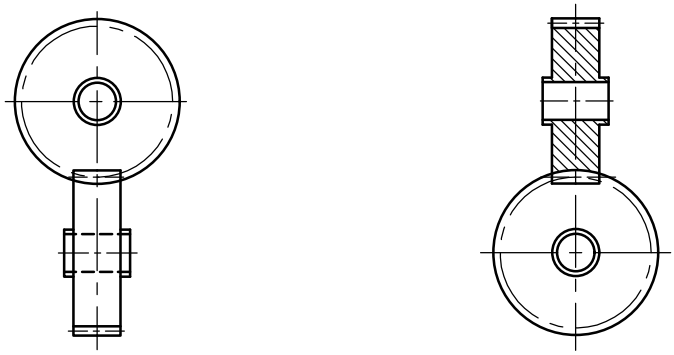
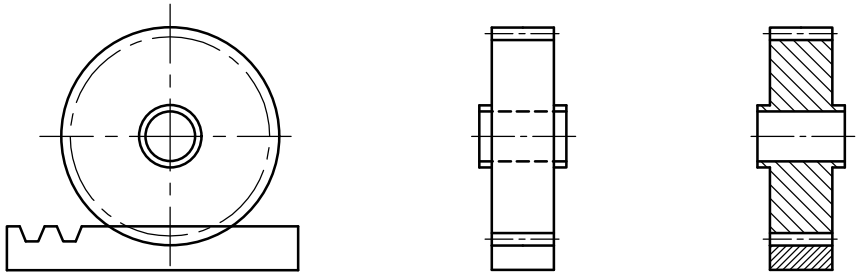
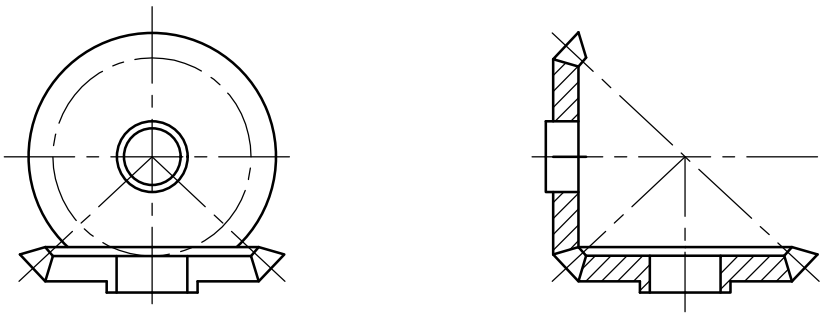
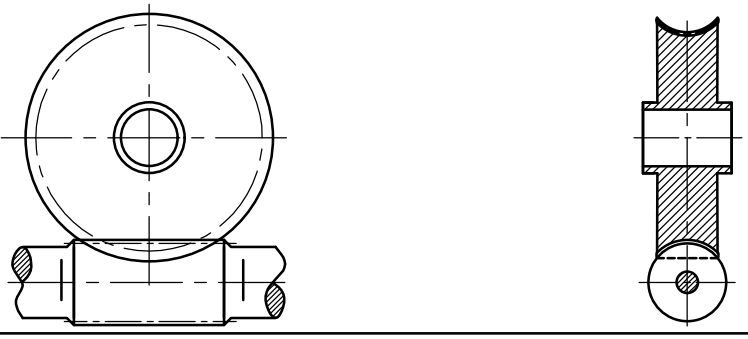
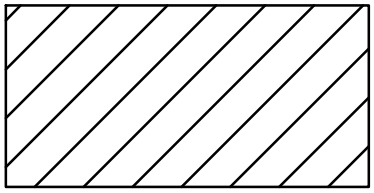
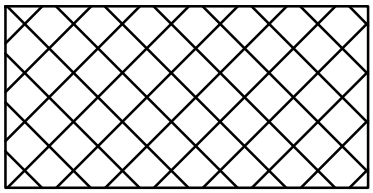
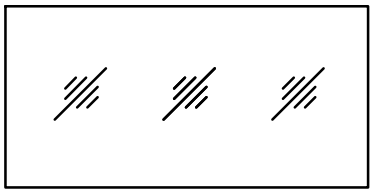
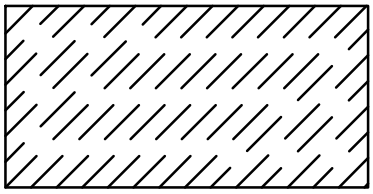
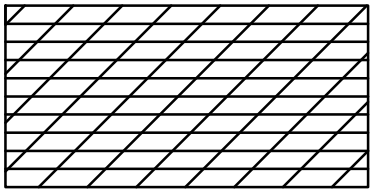
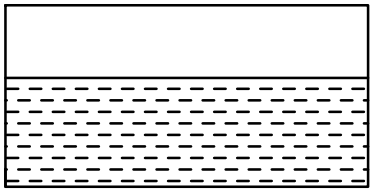
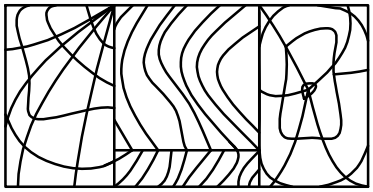
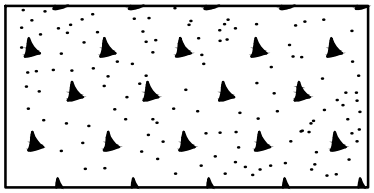
Table 5.5 CONVENTIONAL REPRESENTATION OF GEAR ASSEMBLIES	
TITLE	CONVENTIONAL REPRESENTATION
SPUR/HELICAL GEARS	
SCREW GEARS	
RACK AND PINION	
BEVEL GEARS (ASSEMBLY)	
WORM AND WORM WHEEL	

Table 5.6 CONVENTIONAL REPRESENTATION OF MATERIALS

TYPE	CONVENTION	MATERIAL
METALS		STEEL, CAST IRON, COPPER AND ITS ALLOYS, ALUMINIUM AND ITS ALLOYS,ETC
		LEAD, ZINC, TIN, WHITE-METAL, ETC
GLASS		GLASS
PACKING & INSULTING MATERIALS		PROCELAIN, STONEWARE, MARBLE, SLATE,ETC
		ASBESTOS, FIBRE, FELT, SYNTHETIC RESIN PRODUCTS, PAPER, CORK, LINOLEUMRUBBER, LEATHER, WAX, INSULATING AND FILLING MATERIALS
LIQUIDS		WATER, OIL, PETROL, KEROSINE, ETC
WOOD		WOOD, PLYWOOD, ETC
CONCRETE		CONCRETE BLOCK, CONCRETE WALL, CONCRETE PILLAR AND BEAMS ETC