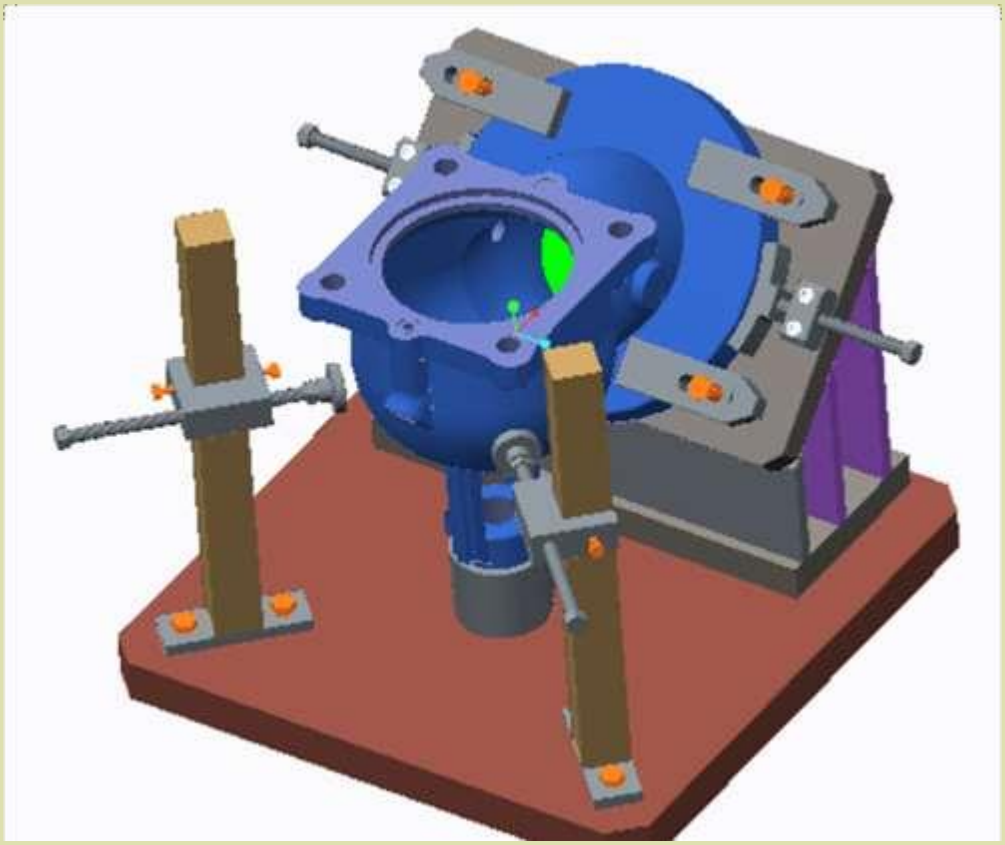
JIGS AND FIXTURES DESIGN NOTES



GENERAL OBJECTIVES:

1.0 Awareness of the difference between jig and fixture.
2.0 Awareness of planes of movements.
3.0 Awareness of possible freedom of movements of job in a jig, fixture.
4.0 Awareness of locating work piece in a jig, fixture.
5.0 Highlight the types of jig.
6.0 Highlight the types of fixture.
7.0 General awareness of mounting jig on a machine tool.
8.0 General awareness of mounting fixture on a machine tool
9.0 Awareness of elements of jig and fixture.
10.0 Highlight the importance of cutting tool used with jig, fixture.
11.0 Awareness of design of jigs, fixture.
12.0 General awareness of cutting forces acting on jig, fixture
13.0 Highlight the common failures of jig, fixture
14.0 General awareness of heat treatment of jig and fixture parts.

REQUIREMENTS TO BECOME A TOOL DESIGNER

To perform the functions of a tool designer, an individual must have the following skills:

- The ability to make mechanical drawings and sketches
- An understanding of modern manufacturing methods, tools, and techniques
- A creative mechanical ability
- An understanding of basic toolmaking methods
- A knowledge of technical mathematics through practical trigonometry
- CAD drafting skills
- File management
- Electronic communication skills
- Geometric dimensioning and tolerance

Design considerations for jigs and fixtures: Keeping in view increase in productivity, product quality, repeatability i.e. interchangeability and overall economy in batch production by machining, the following factors are essentially considered during design, fabrication and assembly of jigs and fixtures:

(1) Study of the component/work piece.
(2) Type and Capacity of the machine.
(3) Locating elements.
(4) Loading and unloading arrangement.
(5) Clamping arrangement.
(6) Power devices for operating the clamping elements.
(7) Clearance required between the Jig and the component.
(8) Indexing devices.
(9) Tool guiding and cutter setting elements.
(10) Fool-proofing arrangement.
(11) Ejecting devices.
(12) Swarf removal arrangement.
(13) Rigidity and vibration problem.
(14) Table fixing arrangement.
(15) Safety devices.
(16) Methods of manufacture of the jig base body or frame

After studying this unit, the students should be able to understand

- Importance of Guiding Elements,
- Needs of Guiding Elements,
- Purpose of Guiding Elements
- Types of Tool Guiding Elements
- Materials used for Guiding Elements and
- Hardness requirements of Guiding elements

MATERIALS FOR JIGS AND FIXTURES

Some of the materials used in the construction of Jigs and fixtures are:

- Alloy steel,
- Carbon steel,
- Hot rolled steel,
- Cold drawn steel,
- Aluminum, Cast iron,
- Plastics,
- Brass,
- Bronze,
- Tool steel.

VARIOUS STEELS USED IN JIGS AND FIXTURES

- ***PROPERTIES OF TOOL MATERIALS:***
  - Hardness
  - Toughness
  - Wear Resistance
  - Machinability
  - Brittleness
  - Tensile Strength
  - Shear Strength
- ***TOOL MATERIALS NORMALLY USED:***
  - Cast Iron
  - Carbon Steel
  - Alloy Steel
  - Tool Steel

HARDNESS REQUIREMENTS FOR TOOL ELEMENTS HRC

Locating Pins	-	55-60	HRC	Flat
Clamp	-	35-60	HRC	Slip

Bushes	-	60-62	HRC	C –
Washers	-	40-45	HRC	Wing
Nut:	-	30-35		
Setting Block	-	55-60		

Web Links for relevant reference:

https://www.theengineerspost.com/jigs-and-fixtures/

https://www.mechanicalbooster.com/2016/11/difference-between-jigs-and-fixtures.html

https://www.slideserve.com/kim-johnston/design-of-jigs-and-fixtures

http://www.rentapen.com/

https://www.slideshare.net/amrutarane5/drill-bushe

Design of Jigs and Fixtures Elements (Standard Elements)

Reference Tables

Tolerance Limits for Selected Holes (Hole Basis)

Nominal sizes		H7		H8		H9		H11	
Over mm	Up to and incl. mm	ul +	ll	ul +	ll	ul +	ll	ul +	ll
6	10	15	0	22	0	36	0	90	0
10	18	18	0	27	0	43	0	110	0
18	30	21	0	33	0	52	0	130	0
30	50	25	0	39	0	62	0	160	0
50	80	30	0	46	0	74	0	190	0
80	120	35	0	54	0	87	0	220	0
120	180	40	0	63	0	100	0	250	0
180	250	46	0	72	0	115	0	290	0

ul = Upper limit; ll = Lower limit; Unit = 0.001 mm.

Figure **14.1**
Hole tolerance for common fits

Editor's Note: Some of the material contained in the following reference tables may not be compatible with current standards as published in North America. Therefore, the reader is advised to consult applicable references for specific projects to avoid potential design errors.

Diamond Pin Locator (Variable Locator) Design Calculation:

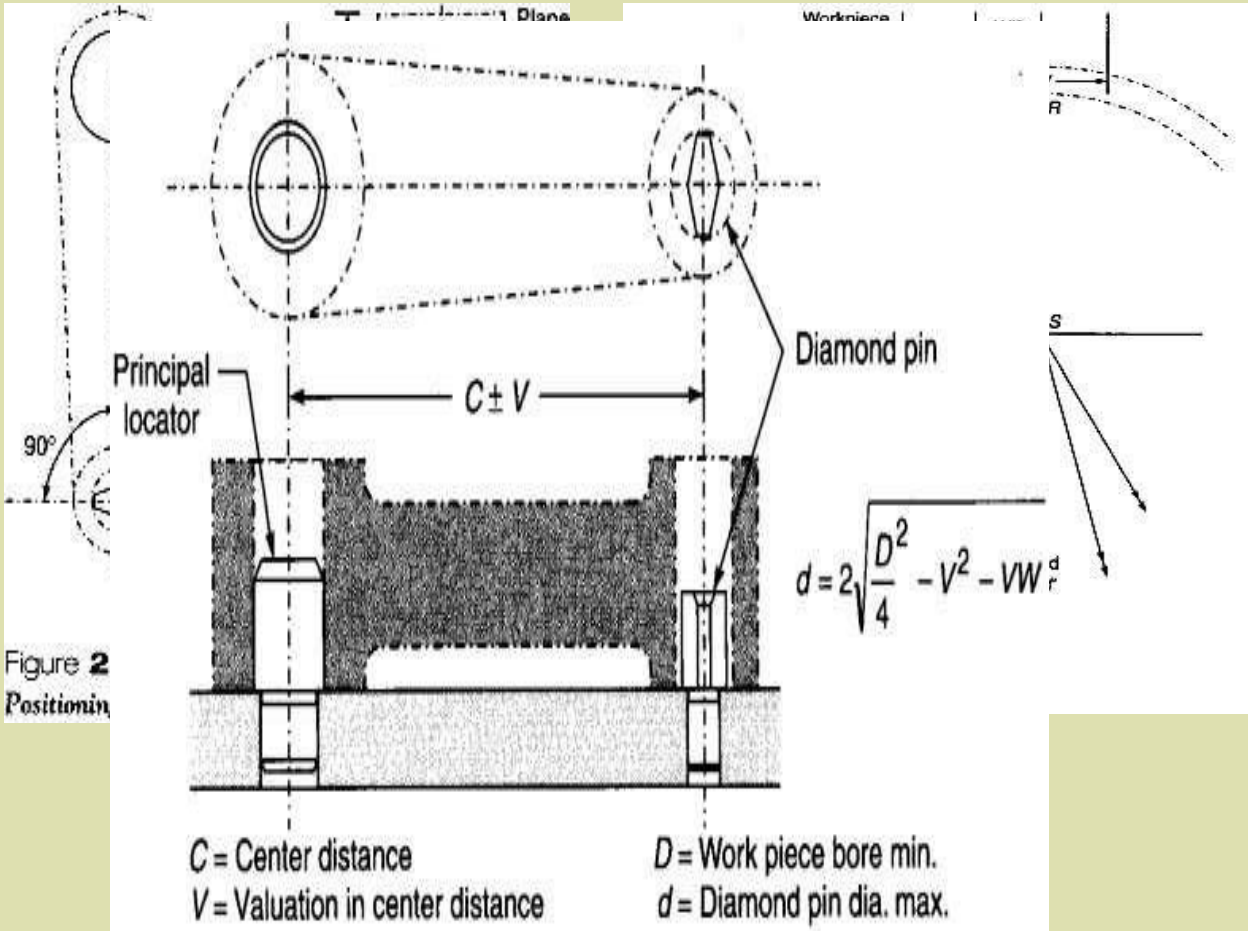


Figure **2.29a**

Diamond pin application

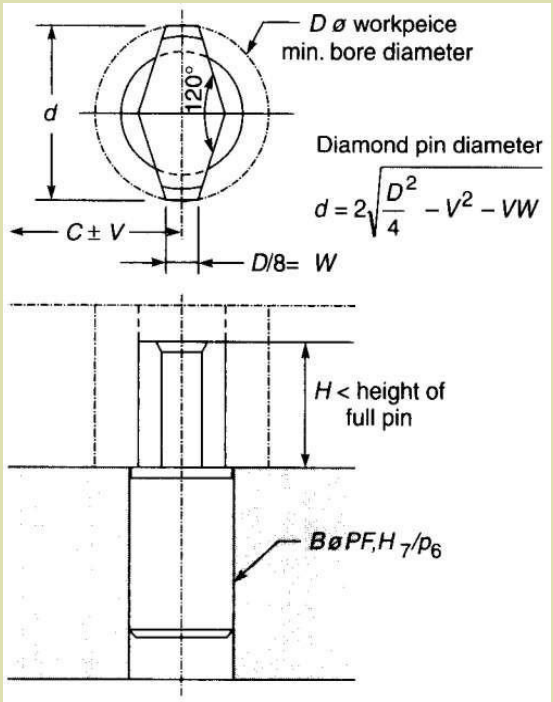


Figure **2.30**
Diamond pin design

Example 2.1 Calculate the diameter of a diamond pin placed at 45 ± 0.15 distance from a plane surface if the locating hole in the workpiece D is 55.55/55.596 and engagement width W of the pin is 2 (*Figure 2.29 b*).

Solution: Minimum ø of workpiece hole = D

$$D = 55.55$$

$$\text{Variation} = V = 0.15$$

$$W = 2$$

$\therefore$ Diamond p in ø = d

$$d = 2\sqrt{\frac{55.55^2}{4} - 0.15 \times 2 - 0.15^2}$$

$$= 2\sqrt{771.45 - 0.3 - 0.0255}$$

$$= 2\sqrt{771.1275} = 55.538$$

Radial clearance $(D-d)/2$ is only 0.006. But the clearance at location corner 'Q' is 0.15, i.e. 25 times the radial clearance. The pin should be made further undersize to provide precision running fit (H7/f6) with the workpiece.

Diamond pin ø = d = 55.538f6

$$= 55.538\ ^{-0.03}_{-0.049}$$

Width W of the diamond pin is usually kept one-eighth of the workpiece hole ø D (*Figure 2.30*). It can, however, be varied suitably to accommodate variation V in centre distance C in the workpiece and the desired fit between the diamond pin and the hole.

Example 2.2 Determine permissible variation V in centre distance 45 in example 2.1, if width W is increased to 7. While pin d remains same, i.e. 55.538f6.

Example 2.2 Determine permissible variation V in centre distance 45 in example 2.1, if width W is increased to 7. While pin d remains same, i.e. 55.538f6.

$$d = 2\sqrt{\frac{D^4}{4} - VW - V^2}$$

$$\therefore \quad 55.538 = 2\sqrt{771.45 - 7V - V^2}$$

$$\text{or} \quad V^2 + 7V - 0.33264 = 0$$

$$V = \pm 0.0472$$

Angular accuracy required in location is the ultimate criterion for the radial clearance permissible between the diamond pin and the workpiece hole.

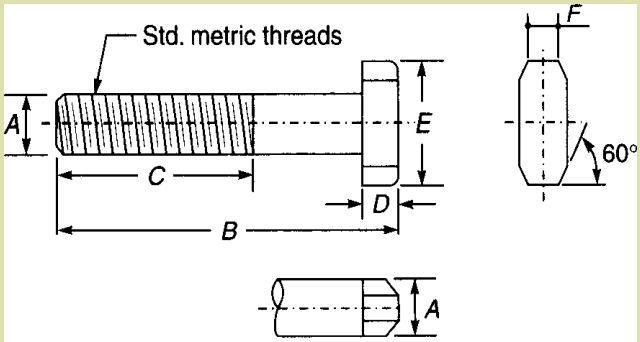
Tolerance Limits for Selected Shafts

Nominal sizes		c11		d10		e9		f7		g6		h6		k6		n6		p6		s6	
Over mm	to mm	ul −	ll −	ul −	ll −	ul −	ll −	ul −	ll −	ul −	ll −	ul −	ll −	ul +	ll +	ul +	ll +	ul +	ll +	ul +	ll +
6	10	80	170	40	98	25	61	13	28	5	14	0	9	10	1	19	10	24	15	32	23
10	18	95	205	50	120	32	75	16	34	6	17	0	11	12	1	23	12	29	18	39	28
18	30	110	240	65	149	40	92	20	41	7	20	0	13	15	2	28	15	35	22	48	35
30	40	120	280	80	180	50	112	25	50	9	25	0	16	18	2	33	17	42	26	59	43
40	50	130	290																		
50	65	140	330	100	220	60	134	30	60	10	29	0	19	21	2	39	20	51	32	72	53
65	80	150	340																	78	59
80	100	170	390	120	260	72	159	36	71	12	34	0	22	25	3	45	23	59	37	93	71
100	120	180	400																	101	79
120	140	200	450	145	305	85	185	43	83	14	39	0	25	28	3	52	27	68	43	117	92
140	160	210	460																	125	100
160	180	230	480																	133	108
180	200	240	530	170	355	100	215	50	96	15	44	0	29	33	4	60	31	79	50	151	122
200	225	260	550																	159	130
225	250	280	570																	169	140

ul = Upper limit;ll = Lower limit; Unit = 0.001 mm

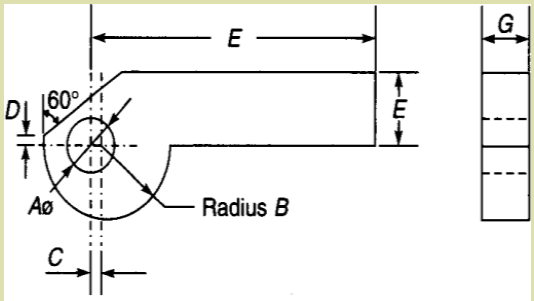
Figure **14.1 *(continued)***

Hole tolerance for common fits



A	B	C	D	E	F
M 10	50	35	12	28	5
M 12	62	38	15	32	6
M 16	82	47	20	35	6
M 20	100	60	22	40	10

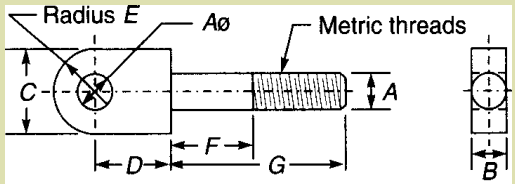
Figure **14.3**
Quarter-turn screw



Material: Mild Steel

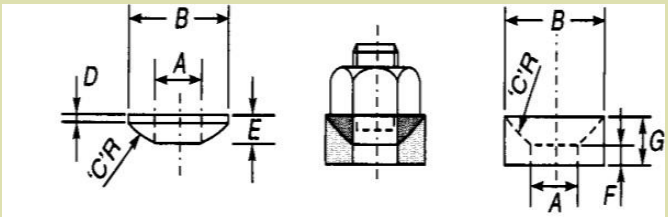
A	B	C	D	E	F	G
10	13	1.5	3	12	60	10
12	16	2	4	15	70	12
16	20	2.5	5	18	90	16
20	25	3	6	24	110	20

Figure **14.2**
Cam clamps



A	B	C	D	E	F	G
10	13	20	13	10	12	32
10	13	20	13	10	25	62
12	16	25	16	12	16	50
12	16	25	16	12	25	75
16	20	32	20	16	20	90
20	22	38	22	20	22	75

Figure **14.4**
Eye bolts

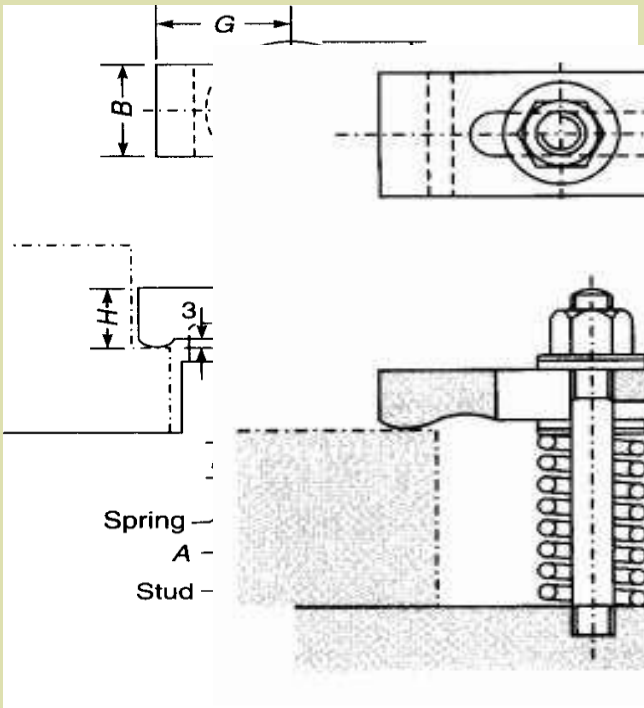


Material: mild steel

A	B	C	D	E	F	G
9	20	20	2.5	4.5	2.5	5
11	22	22	2.5	6	2.5	6
14	28	28	2.5	6.5	2.5	6.5
18	40	40	3	7	3	7

'C'R = Radius *C*

Figure **14.5**
Spherical washers



A	B	C
M_8	14	4
M_{12}	21	6
M_{16}	28	8

Figure **14.6**
Swinging hook

Figure **3.9a**
Slotted strap clamp

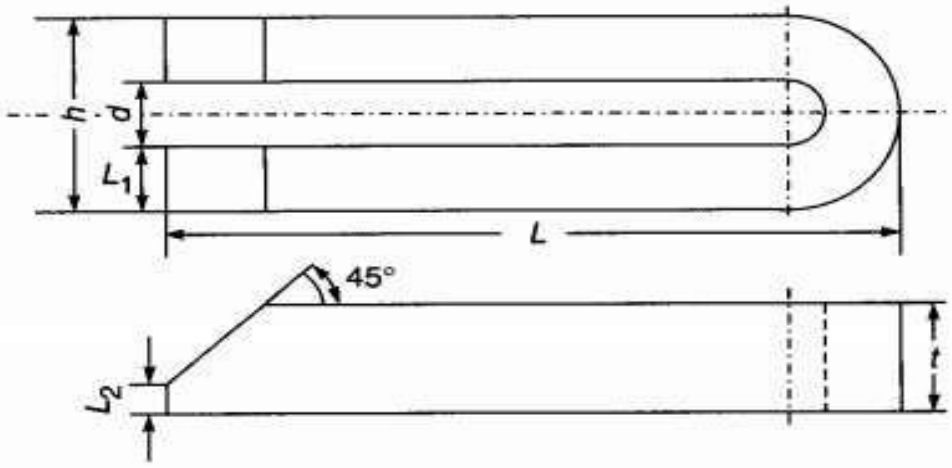
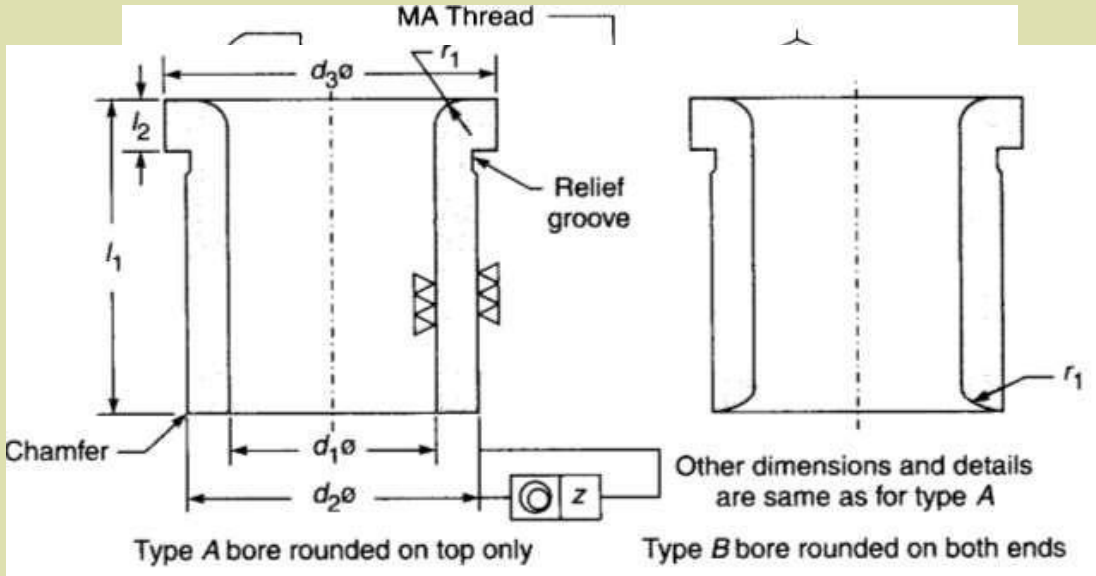


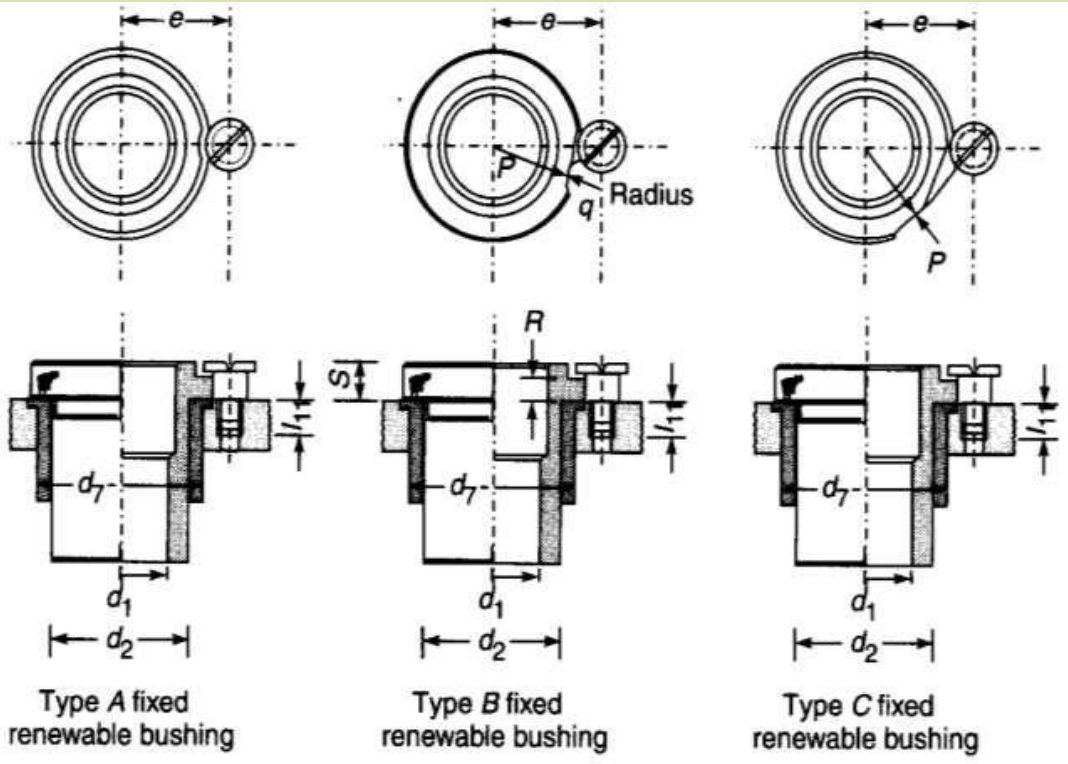
Figure **3.9b**
U clamp with open slot



F_7 d_1		l_1		l_2	d_2 n_6	d_3	r_1	z
Over	Up to	Short	Long					
-	1	6	9	2	3	6	1.2	0.005
1	1.8				4	7		
1.8	2.6				5	8		
2.6	3.3	8	12	2.5	6	10	1.6	
3.3	4				7	11		
4	5				8	12	2	
5	6	10	16	3	10	14		0.01
6	8				12	16		
8	10	12	20	4	15	19	2.5	
10	12				18	22		
12	15	16	28	4	22	26	4	
15	18				26	30		
18	22	20	36	5	30	35	6	0.02
22	26				35	40		
26	30				42	47		
30	35	25	45	5	48	55	8	
35	42				55	62		
42	48	30	56	6	62	69		
48	55				70	77		
55	63	35	72	6	78	85		

Material: Steel hardened to 62–65 HRC

Figure **14.11**
Collared bushings



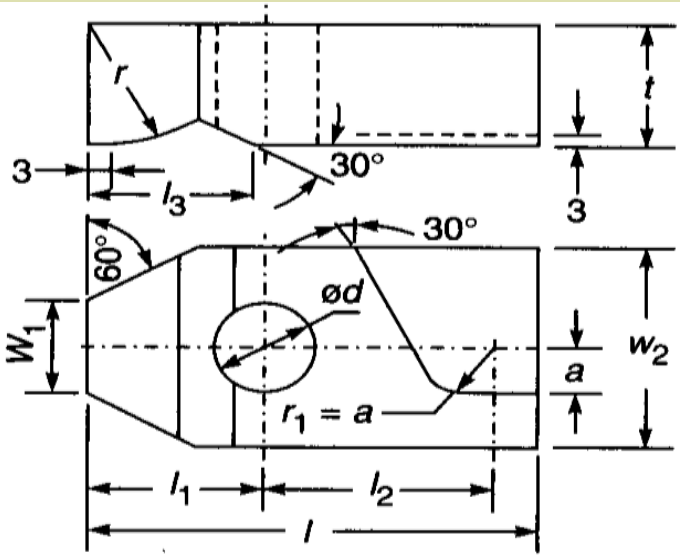
Type *A* fixed renewable bushing | Type *B* fixed renewable bushing | Type *C* fixed renewable bushing

All dimension sin mm

Renewable drill bushing		Liner bushing			e	l_{11}	Locking screw	P	q	R	s
d_1 G_7		d_2	d_2	d_7							
Over	Up to	h_6	H_7	m_6							
—	2.65	8	8	12	11.5	10	M5 × 5	5	7	4	7
2.65	4.75	10	10	15	13			6.5	7	4	7
4.75	8.5	15	15	20	17.5	12	M6 × 6	9	9	5	9
8.5	14	22	22	28	21.5			13	9	5	9
14	19	28	28	36	25.5		M6 × 7.5	17	9	7	11
19	25	35	35	46	31			22.5	9	7	11
25	33.5	46	46	56	37	15	M8 × 10	26	11	9	14
33.5	45	58	58	70	44			33	11	9	14

Material: Steel hardended to 62–65 HRC

Figure **14.12**
Renewable and slip bushings



d H_{13}	w_2	w_1	t	l	l_1	l_2	l_3	a	r	Size of screw
6.6	20	7	12	52	20	25	14	4	12	M_6
9	25	9	14	60	22	30	18	5	14	M_8
11	30	11	16	70	24	35	20	6	16	M_{10}
14	40	15	20	80	26	40	22	7	20	M_{12}
18	45	18	25	90	32	45	28	9	25	M_{16}
22	60	23	30	100	38	50	32	11	30	M_{20}
26	60	26	30	125	50	60	32	13	30	M_{24}
33	70	34	35	150	60	70	40	17	35	M_{30}

Material: Mild steel

Figure **14.10**
Swinging strap clamps

MATERIAL	REF. NO.		IMPORTANT CONSTITUENTS %						MAX. HARDNESS (RC)	APPLICATIONS
	INDIAN	BRITISH	C	Mn	Cr	Ni	W	V		
High speed steel 18%	T75W18 Co6Cr4V1	—	0.75	0.35	4.3	—	18	1.6	65	Metal cutting tools: drills
High speed steel 22%	—		0.8	0.35	4.3		22	1.6	66	High stress cutting tools: milling cutters
Cold working die steel (high carbon, high chromium) [HCHC]	T160Cr12	—	1.6	0.35	12			0.8	62	Cold working high impact press tools, threading rolls
Die steel [hot working]	T35Cr5 Mo100	—	0.32	0.35	5.0		1.4	0.3	48	Forging, extrusion and hot working dies
Carbon steel			0.85	0.87					61	Standard cutting tools
Spring steel	50Cr1V23	En44	1.0	0.5	1.2				47	Collets, springs
Medium carbon steel	C45	En8	0.45	0.75					45	Bolts, shafts, bigger gears.
High tensile steel	40Ni2Cr1 Mo28	En24	0.4	0.55	1.1	1.5			50	Highly stressed parts: piston rods, gears, shafts
Oil hardening non-shrinking tool steel [OHNS]	T110W2 Cr1	—	1.1	1.1	1.1		1.5			Fine engraving tool, taps, reamers, cutters, knives, gauges.
Nickel chrome steel	13Ni3Cr80	En36	0.14	0.5	0.9	3.3			62	Gears, case hardened parts
Carbon chromium bearing steel	103Cr1	En31	1.05	0.35	1.15				62	Cold forming tools, knurling tools, ball bearings
Carburising steel	17Mn1Cr95	—	0.17	1.15	0.95				59 [case]	Shafts, gears, spindles
Carburising steel	15Ni2Cr1M015	En354	0.15	0.8	1.00	1.75			59 [case]	Heavy duty components: gears
Nitriding steel	40Cr2Al1	En41b	0.4	0.55	1.65	0.3			66 [case]	High abrasion, high fatigue, low distortion, low stress parts: boring bars.
Free cutting Mild steel	14Mn1 S14	En202	0.14	1.4					can not be hardened	Parts needing good machinability and finish: threaded fasteners

Figure **14.13a**

Ferrous materials for jigs, fixtures and tools

1. **Aluminium**	Tensile strength 6.5–43 kg/mm². It is used for low stress parts needing light weight, corrosion resistance and good thermal and electrical conductivity.
2. **Brass**	Alloy of copper (54-73%) and zinc (remaining), tensile strength 28–68 kg/mm². It is used for parts needing corrosion resistance, fine surface finish and bearing properties: bushes for low speed shafts.
3. **Bronze**	Tensile strength 20–55 kg/mm². It is used for low speed bearings and parts calling for corrosion resistance. Phosphor bronze is used widely for replaceable nuts mating with lead screws in machine mechanisms.

Figure **14.13b**
Non-ferrous materials

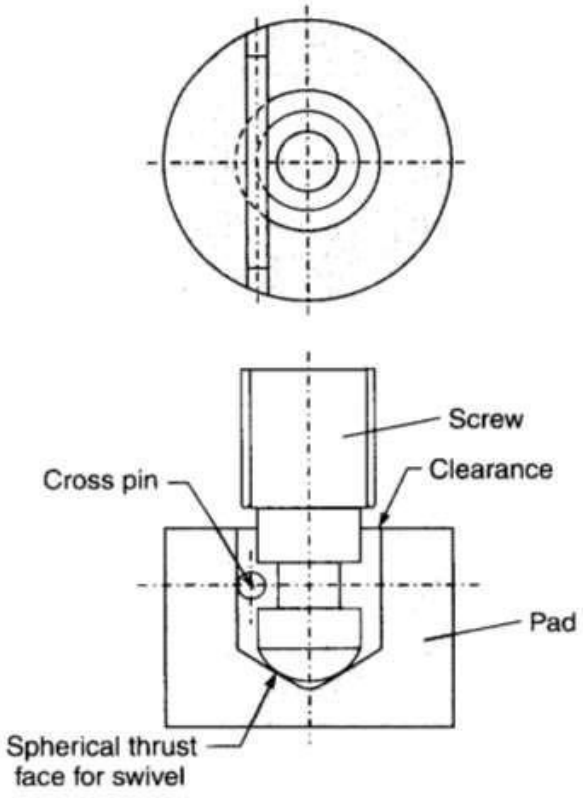
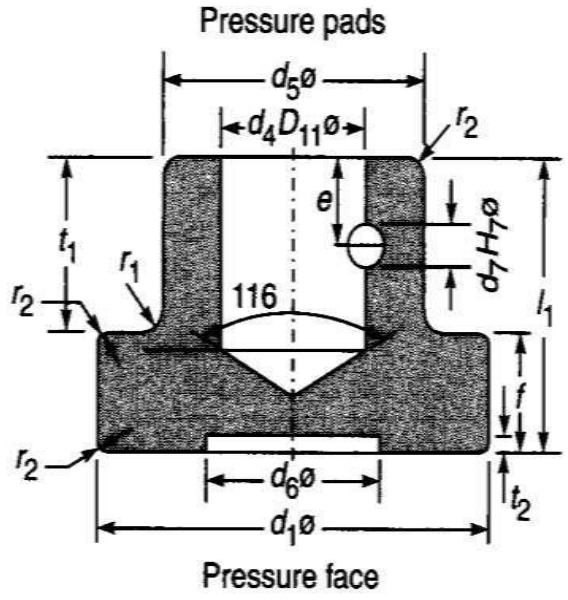
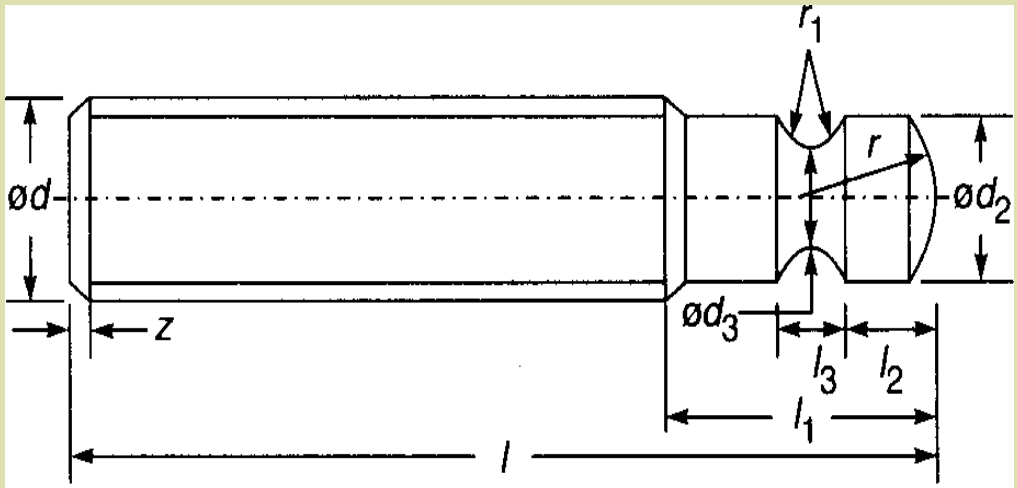


Figure **14.14a**
Floating pad assembly



Dimensions												For screw with thread	Fastening pin
d_1	d_4	d_5	d_6	d_7	e	f	h	r_1	r_2	t_2	t_1		
10	3.8	8	4	1.5	2.5	2.5	7	1.2	0.3	0.5	4.5	M5	1.5m6 × 6
12	4.8	10	5	1.5	2.5	2.5	8	1.5	0.3	0.5	5	M6	1.5m6 × 8
16	6.4	12	7	2	3	3.5	9.5	2	0.4	0.5	6	M8	2m6 × 8
20	7.4	15	8	2	3.5	5	12	2	0.4	1	7	M10	2m6 × 14
25	9.5	18	10	3	4.5	6	15	3	0.6	1	9	M12	3m6 × 14
32	12.5	22	14	3	6	7	19	3	0.6	1	12	M16	3m6 × 16
40	15.5	28	18	4	7.5	9	24	4	0.8	1	15	M20	4m6 × 20

Figure **14.14b**
Floating pressure pads

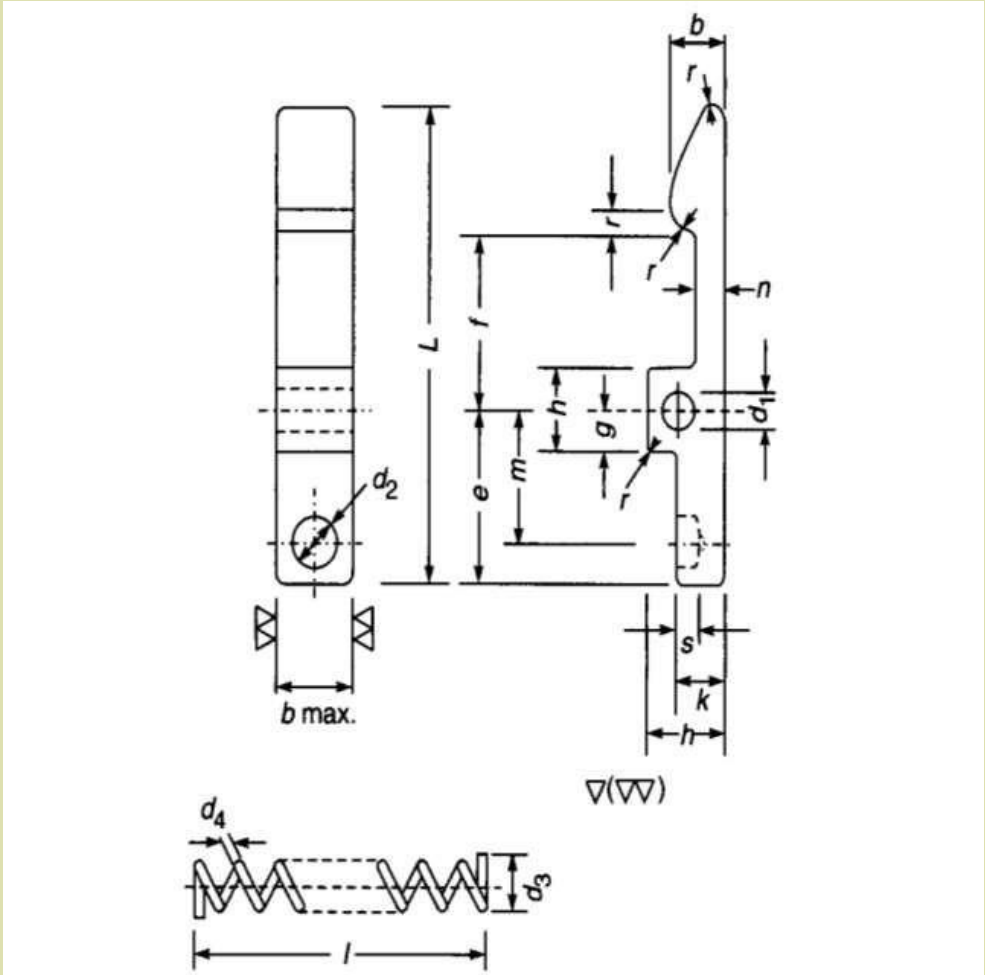


Material: Surface hardening steel

d_1	d_2	d_3	r	r_1	l_1	l_2	l_3	l	z
M6	4.5	3	3	0.6	6.5	2.2	2.2	30,50	1.0
M8	6	4	5	0.8	8.5	2.8	3	40,60	1.25
M10	7	5	6	0.8	10.0	3.2	3	60,80	1.50
M12	9	6	6	1.0	13.0	4.3	4.5	60,80,100	1.75
M16	12	9	9	1.0	17.0	6.3	4.5	80,100,125	2.0
M20	15	10	13	1.5	21	7.4	6	100,125,150	2.5

Figure **14.14c**

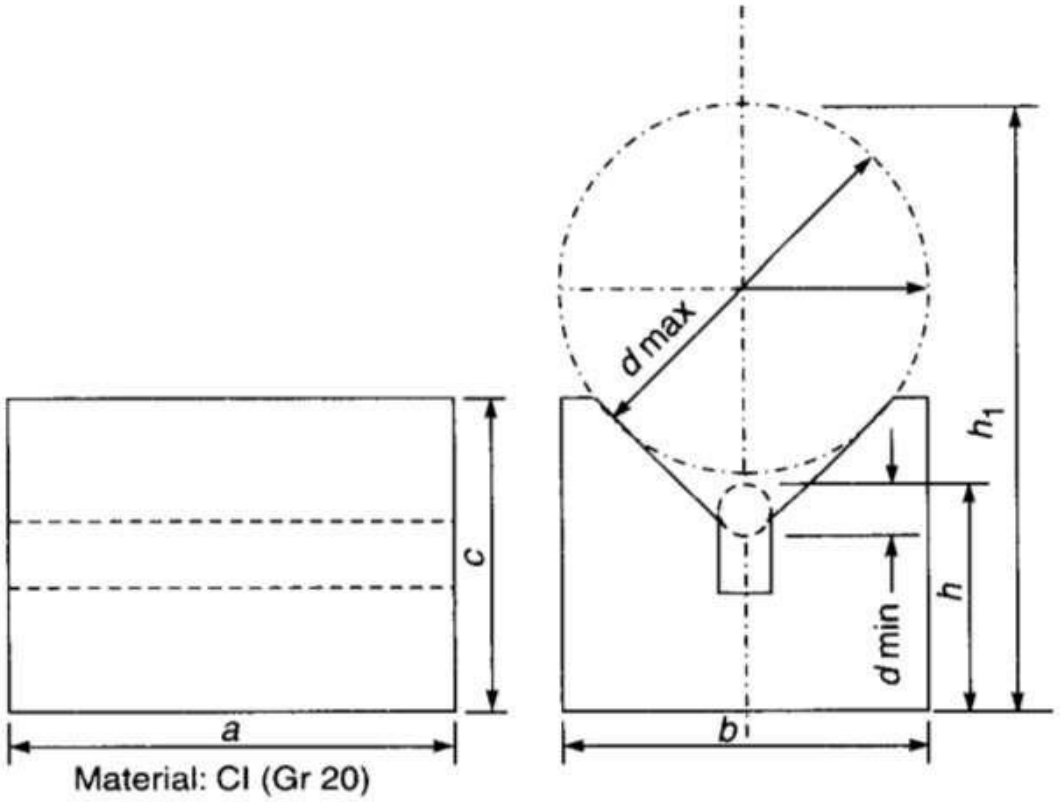
Screws for floating pressure pads



Springs Steel (IS: 727–1964) for Springs
All dimensions in mm

Length		Locking dog													Spring effective coils
L	b	d_1 E_9	d_2	e	f −0.2	g	h	s	k	m	n	r	d_3	d_4	l Free-length
45	8	4	5.5	15	15	4	9.5	2	5.5	11	4	1.6	4.6	0.6	16
60	10	5	7.0	20	20	5	12.0	3	7.0	15	5	2.5	5.8	0.8	18
80	14	6	9.0	30	30	6	15.0	5	9.0	23	7	4.0	7.4	1.0	22

Figure **14.15**
Locking dogs



Material: CI (Gr 20)

a	b	c	d_{max}	d_{min}
50	40	40	40	5
63	50	50	50	5
80	63	63	63	7
100	80	80	80	7
200	200	200	200	10
300	300	300	300	12

(a)

Figure **14.16a**
V Block for long cylinders

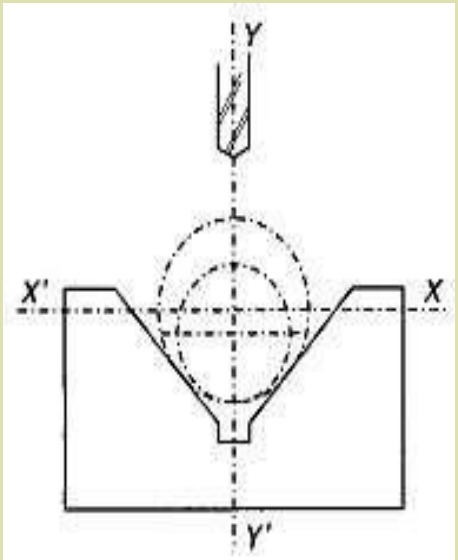


Figure **2.37**
Correct position of V

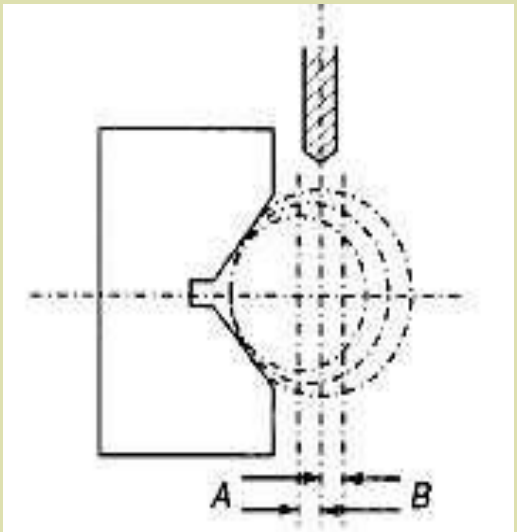
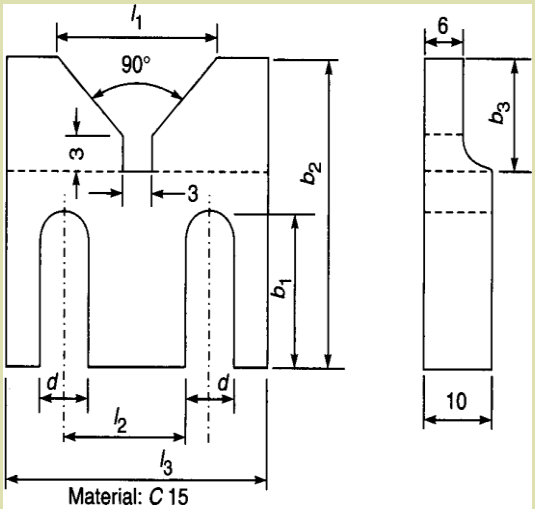


Figure **2.38**
Correct position of V

.

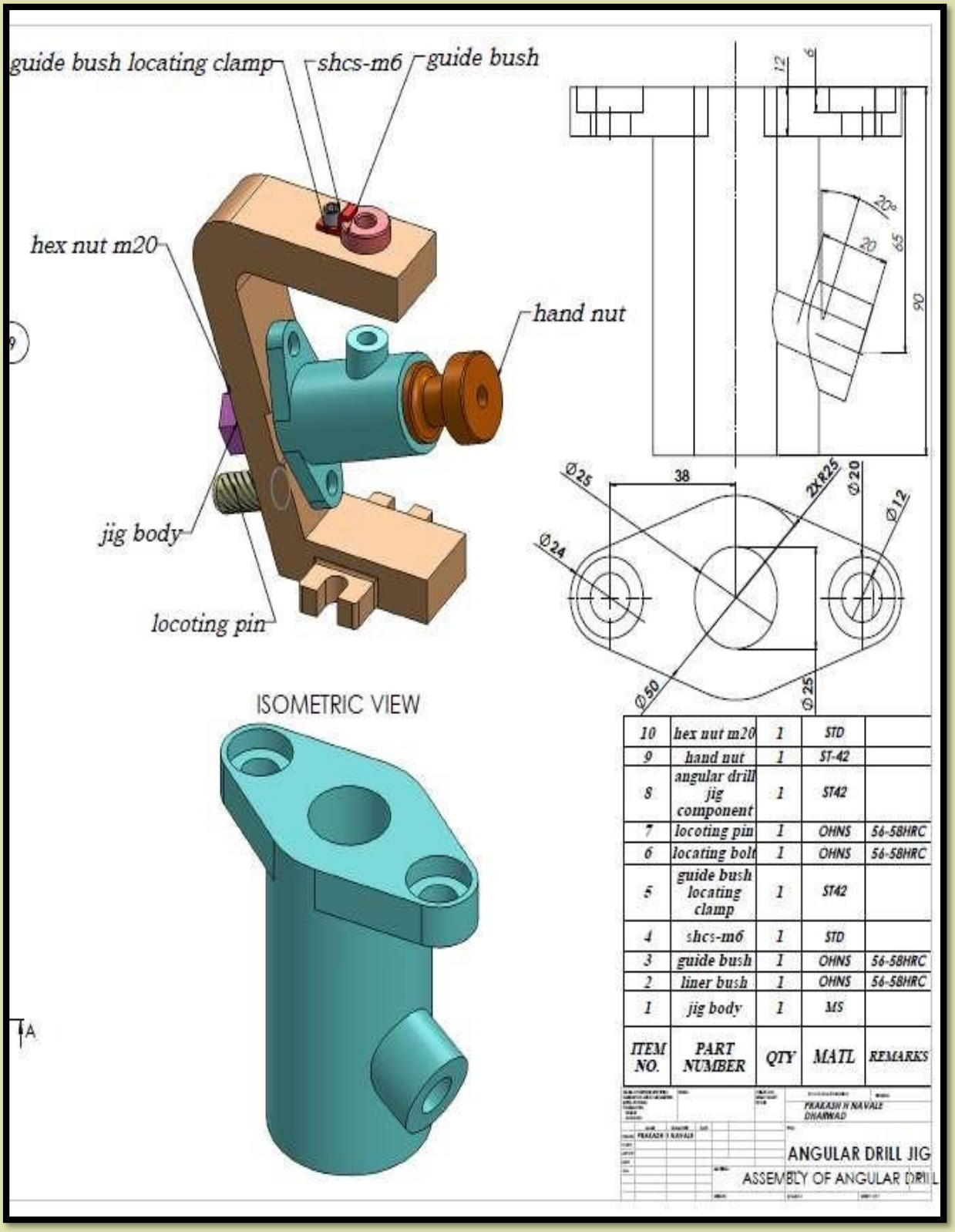


Material: *C* 15
case hardened

l_1	l_2	l_3	b_1	b_2	b_3	d
25	30	35	15	32	15	7
36	25	50	20	45	25	9
50	32	60	22	55	30	11

(b)

Figure **14.16b**
V locator for short cylinders

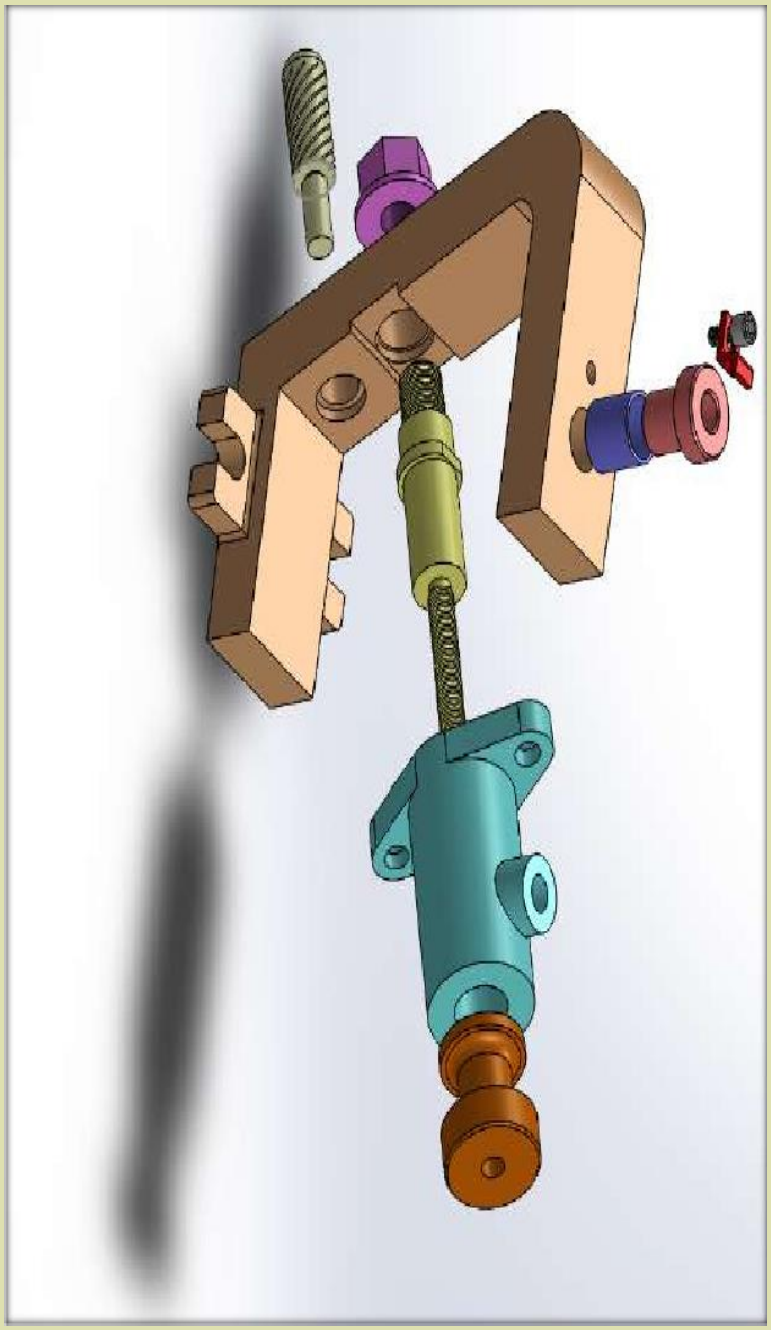


ITEM NO.	PART NUMBER	QTY	MATL	REMARKS
10	hex nut m20	1	STD	
9	hand nut	1	ST-42	
8	angular drill jig component	1	ST42	
7	locoting pin	1	OHNS	56-58HRC
6	locating bolt	1	OHNS	56-58HRC
5	guide bush locating clamp	1	ST42	
4	shcs-m6	1	STD	
3	guide bush	1	OHNS	56-58HRC
2	liner bush	1	OHNS	56-58HRC
1	jig body	1	MS	

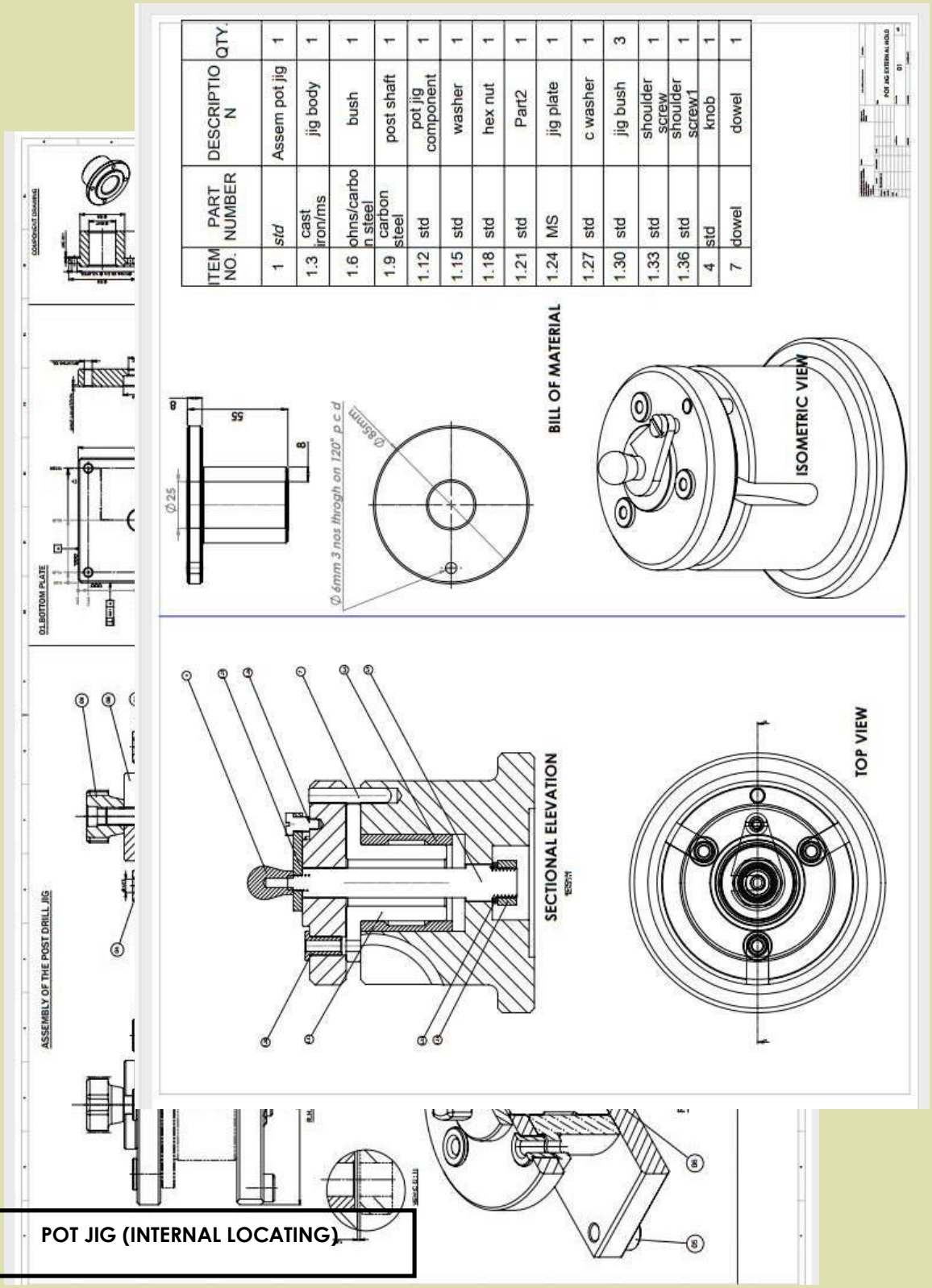
PRAKASH H NAVALE
DHARWAD

ANGULAR DRILL JIG

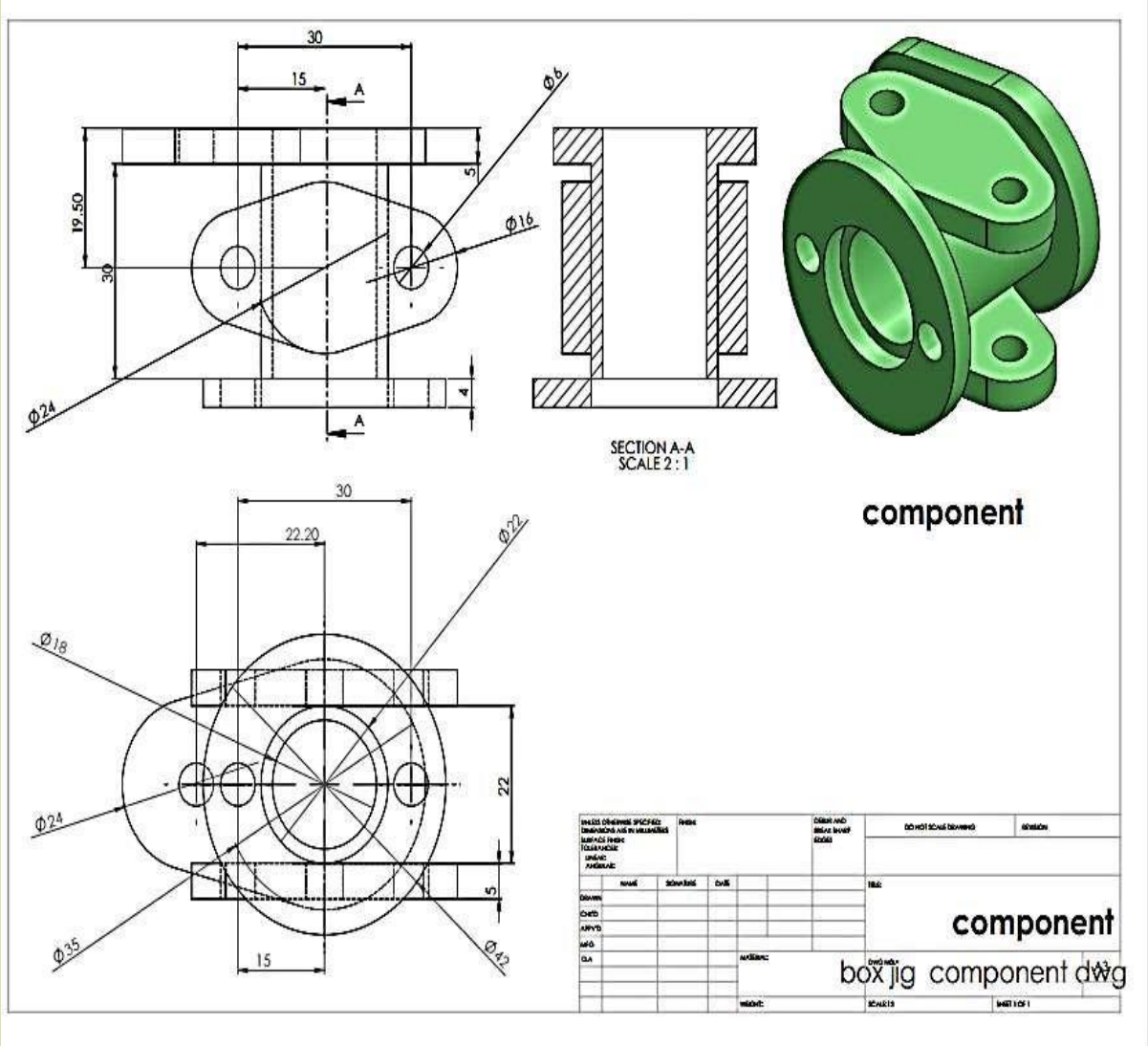
ASSEMBLY OF ANGULAR DRILL



POT JIG (EXTERNAL)



POT JIG (INTERNAL LOCATING)



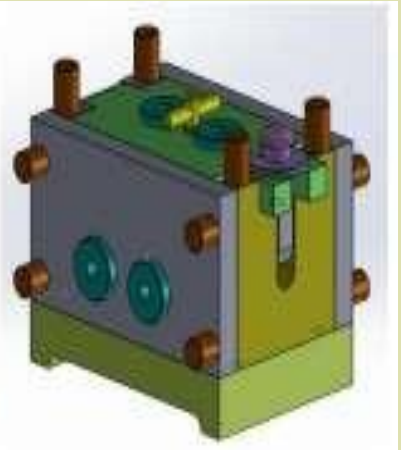
THE BOX JIG.

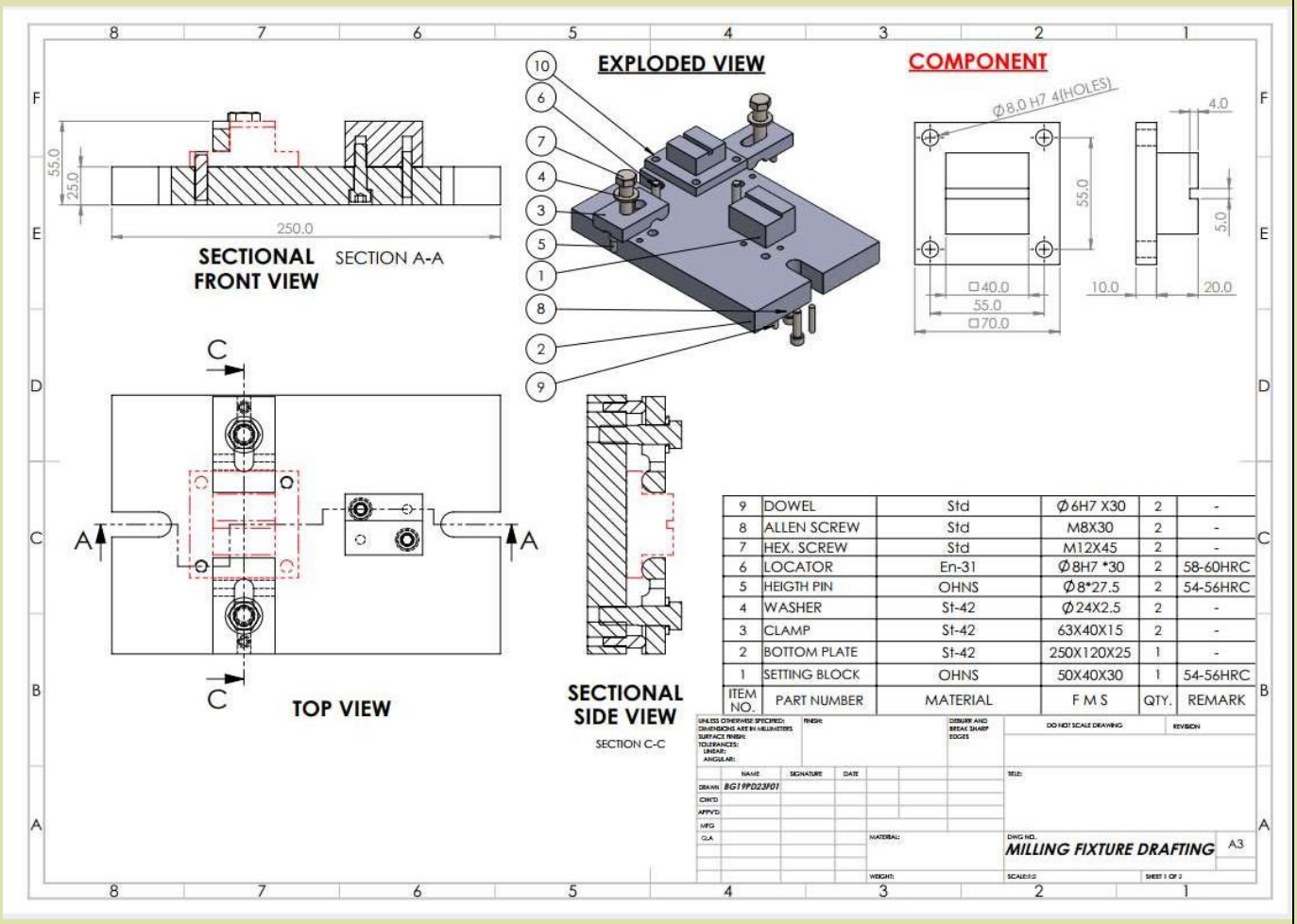
Box jig is used when holes are required to be machined in several faces in a small work pieces.

The box is closed and clamped by the Latch as shown in the figure,

This latch is positively located because it carries drill bush.

Suitable feet are provided to give good seating when drilling on all faces,and suitable swarf clearance parts are incorporated.

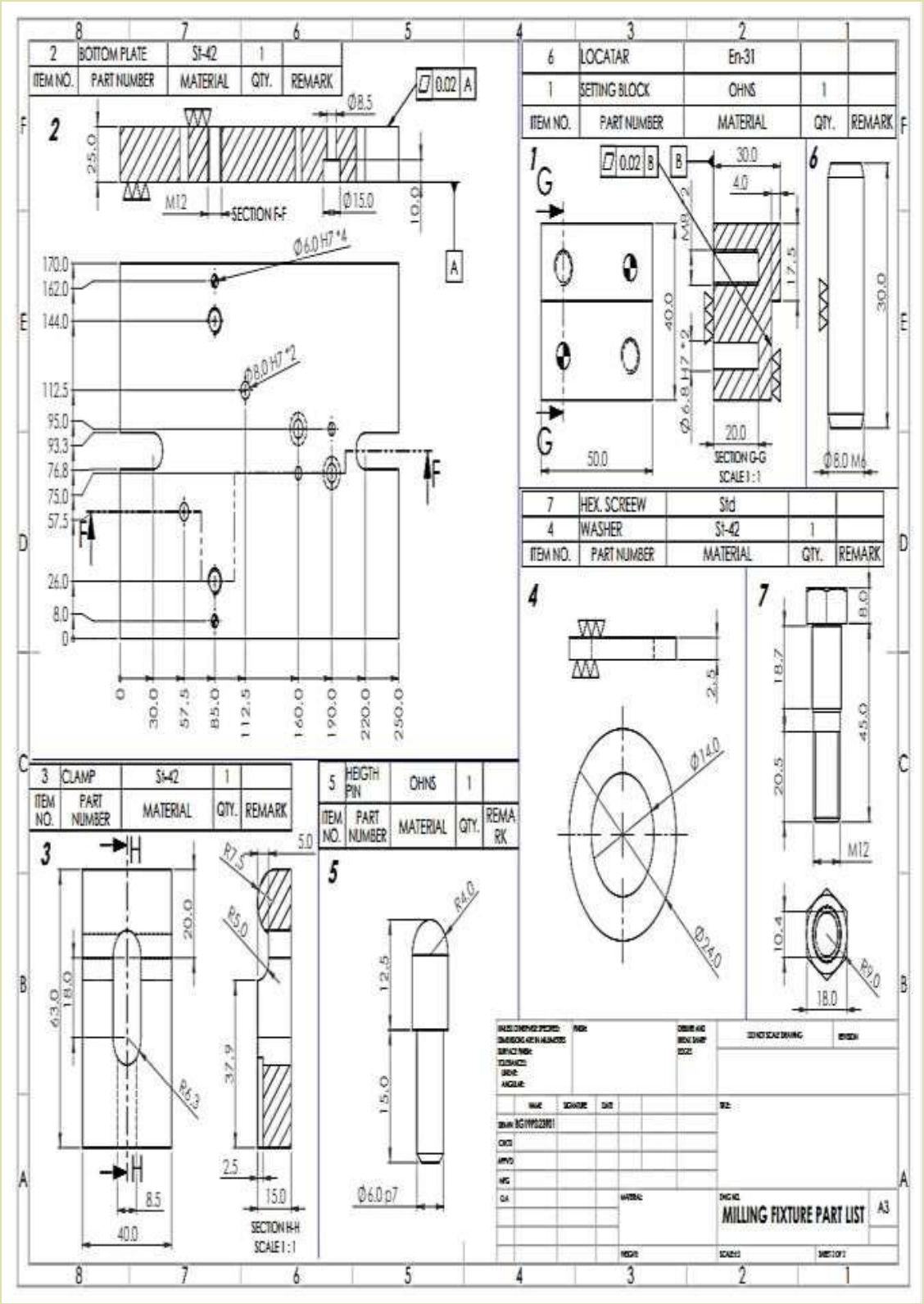


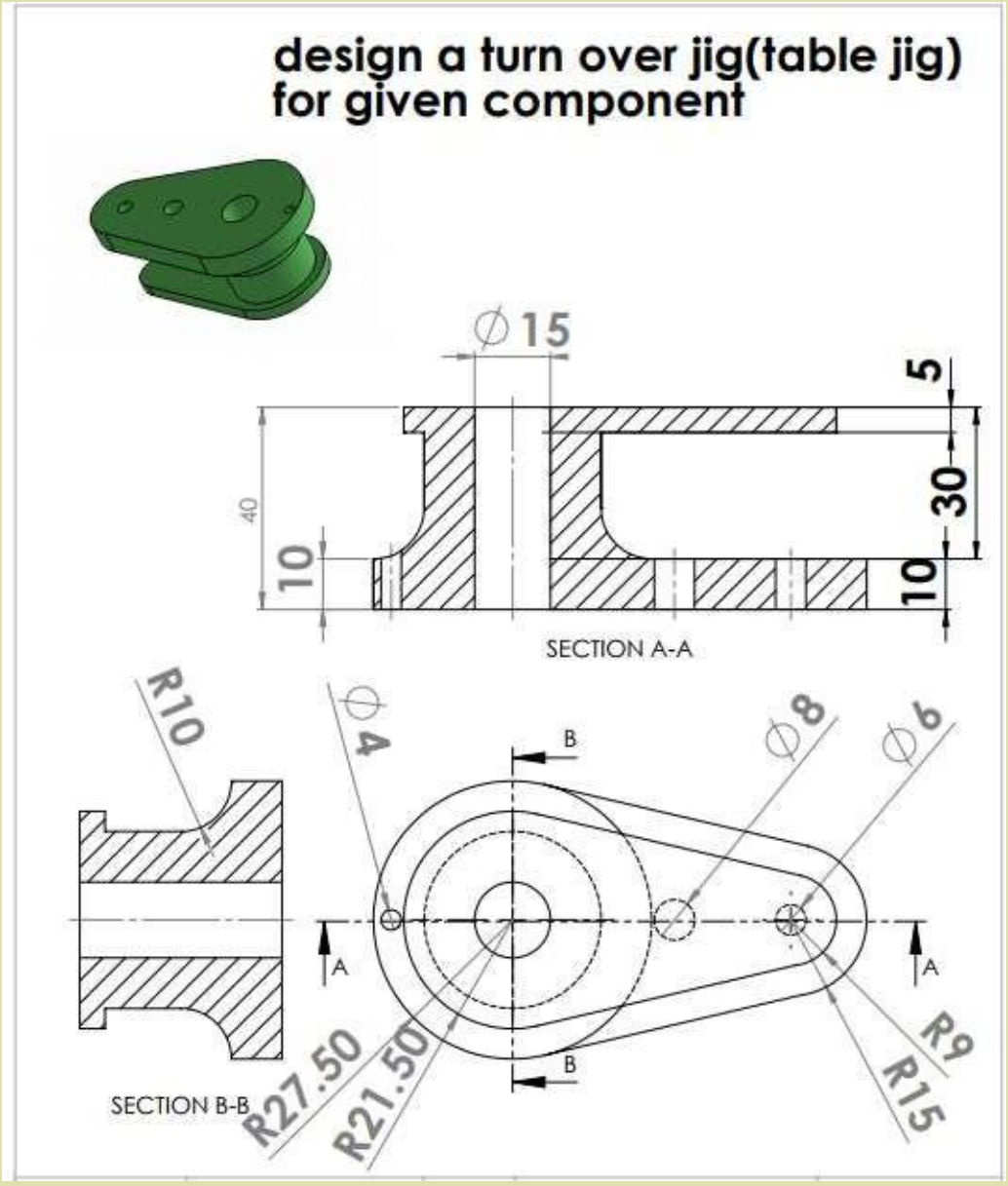


ITEM NO.	PART NUMBER	MATERIAL	F M S	QTY.	REMARK
9	DOWEL	Std	Ø6H7 X30	2	-
8	ALLEN SCREW	Std	M8X30	2	-
7	HEX. SCREW	Std	M12X45	2	-
6	LOCATOR	En-31	Ø8H7 *30	2	58-60HRC
5	HEIGTH PIN	OHNS	Ø8*27.5	2	54-56HRC
4	WASHER	St-42	Ø24X2.5	2	-
3	CLAMP	St-42	63X40X15	2	-
2	BOTTOM PLATE	St-42	250X120X25	1	-
1	SETTING BLOCK	OHNS	50X40X30	1	54-56HRC

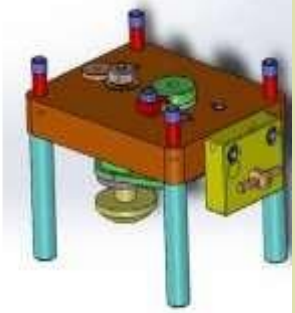
DRAWN BG19PD23P01

MILLING FIXTURE DRAFTING A3


2 BOTTOM PLATE St-42 1
ITEM NO. PART NUMBER MATERIAL QTY. REMARK
6 LOCATAR En-31
1 SETTING BLOCK OHNS 1
7 HEX. SCREEW Std
4 WASHER St-42 1
3 CLAMP St-42 1
5 HEIGTH PIN OHNS 1
SECTION F-F
SECTION G-G
SCALE 1 : 1
SECTION H-H
SCALE 1 : 1
MILLING FIXTURE PART LIST
A3

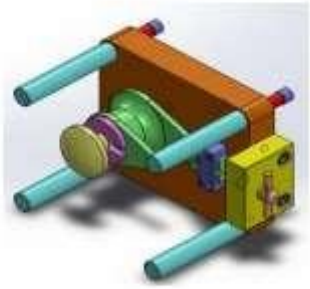

design a turn over jig(table jig)
for given component
∅15
5
30
10
10
40
SECTION A-A
R10
∅4
∅8
∅6
B
A
A
B
R27.50
R21.50
R9
R15
SECTION B-B

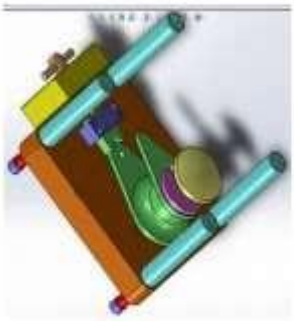
Turn over jig or Table jig (open type jig)



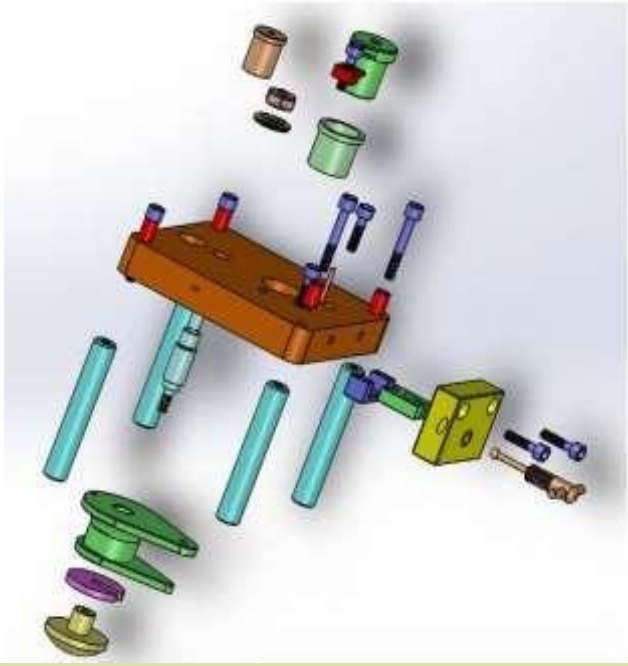
The Turn over jig is so named because the workpiece is located from the face that is to be drilled and clamped in the jig.then the jig is Turned over for drilling. This is also known as open jig as the workpiece is not having any enclosure of the jig body around it.

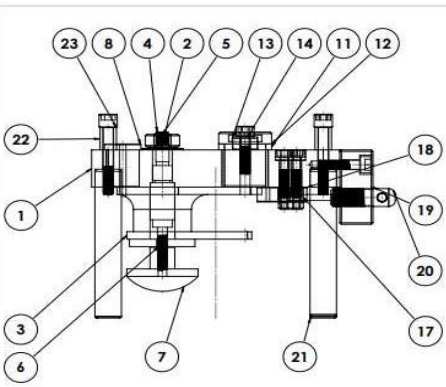
The figure shows a Turn over or open jig or table jig .the jig is seated on the four foot legs.when locating and clamping the workpiece an inverted to the position shown when machining.this way type easy to load and swarf cleance is no problem.

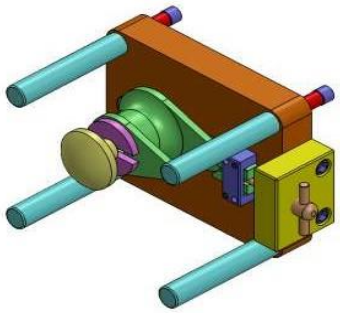


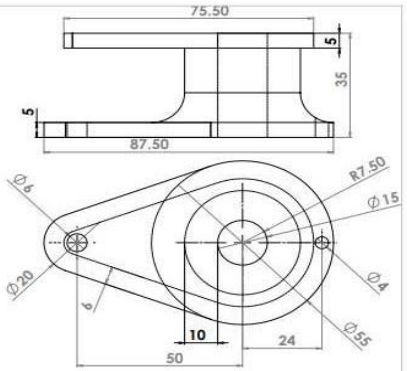


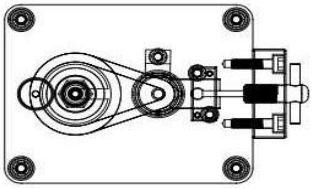
The dis-advantage of the Turn over jig is that only the surface to be drilled, loading and drilling forces are generally directed towards clamping devices. Therefore clamping device should be rigid enough to withstand the drilling forces.

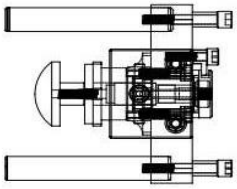








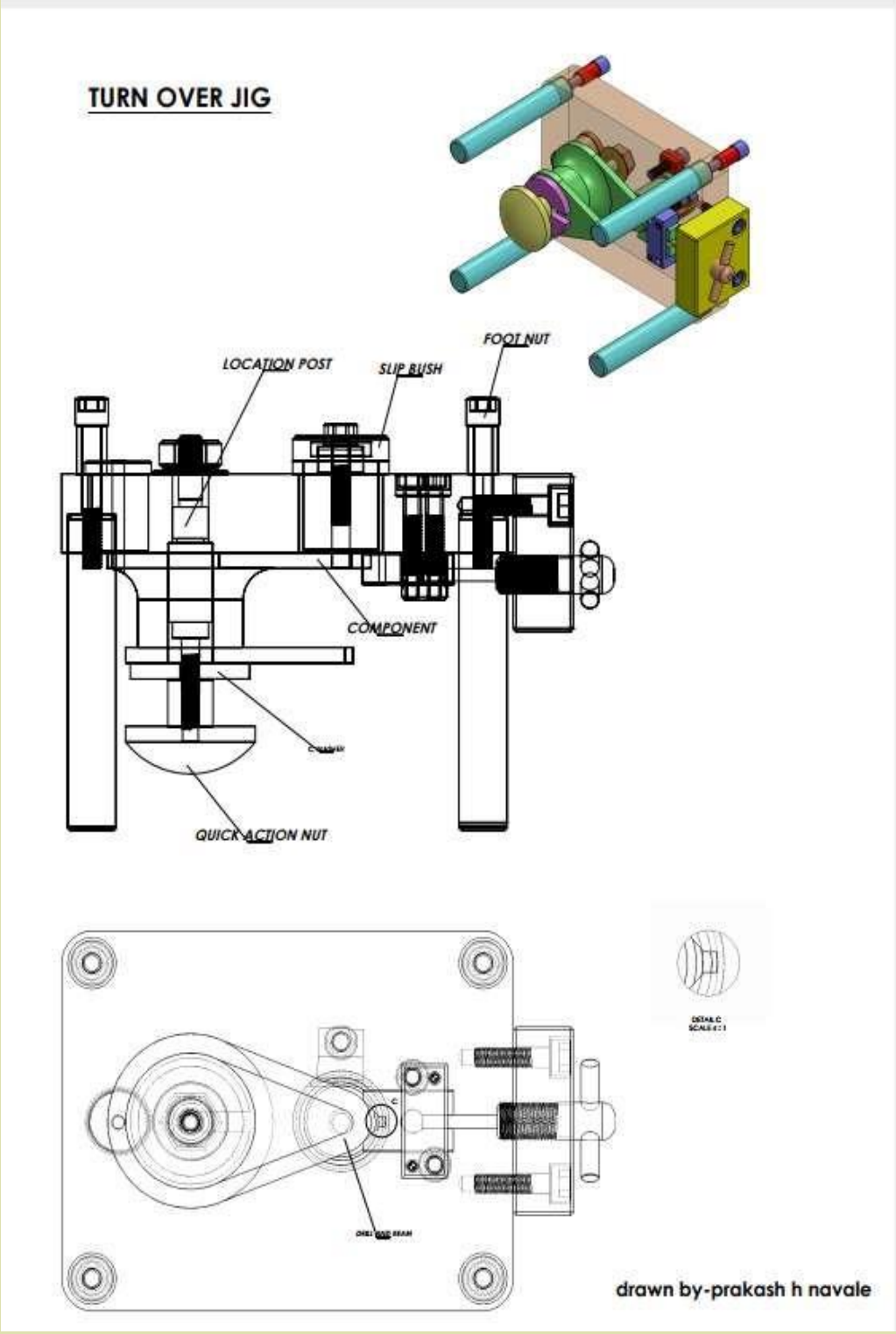




drwn by-prakash h navale
dwd gttc

ITEM NO.	PART NUMBER	mat	QTY.	REMARKS
24	dowel 3x25	STD	2	
23	m6 shcs	STD	4	
22	foot nut washer	OHNS	4	45-48HRC
21	leg	EN31	4	50-52HRC
20	v block sliding bolt	OHNS	1	45-48HRC
19	v slider bolt holder	EN31	1	50-52HRC
18	v block sliding	EN31	1	50-52HRC
17	v block slider	EN31	1	50-52HRC
16	Part2		1	
15	Part1		1	
14	m6 shcsx25L	STD	5	
13	clamp	MS	1	
12	guide bush	EN31	1	60-64HRC
11	linear bush	OHNS	1	45-48HRC
10	Assem3		1	
9	Assem1		1	
8	guide bush small	EN31	1	60-64HRC
7	knob	MS	1	
6	c washer	MS	1	
5	m8 hex nut	STD	1	
4	location shaft	OHNS	1	45-48HRC
3	TURN OVER JIG COMPONENT	Cast iron	2	
2	washer	MS	1	
1	TURN OVER JIG PLATE		1	

PRAKASH H NAVALE
TABLE-TURN OVER JIG

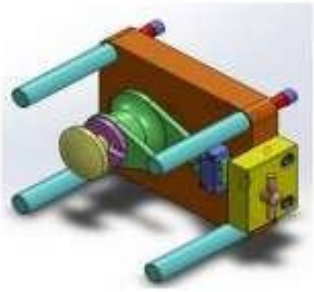

TURN OVER JIG
LOCATION POST
SLIP BUSH
FOOT NUT
COMPONENT
QUICK ACTION NUT
drawn by-prakash h navale

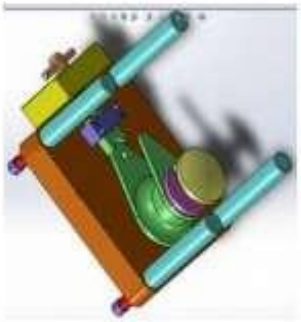
Prepared by-Prakash h Navale

Turn over jig or Table jig (open type jig)

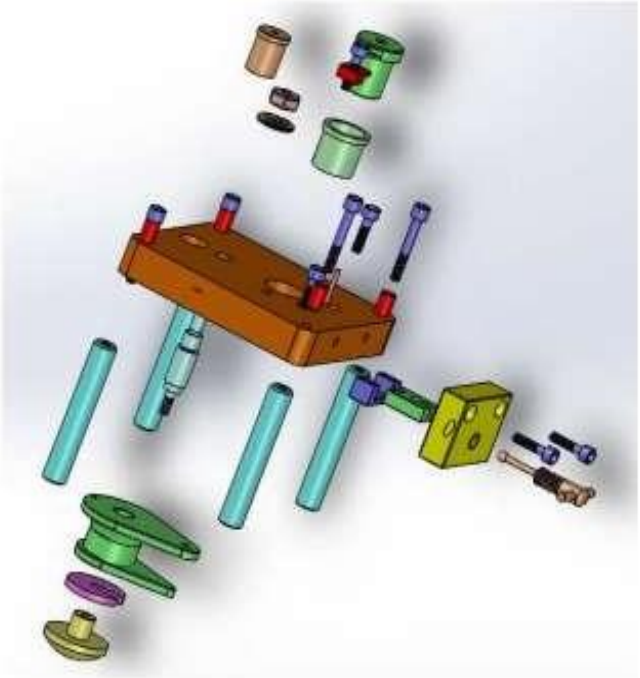
The Turn over jig is so named because the workpiece is located from the face that is to be drilled and clamped in the jig.then the jig is Turned over for drilling. This is also known as open jig as the workpiece is not having any enclosure of the jig body around it.

The figure shows a Turn over or open jig or table jig .the jig is seated on the four foot legs.when locating and clamping the workpiece an inverted to the position shown when machining.this way type easy to load and swarf cleance is no problem.

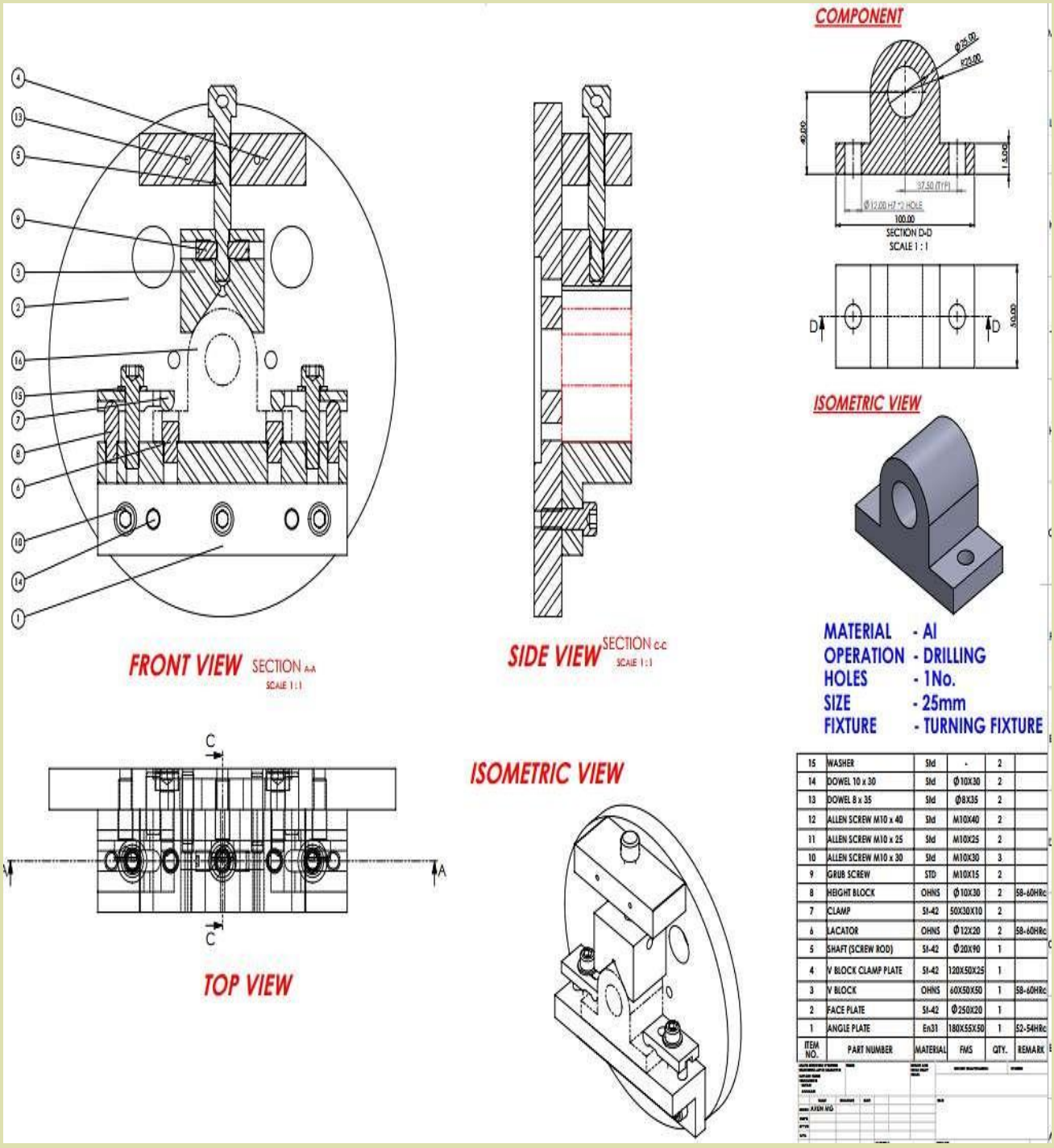




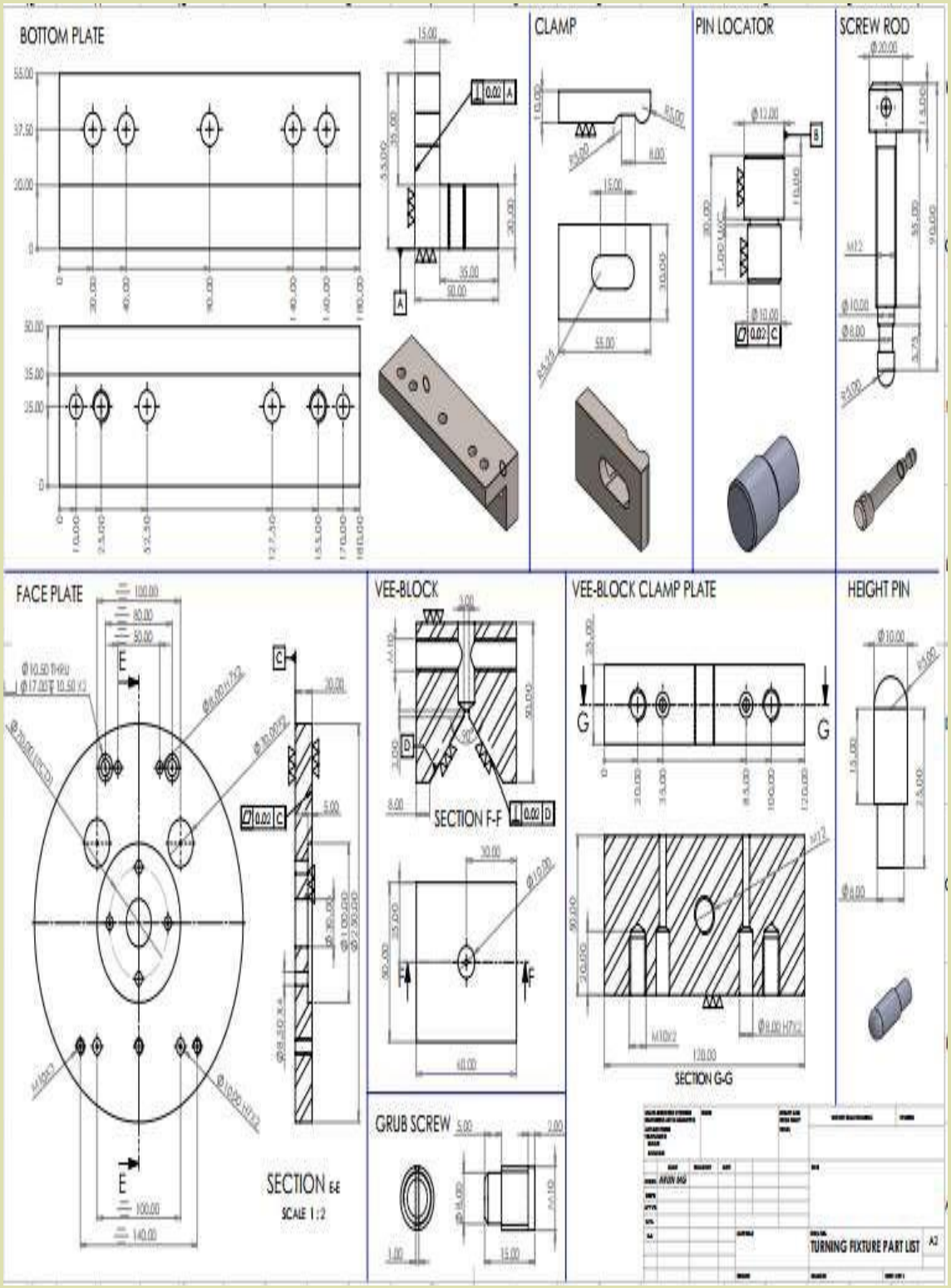
The dis-advantage of the Turn over jig is that only the surface to be drilled, loading and drilling forces are generally directed towards clamping devices. Therefore clamping device should be rigid enough to withstand the drilling forces.

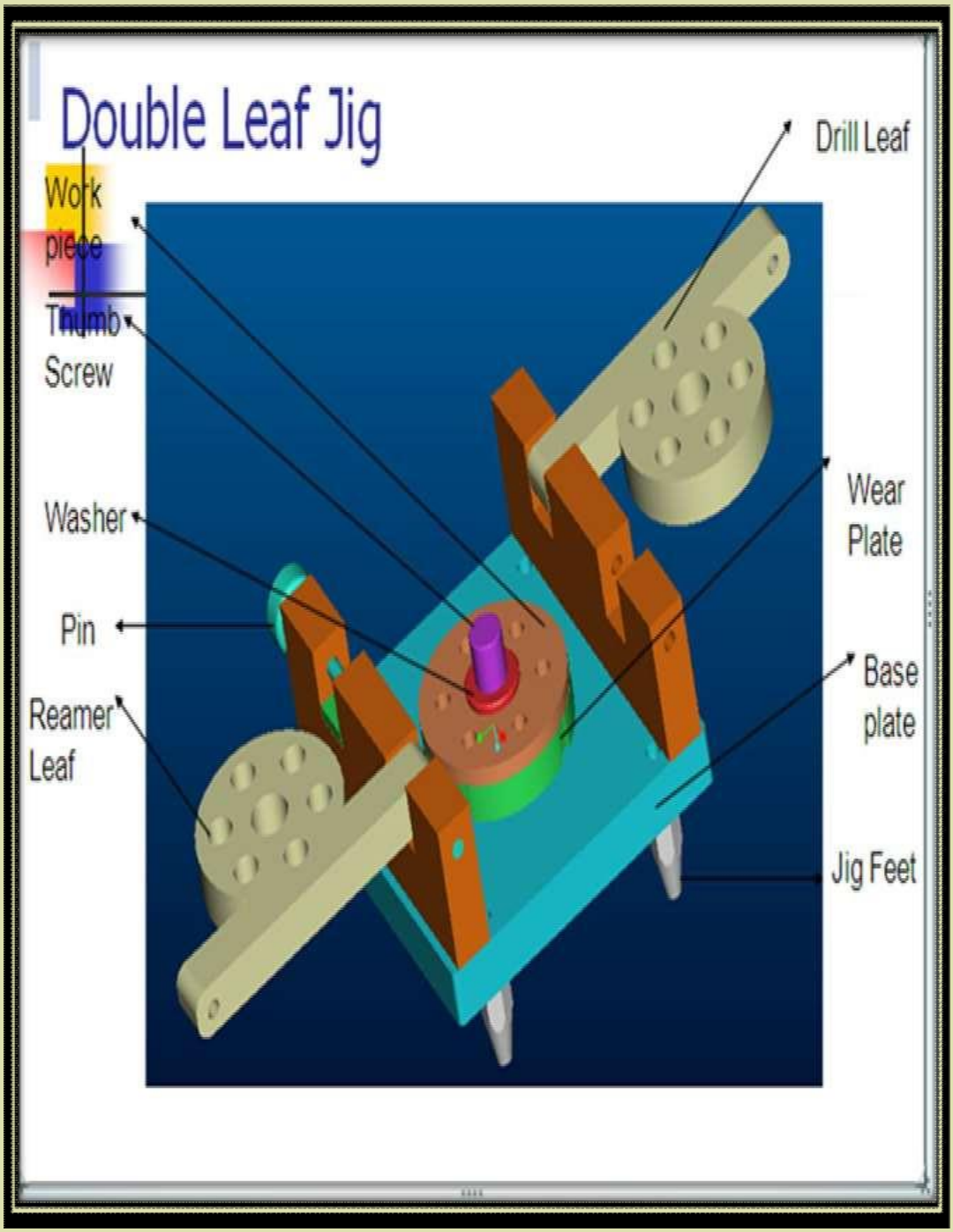


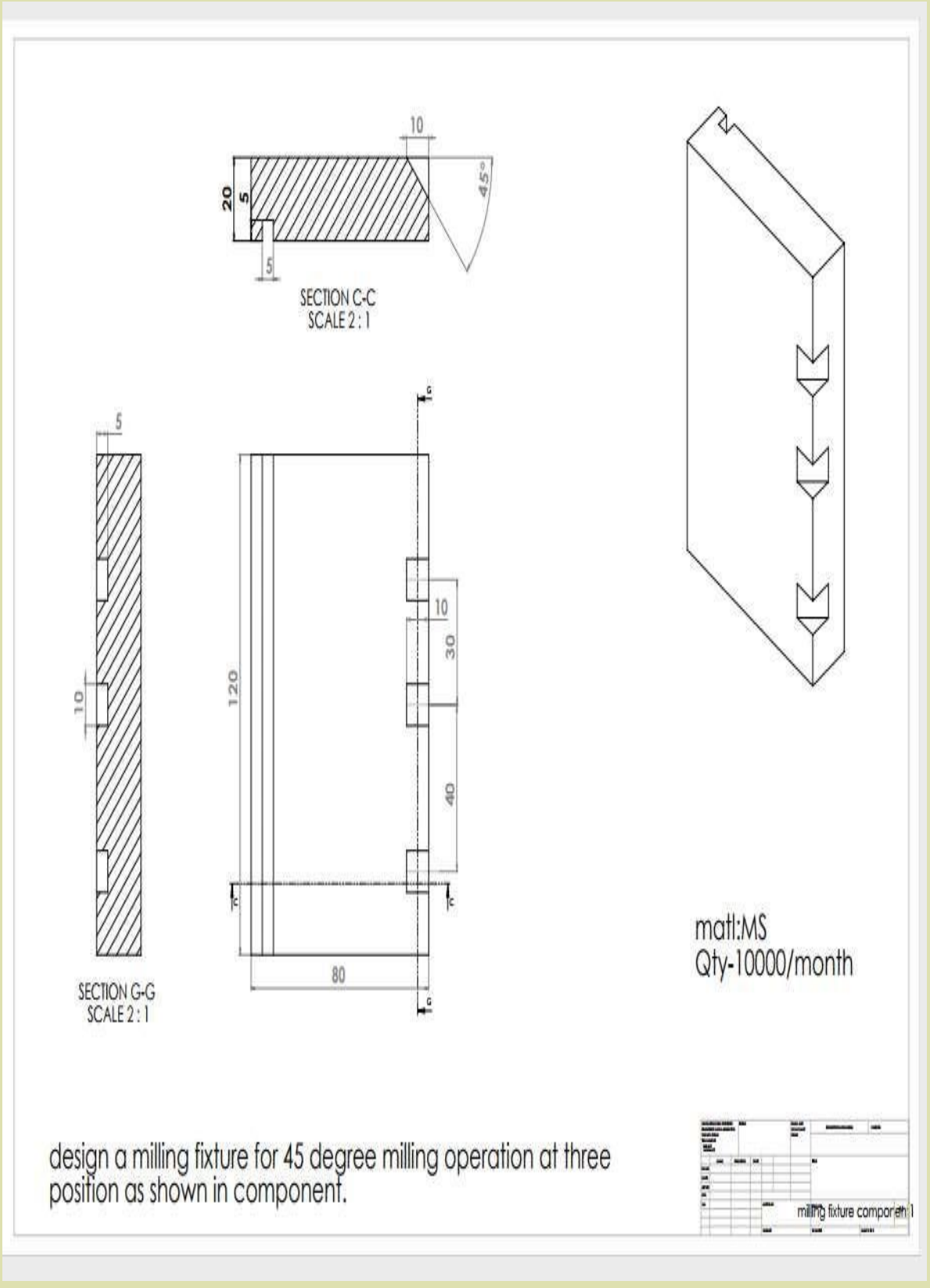
TURNING FIXTURE

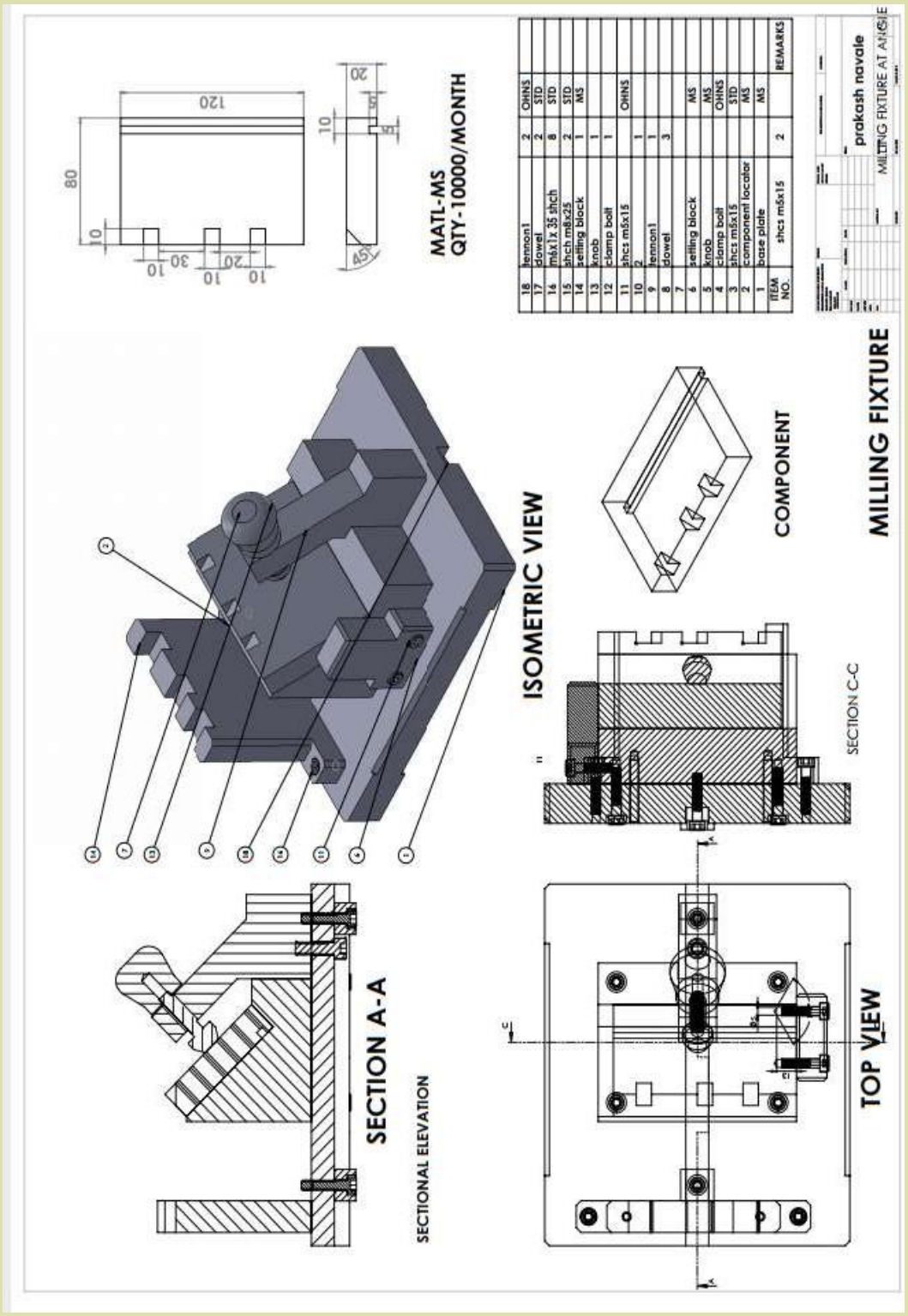


ITEM NO.	PART NUMBER	MATERIAL	FMS	QTY.	REMARK
15	WASHER	Std	-	2	
14	DOWEL 10 x 30	Std	Ø10X30	2	
13	DOWEL 8 x 35	Std	ØBX35	2	
12	ALLEN SCREW M10 x 40	Std	M10X40	2	
11	ALLEN SCREW M10 x 25	Std	M10X25	2	
10	ALLEN SCREW M10 x 30	Std	M10X30	3	
9	GRUB SCREW	STD	M10X15	2	
8	HEIGHT BLOCK	OHNS	Ø10X30	2	58-60HRc
7	CLAMP	SI-42	50X30X10	2	
6	LACATOR	OHNS	Ø12X20	2	58-60HRc
5	SHAFT (SCREW ROD)	SI-42	Ø20X90	1	
4	V BLOCK CLAMP PLATE	SI-42	120X50X25	1	
3	V BLOCK	OHNS	60X50X50	1	58-60HRc
2	FACE PLATE	SI-42	Ø250X20	1	
1	ANGLE PLATE	En31	180X55X50	1	52-54HRc


BOTTOM PLATE
CLAMP
PIN LOCATOR
SCREW ROD
FACE PLATE
VEE-BLOCK
VEE-BLOCK CLAMP PLATE
HEIGHT PIN
SECTION F-F
SECTION G-G
SECTION E-E
SCALE 1:2
GRUB SCREW
TURNING FIXTURE PART LIST


Double Leaf Jig
Drill Leaf
Work piece
Thumb Screw
Washer
Pin
Reamer Leaf
Wear Plate
Base plate
Jig Feet


10
20
5
45°
5
SECTION C-C
SCALE 2 : 1
5
10
SECTION G-G
SCALE 2 : 1
120
10
30
40
80
matl:MS
Qty-10000/month
design a milling fixture for 45 degree milling operation at three position as shown in component.
milling fixture component


MILLING FIXTURE
ISOMETRIC VIEW
COMPONENT
SECTION A-A
SECTIONAL ELEVATION
SECTION C-C
TOP VIEW
MATL-MS
QTY-10000/MONTH
prakash navale
MILLING FIXTURE AT ANGLE
18 tennon1 2 OHNS
17 dowel 2 STD
16 m6x1 x 35 shch 8 STD
15 shch m8x25 2 STD
14 setting block 1 MS
13 knob 1
12 clamp bolt 1
11 shcs m5x15 OHNS
10 2 1
9 tennon1 1
8 dowel 3
7
6 setting block MS
5 knob MS
4 clamp bolt OHNS
3 shcs m5x15 STD
2 component locator MS
1 base plate MS
ITEM NO. shcs m5x15 2 REMARKS

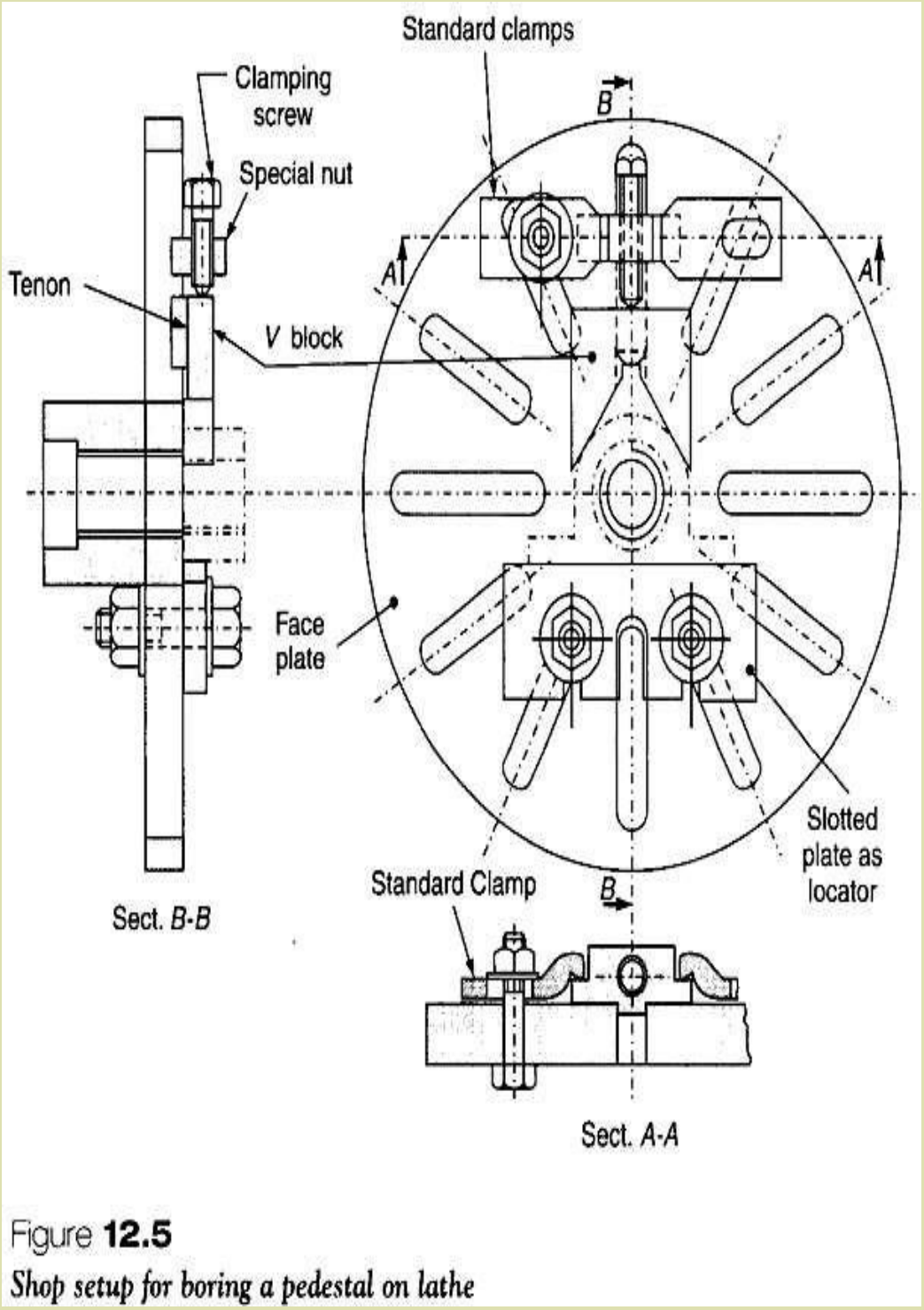


Figure **12.5**

Shop setup for boring a pedestal on lathe

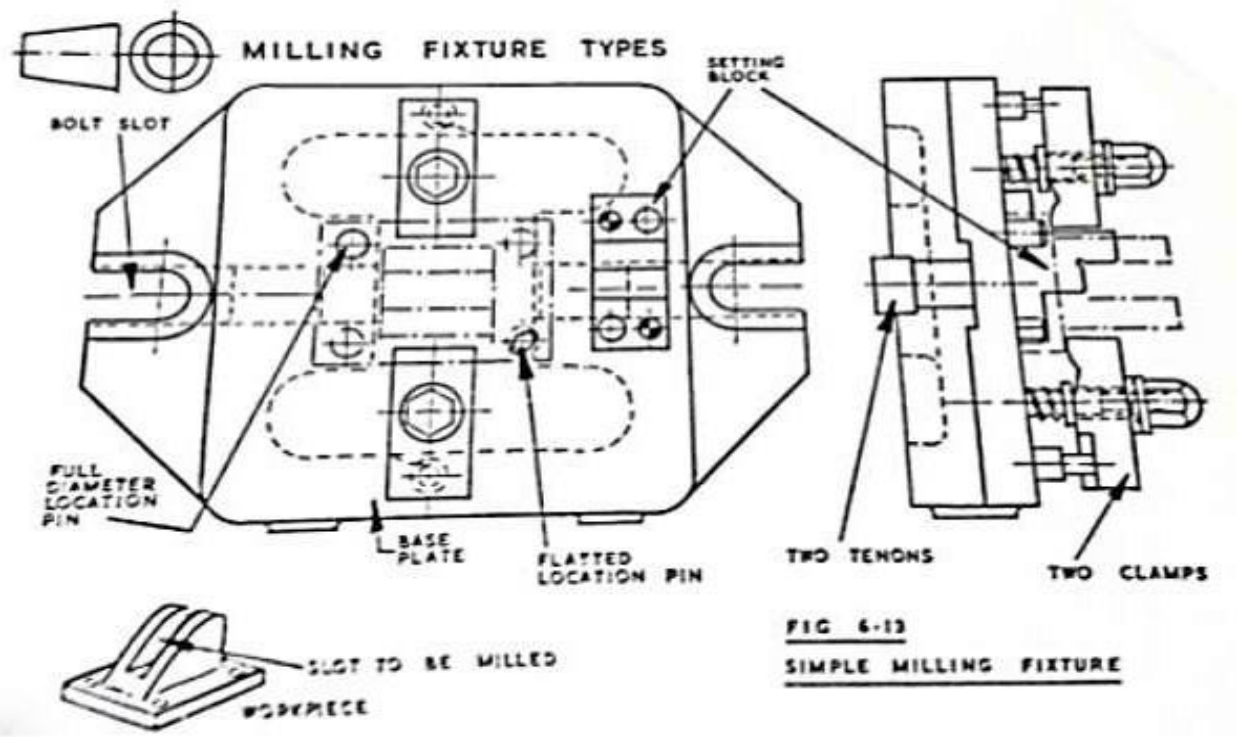
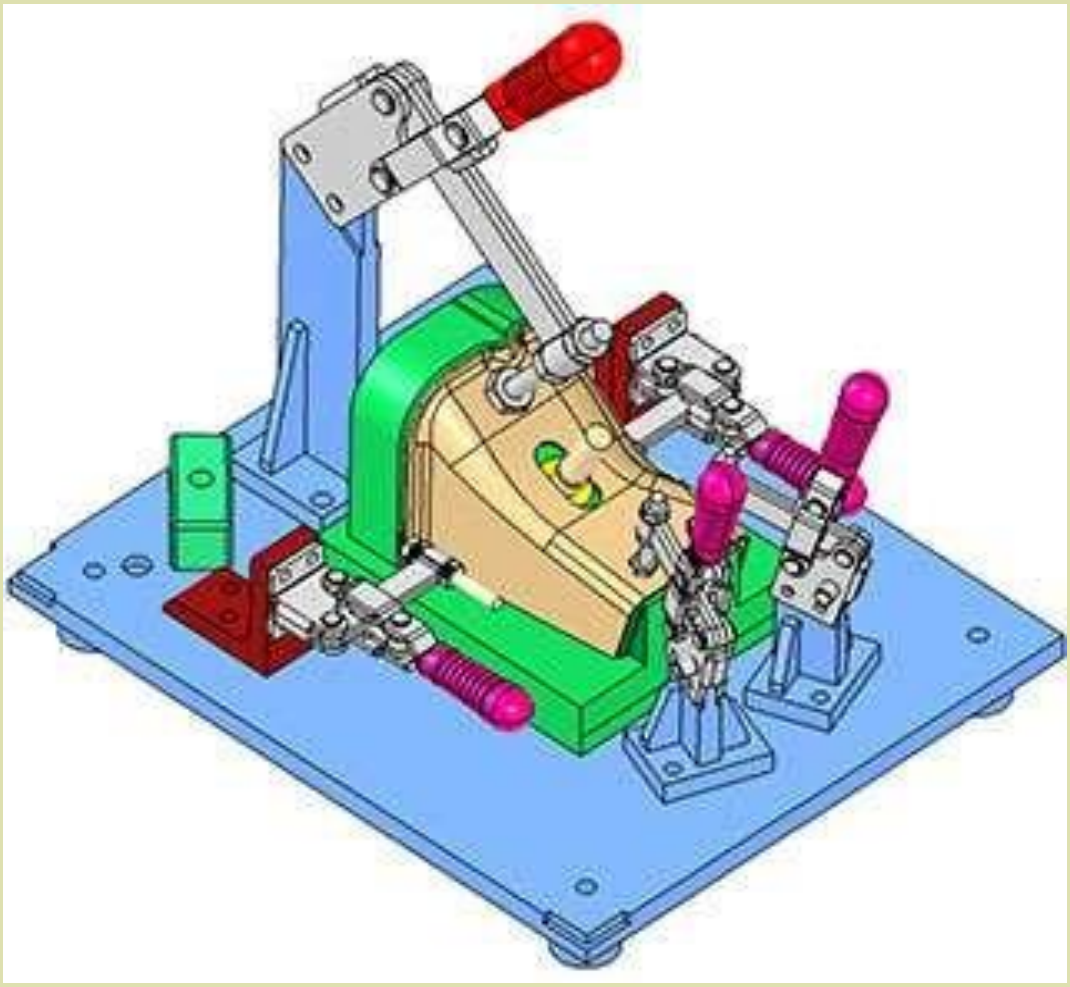
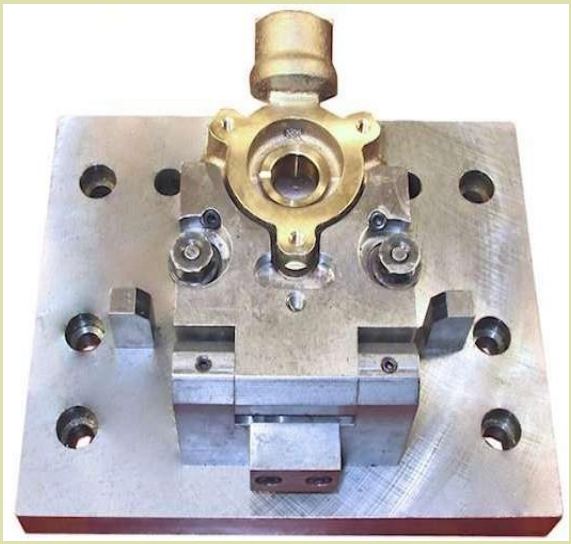
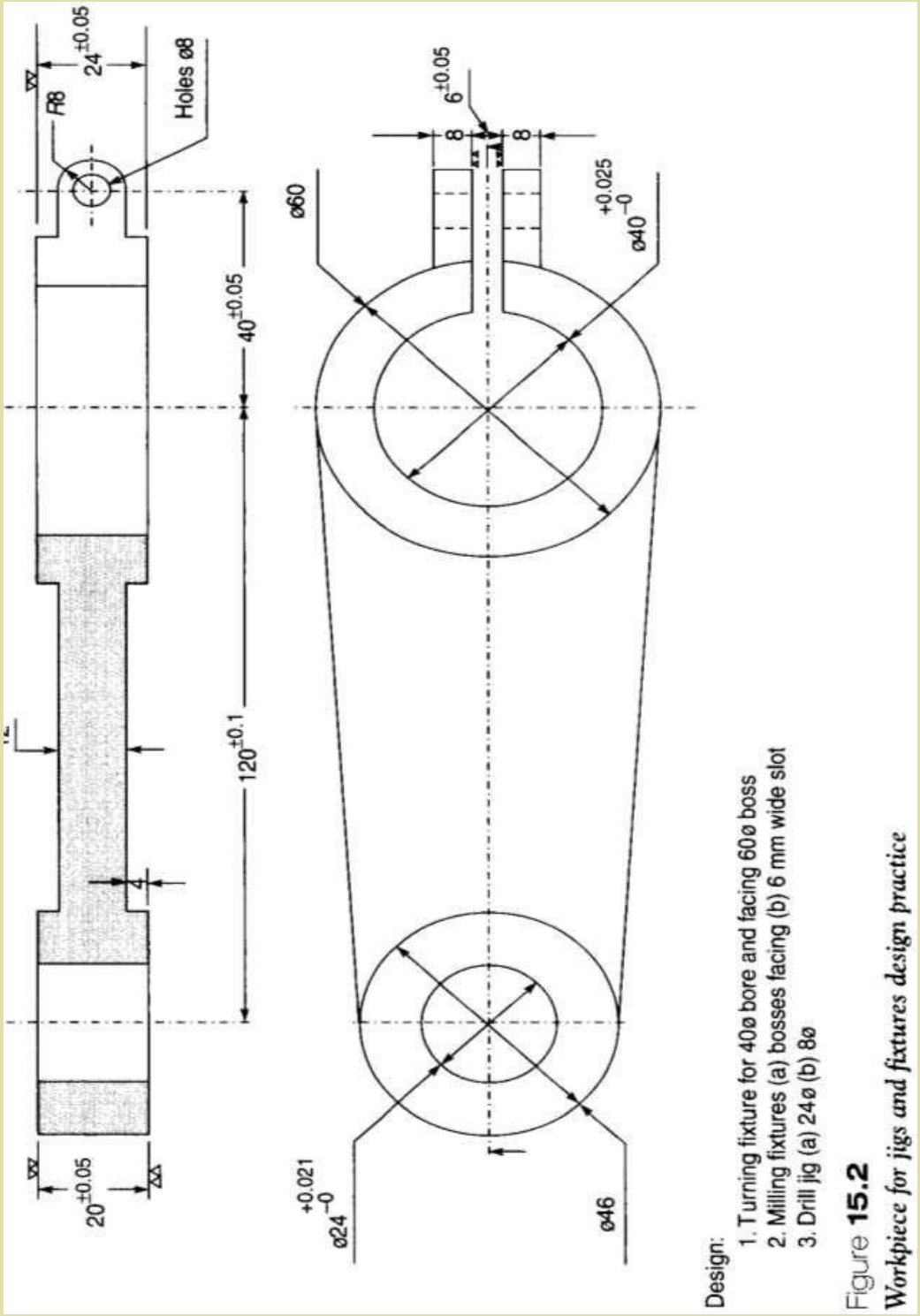


FIG 6-13
SIMPLE MILLING FIXTURE

Exercises



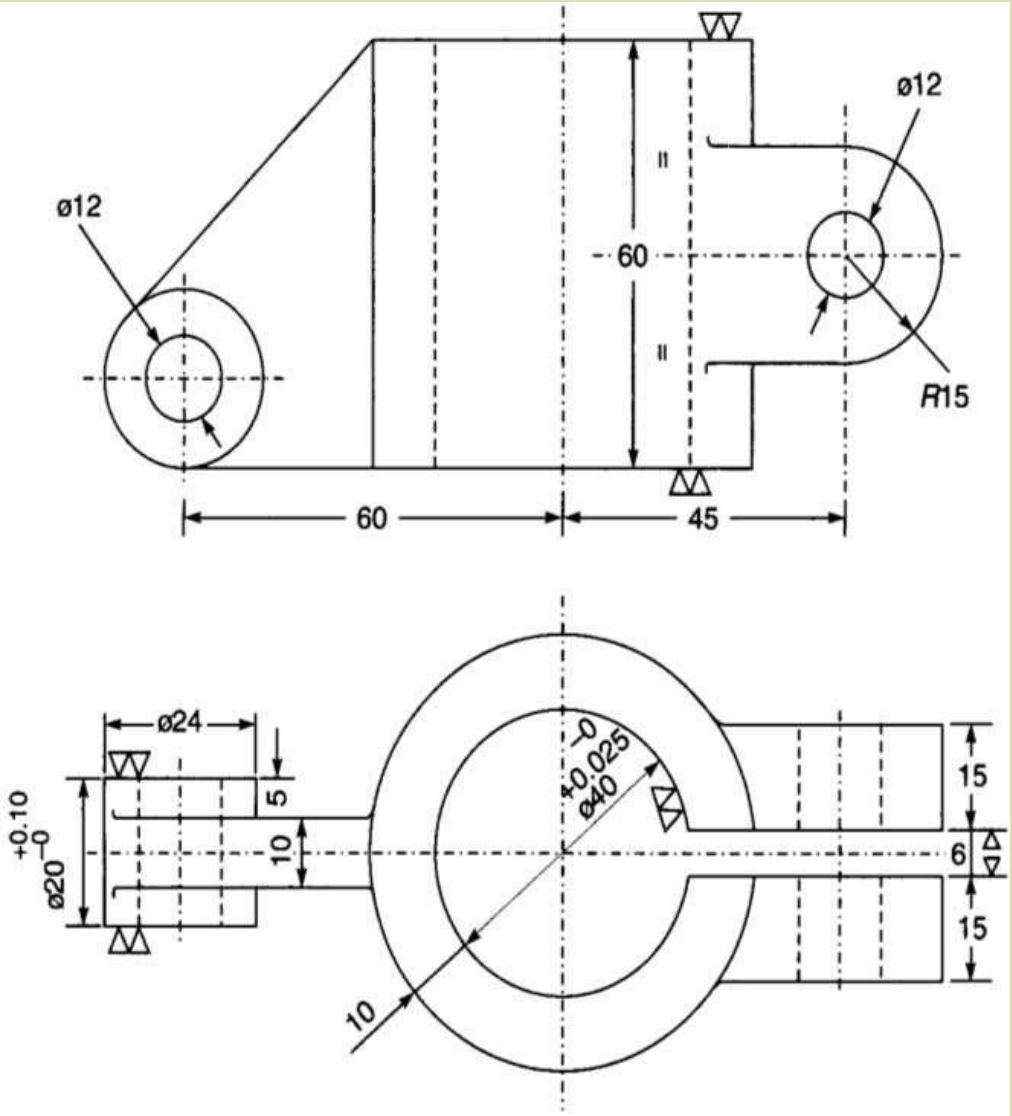




Design:

1. Turning fixture for 40ø bore and facing 60ø boss
2. Milling fixtures (a) bosses facing (b) 6 mm wide slot
3. Drill jig (a) 24ø (b) 8ø

Figure **15.2**
Workpiece for jigs and fixtures design practice

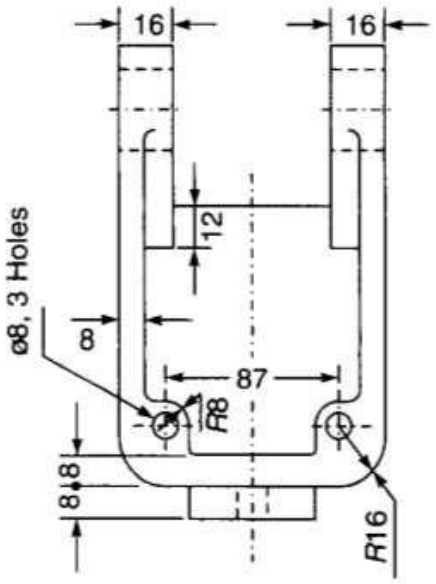


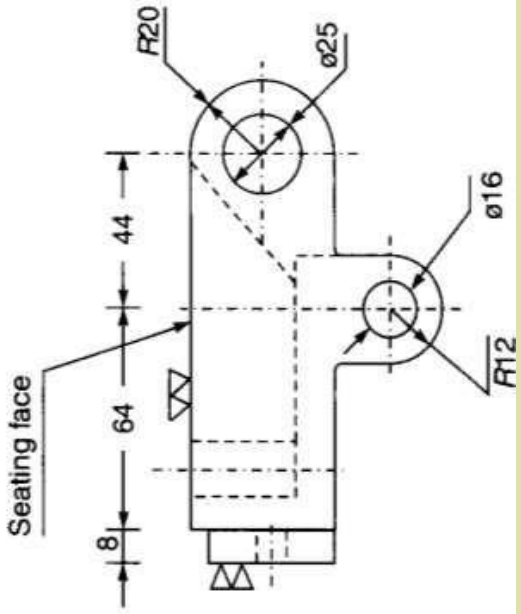
Design:

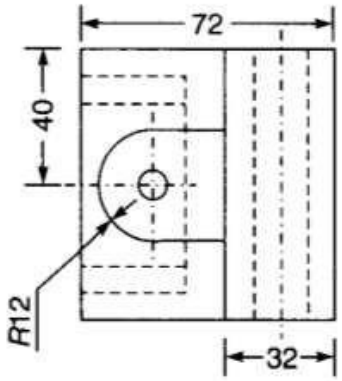
1. Turning fixture bore 40 ø, face 60ø boss
2. Milling fixture (a) Face 24ø bosses (b) Mill 6 wide slot
3. Drill jig 12ø holes

Figure **15.3**

Workpiece for jigs and fixtures design practice





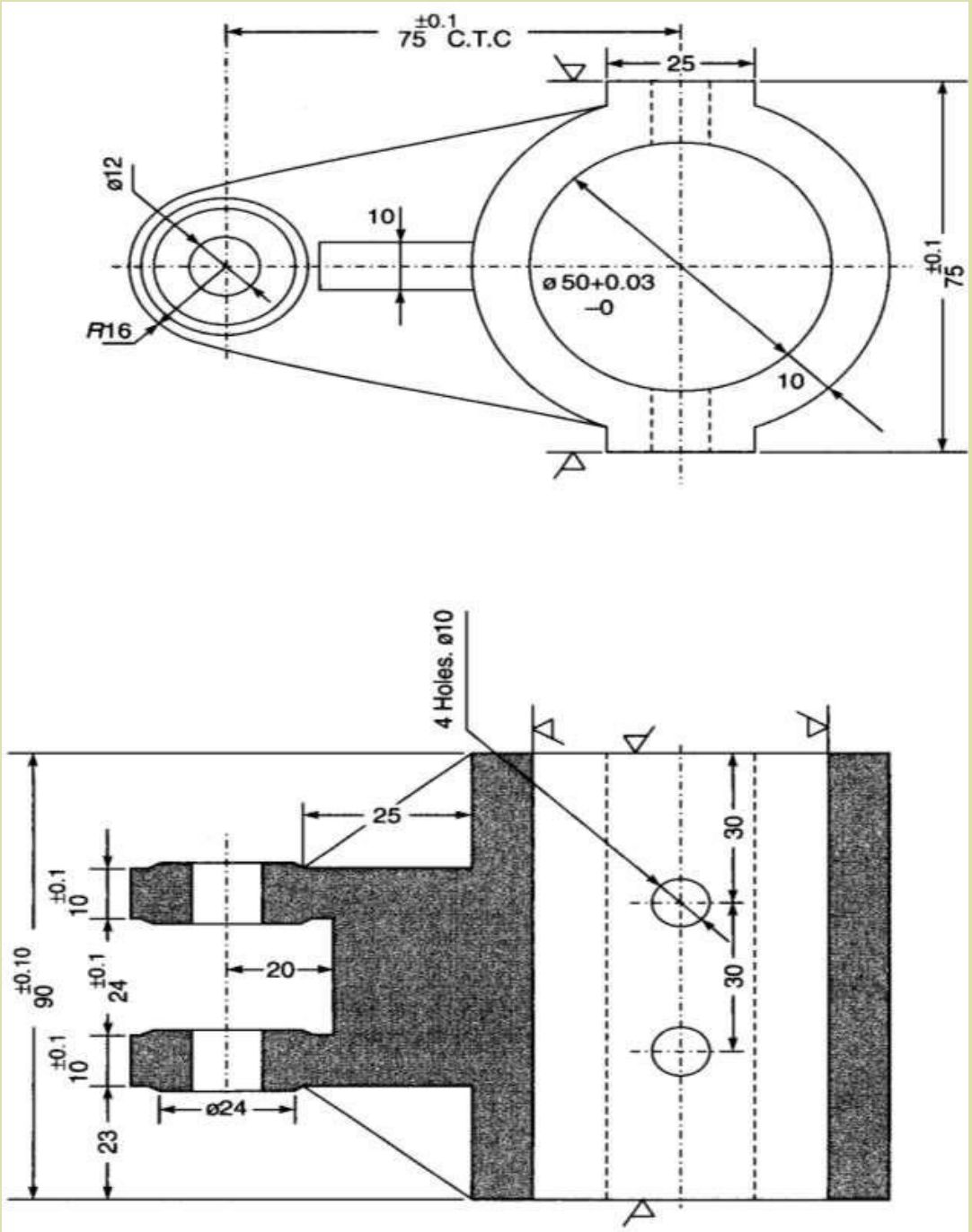


Design:

1. Milling fixtures (a) Seating face (b) 12*R* boss
2. Drill jig (a) 25ø,16ø holes (b) 8ø holes

Figure **15.4**

Workpiece for jigs and fixtures design practice

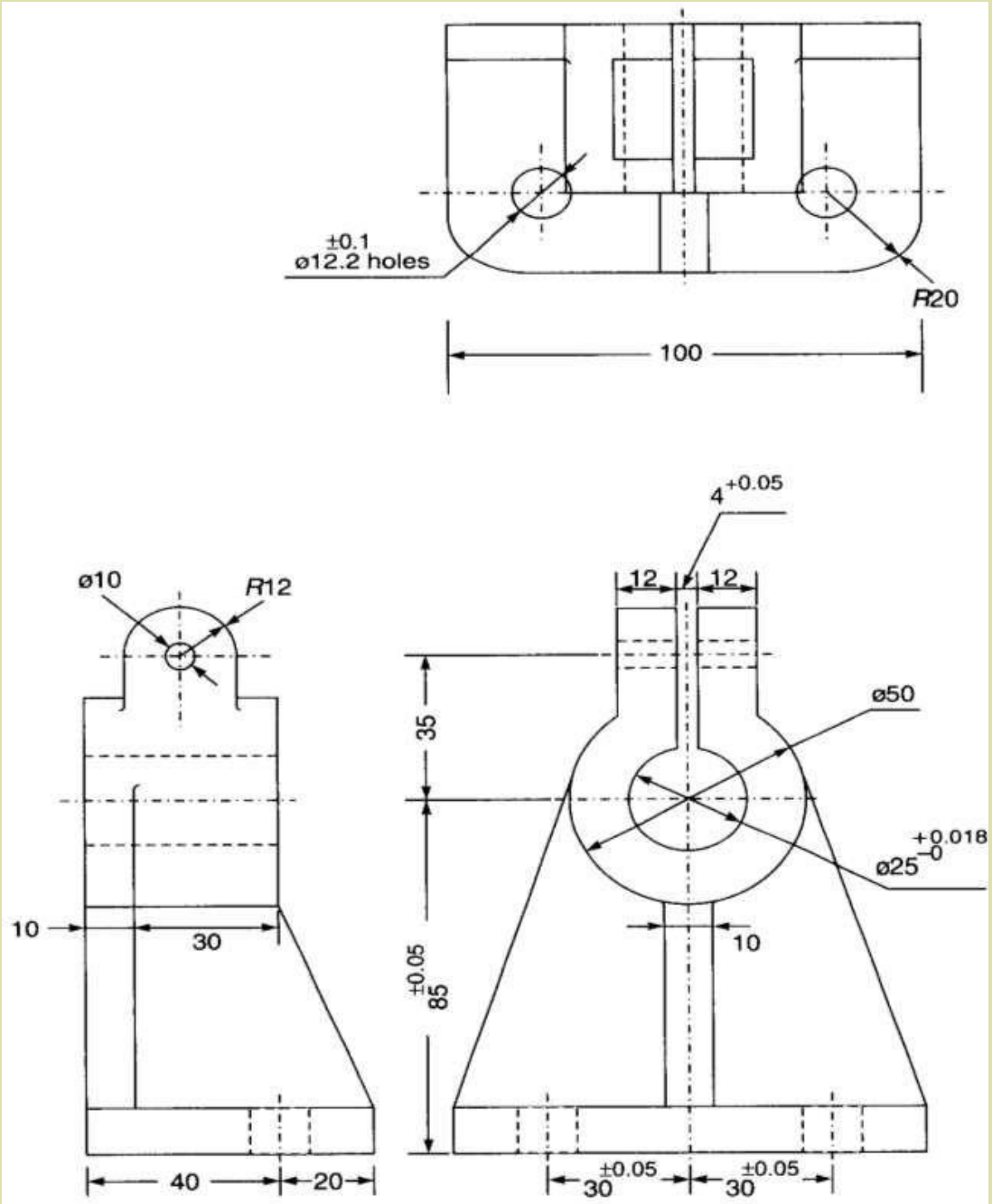


Design:

1. Turning fixture for 50ø bore and 70ø face
2. Milling fixture for (a) 24ø bosses (b) 25 × 90 pads
3. Drill jig for 10ø,12 ø holes

Figure **15.5**

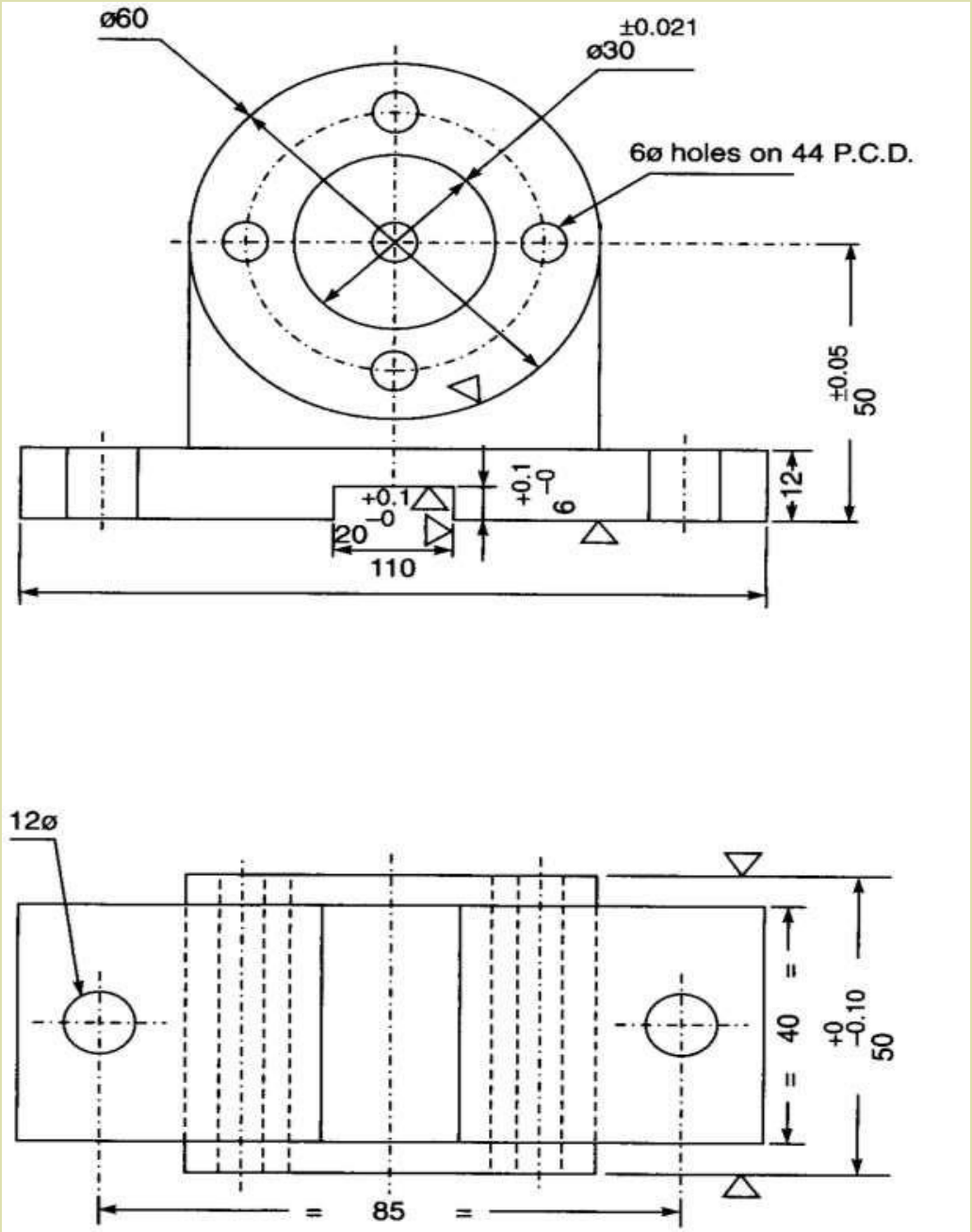
Workpiece for jigs and fixtures design practice



Design:

1. Milling fixtures (a) 60 × 100 base (b) 4 wide slot
2. Turning fixture 25ø bore and vertical face
3. Drill jig 12.2ø, 10ø holes

Figure **15.6**
Workpiece for jigs and fixtures design practice

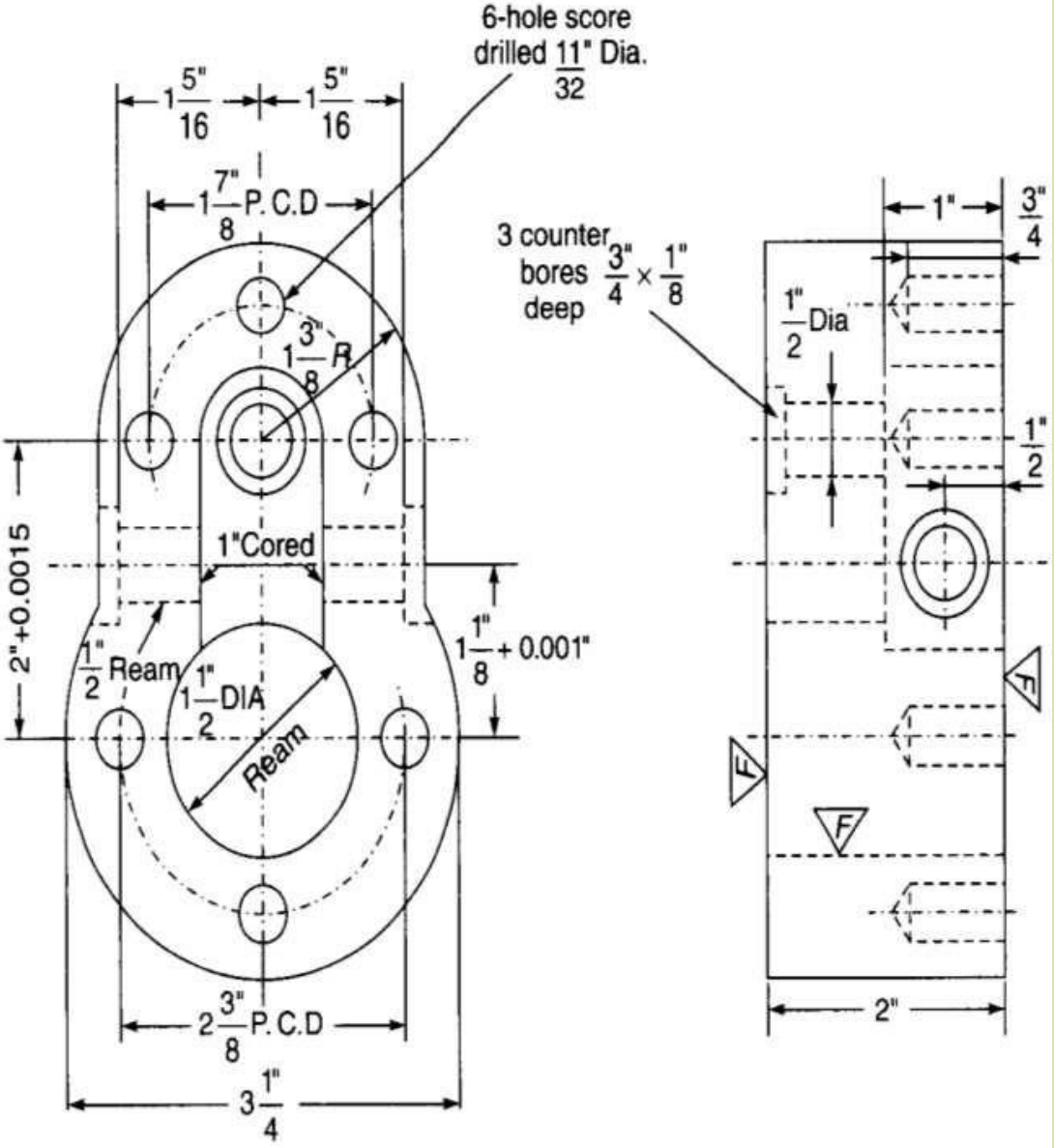


Design:

1. Milling fixtures (a) 110 × 40 base (b) 20 × 6 slot (c) 60ø bosses
2. Turning fixture bore 30ø face 60ø boss
3. Drill jig (a) 12ø holes (b) 6ø holes

Figure **15.7**

Workpiece for jigs and fixtures design practice

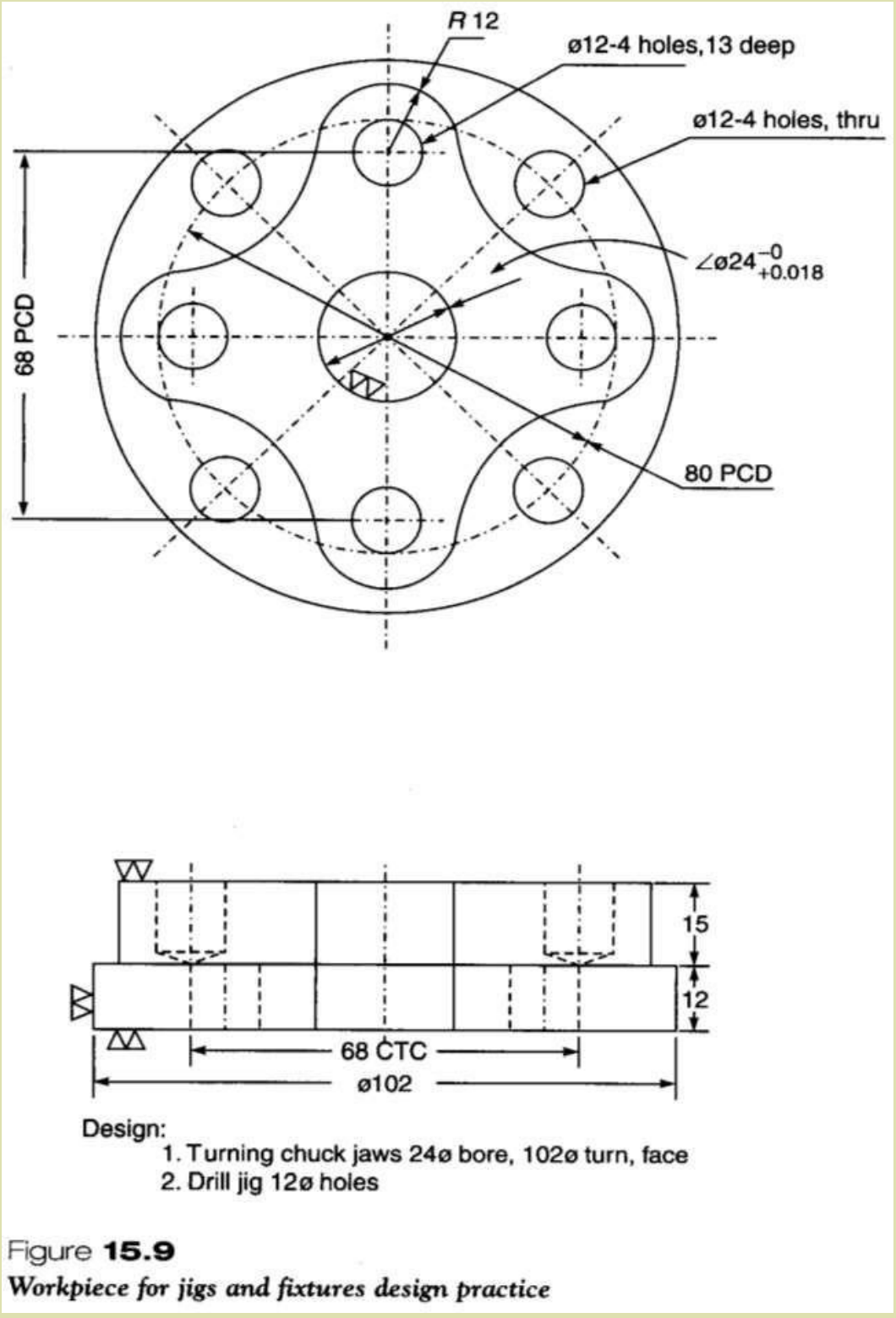


Design:

1. Turning fixture for $1^{1}/_{2}$" dia ream and one end facing
2. Milling fixture for other end face
3. Drill jigs (a) 11/32" holes
   (b) 1/2" ream, 3/4"C ' bore

Figure **15.8**

Workpiece for jigs and fixtures design practice

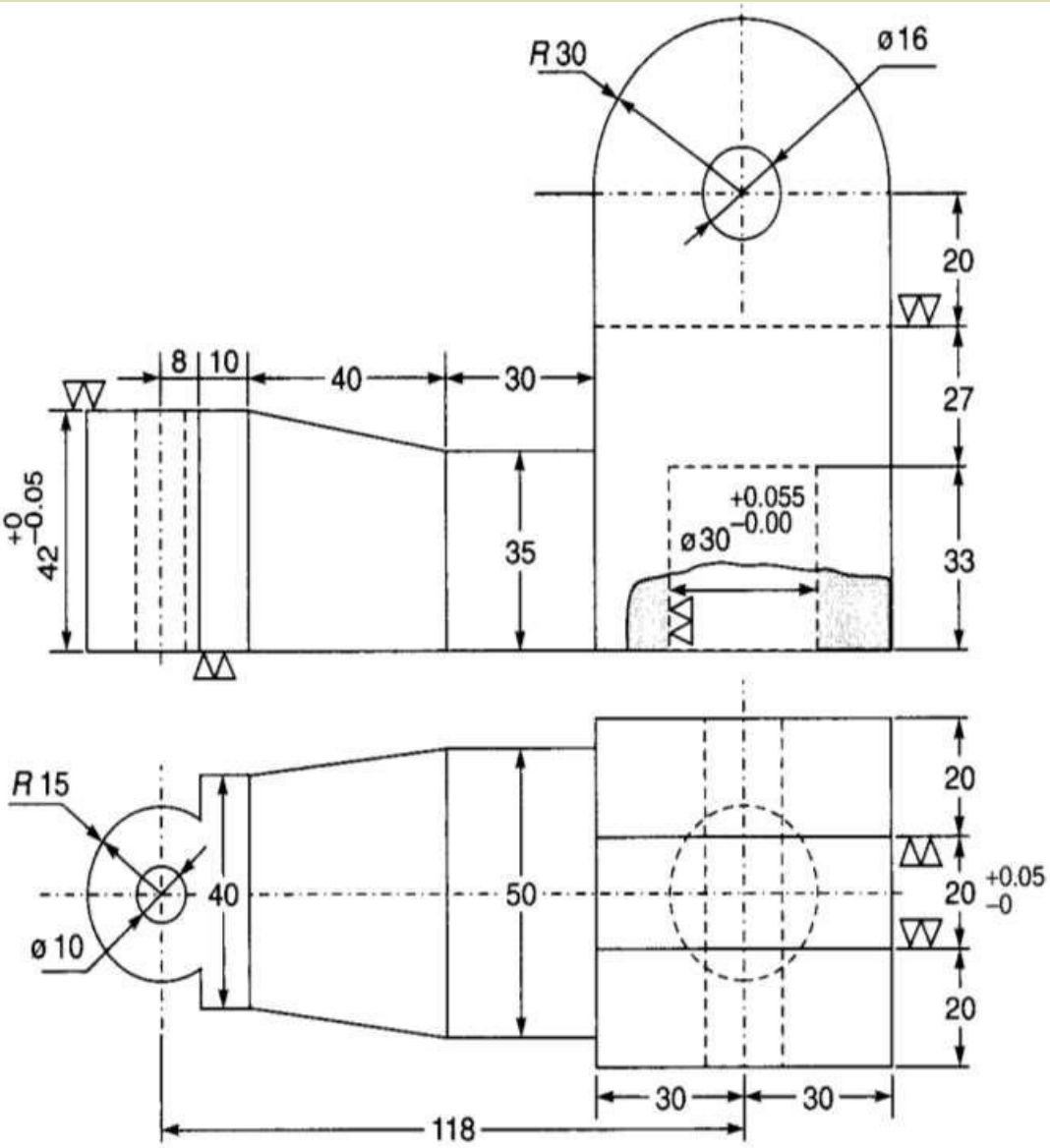


Design:

1. Turning chuck jaws 24ø bore, 102ø turn, face
2. Drill jig 12ø holes

Figure **15.9**

Workpiece for jigs and fixtures design practice



Design:

1. Turning fixture bore 30 ø and face base
2. Milling fixtures (a) 20 wide slot (b) 42 Thk boss
3. Drill jig 10ø,16 ø holes

Figure **15.10**

Workpiece for jigs and fixtures design practice

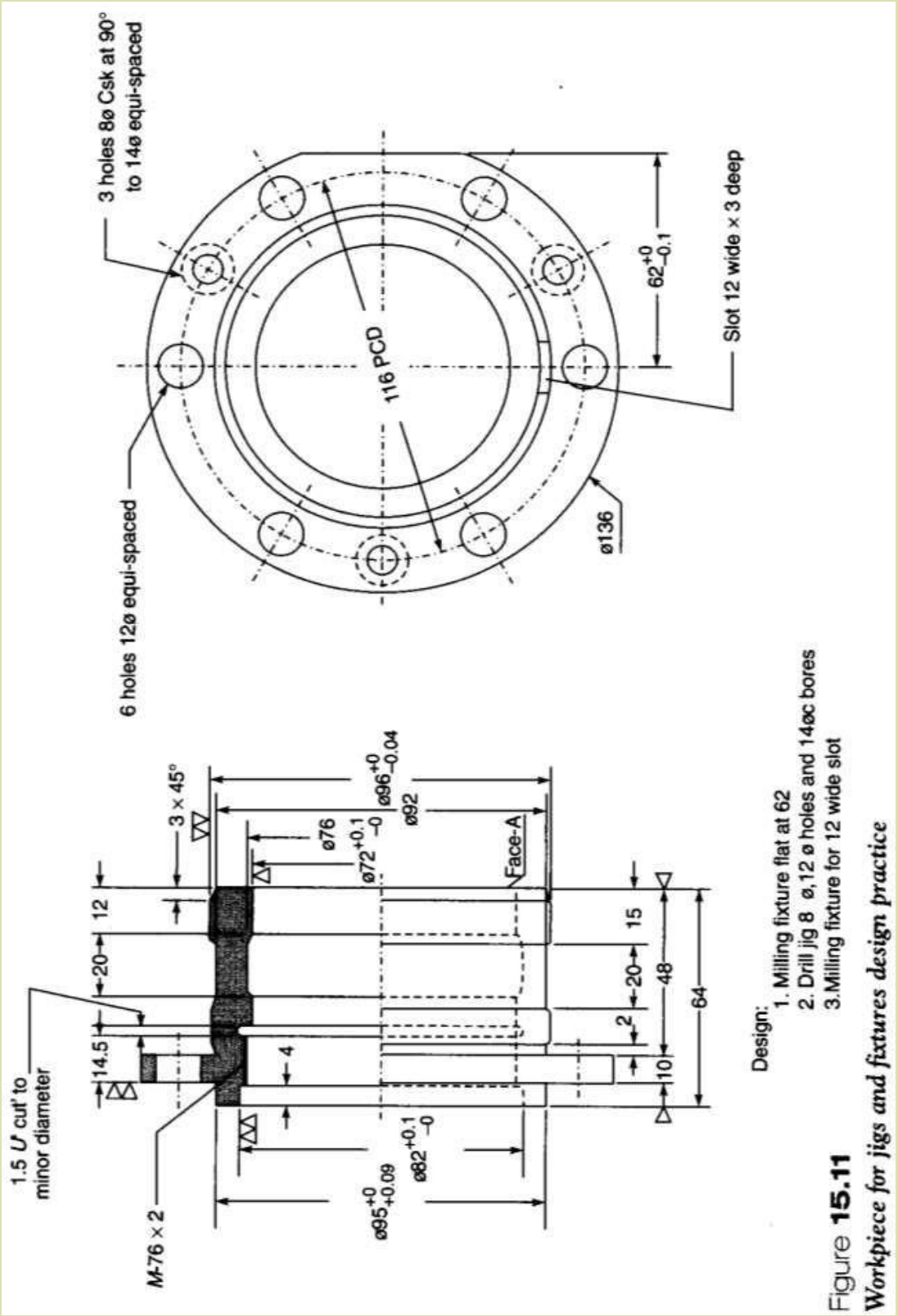
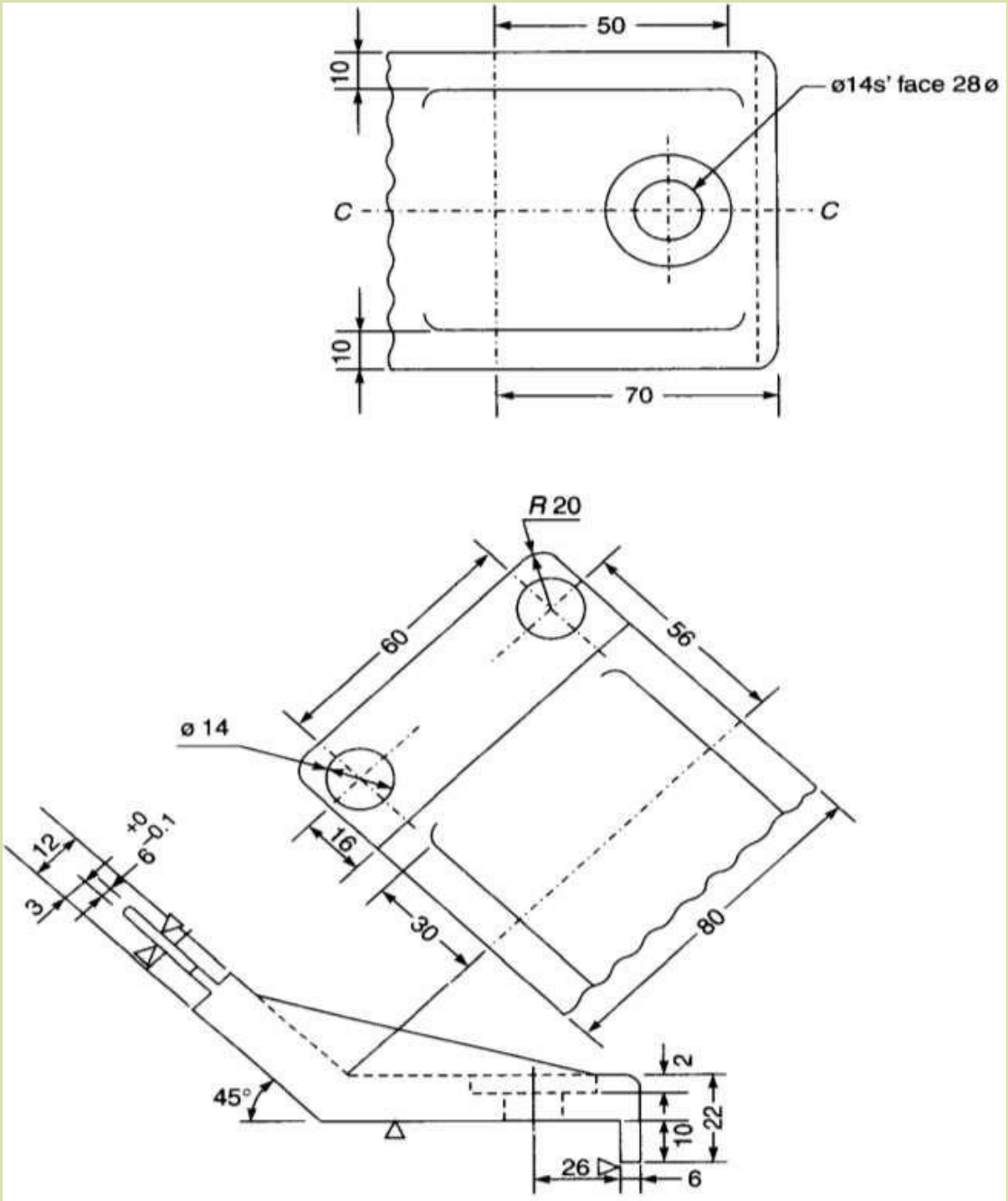


Figure **15.11**
Workpiece for jigs and fixtures design practice



Design:

1. Milling fixture 6 THK flats
2. Drilljig 14 ø holes
3. Projection

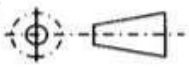
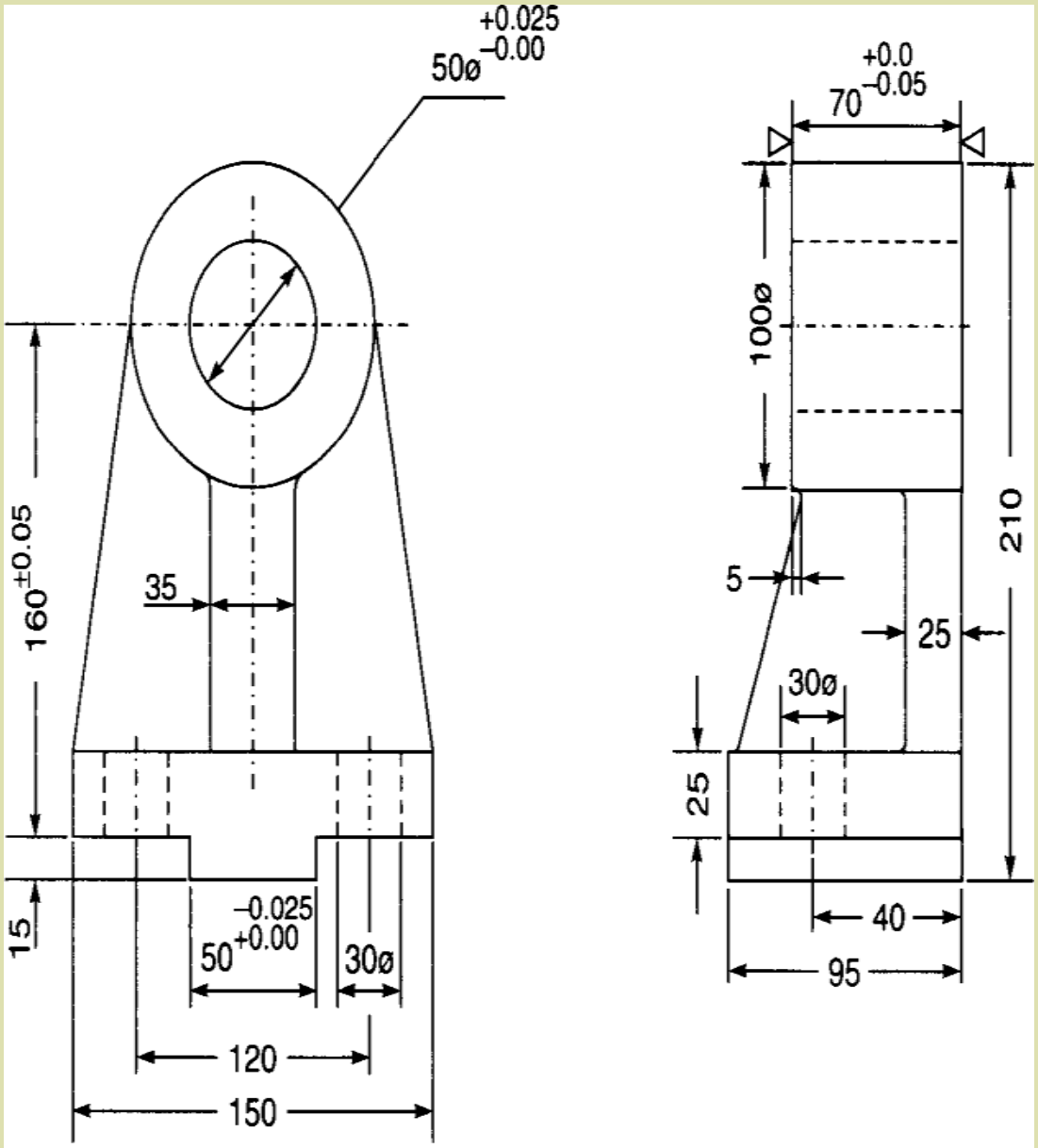


Figure **15.12**

Workpiece for jigs and fixtures design practice

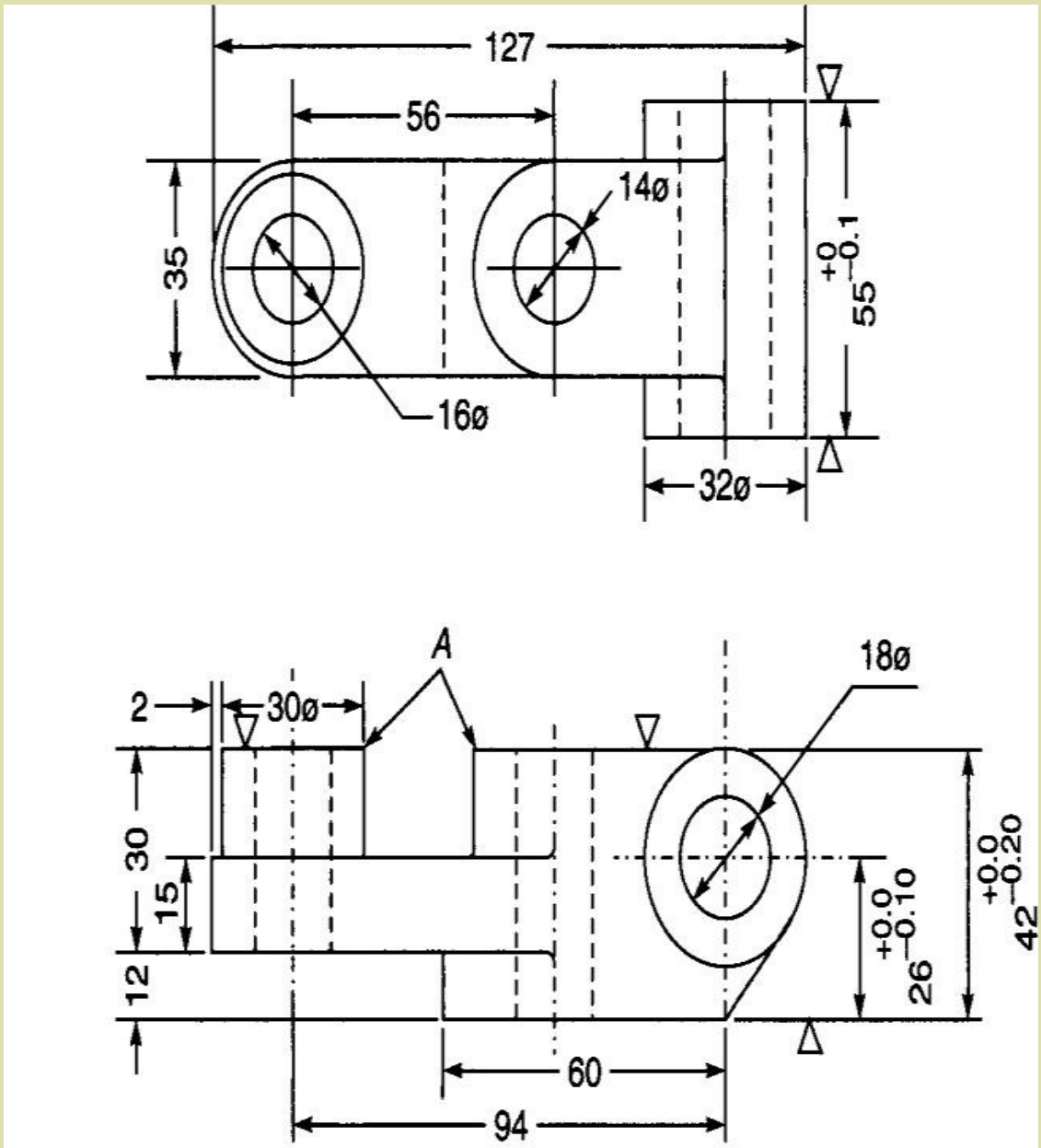


Design:

1. Milling fixtures: 50 × 15
2. Drill jig: 30 ø holes
3. Turning fixture: 50ø, face

Figure **15.20**

Workpiece for jigs and fixtures design practice

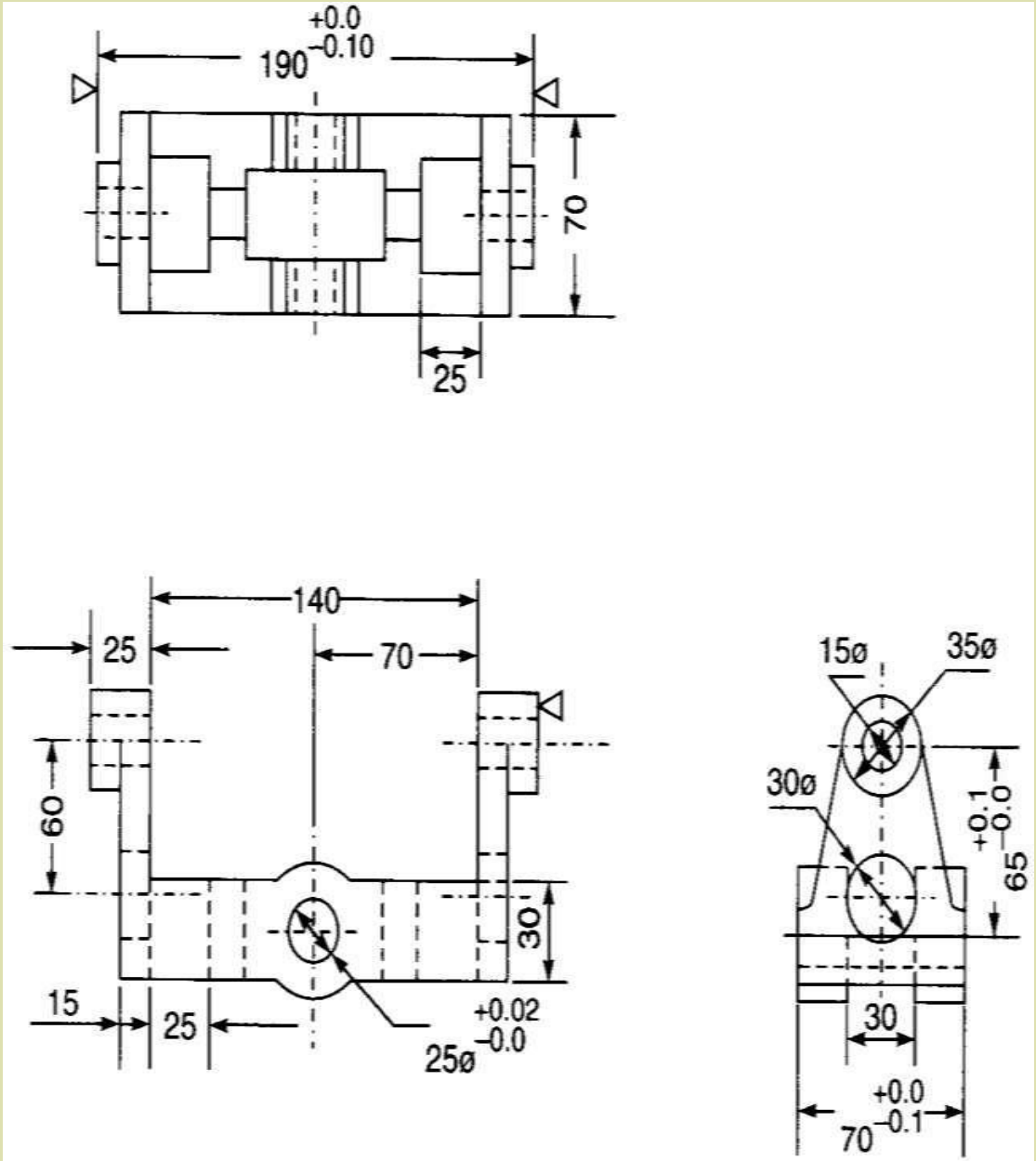


Design:

1. Milling fixtures (a) face (b) dim 55
2. Drill jigs (a) 14ø, 16ø (b) 18ø

Figure **15.21**

Workpiece for jigs and fixtures design practice

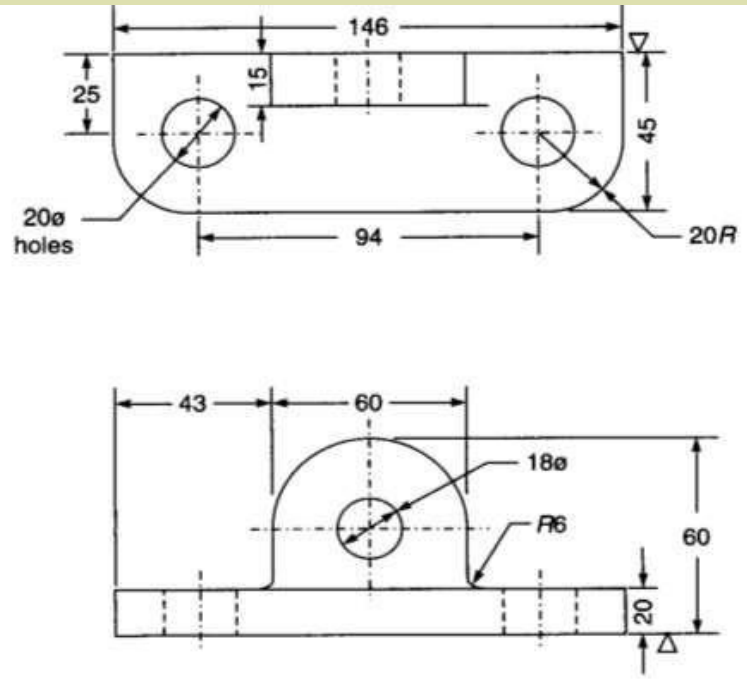


Design:

1. Milling fixtures (a) 35ø bosses (b) faces to $70^{+0.0}_{-0.1}$
2. Drill jigs (a) 15ø, 30ø (b) 25ø

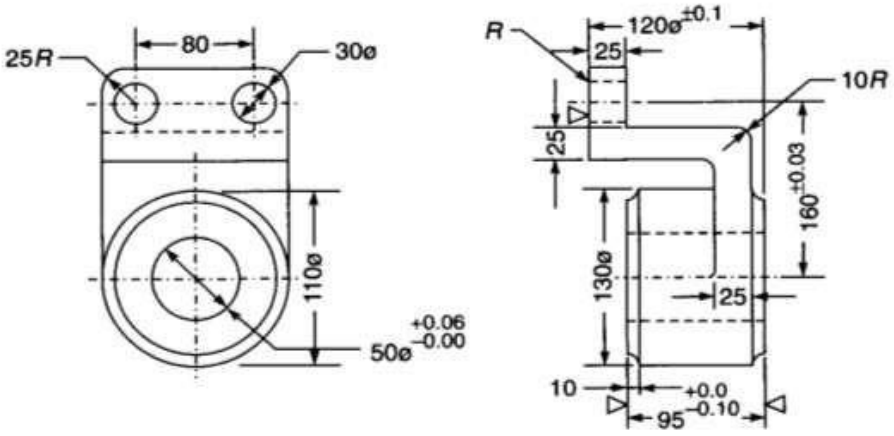
Figure **15.22**

Workpiece for jigs and fixtures design practice



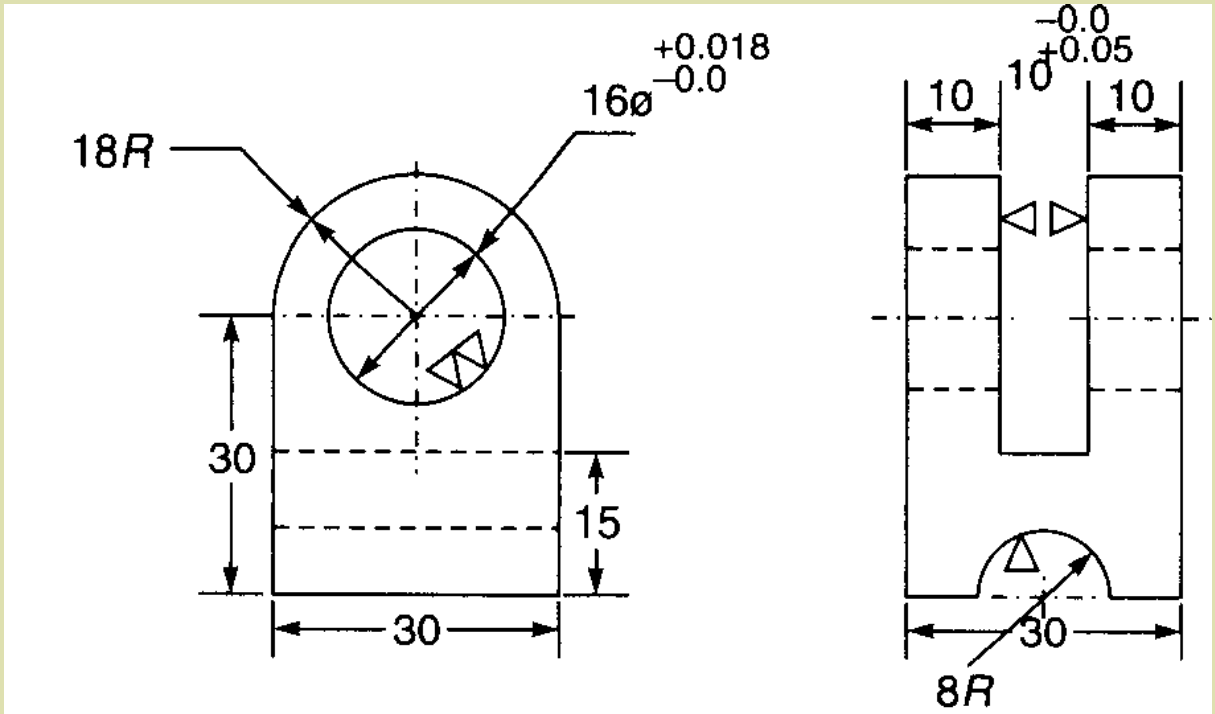
Design:
1. Milling fixtures (a) 146 × 45 (b) 146 × 60
2. Drill jig 18ø, 20ø

Figure **15.23**
Workpiece for jigs and fixtures design practice



Design:
1. Milling fixtures face *R*
2. Drill jig 25ø holes
3. Turning fixture 130ø face, 50ø bore

Figure **15.24**
Workpiece for jigs and fixtures design practice



Design:

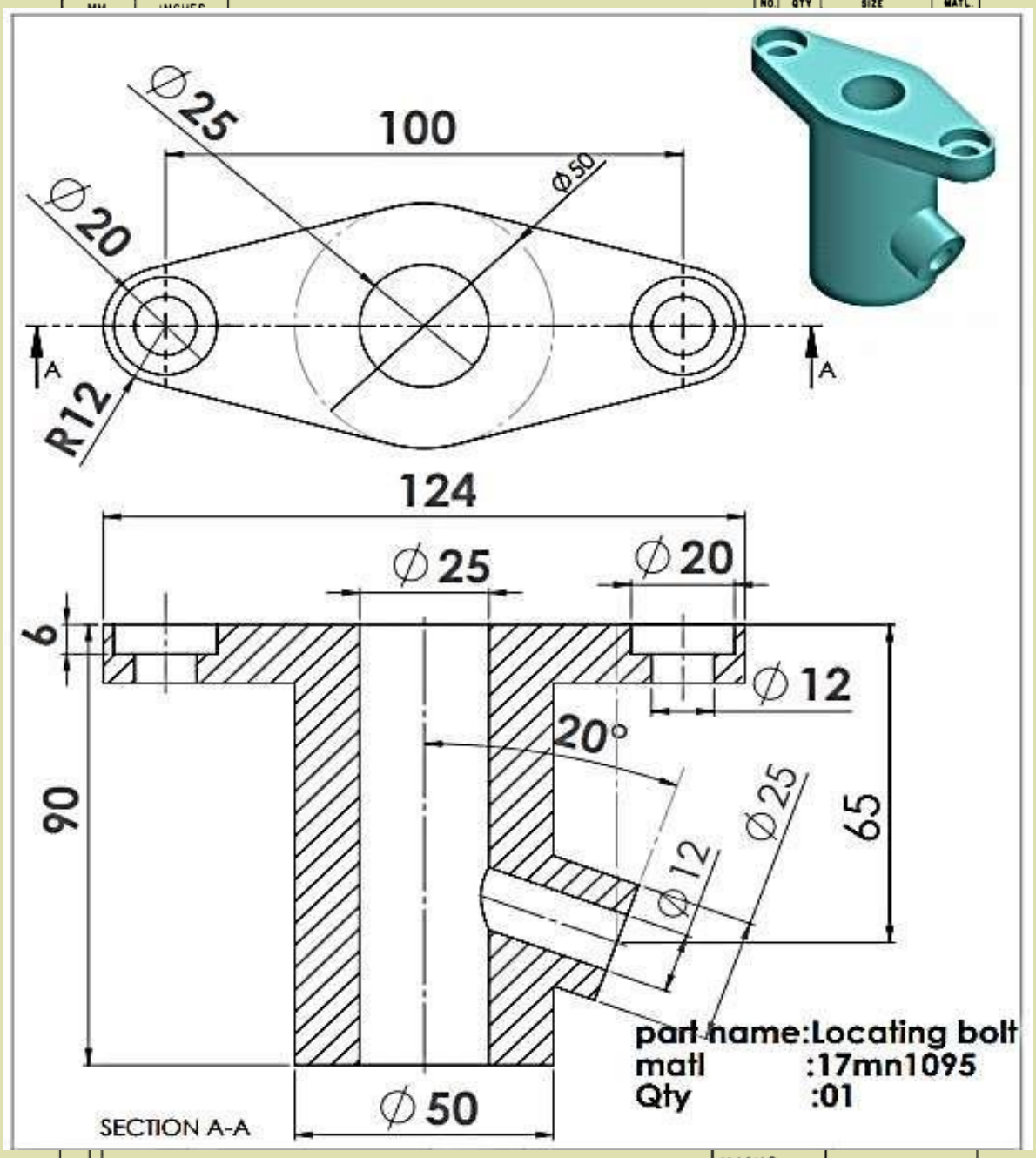
1. Milling fixtures (a) 10 slot (b) 8 *R*
2. Drill jig 16ø hole

Figure **15.25**

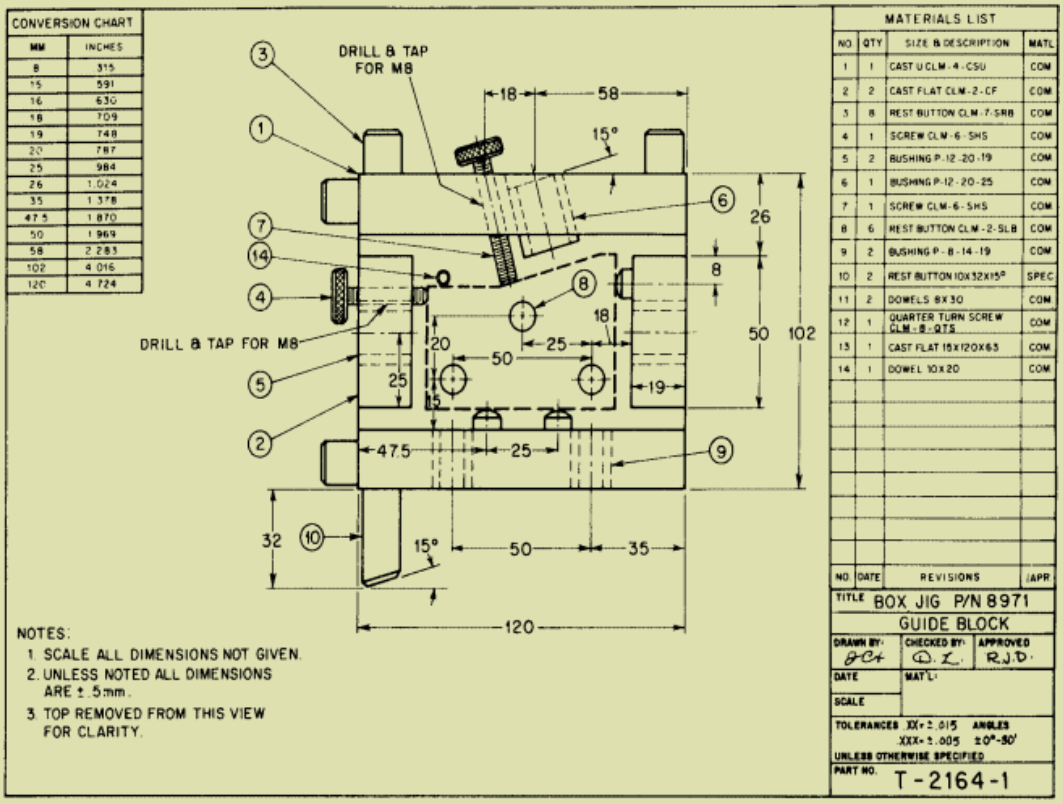
Workpiece for jigs and fixtures design practice

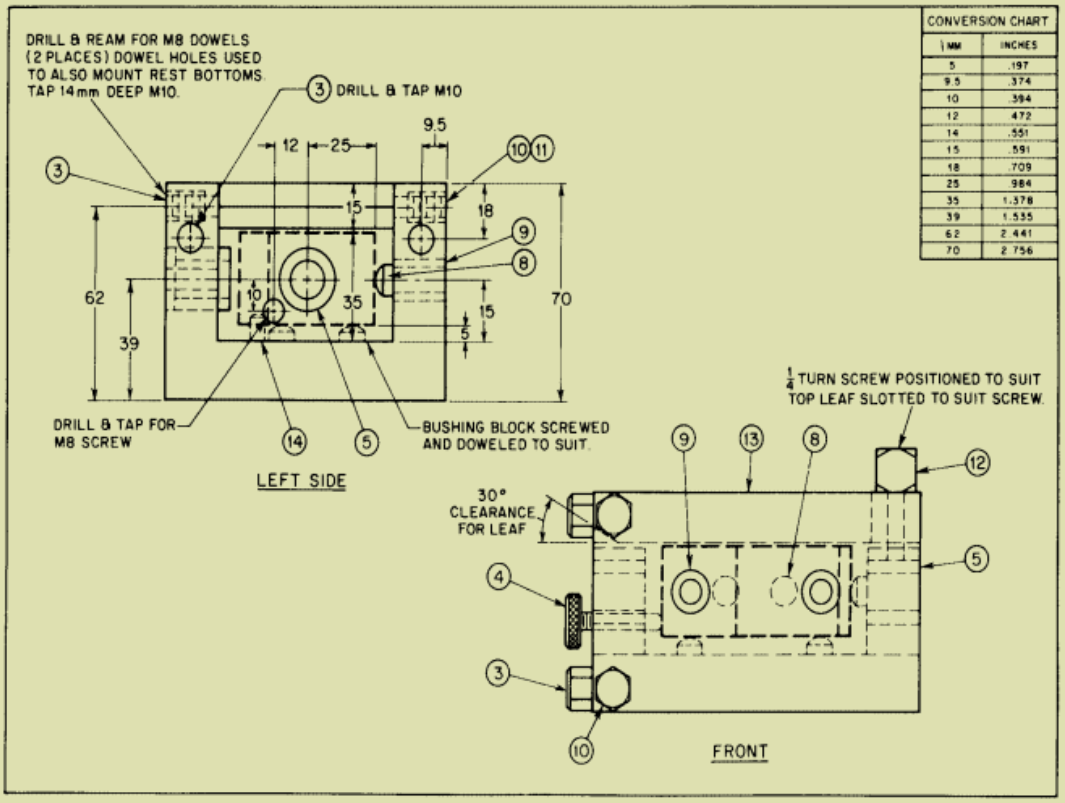
15.26 Design a suitable jig for the following given component.

Design a Drill jig for the following Component:

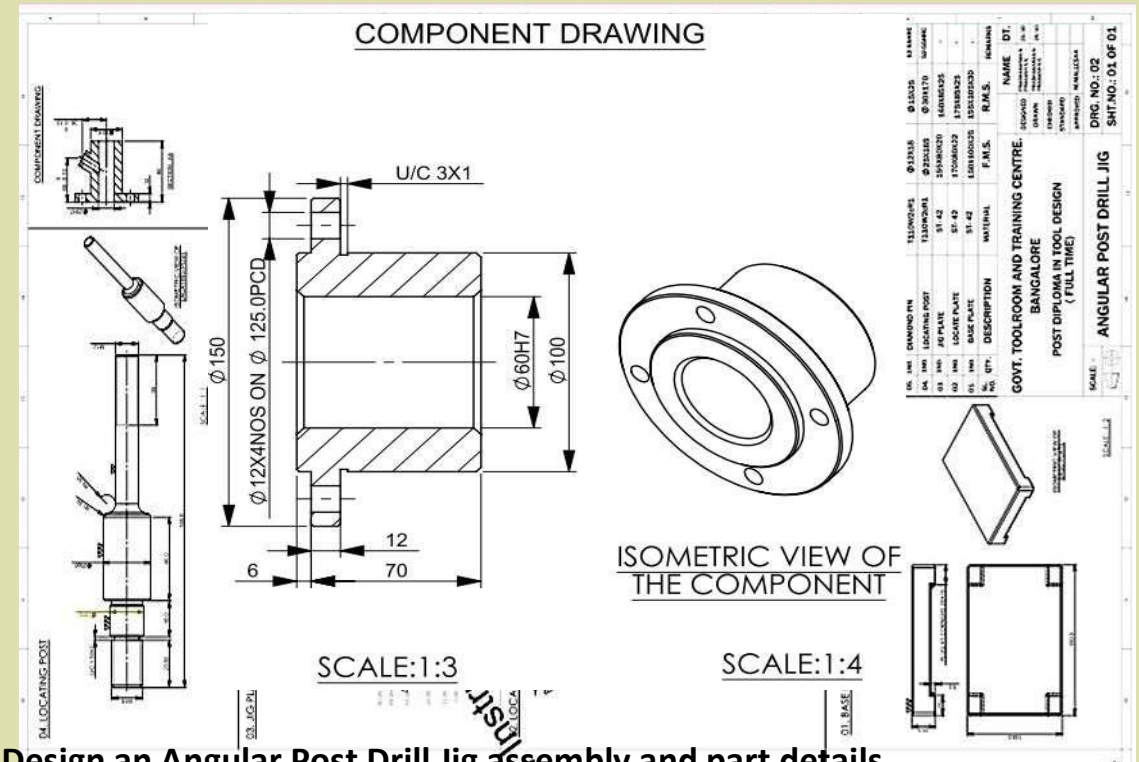


OPR NO.	TOOL DESCRIPTION	SIZE	SPECIAL TOOL NO.
5	TAP, 4 FLUTE	M 14 X 2	———
4	DRILLS, JOBBER'S LENGTH, TAPER SHANK	8mm 12mm	BOX JIG T-8971-2
2	MILLING CUTTERS, INTERLOCK	100X30X25 100X40X25(15°) 90X10X25	VISE JAW FIXTURE T-8971-1

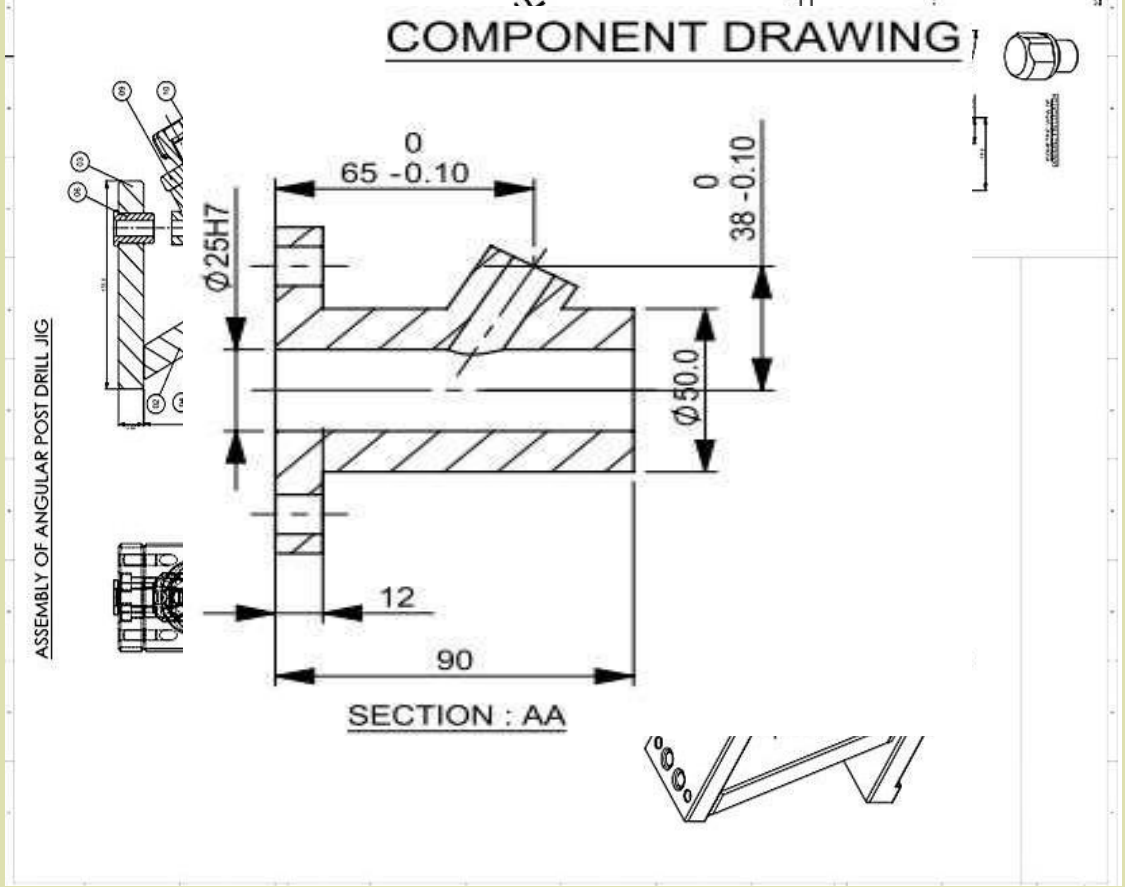

CONVERSION CHART
MM | INCHES
8 | 315
15 | 591
16 | 630
18 | 709
19 | 748
20 | 787
25 | 984
26 | 1.024
35 | 1.378
47.5 | 1.870
50 | 1.969
58 | 2.283
102 | 4.016
120 | 4.724
DRILL & TAP FOR M8
DRILL & TAP FOR M8
18
58
15°
26
8
50
102
20
50
25
18
25
19
15
47.5
25
32
15°
50
35
120
MATERIALS LIST
NO. | QTY | SIZE & DESCRIPTION | MATL
1 | 1 | CAST U CLM-4-CSU | COM
2 | 2 | CAST FLAT CLM-2-CF | COM
3 | 8 | REST BUTTON CLM-7-SRB | COM
4 | 1 | SCREW CLM-6-SHS | COM
5 | 2 | BUSHING P-12-20-19 | COM
6 | 1 | BUSHING P-12-20-25 | COM
7 | 1 | SCREW CLM-6-SHS | COM
8 | 6 | REST BUTTON CLM-2-SLB | COM
9 | 2 | BUSHING P-8-14-19 | COM
10 | 2 | REST BUTTON 10X12X15° | SPEC
11 | 2 | DOWELS 8X30 | COM
12 | 1 | QUARTER TURN SCREW CLM-8-QTS | COM
13 | 1 | CAST FLAT 15X120X63 | COM
14 | 1 | DOWEL 10X20 | COM
NO. | DATE | REVISIONS | APR
TITLE BOX JIG P/N 8971
GUIDE BLOCK
DRAWN BY: GC
CHECKED BY: D.L.
APPROVED R.J.D.
DATE
MAT'L
SCALE
TOLERANCES XX=±.015 ANGLES
XXX=±.005 ±0°-30'
UNLESS OTHERWISE SPECIFIED
PART NO. T-2164-1
NOTES:
1. SCALE ALL DIMENSIONS NOT GIVEN.
2. UNLESS NOTED ALL DIMENSIONS ARE ±.5mm.
3. TOP REMOVED FROM THIS VIEW FOR CLARITY.

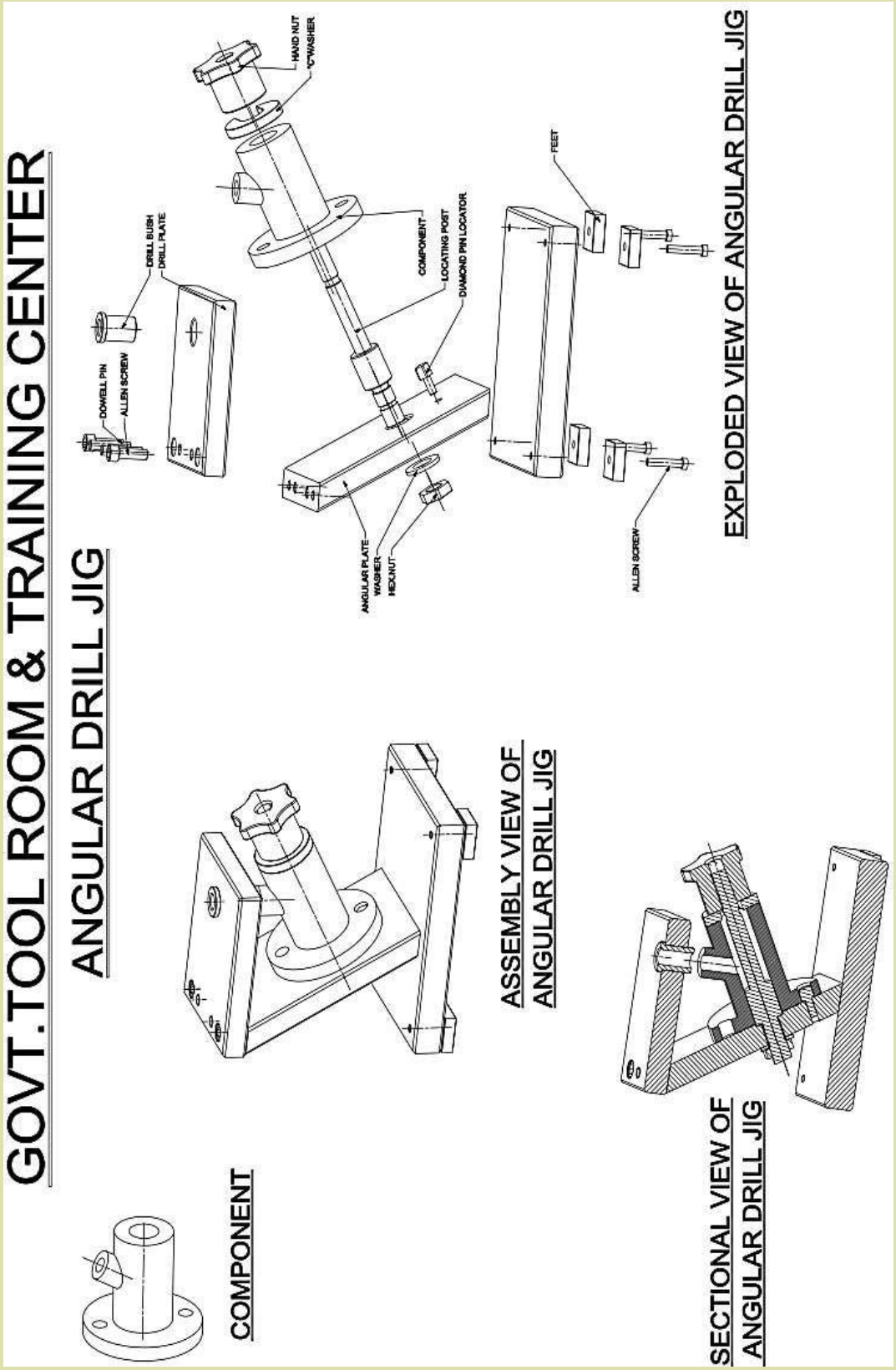

CONVERSION CHART
MM | INCHES
5 | .197
9.5 | .374
10 | .394
12 | .472
14 | .551
15 | .591
18 | .709
25 | 984
35 | 1.378
39 | 1.535
62 | 2.441
70 | 2.756
DRILL & REAM FOR M8 DOWELS (2 PLACES) DOWEL HOLES USED TO ALSO MOUNT REST BOTTOMS. TAP 14mm DEEP M10.
DRILL & TAP M10
9.5
12
25
15
18
62
39
10
35
15
5
70
DRILL & TAP FOR M8 SCREW
BUSHING BLOCK SCREWED AND DOWELED TO SUIT.
LEFT SIDE
¼ TURN SCREW POSITIONED TO SUIT TOP LEAF SLOTTED TO SUIT SCREW.
30° CLEARANCE FOR LEAF
FRONT

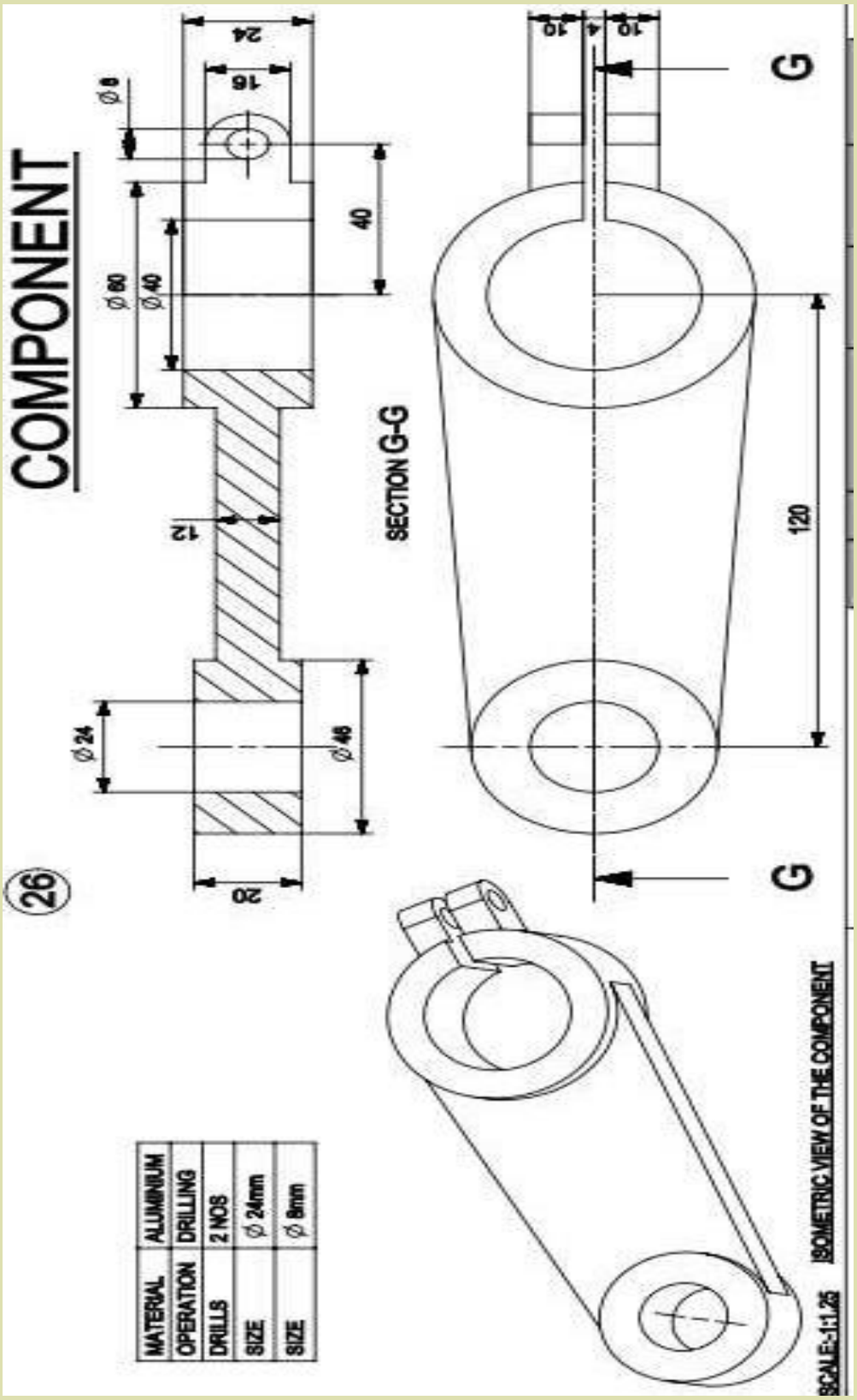
Q) Design a Post drill jig assembly and details of elements.

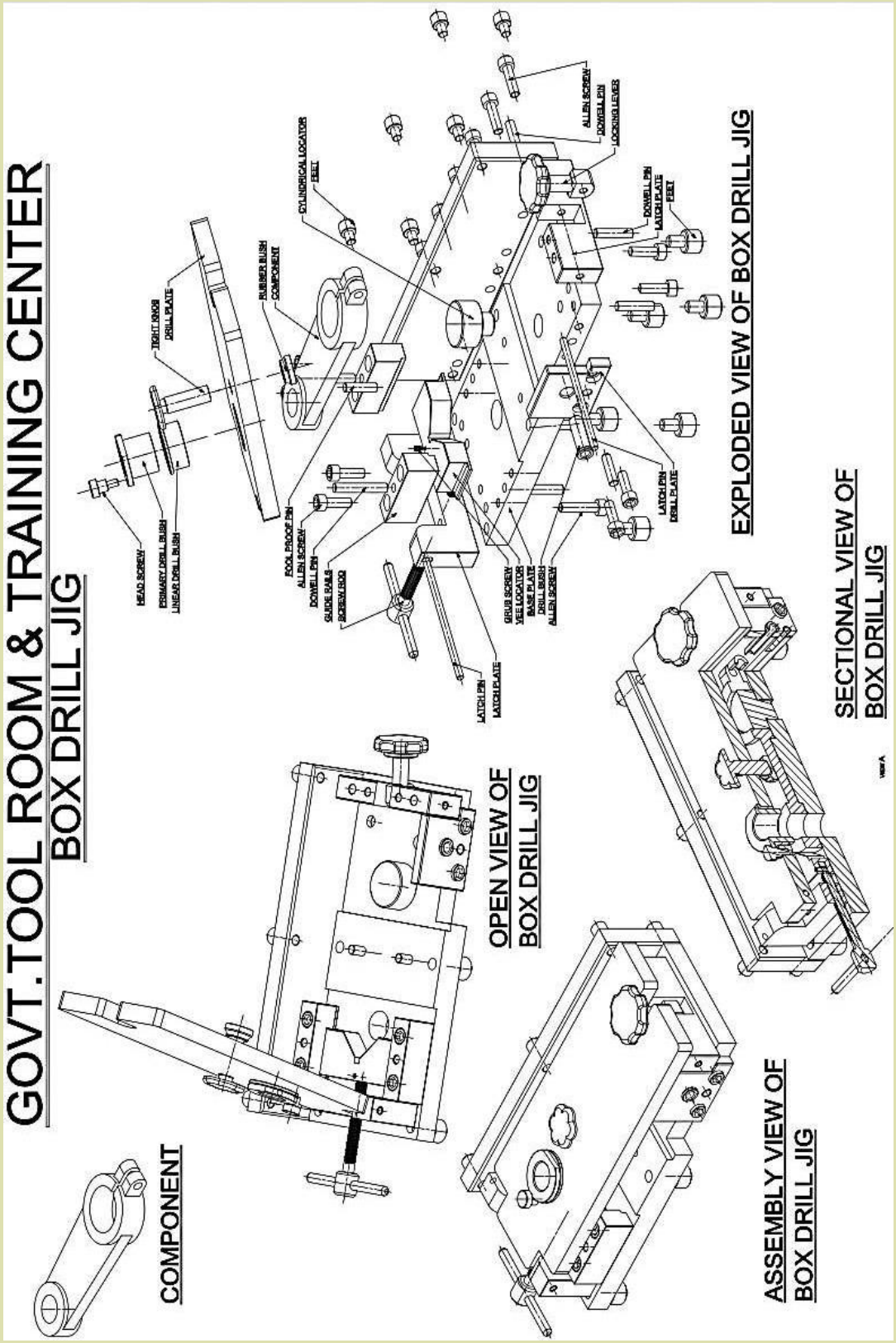


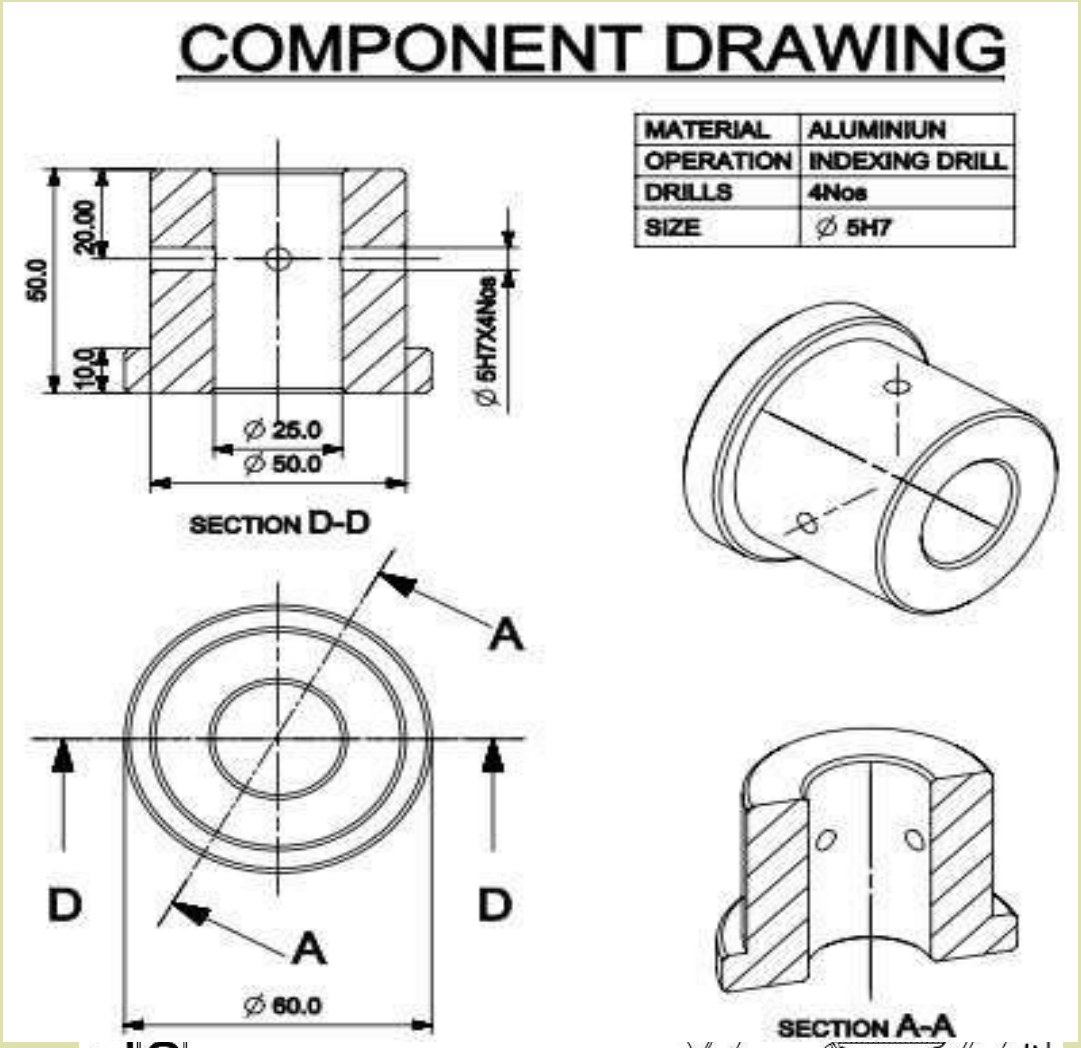
Q2) Design an Angular Post Drill Jig assembly and part details.

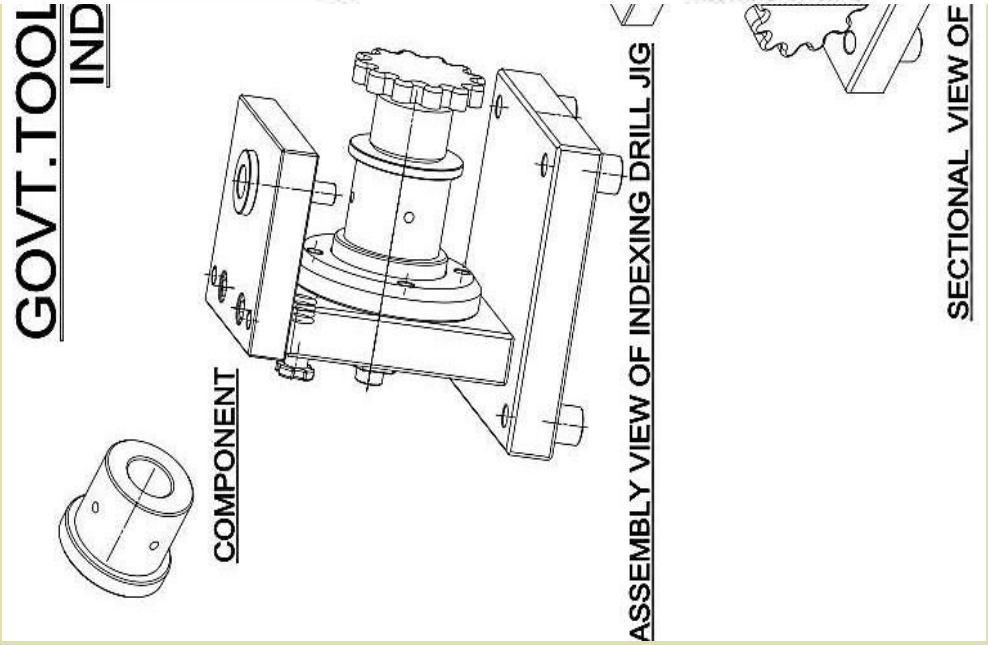


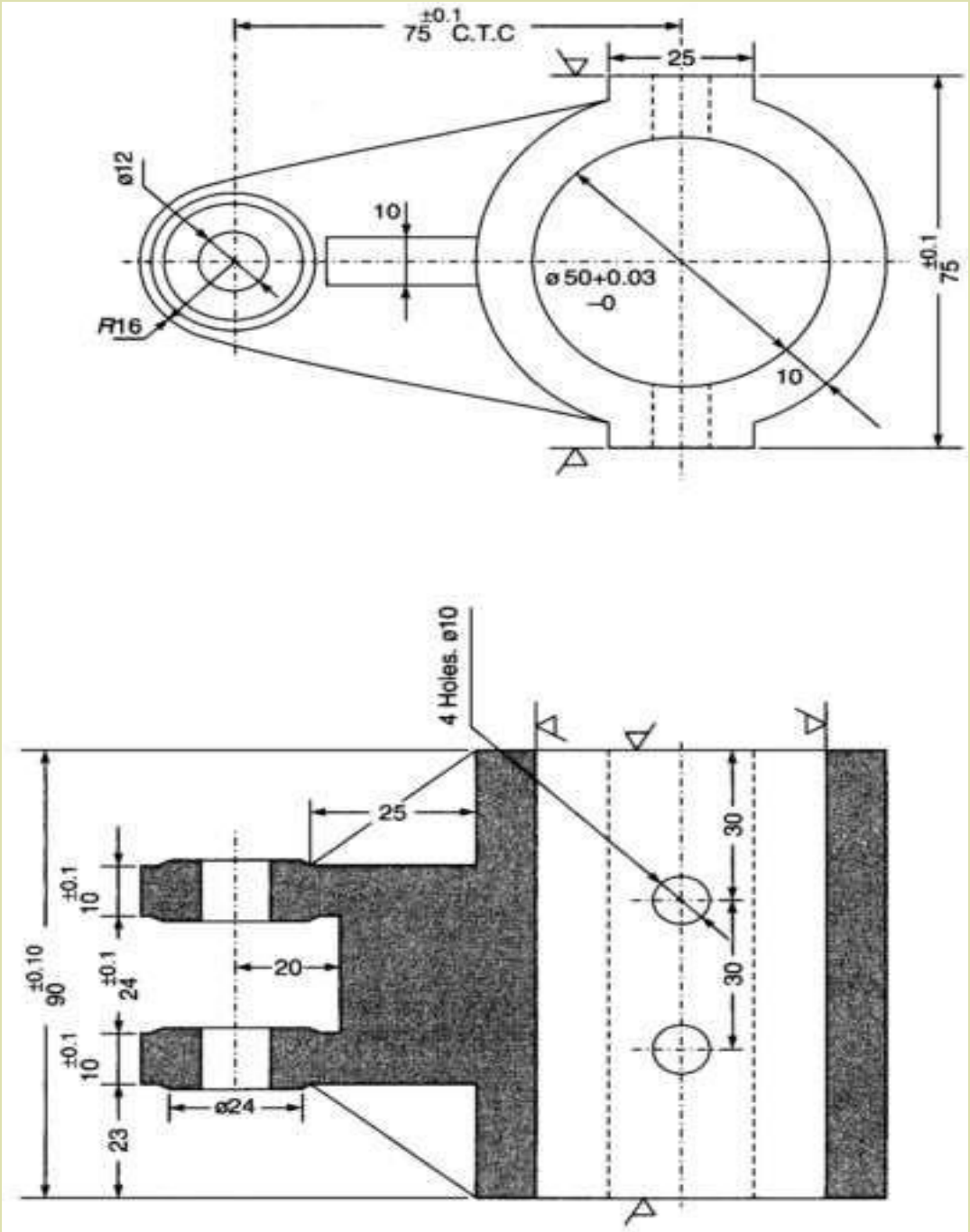

GOVT.TOOL ROOM & TRAINING CENTER
ANGULAR DRILL JIG
EXPLODED VIEW OF ANGULAR DRILL JIG
HAND NUT
WASHER
DRILL BUSH
DRILL PLATE
DOWELL PIN
ALLEN SCREW
COMPONENT
LOCATING POST
DIAMOND PIN LOCATOR
FEET
ANGULAR PLATE
WASHER
HEX.NUT
ALLEN SCREW
COMPONENT
ASSEMBLY VIEW OF
ANGULAR DRILL JIG
SECTIONAL VIEW OF
ANGULAR DRILL JIG


COMPONENT
26
SECTION G-G
ISOMETRIC VIEW OF THE COMPONENT
SCALE:-1:1.25
MATERIAL ALUMINIUM
OPERATION DRILLING
DRILLS 2 NOS
SIZE Ø 24mm
SIZE Ø 8mm
24
16
40
120
12
20
10
4
G


GOVT.TOOL ROOM & TRAINING CENTER
BOX DRILL JIG
COMPONENT
OPEN VIEW OF
BOX DRILL JIG
ASSEMBLY VIEW OF
BOX DRILL JIG
SECTIONAL VIEW OF
BOX DRILL JIG
EXPLODED VIEW OF BOX DRILL JIG
HEAD SCREW
PRIMARY DRILL BUSH
LINEAR DRILL BUSH
TIGHT KNOB
DRILL PLATE
RUBBER BUSH
COMPONENT
CYLINDRICAL LOCATOR
FEET
ALLEN SCREW
DOWELL PIN
LOCKING LEVER
DOWELL PIN
LATCH PLATE
FEET
LATCH PIN
DRILL PLATE
FOOL PROOF PIN
ALLEN SCREW
DOWELL PIN
GUIDE BUSH
SCREW KNOB
GRUB SCREW
VEE LOCATOR
BASE PLATE
DRILL BUSH
ALLEN SCREW
LATCH PIN
LATCH PLATE


COMPONENT DRAWING
MATERIAL ALUMINIUN
OPERATION INDEXING DRILL
DRILLS 4Nos
SIZE ∅ 5H7
50.0
20.00
10.0
∅ 5H7X4Nos
∅ 25.0
∅ 50.0
SECTION D-D
A
D
D
A
∅ 60.0
SECTION A-A

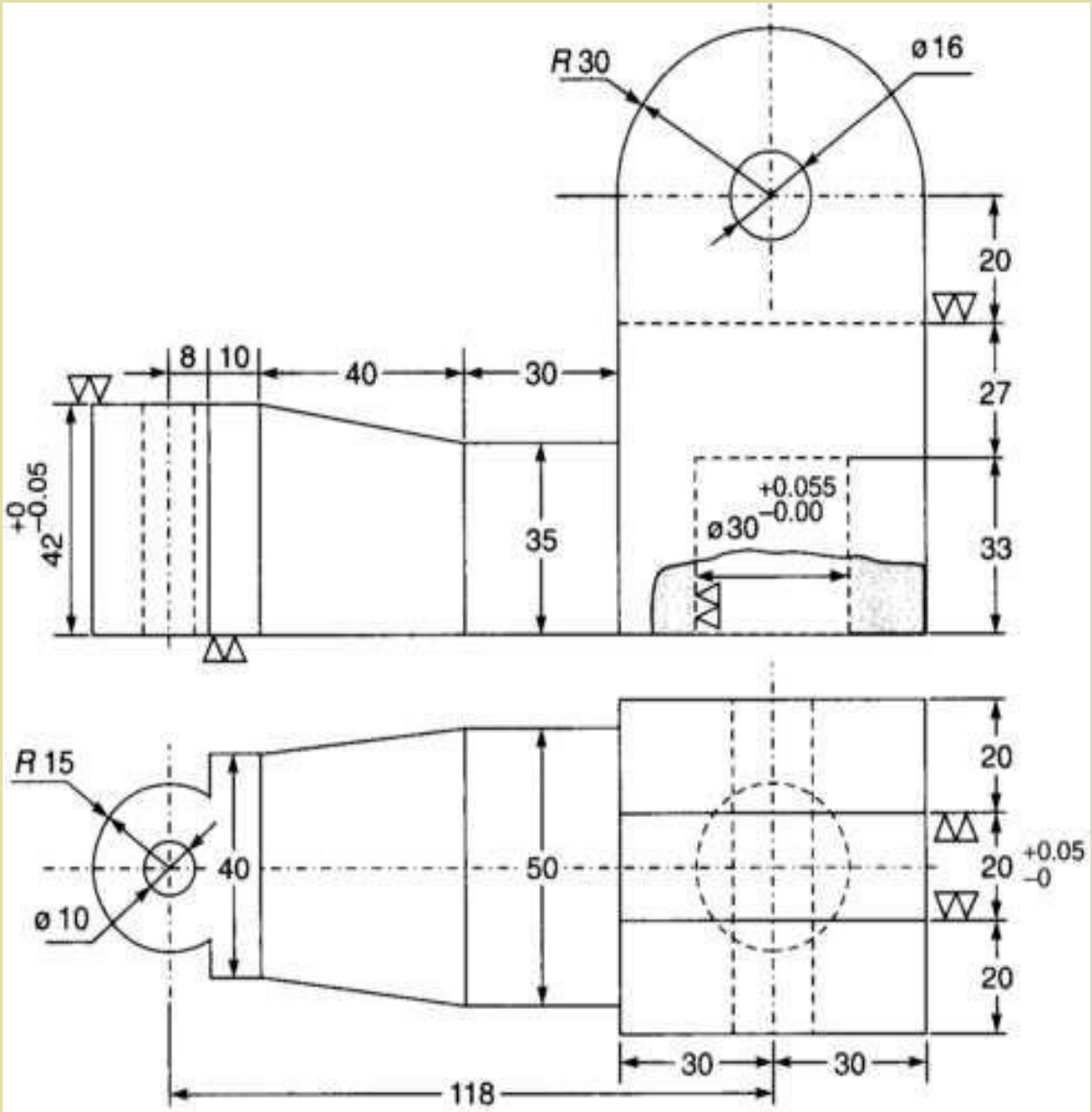

GOVT.TOOL IND
COMPONENT
ASSEMBLY VIEW OF INDEXING DRILL JIG
SECTIONAL VIEW OF



Design:

1. Turning fixture for 50ø bore and 70ø face
2. Milling fixture for (a) 24 ø bosses (b) 25 × 90 pads
3. Drill jig for 10ø,12 ø holes

Figure **15.5**
Workpiece for jigs and fixtures design practice

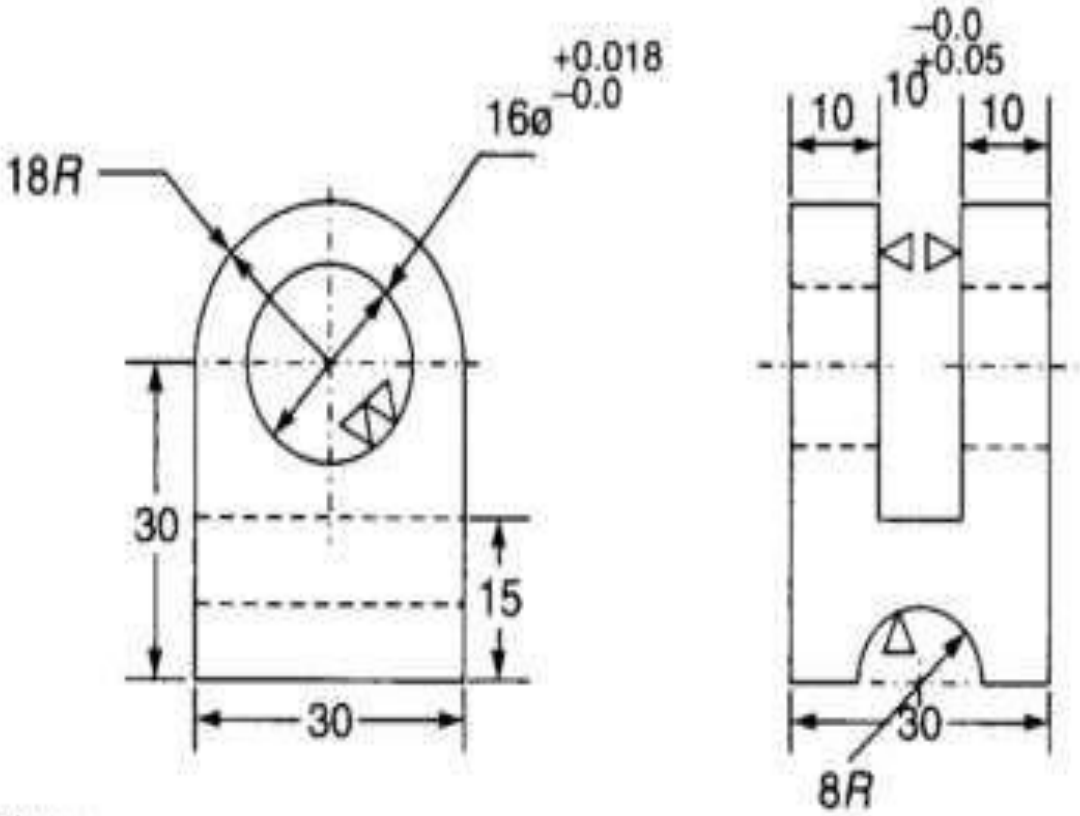


Design:

1. Turning fixture bore 30 ø and face base
2. Milling fixtures (a) 20 wide slot (b) 42 Thk boss
3. Drill jig 10ø,16 ø holes

Figure **15.10**

Workpiece for jigs and fixtures design practice



Design:

1. Milling fixtures (a) 10 slot (b) 8 *R*
2. Drill jig 16ø hole

Figure **15.25**

Workpiece for jigs and fixtures design practice

WORK BOOK FOR SELF-ASSESMENT

I. Fill in the Blanks:

Q. No.	Questions	Answers
01	The jig with leg is called……..	
02	Rapid and secure clamping action is possible in ..... clamps.	
03	Locating system should prevent wrong loading of work piece by providing……..	
04	To set the correct relationship between work piece and cutter are …….are used.	
05	The position of fixture on the machine is registered by……..	
06	A jig is a device used to locate and .....the tool.	
07	A body in a space has six or twelve……..	
08	To locate the fixture on the table of a milling machine..... is used.	
09	To avoided redundant location ..... locators are used.	
10	For drilling holes on PCD …….indexing jigs are used.	
11	The fit between liner bush and slip bush is ……	
12	Tool guiding elements are used in ……	
13	In the design of jigs, the component will be indicated in ..... line.	
14	The materials used for the drill bush is ……	
15	Jig plates and Liner bush will have..... fit.	
16	Locator and work piece have..... fit.	
17	Milling fixtures are used with .....blocks.	
18	Tennon are made from…….	
19	Method of avoiding the wrong loading of work piece in jig/fixture is……	
20	Primary locators eliminate ..... number of degrees of freedom	
21	Jigs and Fixtures are preferred for ..... type of industries.	
22	In 3-2-1 pin location method, an object is arrested to move in ……..DOF.	
23	Setting blocks are used in ……..	
24	Primary, secondary & tertiary locators will be eliminating respectively……, ……, &…….degrees of freedom.	
25	Drill Bushes have hardness (HRC) of about…….	

II. Multiple Choice Questions:

Q.No.	Questions				Answers
01	When number of pieces is located behind each other in a line, in a fixture, then it is called .....milling.				
	a	String	b	Gang	
	c	Duplex	d	Continuous	
02	For rough jobs, the support pin should be.....				
	a	Flat headed	b	Round headed	
	c	Diamond headed	d	None of these	
03	In 3-2-1 location, method an object is arrested to move in..... degrees of freedom.				
	a	7	b	9	
	c	12	d	8	
04	The recommended hardness for C-washer is.....				
	a	40-45HRC	b	50-52HRC	
	c	60-62HRC	d	58-60HRC	
05	Nylon and fibre are used in jigs and fixture to.....				
	a	reduce weight	b	to have wear resistance	
	c	prevent denting to the job	d	to add more life	
06	V-blocks (Vee locators) are used for clamping as well as locating when faces are inclined unto.....				
	a	30°	b	12°	
	c	9°	d	3°	
07	Jigs and fixtures are				
	a	machining tools	b	precision tools	
	c	both a. and b.	d	none of the above	
08	A device, in which a component is held and located for a specific operation and bushes are integrated that guide the tool, is called as				
	a	jig	b	fixture	
	c	both a. and b.	d	none of the above	
09	Fixtures are used in connection with				
	a	drilling operation	b	reaming operation	
	c	tapping operation	d	milling operation	
10	How jigs are in terms of weight compared to fixtures?				
	a	Jigs are lighter than fixtures	b	Jigs are heavier than fixtures	
	c	Jigs are equal in weight to fixtures for same operation	d	cannot say	
11	Which of the following sentences are true for jigs and fixtures?				
	1	Using jigs and fixture produce work rapidly			
	2	High speed, feed and depth of cut can be used in machining with the help of jigs and fixtures			
	3	Jigs and fixture cannot be used in machining of complex and heavy components			

	a	(1) and (2)	b	(2) and (3)	
	c	(1) and (3)	d	All of the (1), (2) and (3)	
12	The device which place the workpiece in the same position, in jig and fixture, cycle after cycle is called as				
	a	placing device	b	fixing device	
	c	locating device	d	positioning device	
13	Which fixtures are used for machining parts, which must have machined details evenly spaced?				
	a	Profile fixtures	b	Duplex fixtures	
	c	Indexing fixtures	d	None of the above	
14	The device which is used to remove workpiece from close-fitting locators, after the workpiece has been removed is called as				
	a	remover	b	ejector	
	c	escaper	d	blocker	
15	With the use of Jigs and fixture total cost of production				
	a	Increases	b	Decreases	
	c	Remains same	d	Jigs are not used in any production process	
16	With the use of Jigs and fixture rate of production will				
	a	Increase	b	Decrease	
	c	Remains same	d	Jigs are not used in any production process	
17	With the use of Jigs and fixture quality control expenses will				
	a	Increase	b	Decrease	
	c	Remains same	d	None of the mentioned	
18	With the use of Jigs and fixture				
	a	Labour cost decreases	b	Labour cost increases	
	c	Labour cost decreases	d	None of the mentioned	
19	Which of the following is not correct about fixture?				
	a	It is used to hold the work	b	It is used to position the work the work	
	c	It assures high accuracy of parts	d	It is used to guide the cutting tool	
20	Jigs and Fixtures are used for				
	a	Mass production	b	Identical parts production	
	c	Both ‘A’ and ‘B’	d	None of the above	
21	The use of jigs and fixtures				
	a	Facilitates deployment of less skilled labour for production	b	Eliminates pre-machining operations like marking, measuring, laying out etc.	

	c	reduced manual handling operations	d	All of the above	
22	The following type of jig is used for machining in more than one plane				
	a	Template jig	b	Plate type jig	
	c	Open type jig	d	Box type jig	
23	The following type of jig suits best for drilling of holes in hollow cylindrical components, with relatively smaller outside and inside diameters, such as bushes				
	a	Solid type jig	b	Pot type jig	
	c	Box type jig	d	Open type jig	
24	The following type of jig is used to drill a series of equidistant hole along a circle.				
	a	Index jig	b	Plate type jig	
	c	Open type jig	d	Pot type jig	
25	This type of jig is employed on multi-spindle machines				
	a	Index jig	b	Universal jig	
	c	Open type jig	d	Multi-station jig	
26	The following jig can be used for several different work pieces and operations				
	a	Template jig	b	Index jig	
	c	Multi-station jig	d	Universal jig	
27	The jigs and fixtures can be constructed through				
	a	Casting	b	Welding	
	c	Fabrication	d	All of the above	
28	The following is(are) the function(s) of a jig				
	a	Holding	b	Locating	
	c	Guiding	d	All of the above	
29	A fixture does not				
		Holds the workpiece	b	Locate the workpiece	
		Guide the tool	d	All of the above	
30	Principle of_____states, “In order to achieve the maximum accuracy in location the locating points should, therefore, be placed as far apart from one another as it is possible”.				
	a	Six point location	b	Least points	
	c	Extreme positions	d	Mutually perpendicular planes	
31	The following holds the workpiece securely in a jig or fixture against the cutting forces				
	a	Locating device	b	Clamping device	
	c	Guiding device	d	Indexing device	
	The following is a quick acting clamp				

32	a	Hinged clamp	b	cam operated clamp	
	c	Bridge clamp	d	Edge clamp	
33	The following material is commonly used for making locating and clamping devices				
	a	High carbon steel	b	Low carbon steel	
	c	High speed steel	d	Die steel	

34	The purpose of jigs & fixtures are:				
	a	Increase in Machining accuracy	b	Facilitate Interchangeability	
	c	Decrease expenditure on quality controle	d	All of the these.	
35	To Locate a hole with variable distance betwen holes, which of the following locator should be used:				
	a	Pin Locator	b	Diamond Pin locator	
	c	Cylindrical Locator	d	Flat Locator	

Set-I		**III. Match the followings:**		**Answer**	
Sl. No.	A	Sl. No.	B	A	B
01	Thin & soft parts	a	H7/g6	01	
02	Approximate machining	b	Conical locators	02	
03	Tapered hole	C	Four bar linkage	03	
04	Liner bush/slip bush	D	Sight locators	04	
05	Toggle Clamp	E	Sandwich jig	05	
06	Screw Clamp	F	H7/h9	06	
07	Multi Station Jig	G	Trunnion jig	07	
08	Solid Jig	H	Interchaneability	08	
09	Identical Parts	I	Indexing arrangement	09	
10	V-Locator angle	J	Simplest and least expensive	10	

Set-II		**III. Match thek followings:**		**Answer**	
Sl. No.	A	Sl. No.	B	A	B
01	Fixture	a	Made from a single block	01	
02	Shaped bush	b	Press fitted in the jig plate	02	
03	Hinged Clamp	C	For quick loading and unloading the job	03	
04	Drill bushes	D	Support against bending of drill bit	04	
05	Rapid to operate	E	Deos not guide the cutting Tool	05	
06	Feet buttons	F	90°	06	
07	H7p6	G	Toggle clamp	07	
08	Indexing	H	Machined Face	08	

09	Jig body	I	Drill radial holes	09	
10	Flat Locator	J	Cast iron	10	

Set-III	**III. Match the followings:**			**Answer**	
Sl. No.	A	Sl. No.	B	A	B
01	Drill Bush	a	50-60	01	
02	Solid Jig	b	Turning Fixture	02	
03	Location Post	C	3-2-1 principle	03	
04	HRC of diamond pin locator	D	Made out of single block	04	
05	Six point location	E	Minimum number of locators	05	
06	Joining w/p without machining	F	Welding fixtures	06	
07	Slip Bushes	G	Hole location	07	
08	Redundant location	H	Fitted inside linee bush	08	
09	Balancing weight	I	Used to guide the tool	09	
10	Diameter Jig	J		10	

Multiple Choice Question and Answers:

1 Jigs and Fixtures are used for

(A) Mass production
(B) Identical parts production
(C) Both 'A' and 'B'
(D) None of the above

2 The use of jigs and fixtures

(A) Facilitates deployment of less skilled labour for production
(B) Eliminates pre-machining operations like marking, measuring, laying out etc.
(C) reduced manual handling operations
(D) All of the above

3 The following is (are) the function(s) of a jig

(A) Holding
(B) Locating
(C) Guiding
(D) All of the above

4 A fixture does not

(A) Holds the work piece
(B) Locate the work piece
(C) Guide the tool
(D) All of the above

5. Jigs are not used in

(A) Drilling
(B) Reaming
(C) Tapping
(D) Milling

6 Fixtures are used in

(A) Milling
(B) Shaping
(C) Turning
(D) All of the above

1. **Principle of____states that "In order to achieve the maximum accuracy in location the locating points should, therefore, be placed as far apart from one another as it is possible".**

(A) Six point location
(B) Least points
(C) Extreme positions
(D) Mutually perpendicular planes

2. **The following holds the work piece securely in a jig or fixture against the cutting forces**

(A) Locating device
(B) Clamping device
(C) Guiding device
(D) Indexing device

3. **The following is a quick acting clamp**

(A) Hinged clamp
(B) Cam operated clamp
(C) Bridge clamp
(D) Edge clamp

4. **The following material is commonly used for making locating and clamping devices**

(A) High carbon steel
(B) Low carbon steel
(C) High speed steel
(D) Die steel

5. **The following type of jig is used for machining in more than one plane**

(A) Template jig
(B) Plate type jig
(C) Open type jig
(D) Box type jig

6. **The following type of jig suits best for drilling of holes in hollow cylindrical**

components, with relatively smaller outside and inside diameters, such as bushes

(A) Solid type jig
(B) Pot type jig
(C) Box type jig
(D) Open type jig

7. The following type of jig is used to drill a series of equidistant hole along a circle
(A) Index jig
(B) Plate type jig
(C) Open type jig
(D) Pot type jig

8. This type of jig is employed on multi-spindle machines

(A) Index jig
(B) Universal jig
(C) Open type jig
(D) Multi-station jig

9. The following jig can be used for several different work pieces and operations

(A) Template jig
(B) Multi-station jig
(C) Index jig
(D) Universal jig

10. The following is (are) the advantage(s) of cast jigs or fixtures

(A) No heat treatments are required for the cast jigs and fixtures
(B) It prevents the occurrence of tool chatter in milling
(C) If cast jigs or fixture drops down, they don't get misaligned or de-shaped, although it may break
(D) All of the above

11. The jigs and fixtures can be constructed through

(A) Casting
(B) Fabrication
(C) Welding
(D) All of the above

For more Assesments click the belowe link.

http://objectivequestions.mytutorialworld.com/fitter_set_1/fitter_set_1_jigs_and_fixtures