ME 114
Computer Aided Engineering Drawing - II

Assembly Drawing Exercises

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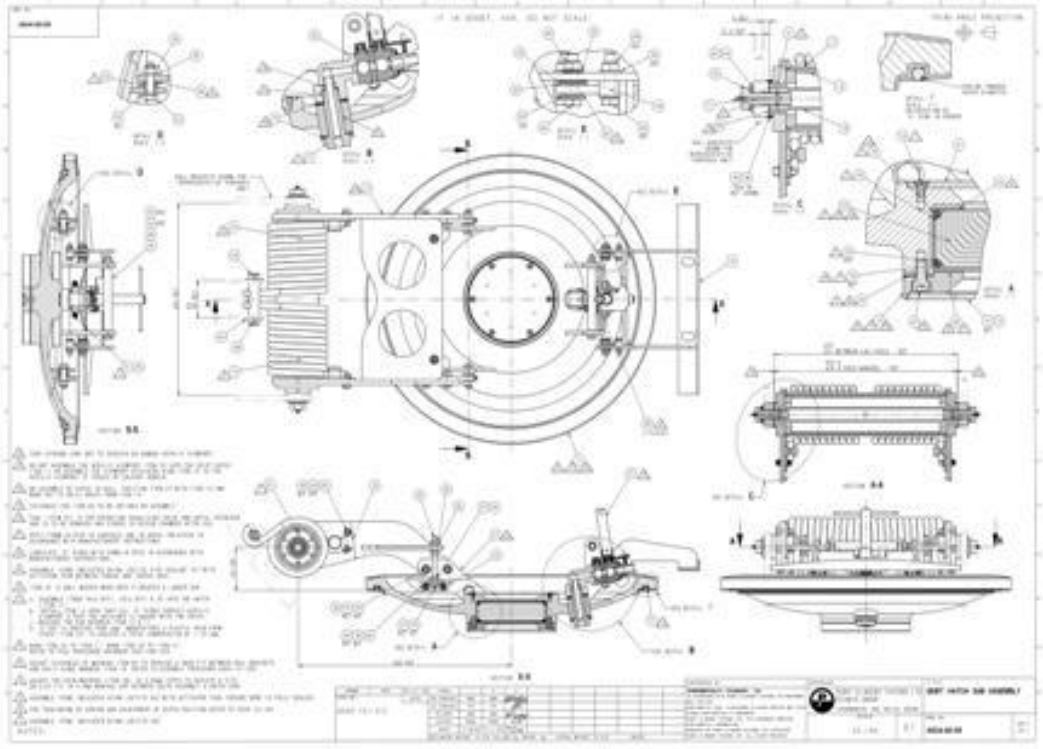
Working Drawing/Production Drawing

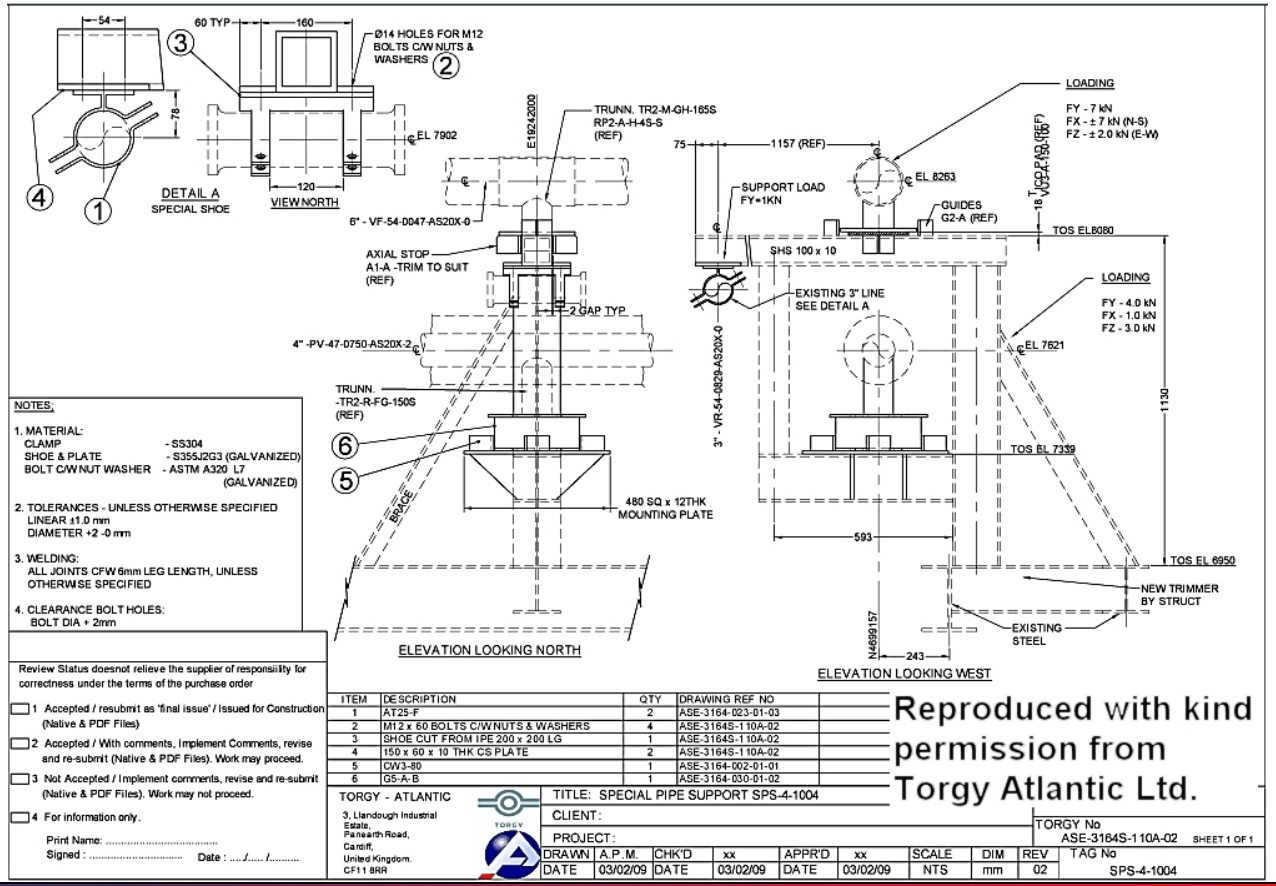
- The drawings that are used to give information for the manufacture or construction of a machine or structure are called as working drawings or production drawings.



http://www.linmech.co.uk/detail.html

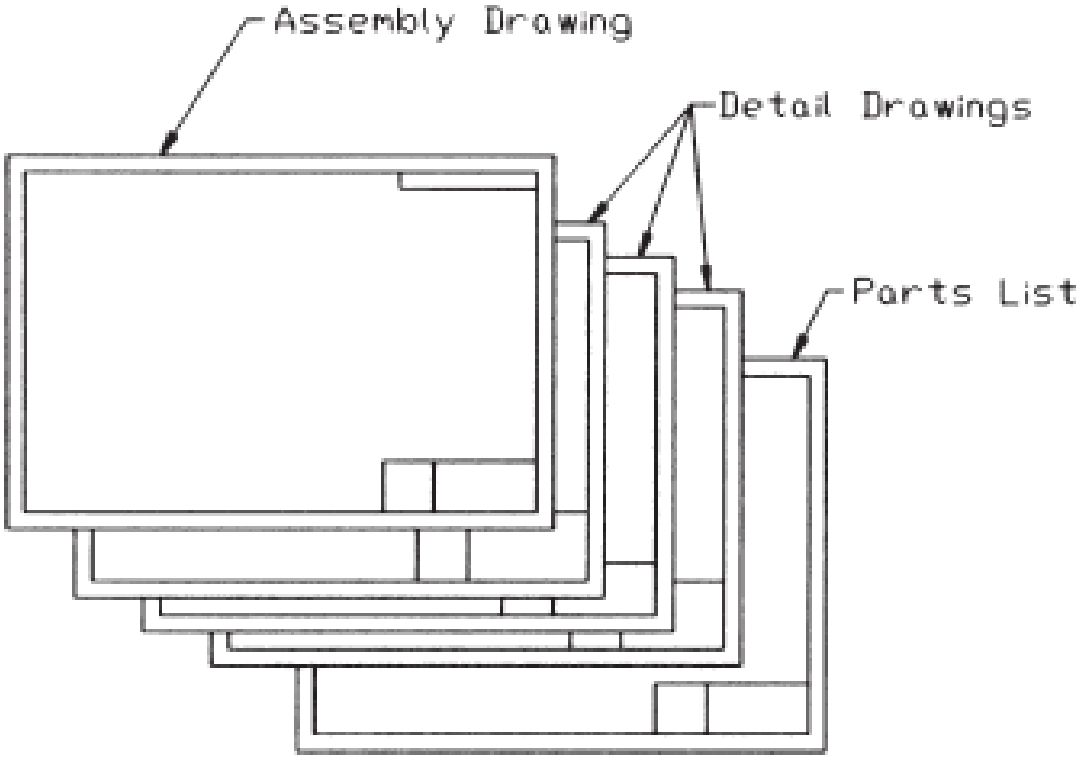
Working Drawing

- Working drawings must include all the knowledge for the production of a machine or structure explicitly so that no further information is required to complete the production.



Working Drawing

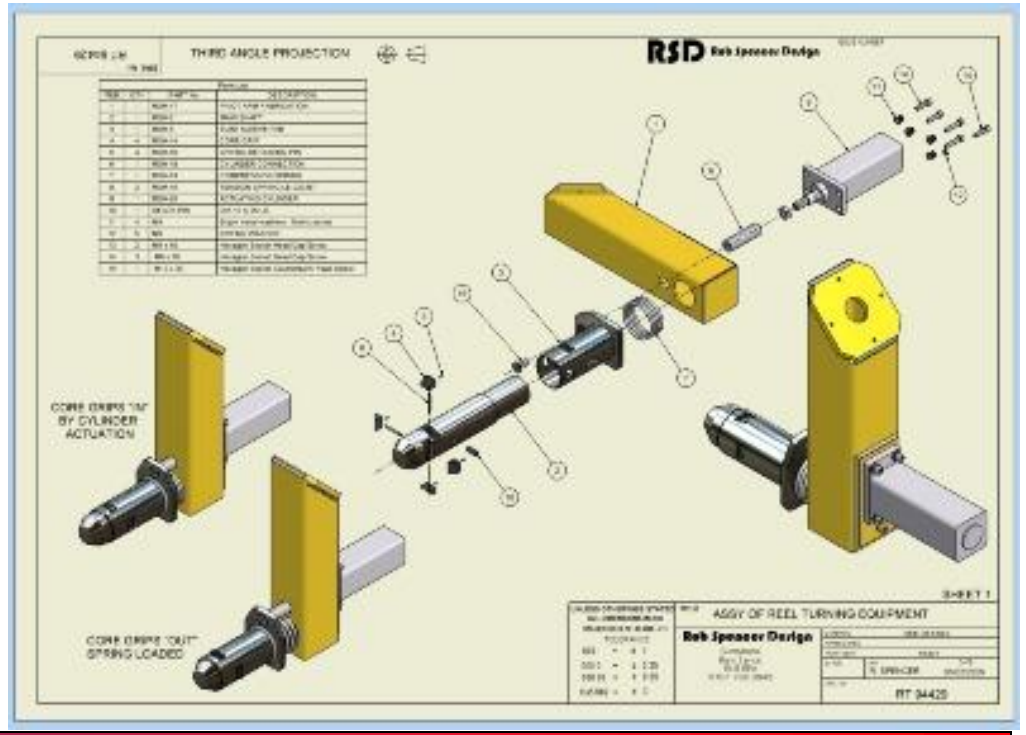
❑ Working drawings are specialized engineering drawings that provide information required to make the part or assembly of the final design.



•May be more than one sheet.
•Includes
-Assembly drawing
-Detail drawings of non-standard parts
-Parts list

Assembly Drawing

- An assembly drawing shows how each part of a design is put together.
- If the design depicted is only part of the total assembly, it is referred to as subassembly.



http://www.robspencerdesign.co.uk/13912.html

Constructing an Assembly

- Constructing an assembly begins with bringing in a base component. A base component will be selected because of its central role in defining the overall assembly.
- Each successive component brought in needs to be oriented and located relative to other components in the assembly.
- Location and orientation is achieved by defining geometric relations between geometric elements of a component in the assembly and elements of components beeing brought in.

Content of Working Drawings for an Assembly

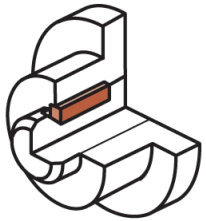
- An assembly or subassembly drawing showing all the standard and nonstandard parts in a single drawing, drawn in their operating position
- A parts list or bill of materials, showing
  - detail number for each part,
  - the quantity needed for a single assembly,
  - the description or name of the part,
  - catalog number if it is a standard part,
  - and the company part number
- A title block
- Detail drawings of each nonstandard part

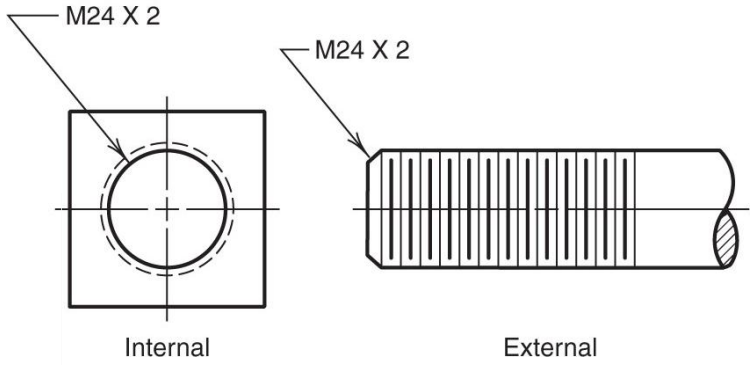
Assembly Drawing Content

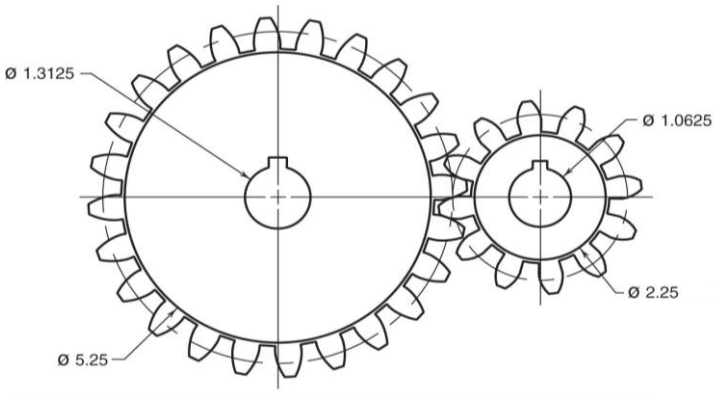
- All the parts drawn in their operating position
- A parts list or bill of materials, showing
  - detail number for each part,
  - the quantity needed for a single assembly,
  - the description or name of the part,
  - catalog number if it is a standard part,
  - and the company part number
- Leader lines with balloons, assigning each part a detail number, in sequential order and keyed to the list of parts in the parts list
- Machning and assembly operations and critical dimensions related the functions.

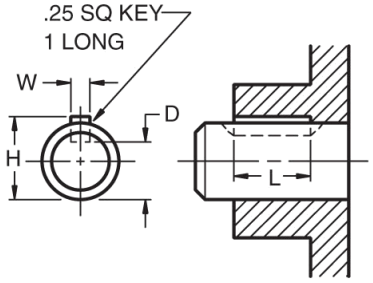
Standard Parts

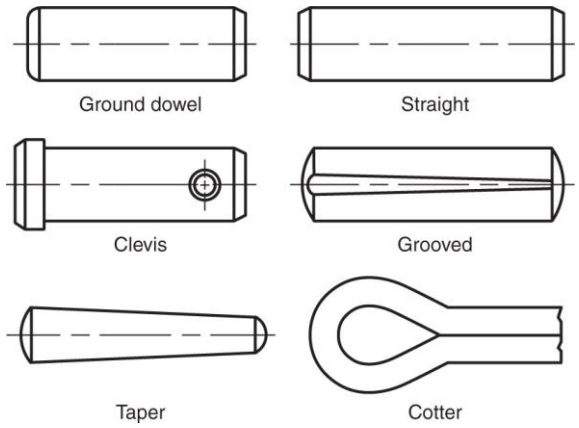
- Standards parts are commonly used in assemblies.
  - Threaded fasteners
  - Non-threaded fasteners
  - Gears
  - Keys











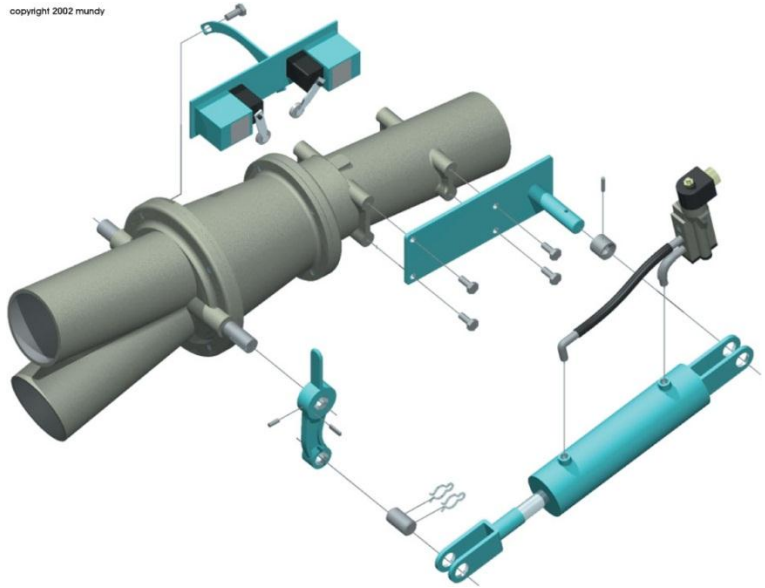
Kinds of Assembly Drawings

- Pictorial assembly drawings
- Outline assembly drawings
- Sectioned assembly drawings

Kinds of Assembly Drawings

- **Pictorial assembly drawings**

  These drawings are very useful to indicate the method of assembly, and are often used in technical manuals.

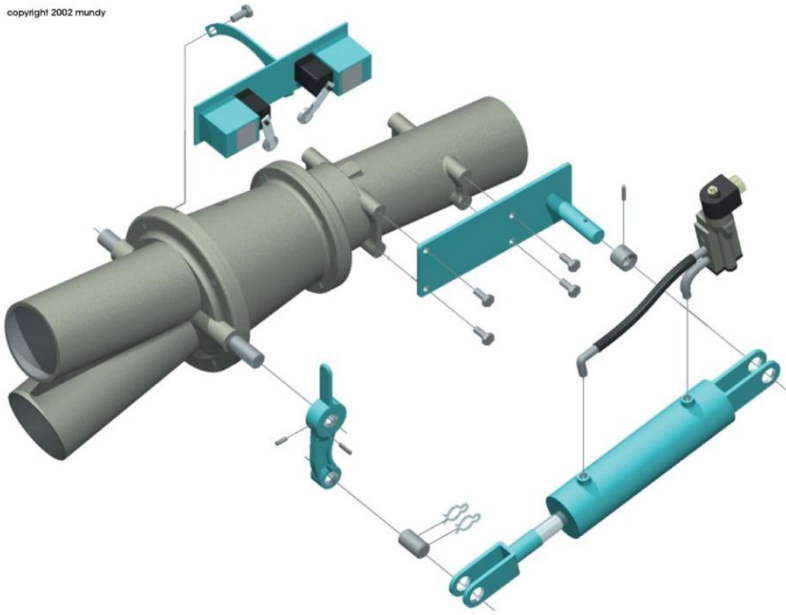


A Model Created as an Illustration for Maintenance Handbooks

- Outline assembly drawings
- Sectioned assembly drawings

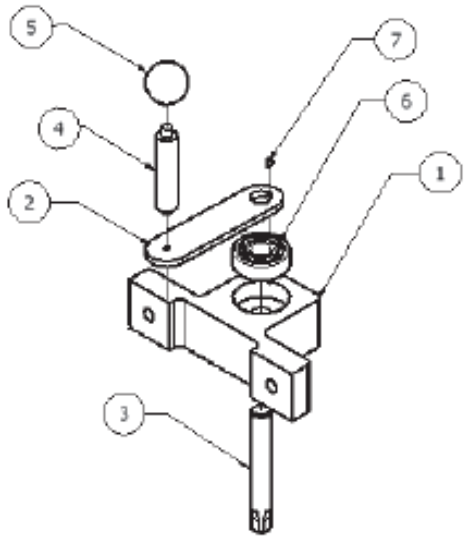
Pictorial Assembly Drawings

- Pictorial assembly drawings give general graphic description of each part and uses center lines to show how the parts are assembled.
- The pictorial assembly is normally an isometric view and is used in installation and maintenance manuals.



Pictorial Assembly Drawings

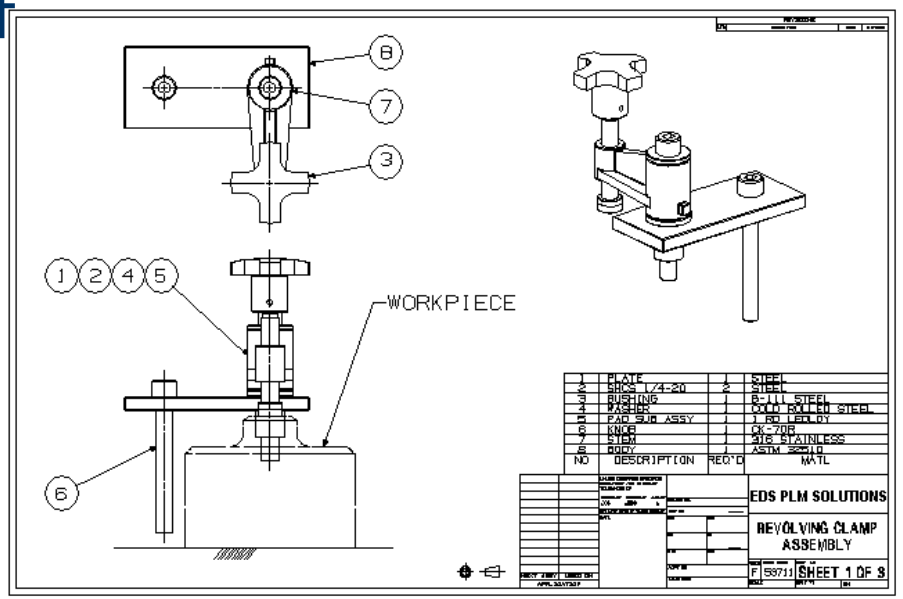
- With 2-D CAD, pictorial assembly drawings can be created using traditional techniques. A 3-D CAD model also can be used to render and create pictorial assemblies by positioning each part in a pictorial view.
- Center lines and a parts list are added to complete the drawing.



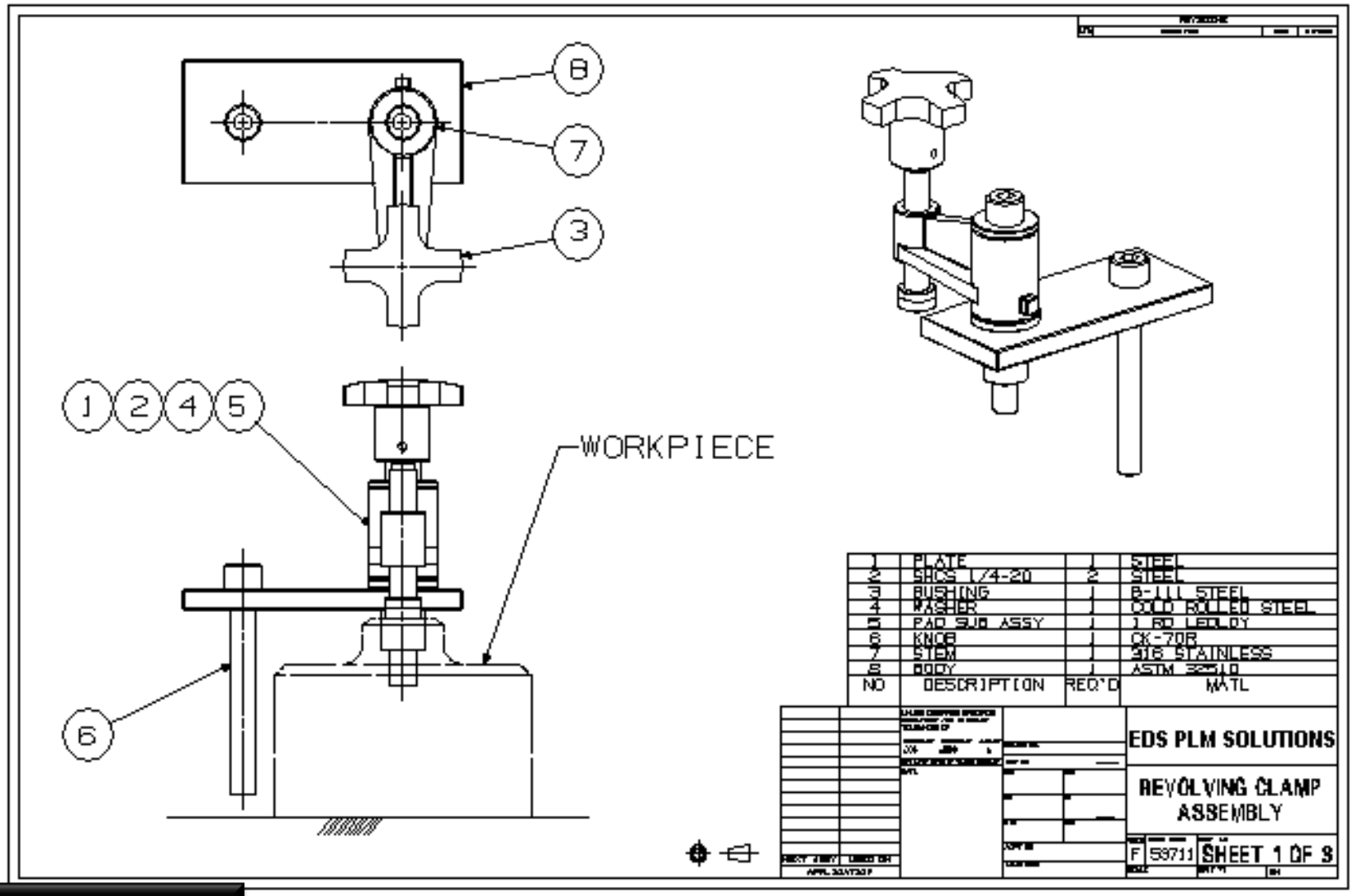
Parts List				
ITEM	PART NUMBER	DESCRIPTION	MATERIAL	QTY
1	EK131-1	SUPPORT	STEEL	1
2	EK131-2	LINK	STEEL	1
3	EK131-3	SHAFT,DRIVE	STEEL	1
4	EK131-4	POST, THREADED	STEEL	1
5	EK131-5	BALL	STEEL	1
6	BS 292 - BRM 3/4	Deep Groove Ball Bearings	STEEL,MILD	1
7	3/16x1/8x1/4	RECTANGULAR KEY	STEEL	1

Kinds of Assembly Drawings

- Pictorial assembly drawings
- Outline assembly drawings
  - give general graphic description of the exterior shape.
  - are used for parts catalogs and installation manuals, or for production if the assembly is simple.
  - Therefore, keep number of views minimum necessary to describe the assembly.
  - It is common to have a single orthographic assembly view, such as the front view.
- Sectioned assembly drawings



Outline Assembly

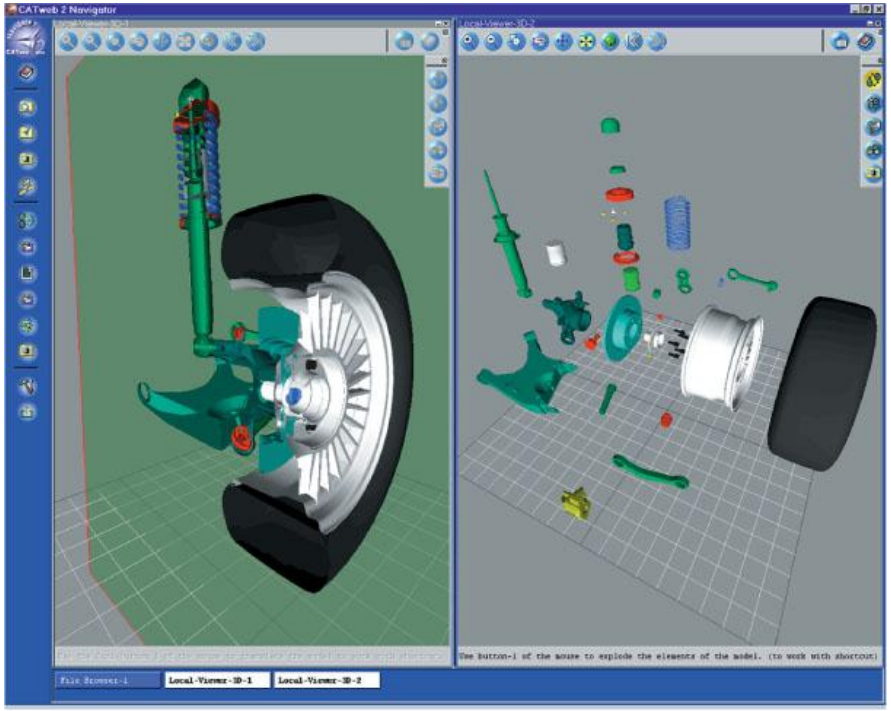


Fixture Assembly

http://odin.me.memphis.edu/ugs_docs/NX3/draftingeff/drawing_types/inprocess_drawings.html

Kinds of Assembly Drawings

- Pictorial assembly drawings
- Outline assembly drawings
- Sectioned assembly drawings
  - For determining how complicated devices are assembled,
  - For design visualization.



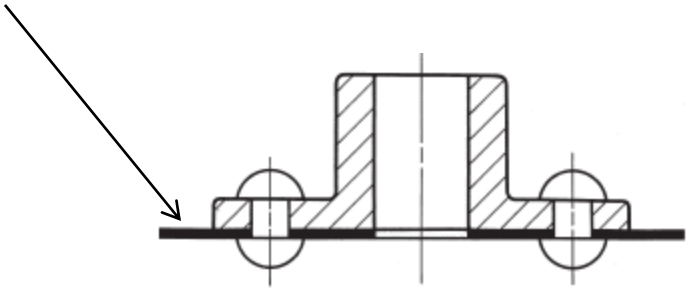
(Courtesy of Parametric Technologies.)

Sectioned Assembly Drawings

- Sectioned assembly drawings give general graphic description of the interior shape by passing a cutting plane through all or part of the assembly.
- The sectioned assembly is usually a multiview drawing of all the parts, with one view in full section (or half section, or broken-out section etc.).

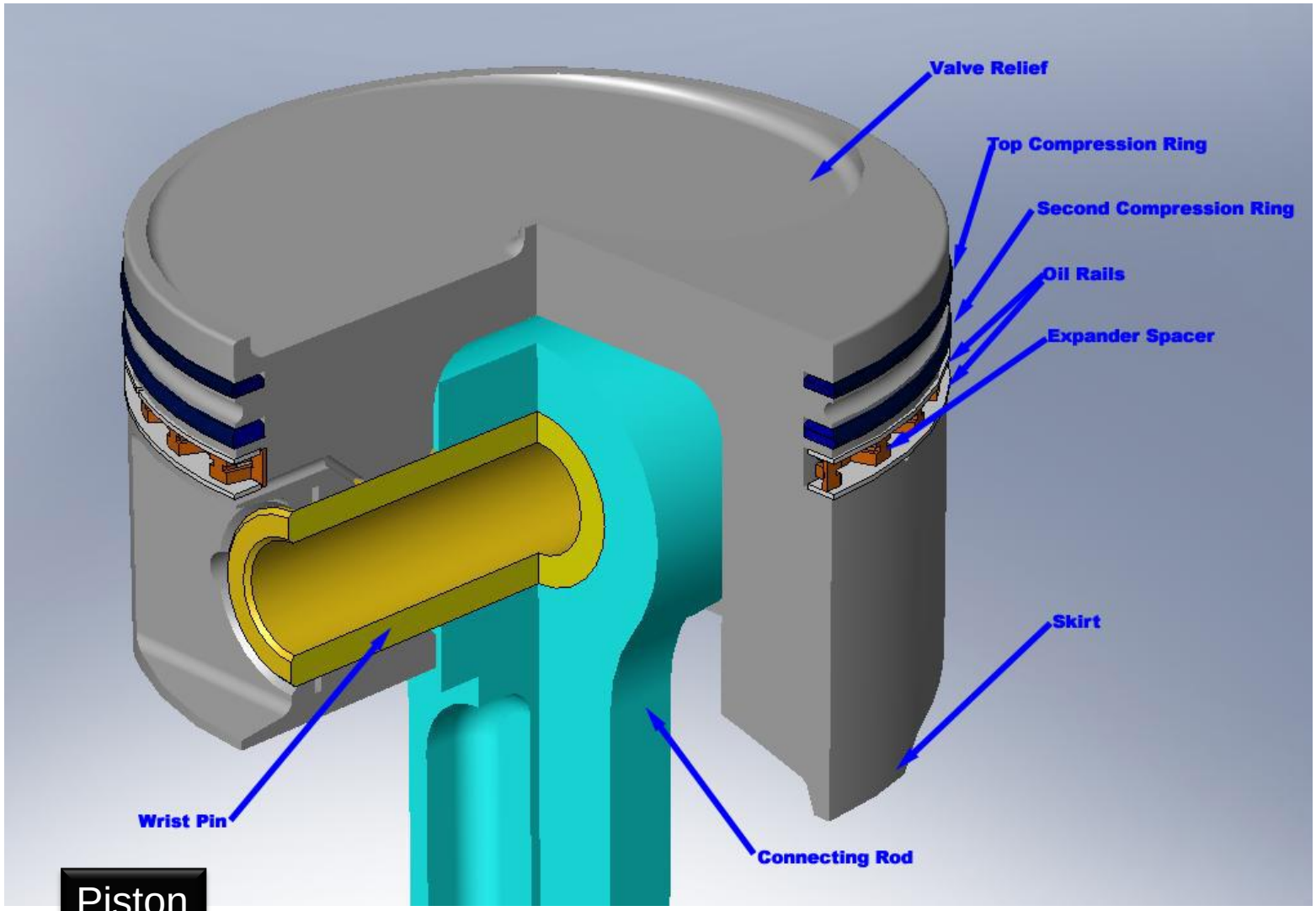
Sectioned Assembly Drawings

- Reminder on section views:
  - Standard parts, such as fasteners, dowels, pins, bearings, and gears, and nonstandard parts, such as shafts, are not sectioned; they are drawn showing all their exterior features.
  - Adjacent parts in section are lined at different angles, using the cast iron or other type of symbol.
  - Thin parts, such as gaskets, are shown solid black.



Solidly Hatching Small Parts

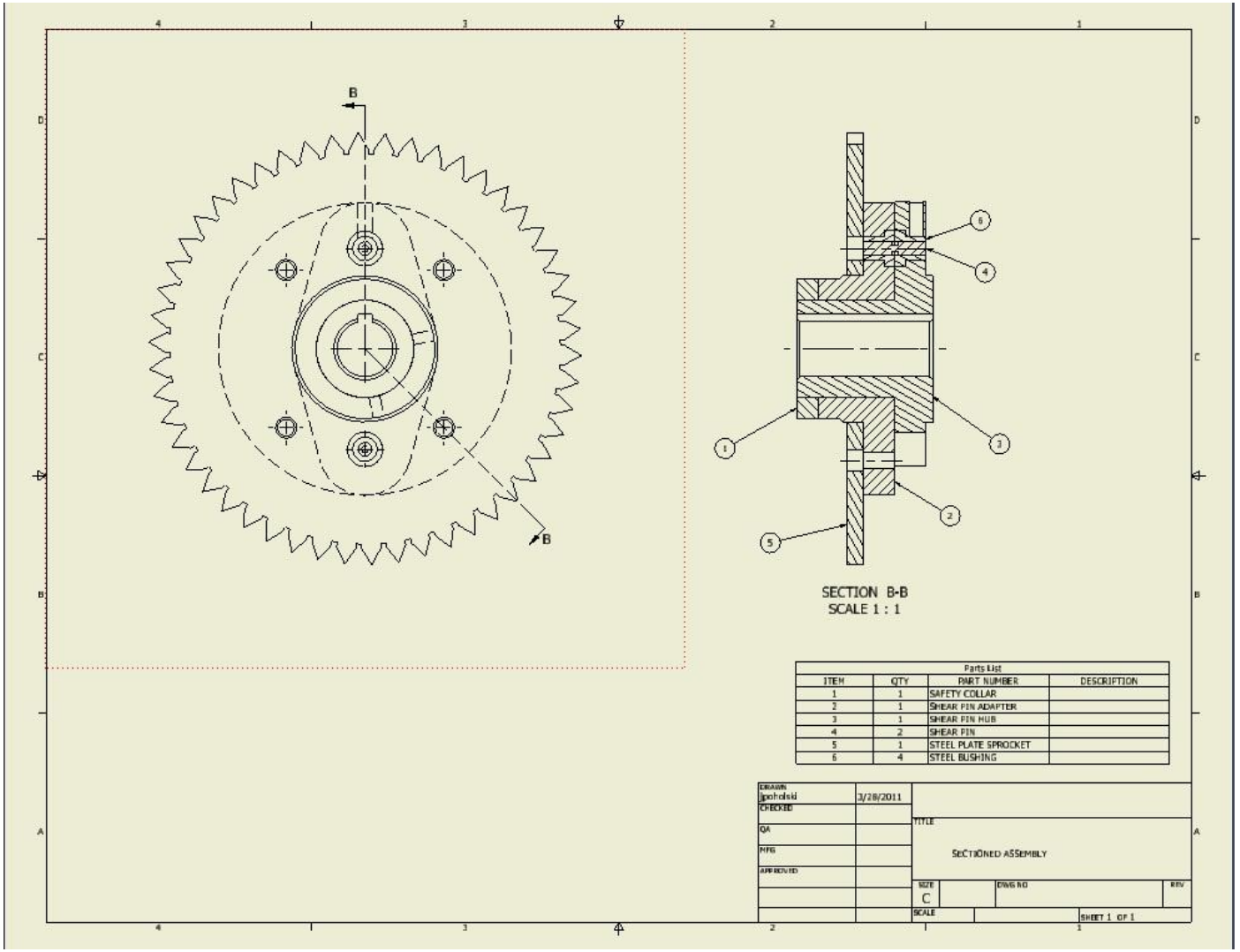
Sectioned Assembly



Piston

http://www.confident-instruments.com/3DModeling.htm

Sectioned Assembly

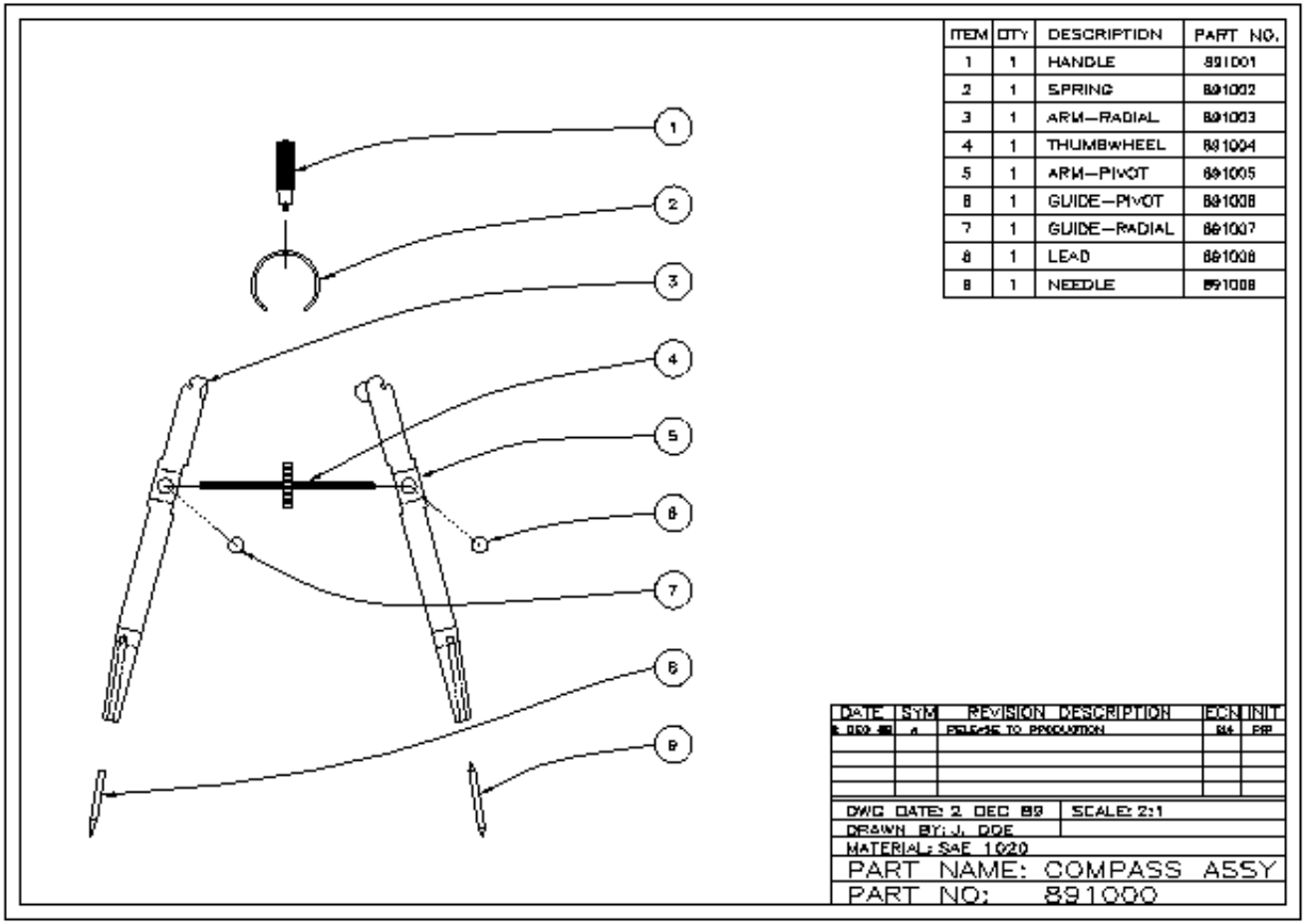


Sprocket

http://jpengineering.blogspot.com/2011/04/sprocket-sectioned-assembly.html

Exploded Assembly Drawing

- One common variation on the assembly drawing is the **exploded assembly drawing**: This can be either a pictorial or an orthographic assembly drawing in which the parts are shown exploded apart from each other.



Exploded Compass Assembly Drawing

Creating Assembly Drawings

- How to create an assembly drawing?
  - An assembly drawing is produced by tracing the needed views from the detail drawings, or by creating the drawing from scratch.
  - With 2-D CAD, it is possible to copy detail views, then place them on the assembly drawing.
  - With 3-D models, simply assemble all the models, then determine the line of sight to extract the needed assembly view (recall the video at the beginning of the course).

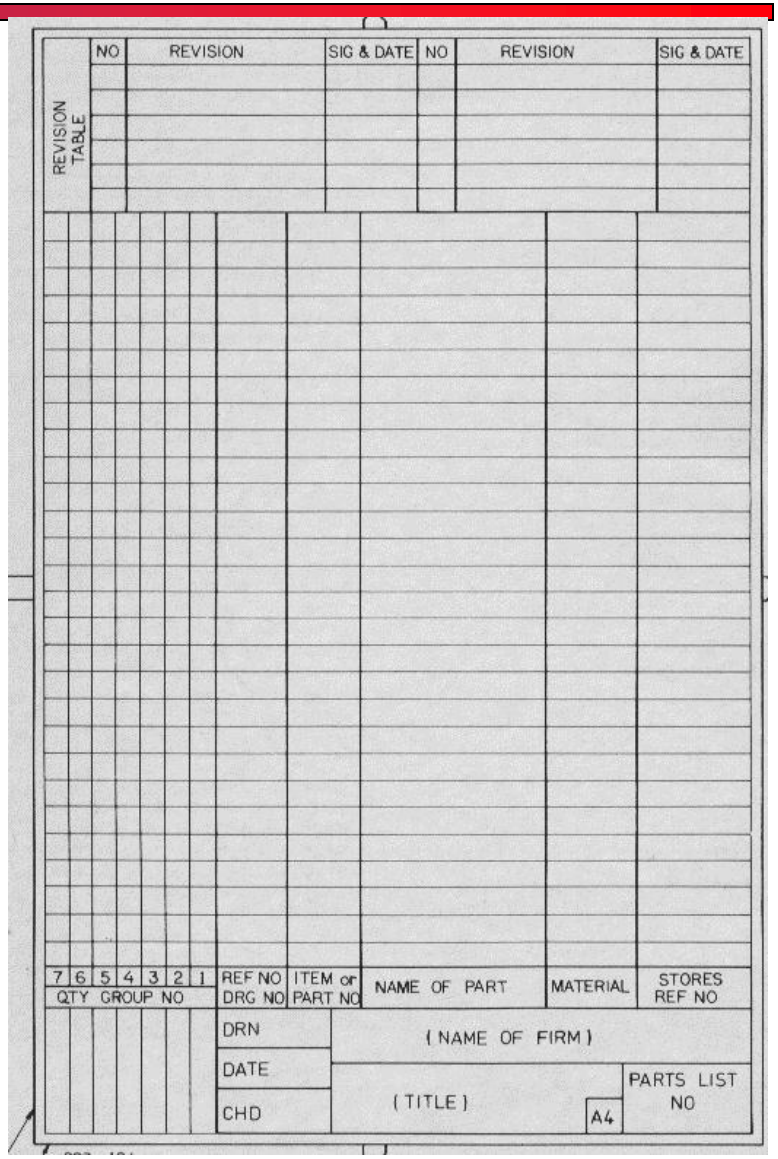
Creating Assembly Drawings

- Dimensions are not shown on assembly drawings, unless necessary to provide overall assembly dimensions, or to assist machining operations necessary for assembly.
- Hidden lines are omitted in assembly drawings, except when needed for assembly or clarity.

Parts List (Bill of Material)

Parts List should include information such as:

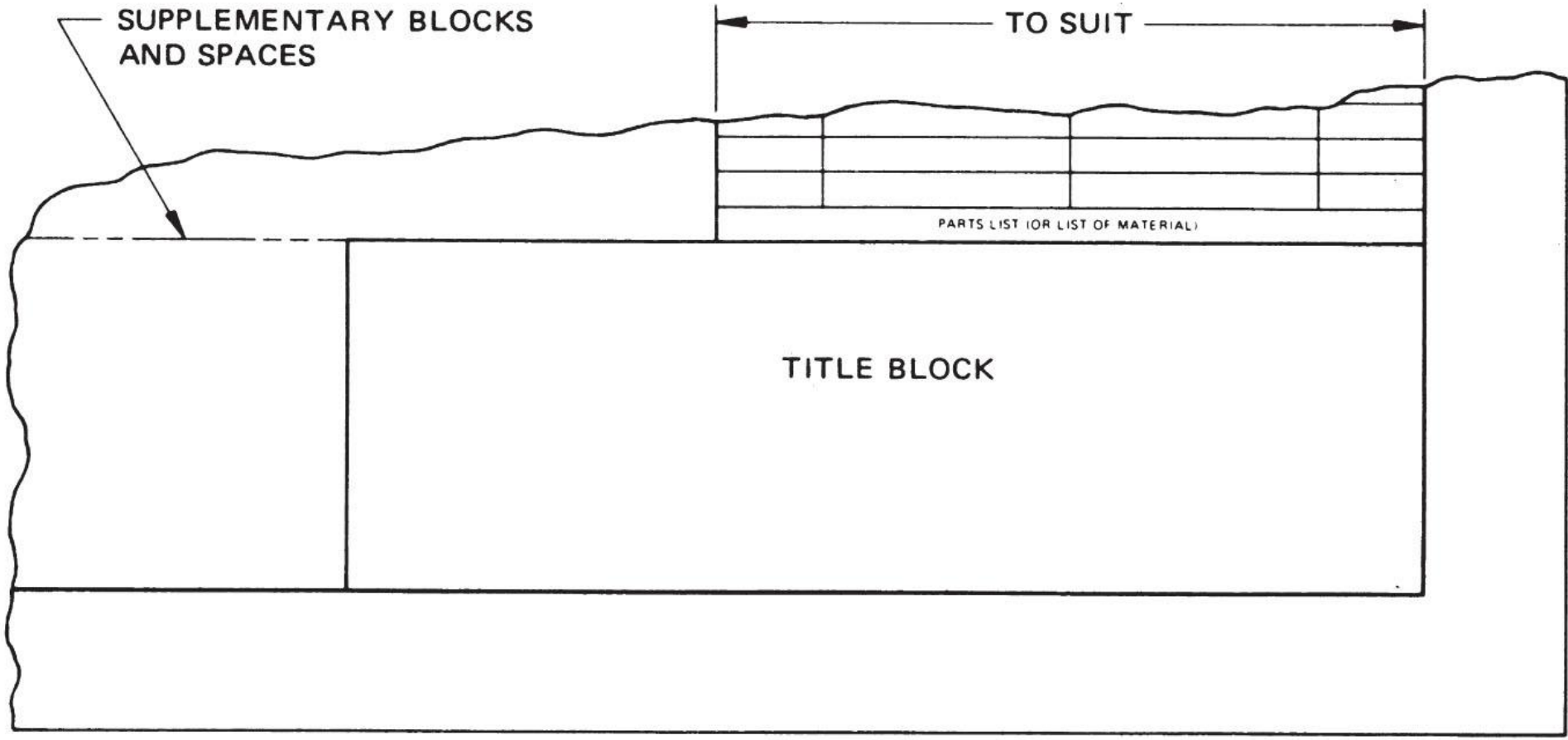
- Item or part number.
- Description or name of part.
- Quantity required.
- Material specification.
- Drawing number of detail drawing if required.
- Stores or part reference number, if applicable.



Parts List (Bill of Material)

Standard parts list

The parts list runs vertically for as many rows as are needed to list the parts.



(Courtesy of ASME.)

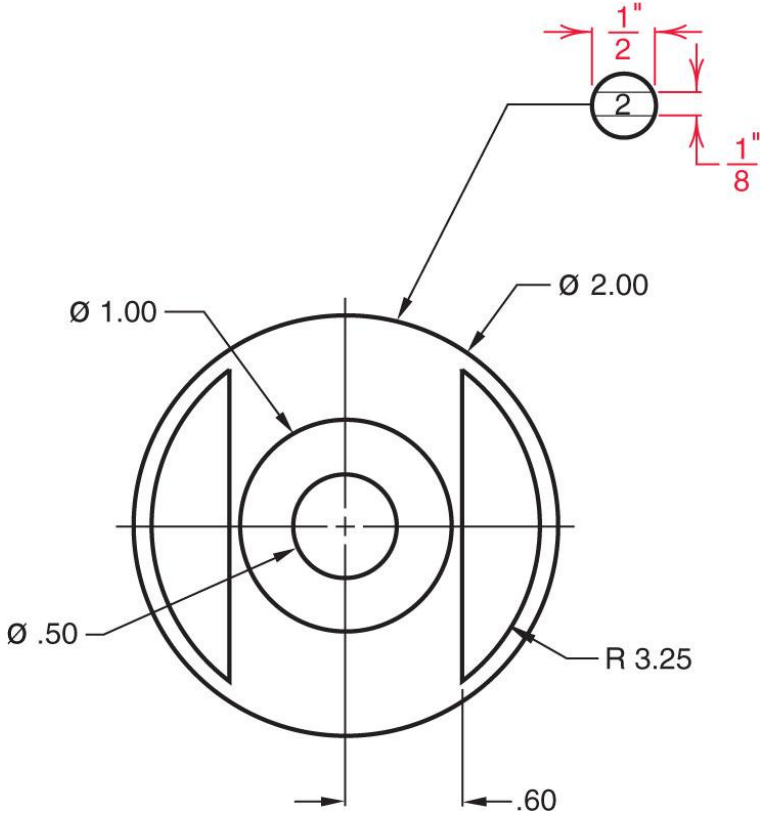
Parts List (Bill of Material)

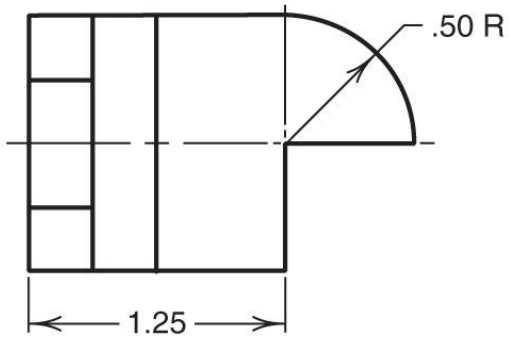
Item No	Drawing Number	Description	Material	Qty
23		Attachment stud	10/24 stud	1
		Oil filter		1
		Attachment stud	10/24 stud	1
		Plug wiring		9
22	MM-024	Distributor	Cast aluminium	1
21		Pushrods	Ø1/8" silver steel rod (or similar)	8
		Rod retainer	E type circlip	4
		Spacer springs	3/16" ID spring	10
20		Rocker arm shaft	Ø3/16" silver steel rod	2
19		Rocker arm	½" x ¼" 2024 aluminium	8
		Spring Retainer	E type circlip	8
		Valve spring	3/16" ID spring	8
18	MM-023	Valve	Ø5/16" Silver steel rod (or similar)	8
	MM-022	Crankshaft - Marking cams		
		Exhaust tubing (optional)	Ø5/16" Stainless steel tubing	8
17		Exhaust attachment screws	8/32 RH machine screws	4
16	MM-021	Exhaust manifold (2 drg sheets)	Cast aluminium	2
		Adaptor plate attachment screws	8/32 RH machine screws	4
12	MM-020	Inlet adaptor plates	16 gauge 2024 sheet or similar	2
15		Needle valve	8/32 x 1½" cheese head screw	1
14		Fuel inlet	Ø5/32" brass tube	1
13		Air cleaner (optional supplied with kit)	Cast aluminium	1
		Inlet manifold attachment screws	8/32 RH machine screws	2
11	MM-019	Inlet Manifold	Cast aluminium	1
		Piston Rings	Ø1½" x 1/16" spring coil	8
	MM-018	Installing Pistons		
	MM-017	Crankcase con rod clearance		
		Piston tool	1" AF Hex bar or similar	1
		Gudgeon Pins	Ø1/8" MS rod	8
10	MM-016	Pistons	Ø1½" 2024 Aluminium bar	8
		Big end screws	4/40 RH machine screws	16
9	MM-015	Con rod blank construction	3/16" 2024 aluminium sheet	8
8		Glo plug		8
	MM-014	Glo plug arrangement		
		Head attaching screws	8/32 RH machine screws	4
7	MM-013	Right hand head - cylinders 5-8	Cast aluminium	1
6	MM-012	Left hand head - cylinders 1-4	Cast aluminium	1
	MM-011	Cylinder and head drilling template	16 gauge MS Sheet 4¼" x 4¼"	1
		Water pump attachment screws	8/32 RH machine screws	2
5	MM-010	Water pump and impeller	See detail	1
	MM-009	Crankshaft big end machining		
	MM-008	Crankshaft - Marking big ends		
		Main bearing retaining screws	8/32 machine screws	2
		Main bearing retaining disc	See detail	1
4		Rear main bearing	¼" ID sealed flanged ball race	1
3	MM-006	Crankshaft blank	Ø1" x 7½" MS	1
	MM-007	Crankshaft Marking Tools	See Detail	
		Sump retaining screws	MS or brass	2
2	MM-005	Sump or Pan	Cast aluminium	1
	MM-004	Engine Block step 2		
1	MM-003	Engine Block step 1	Cast aluminium	1
	MM-002	Engine Block Machining jig (optional)	See Detail	1

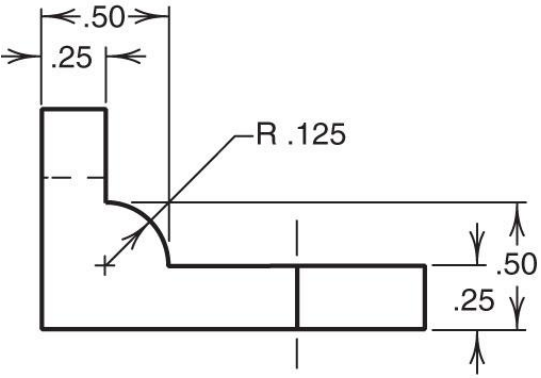
Part Identification

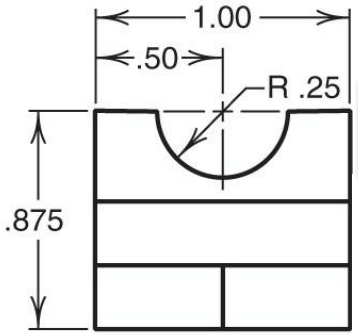
Balloons in an assembly

Balloons are used to identify parts by their assigned number in the assembly.









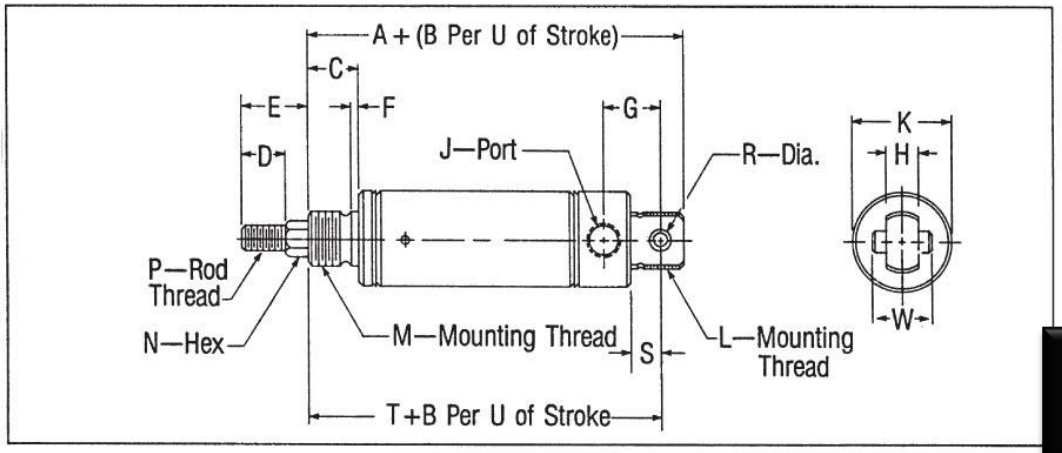
4 PART NAME

Part name in a detail drawing

In detail drawings of an assembly, the part name and detail number are located near one of the views or title block.

Tabular Drawings

Tabular drawings are used when several similar parts have common features.



Tabular drawing of an cylinder, from a Paris catalog

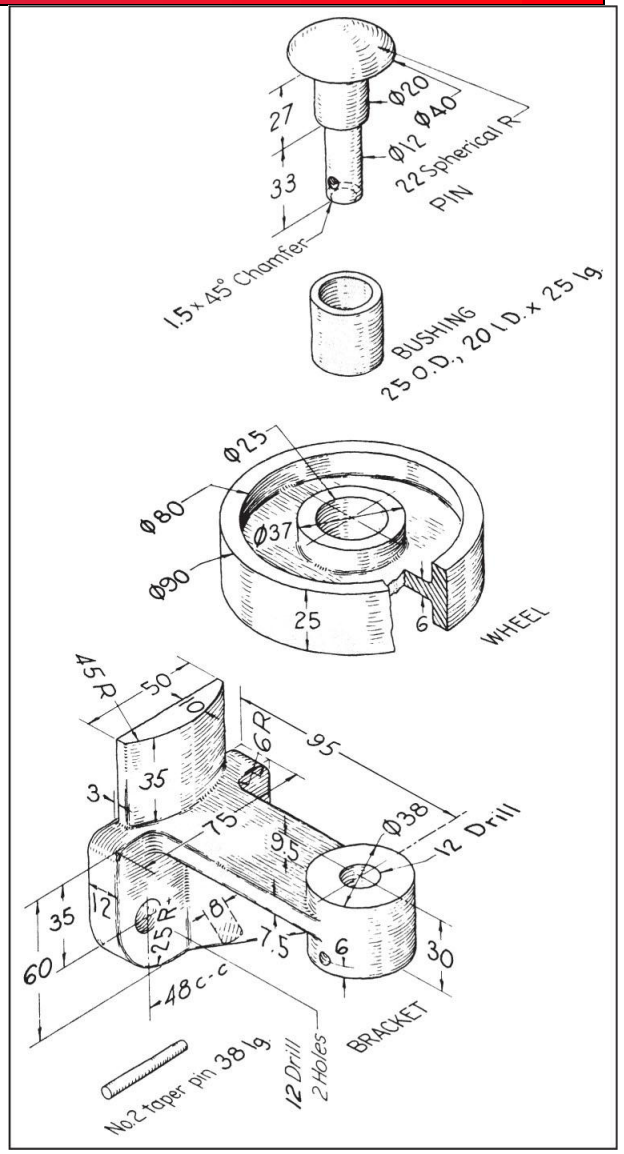
	Dimension																		Mounting Accessories		
Bore	A	B	C	D	E	F	G	H	J	K	L	M	N	P	R	S	T	U	W	Pivot Bkt.	Rod Clevis	Foot Bkt.
7/16"	2.00	.93	.31	.50	.75	.05	.43	.31	10-32	.74	7/16-20	3/8-24	3/16	10-32	.15	.25	1.75	0.50	.50	M13S	M14S	M11SS
9/16"	2.00	1.62	.37	.50	.75	.05	.43	.31	10-32	.62	7/16-20	7/16-20	3/16	10-32	.15	.25	1.81	1.00	.50	M13S	M14S	M11SD
3/4"	2.56	1.68	.43	.50	.75	.05	.62	.37	1/8NPT	.86	5/8-18	1/2-20	1/4	1/4-28	.25	.34	2.28	1.00	.75	M23S	M24S	M21SS
1 1/16"	2.81	1.56	.50	.50	.75	.06	.62	.37	1/8NPT	1.12	5/8-18	5/8-18	3/8	5/16-24	.25	.34	2.53	1.00	.75	M23S	M24	M21
1 1/4"	3.53	1.81	.62	.87	1.12	.09	.71	.50	1/8NPT	1.34	3/4-16	3/4-16	7/16	7/16-20	.25	.40	3.12	1.00	.87	M23S	M64S	M61S
1 1/2"	3.25	1.68	.62	.87	1.25	.09	.81	.62	1/8NPT	1.56	(—*)	3/4-16	7/16	7/16-20	.37	.50	2.87	1.00	1.00	M63S	M64S	M61S

*Unthreaded; see Standard Option Section for threaded rear stud mounting.
Note: Spring Forces same as for Model SNHS.

(Courtesy of American Cylinder.)

Classic Problem 11.1:Sliding-Door Guide

1. Sketch orthographic views of each part, with dimensions.
2. If dimensions are missing, determine what they should be by their relationship to other parts.
3. Determine tolerances as noted or assigned.
4. Create 3-D models of each part, then extract orthographic views.
5. Determine finished surfaces and mark them on the sketch.
6. Create dimensioned detail drawings of each non-standard part in the assembly.
7. Create an orhthographic or exploded pictorial assembly drawing in section.
8. Label all parts in the assembly drawing, using numbers and balloons.
9. Create an ASME standard parts list with all relavent information for the parts in the assembly.



Problem 11.2:Quick-Acting Hold-Down Clamp

1. Sketch orthographic views of each part, with dimensions.
2. If dimensions are missing, determine what they should be by their relationship to other parts.
3. Determine tolerances as noted or assigned.
4. Create 3-D models of each part, then extract orthographic views.
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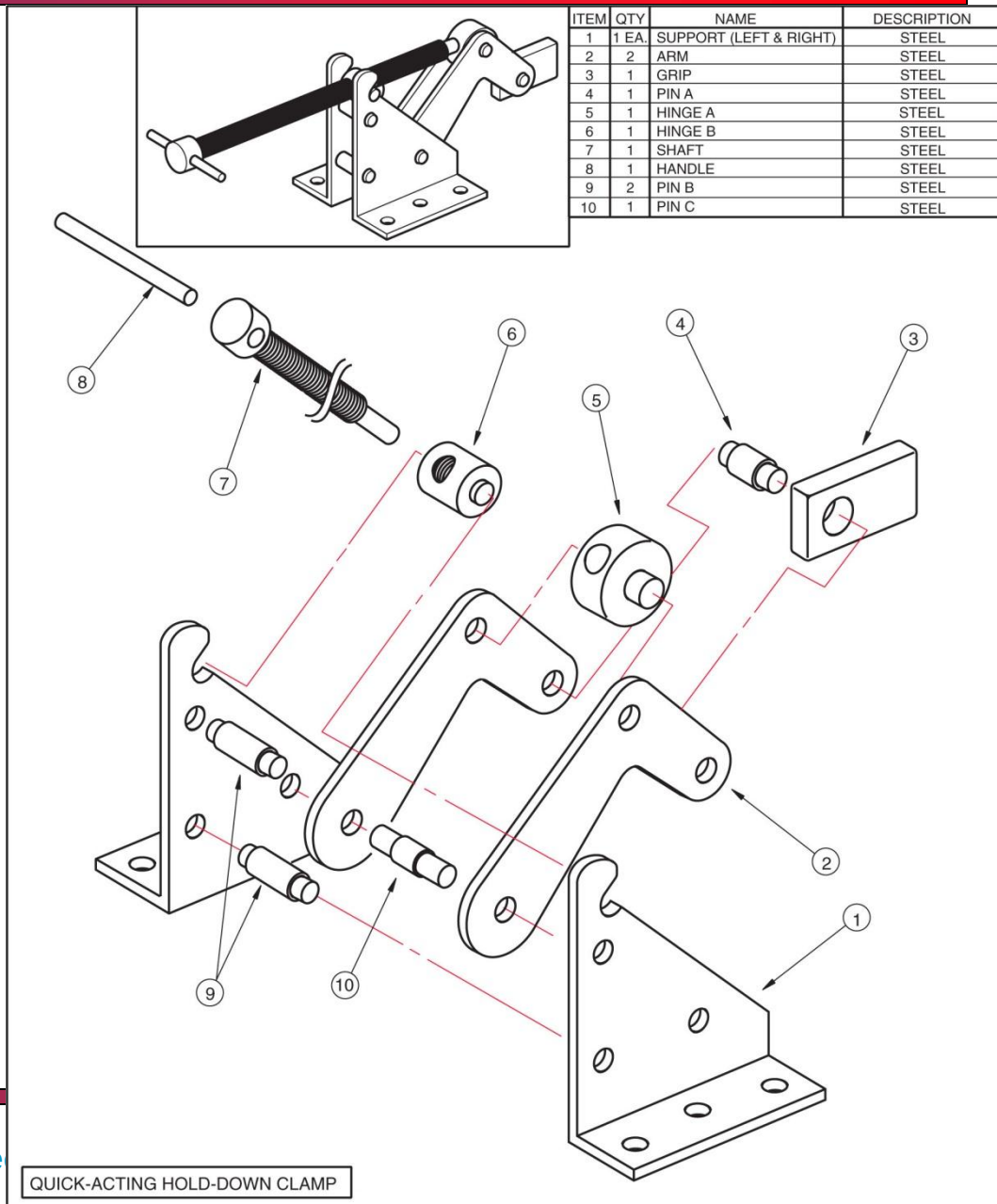
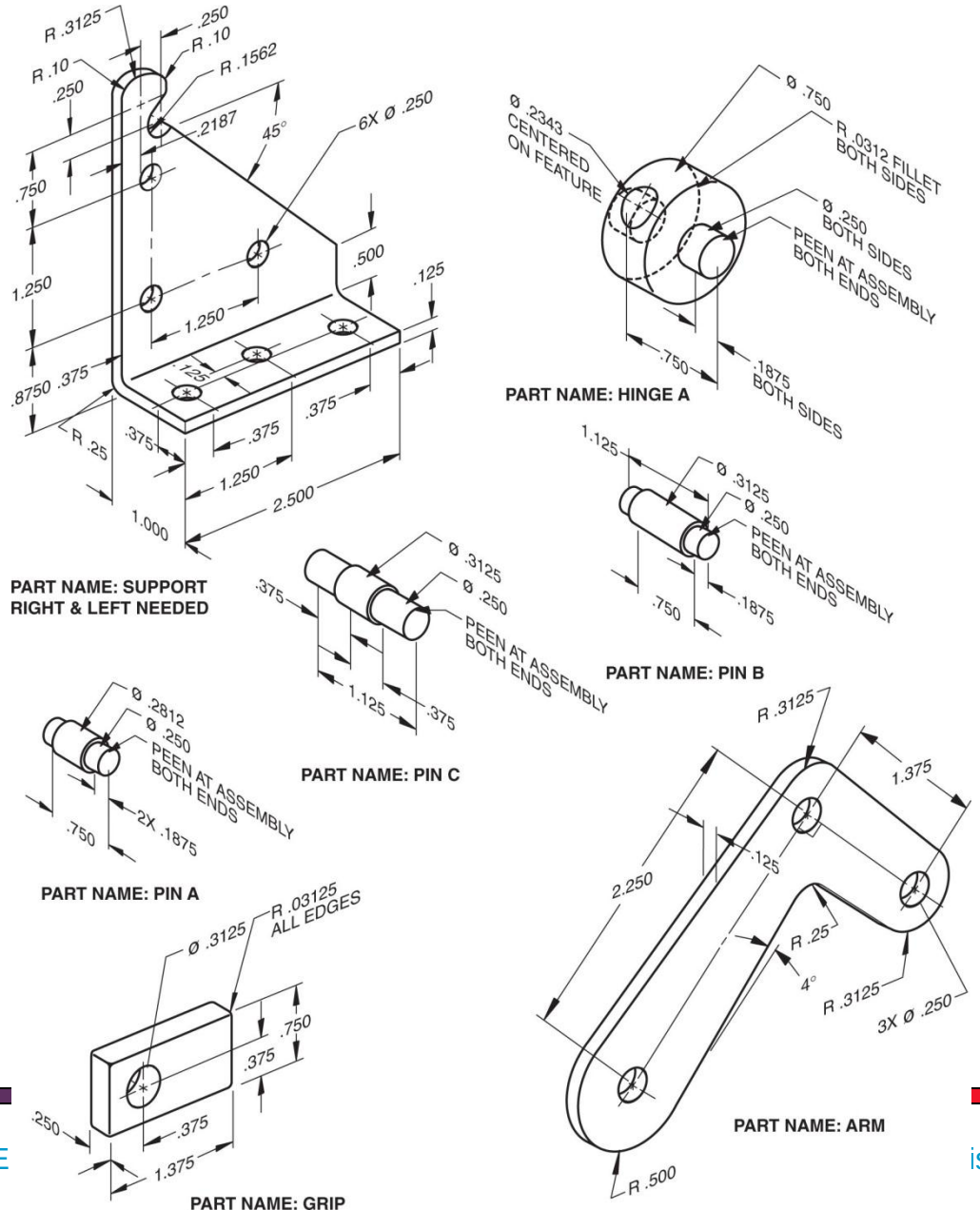
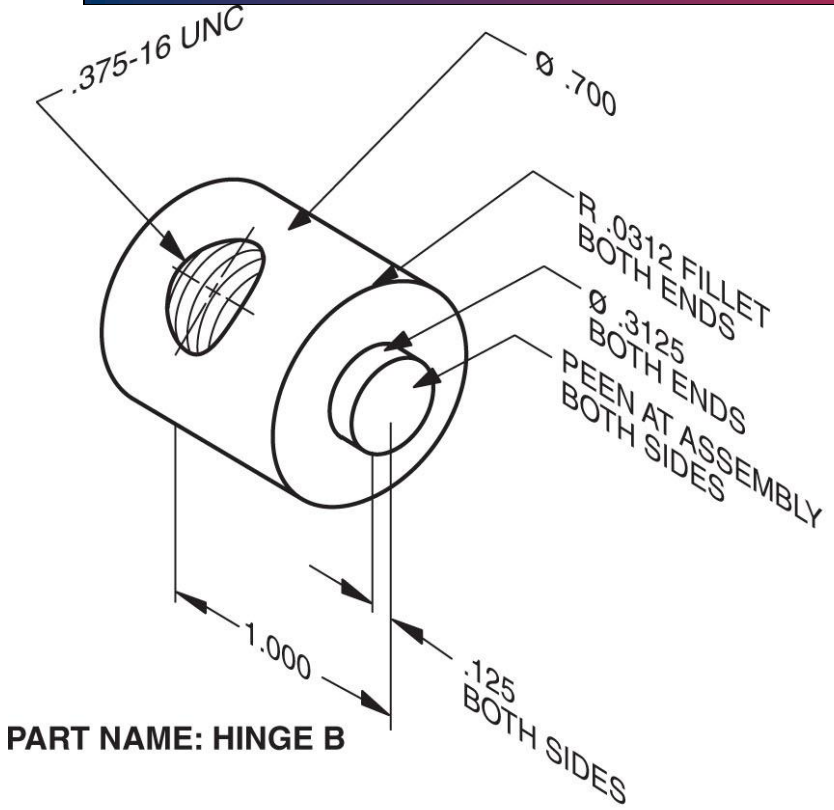


ITEM	QTY	NAME	DESCRIPTION
1	1 EA.	SUPPORT (LEFT & RIGHT)	STEEL
2	2	ARM	STEEL
3	1	GRIP	STEEL
4	1	PIN A	STEEL
5	1	HINGE A	STEEL
6	1	HINGE B	STEEL
7	1	SHAFT	STEEL
8	1	HANDLE	STEEL
9	2	PIN B	STEEL
10	1	PIN C	STEEL

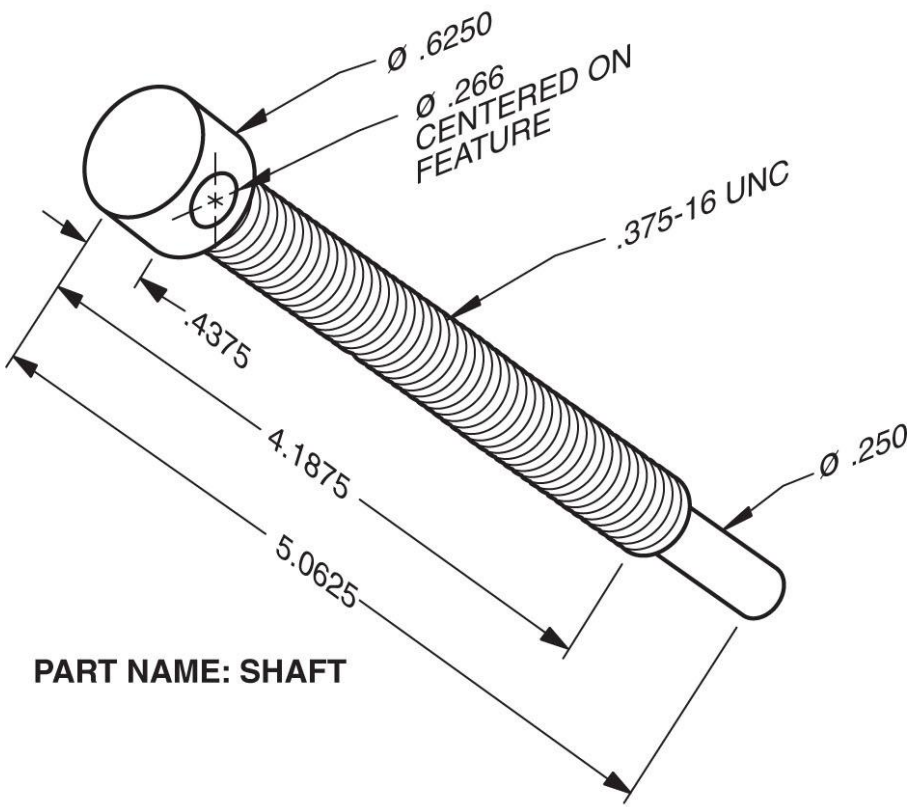
Problem 11.2:Quick-Acting Hold-Down Clamp



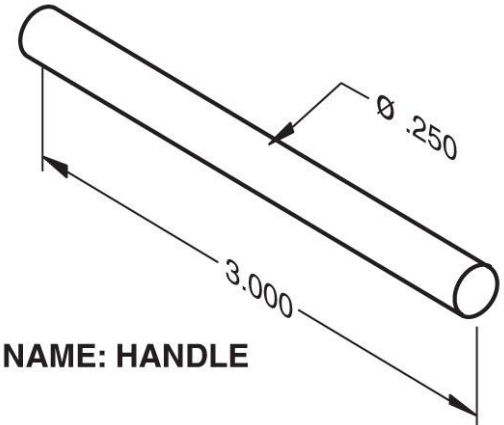
Problem 11.2:Quick-Acting Hold-Down Clamp



PART NAME: HINGE B

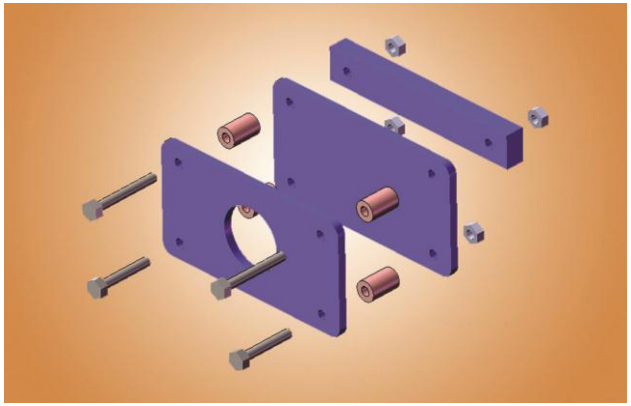


PART NAME: SHAFT



PART NAME: HANDLE

Plate Assembly



NO.	NAME	QTY.
1	OUTER PLATE	1
2	INNER PLATE	1
3	STRAP PLATE	1
4	SPACER	4
5	HEX BOLT - 50	2
6	HEX BOLT - 40	2
7	HEX NUT	4

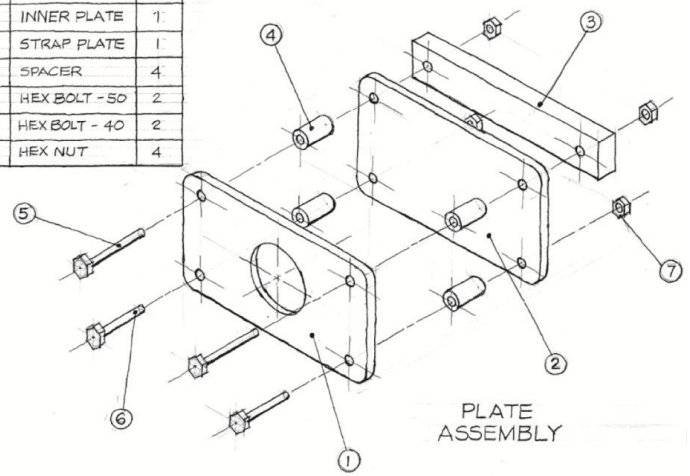
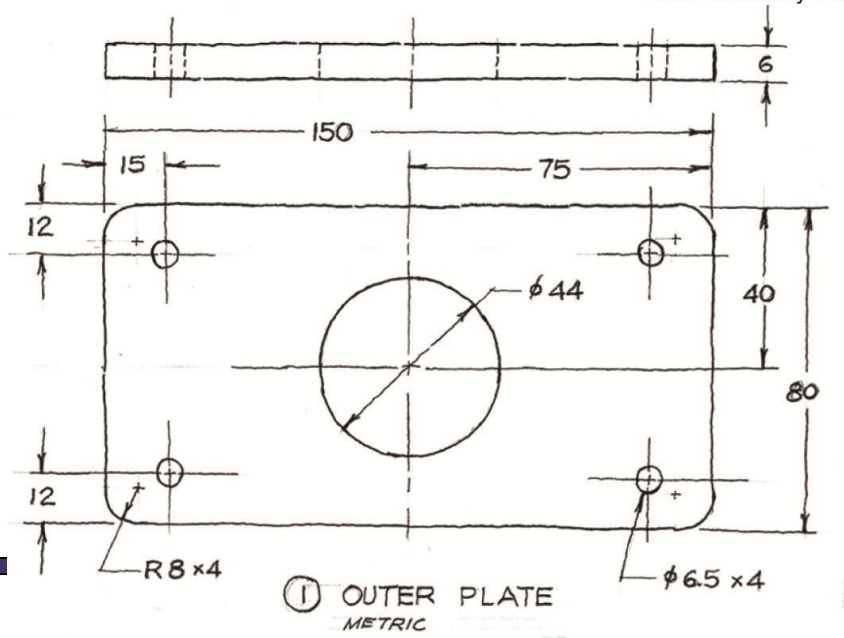
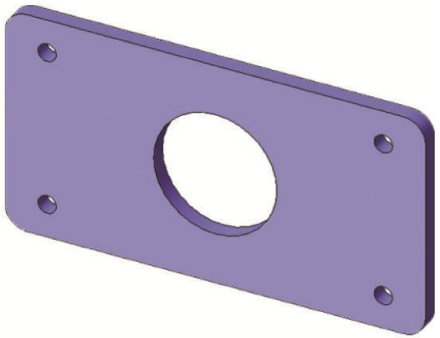


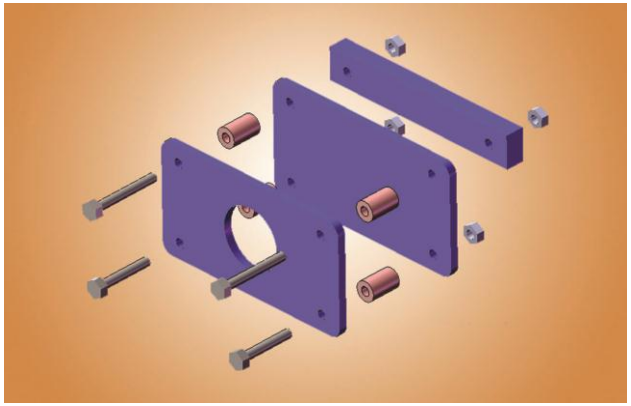
Plate Assembly Pictorial Sketch & Parts List





Sketch for Part Number 1: OUTER PLATE

Plate Assembly



NO.	NAME	QTY.
1	OUTER PLATE	1
2	INNER PLATE	1
3	STRAP PLATE	1
4	SPACER	4
5	HEX BOLT - 50	2
6	HEX BOLT - 40	2
7	HEX NUT	4

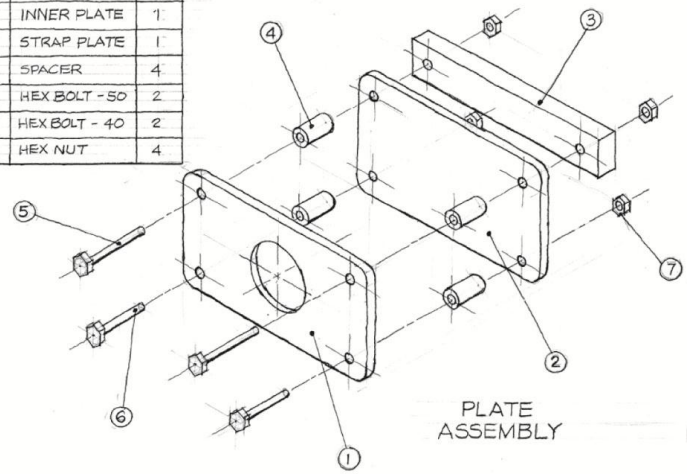
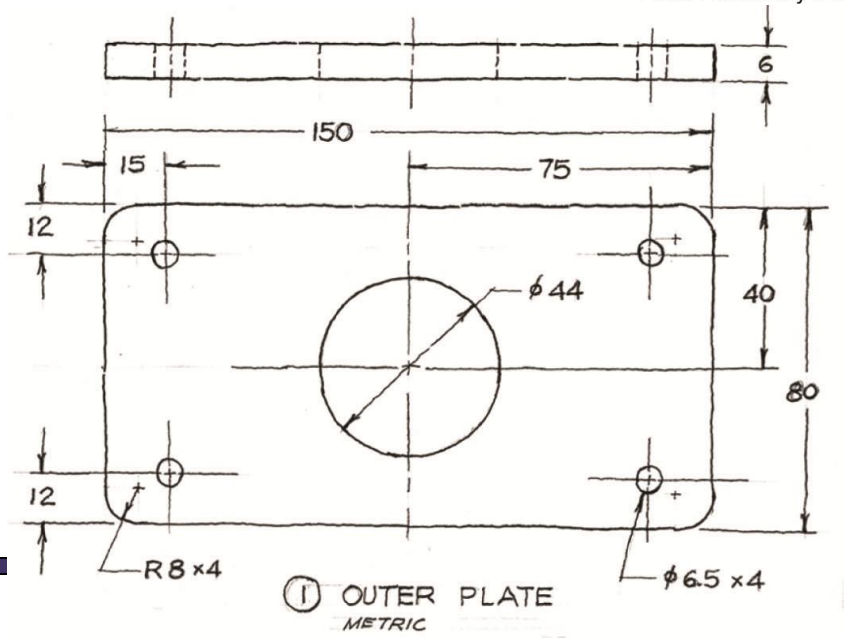
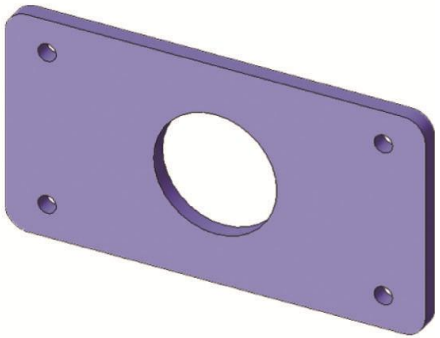


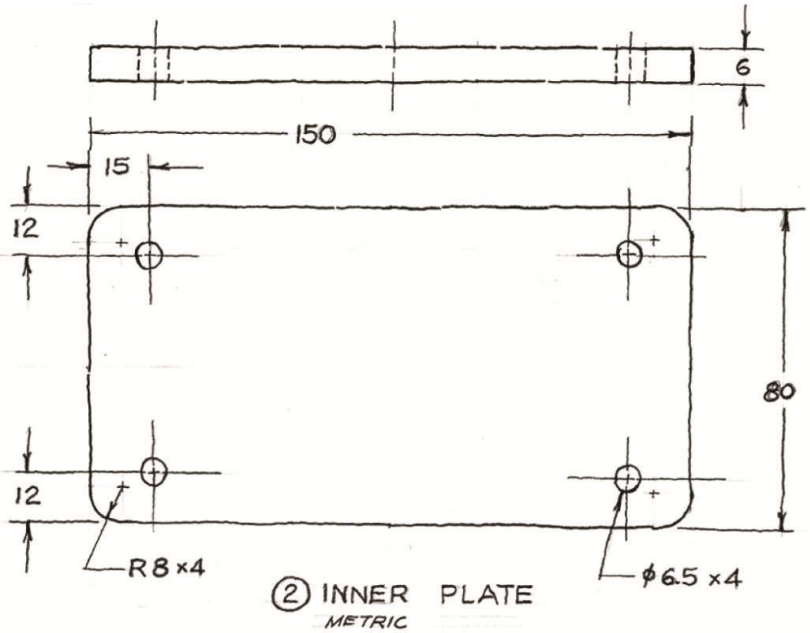
Plate Assembly Pictorial Sketch & Parts List

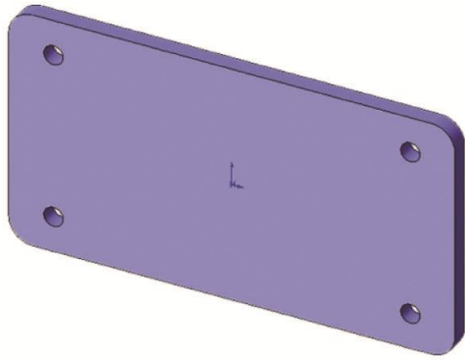




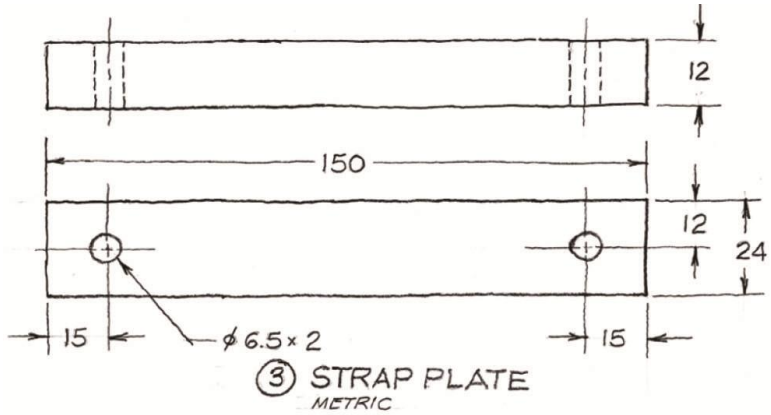
Sketch for Part Number 1: OUTER PLATE

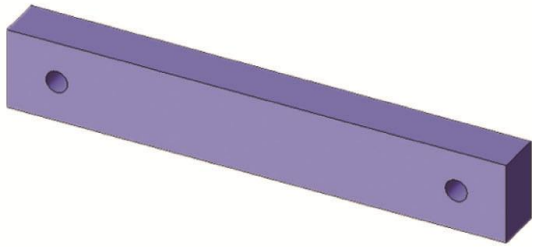
Plate Assembly





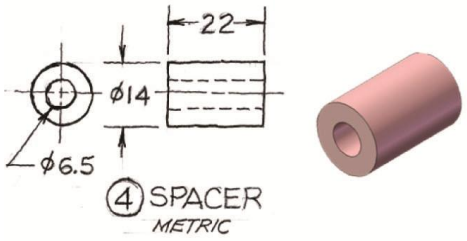
Sketch for Part Number 2: INNER PLATE

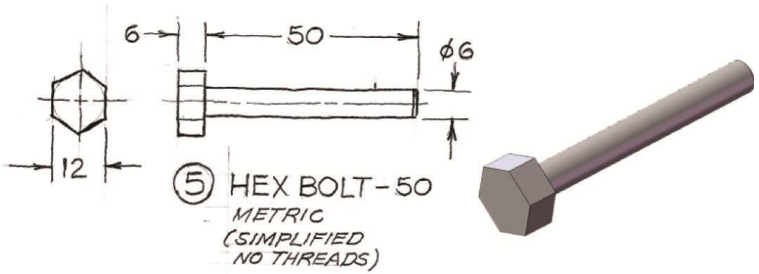




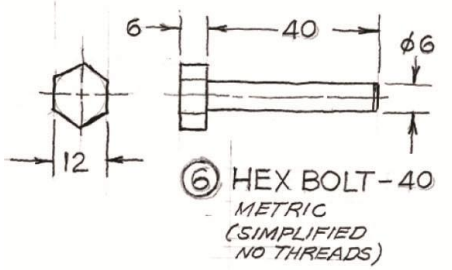
Sketch for Part Number 3: STRAP PLATE

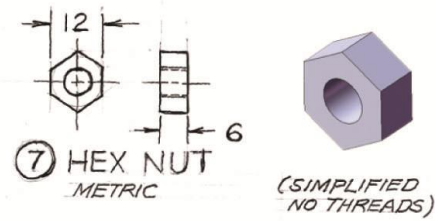
Plate Assembly



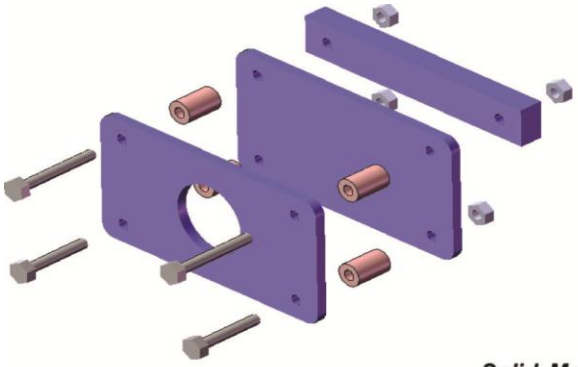


Sketch for Part Number 4 & 5: SPACE & HEX BOLT-50

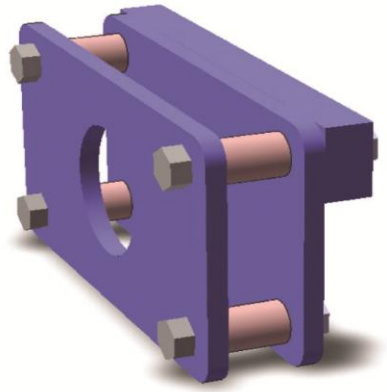




Sketch for Part Number 6 & 7: HEX BOLT-40 & HEX NUT

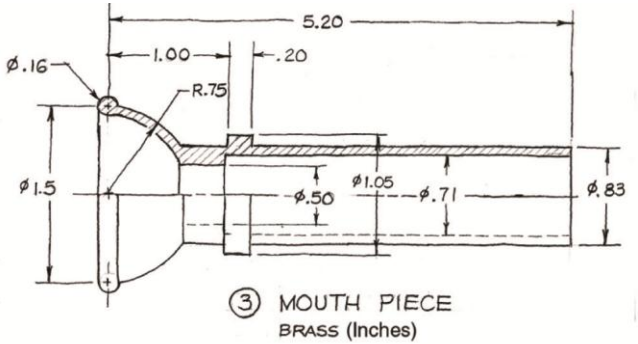


Solid-Model:
Exploded & Assembled

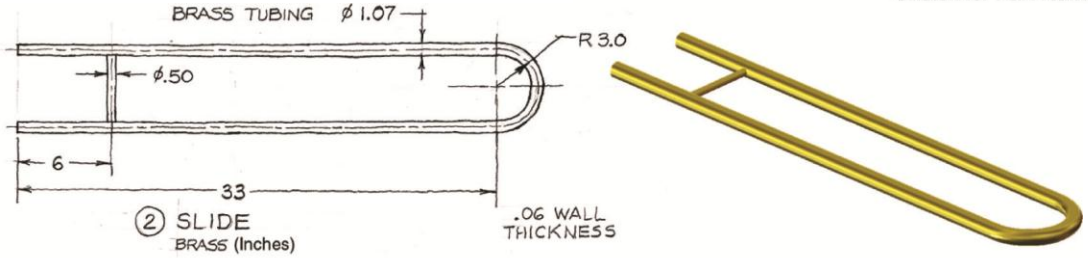


Exploded and Assembled Model of PLATE ASSEMBLY

Trombon Assembly

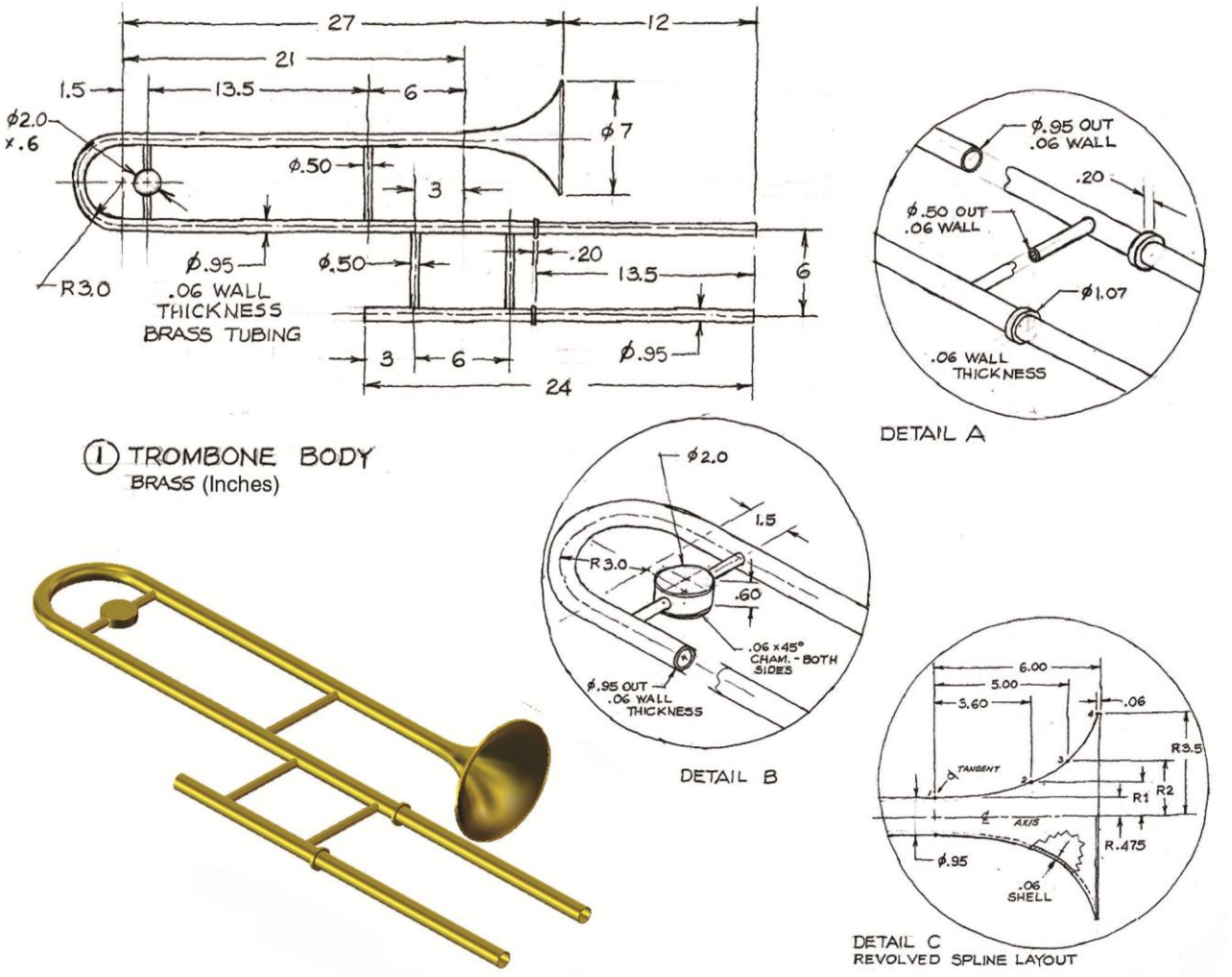


Sketch for Part Number 2: TROMBONE SLIDE



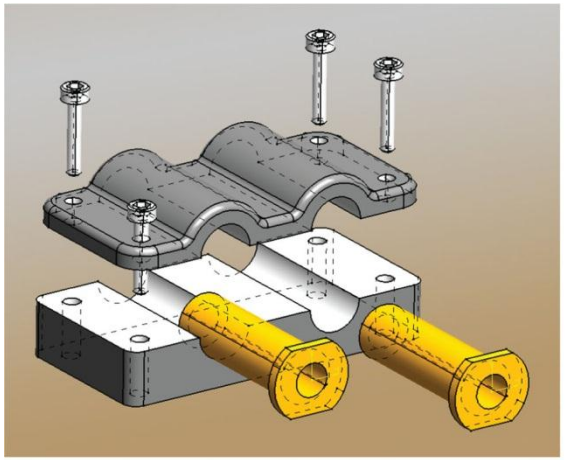
Sketch for Part Number 2: TROMBONE SLIDE

Trombon Assembly

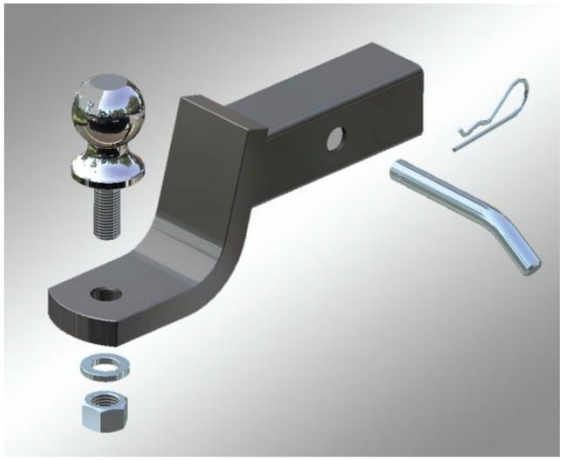


Sketch for Part Number 1: TROMBONE BODY

Bearing Block

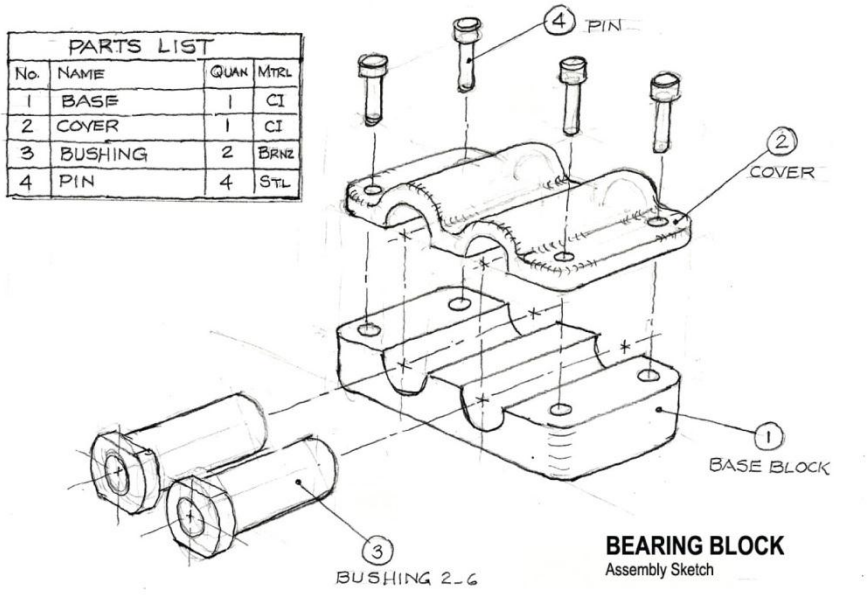


1: Bearing Block 5-1 – Basic Assembly



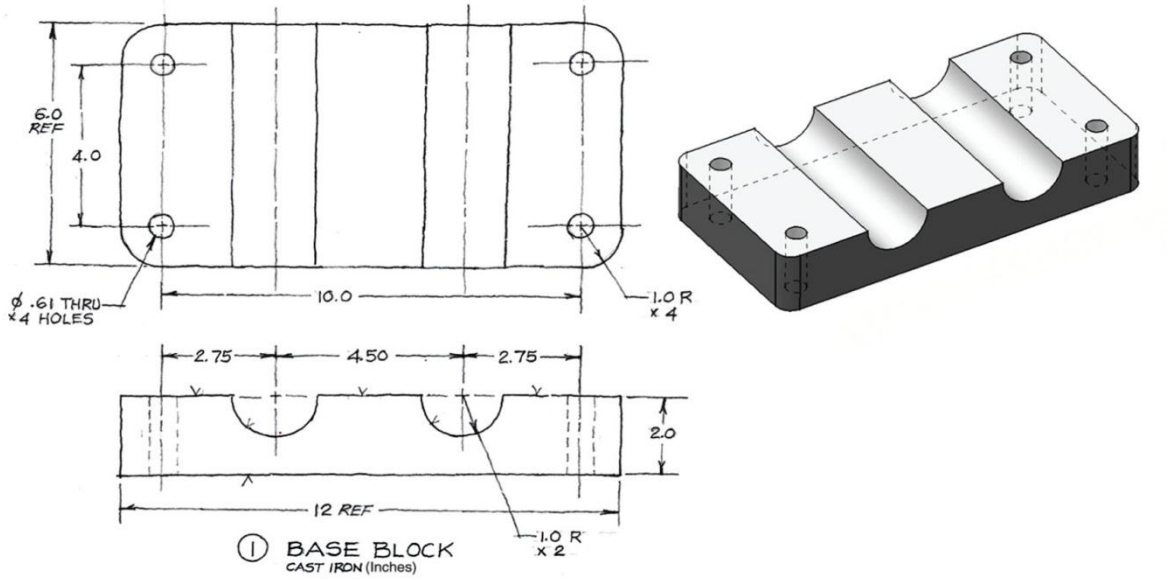
2: Hitch Mount 5-2 – Product Assembly

Assembly 5-1: Bearing Block

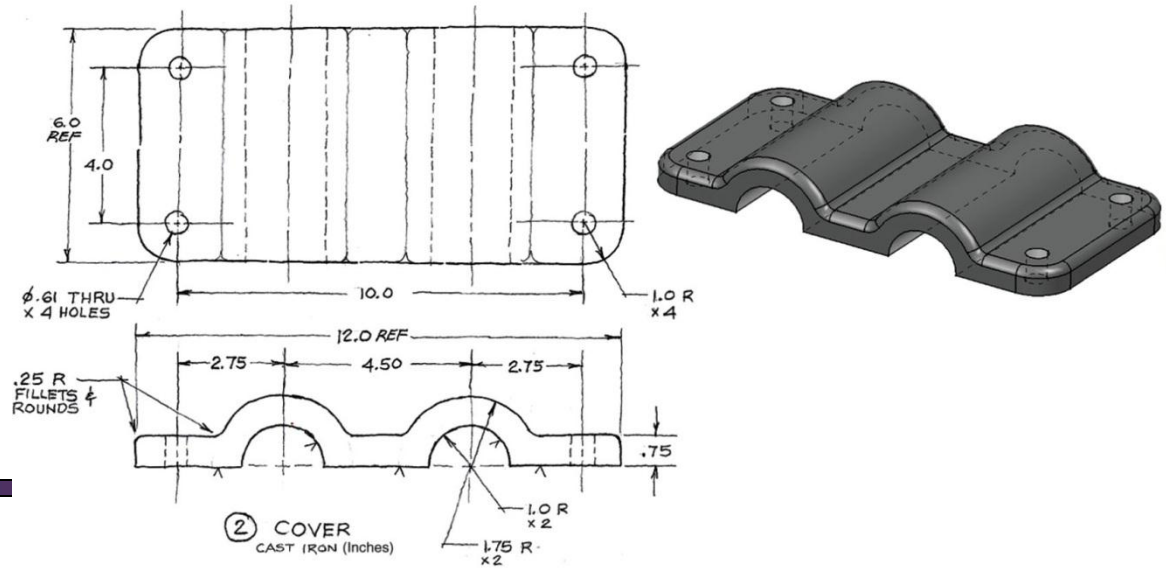


Bearing Block Assembly Pictorial Sketch & Parts List

Bearing Block

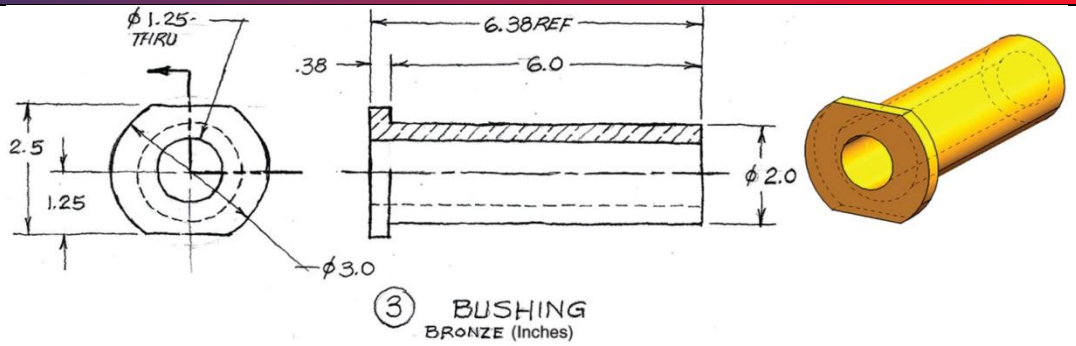


Sketch for Part Number 1: BASE BLOCK

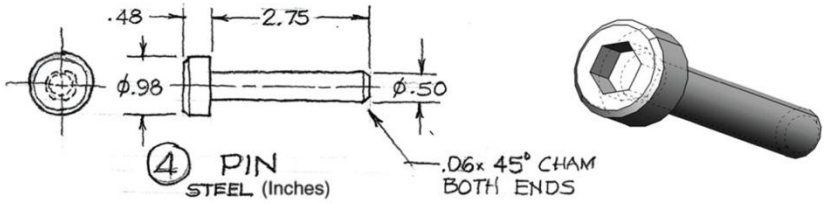


Sketch for Part Number 2: COVER

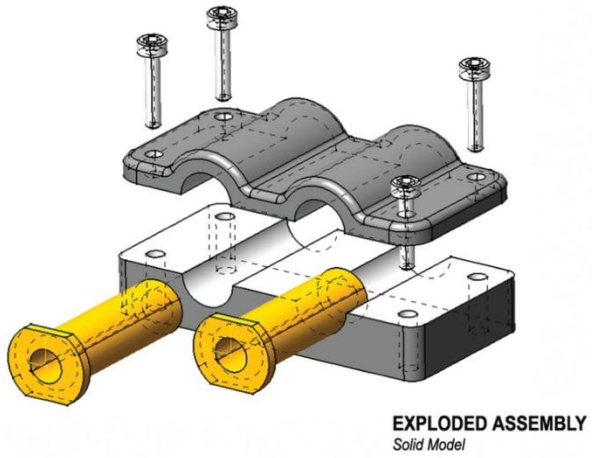
Bearing Block



Sketch for Part Number 3: BUSHING

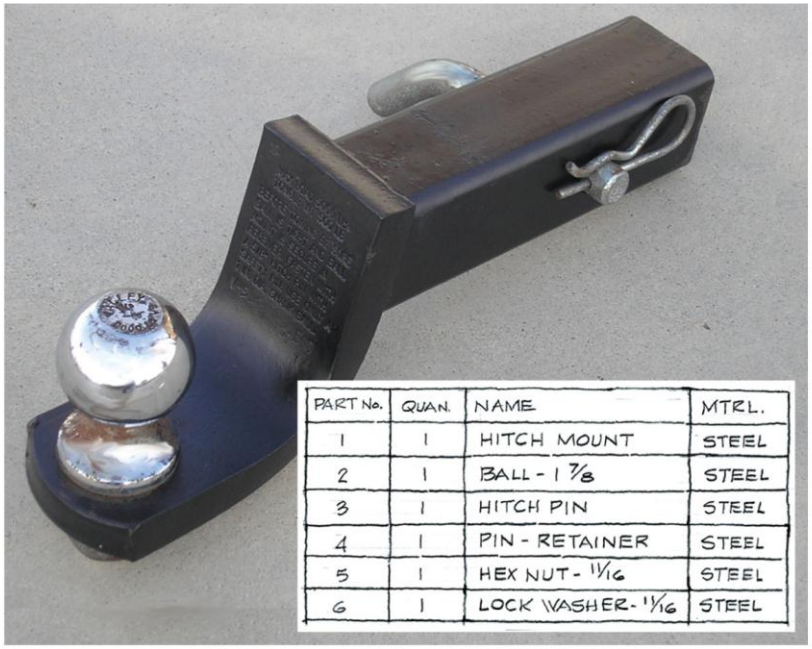


Sketch for Part Number 4: PIN



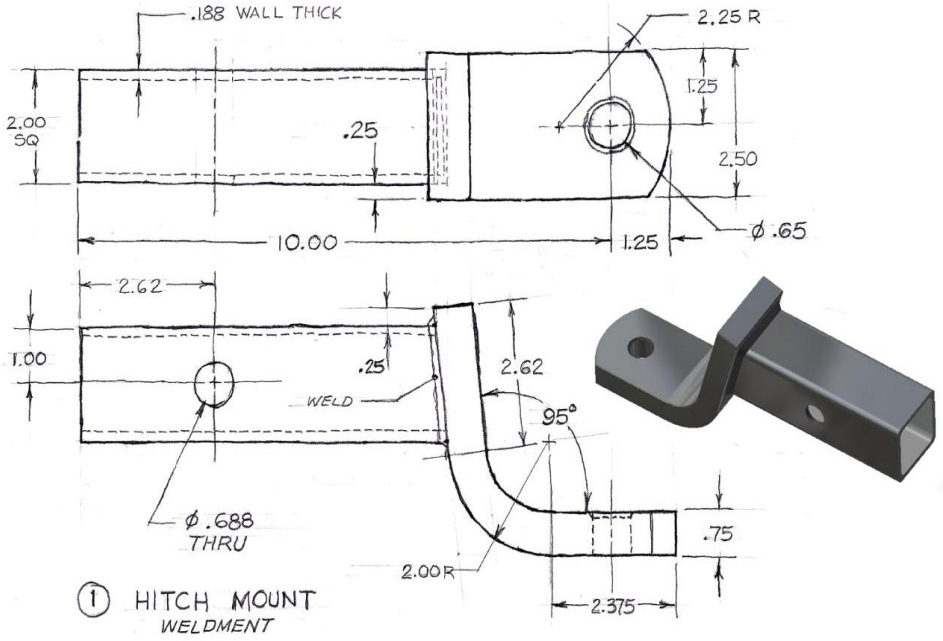
Exploded and Assembled Model of BEARING BLOCK 5-1

Hitch Mount



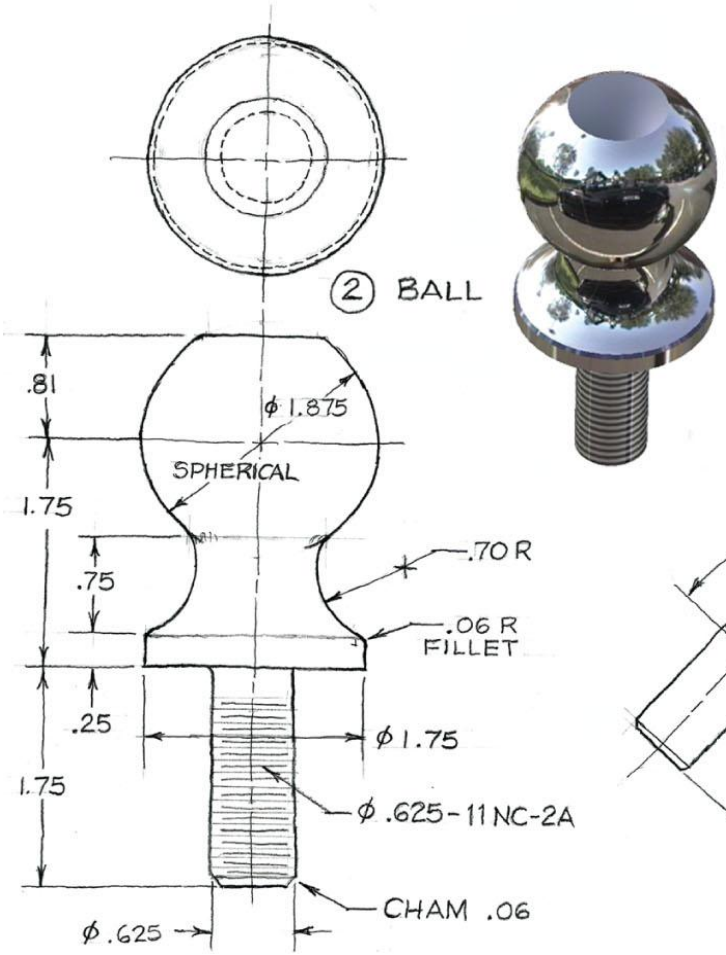
PART No.	QUAN.	NAME	MTRL.
1	1	HITCH MOUNT	STEEL
2	1	BALL - 1 7/8	STEEL
3	1	HITCH PIN	STEEL
4	1	PIN - RETAINER	STEEL
5	1	HEX NUT - 1"/16	STEEL
6	1	LOCK WASHER - 1"/16	STEEL

Hitch Mount Photo & Parts List

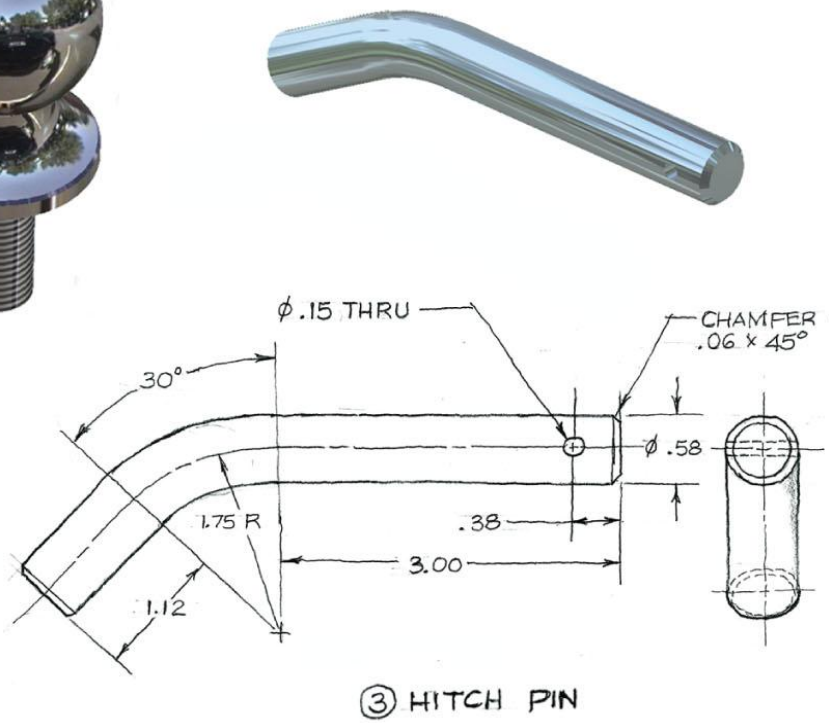


Sketch for Part Number 1: HITCH MOUNT

Hitch Mount

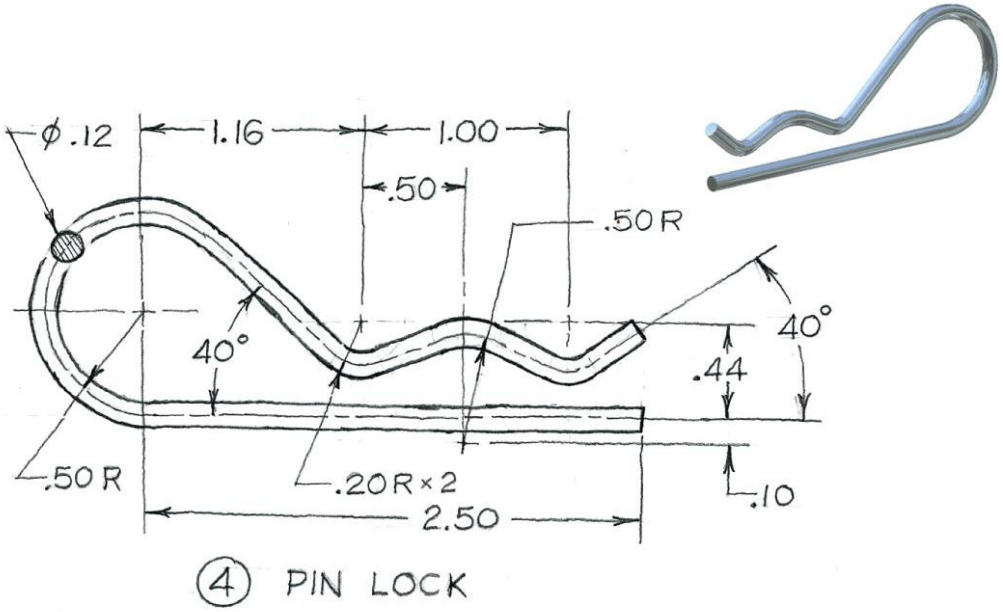


Sketch for Part Number 2: BALL



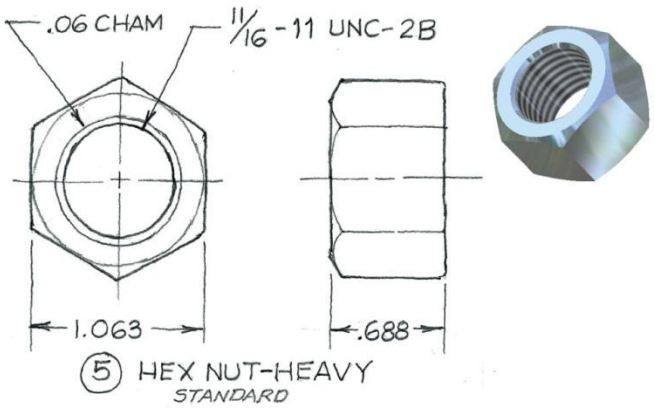
Sketch for Part Number 3: HITCH PIN

Hitch Mount

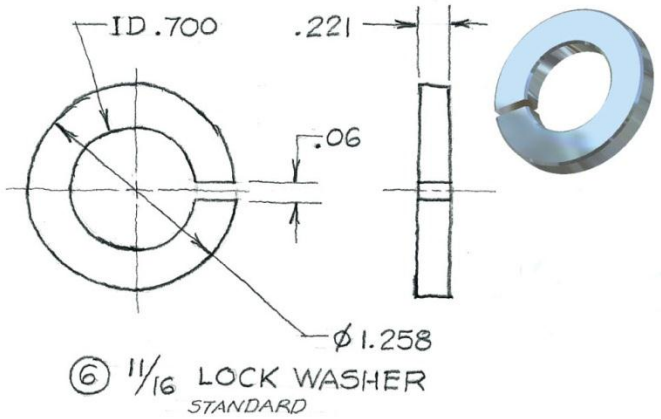


Sketch for Part Number 4: PIN LOCK

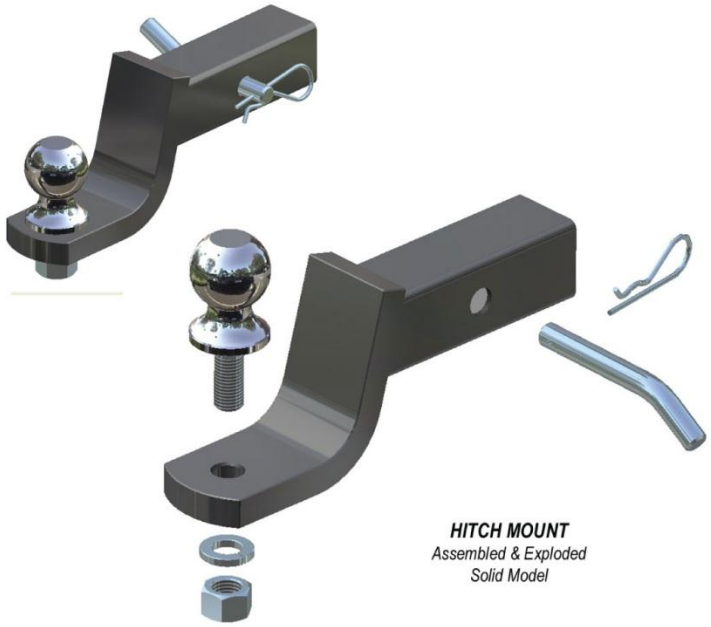
Hitch Mount



Sketch for Part Number 5: HEX NUT

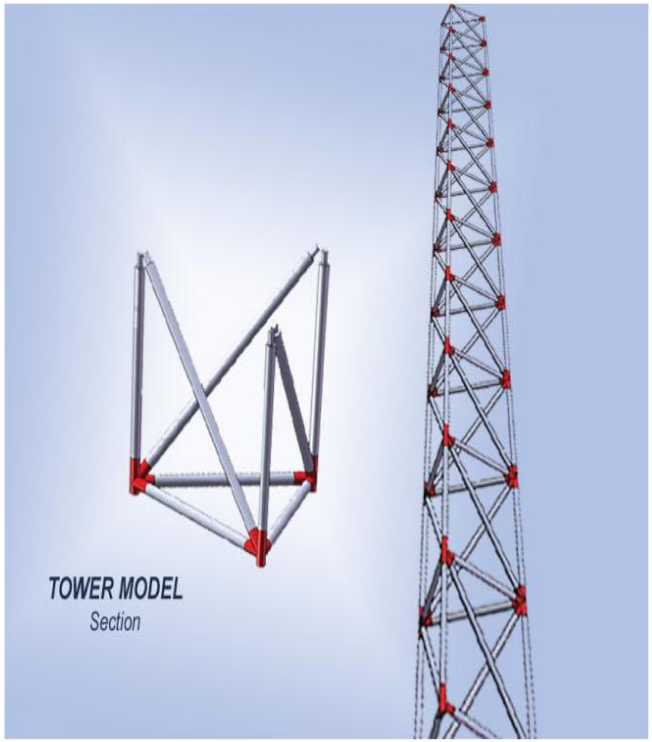


Sketch for Part Number 6: LOCK WASHER

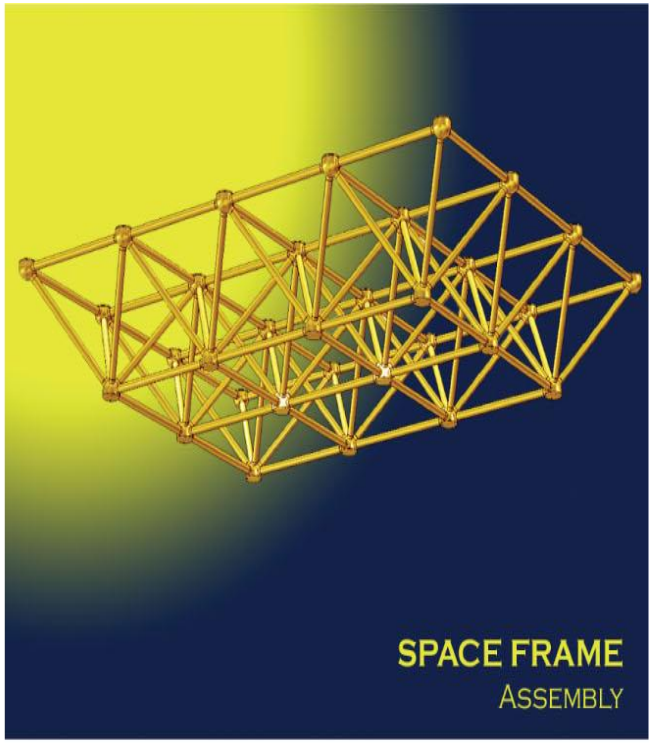


Hitch Mount 5-2 – Assembled & Exploded Solid Models

Tower Assembly



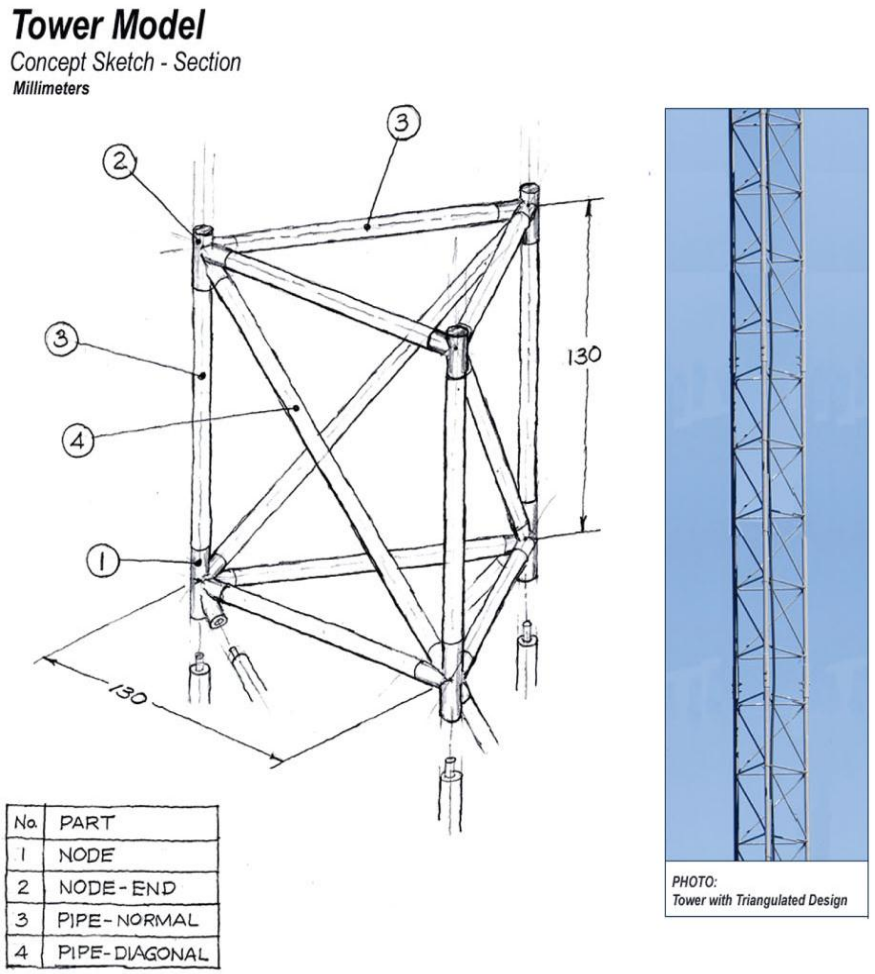
1: Structural Tower Model 6-1–*Subassemblies*



2: Space Frame 6-2–*Use of Subassemblies*

Assembly 6–1: Structural Tower Model—Sections & Subassemblies

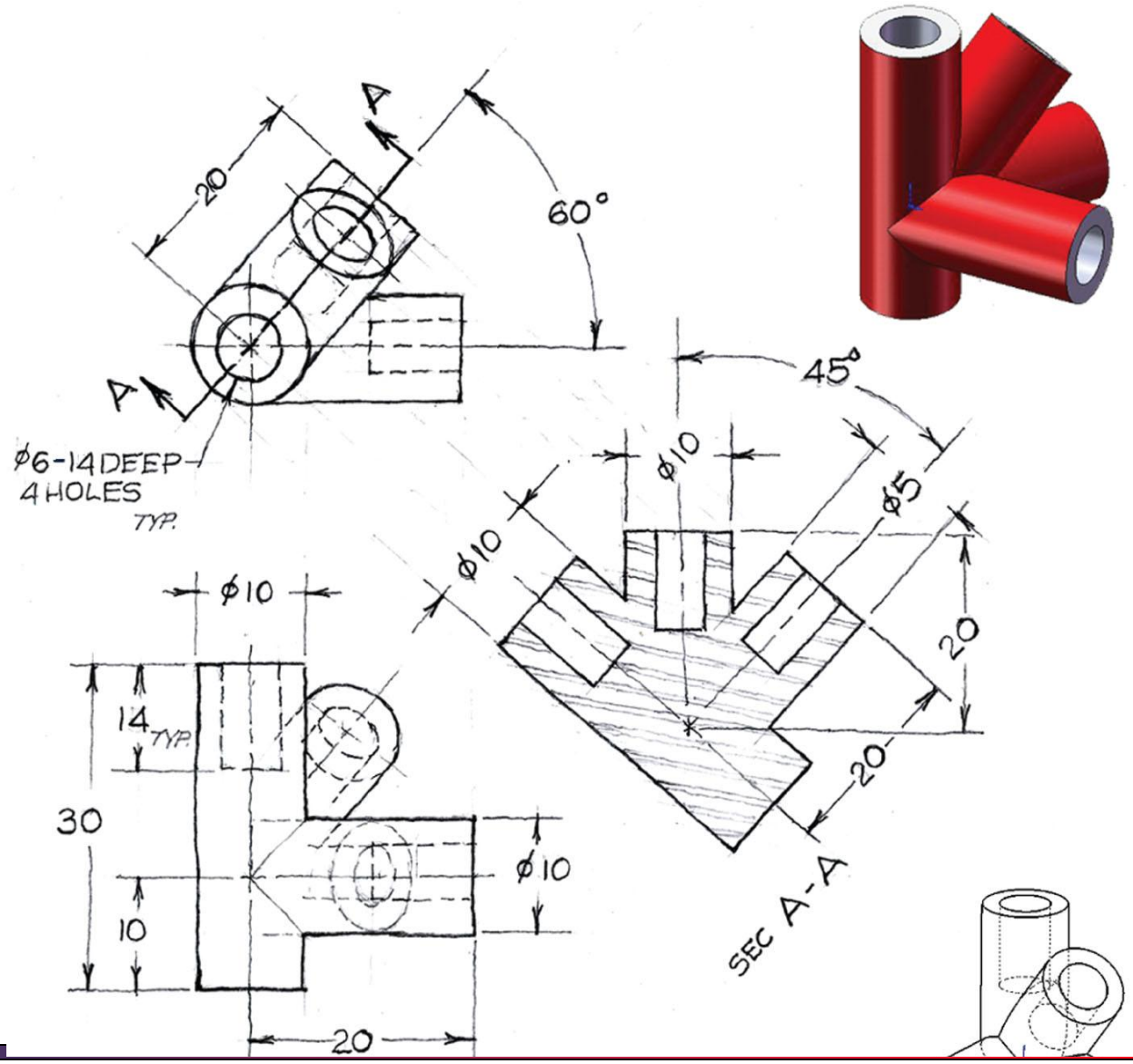
Tower Assembly



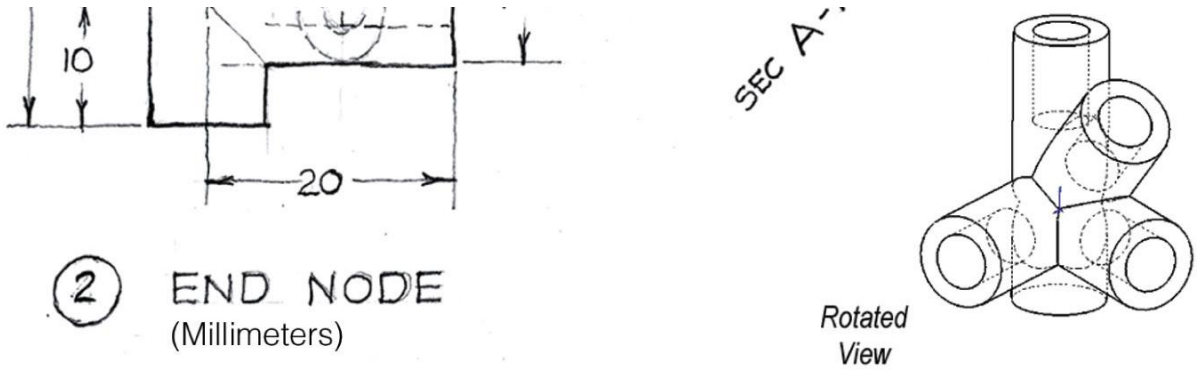
Tower Model 6-1–Sectional Concept Subassembly Sketch, Photo & Parts List

(Courtesy of William A. Ross.)

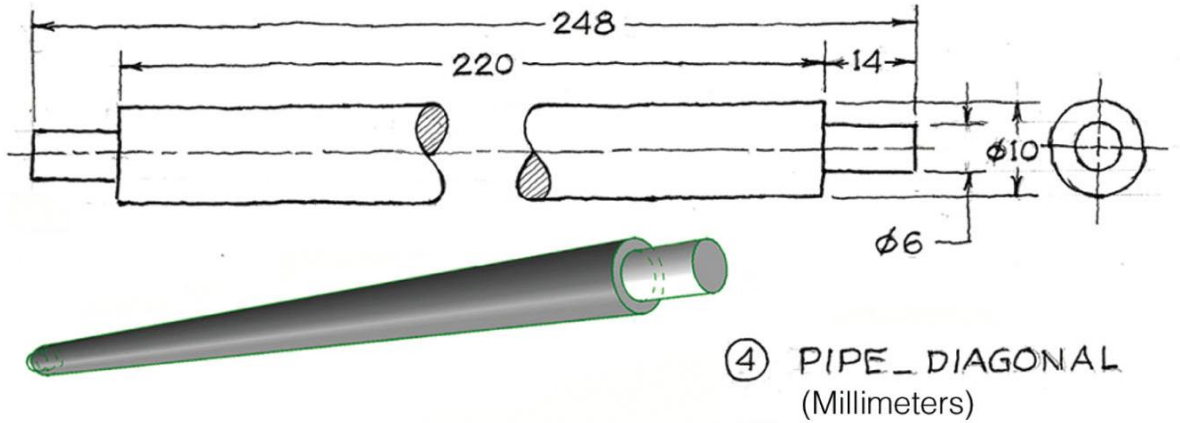
Tower Assembly



Tower Assembly

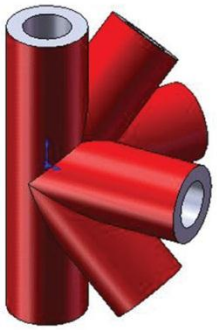


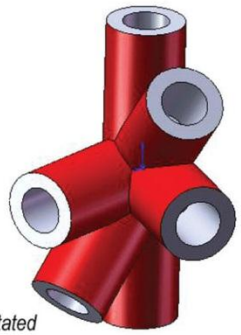
Sketch for Part Number 2: NODE - END



Sketch for Part Number 4: PIPE - DIAGONAL

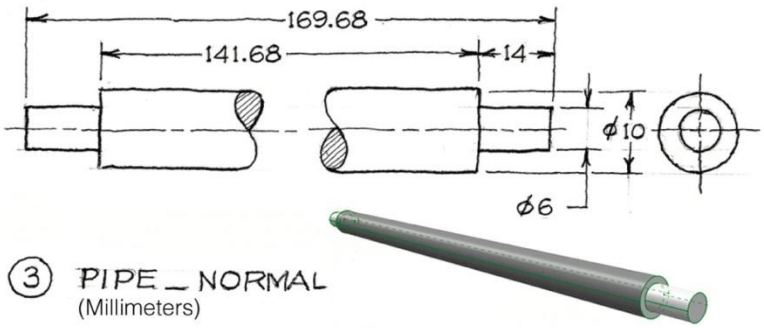
Tower Assembly





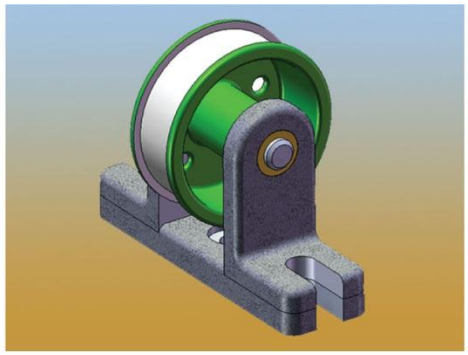
Rotated View

Sketch for Part Number 1: NODE

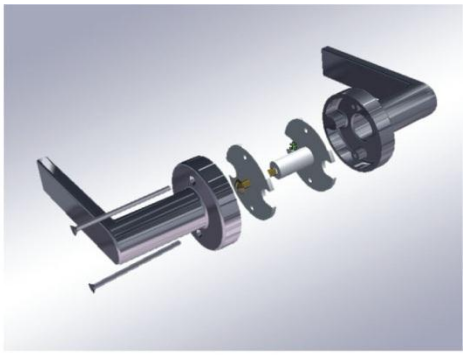


Sketch for Part Number 3: PIPE-NORMAL

Roller Guide Assembly



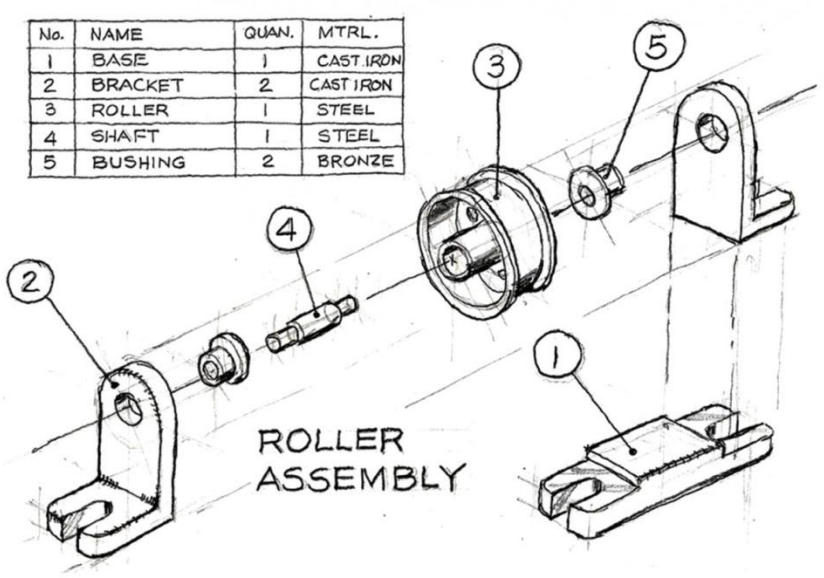
1: Roller Guide Assembly



2: Door Handle

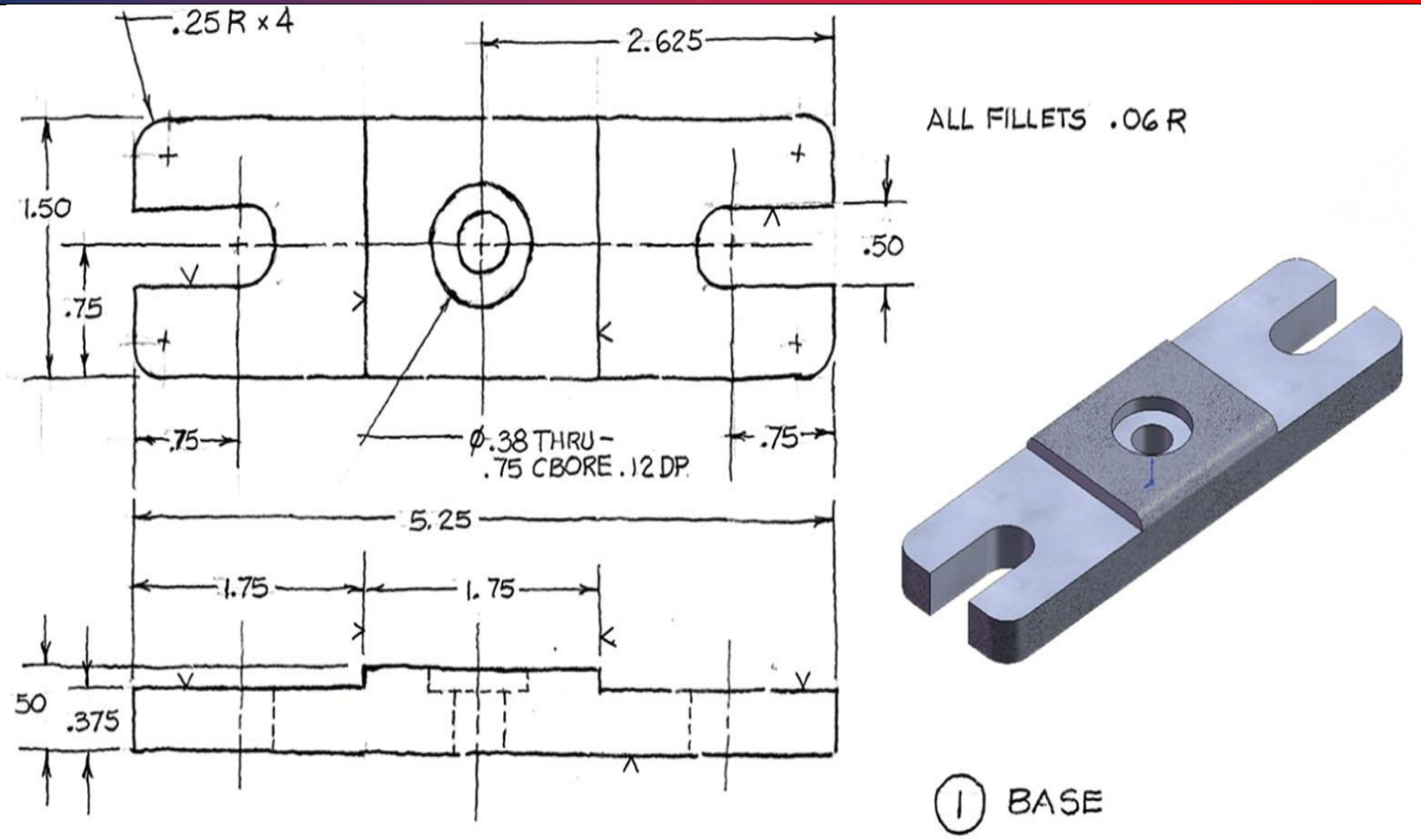
Assembly 1: Roller Guide Assembly

No.	NAME	QUAN.	MTRL.
1	BASE	1	CAST IRON
2	BRACKET	2	CAST IRON
3	ROLLER	1	STEEL
4	SHAFT	1	STEEL
5	BUSHING	2	BRONZE



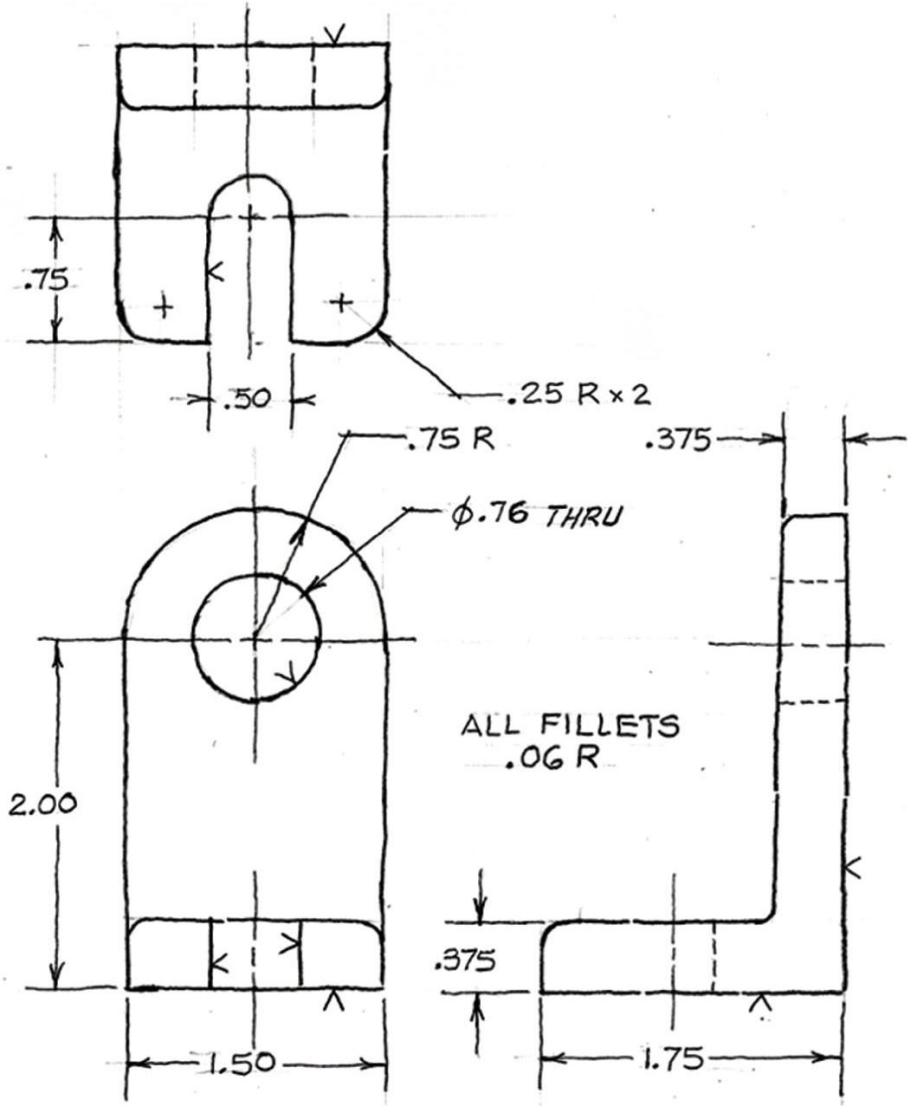
Roller Guide Assembly Sketch & Parts List

Roller Guide Assembly



Sketch for Part Number 1: BASE

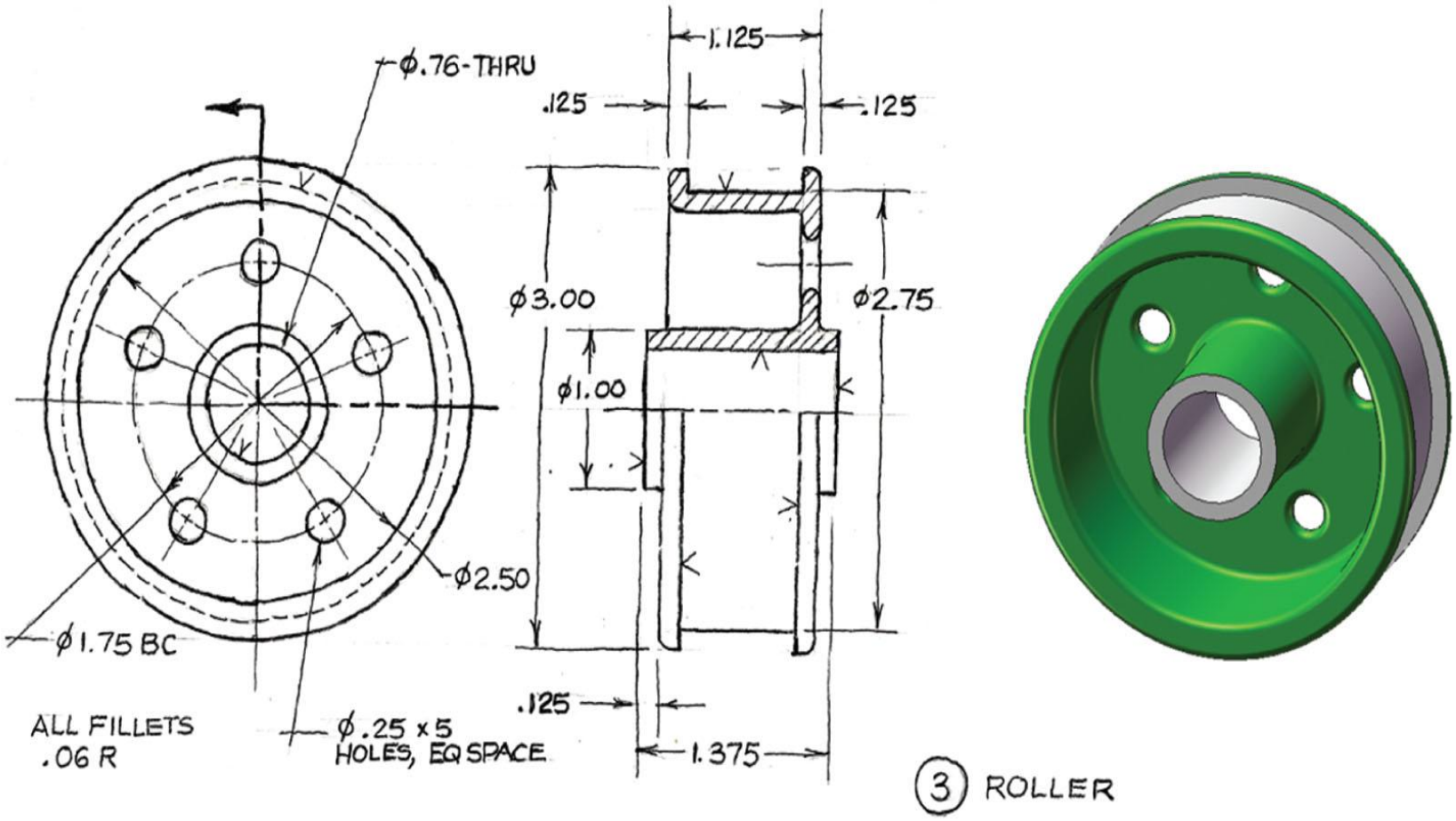
Roller Guide Assembly



(2) BRACKET

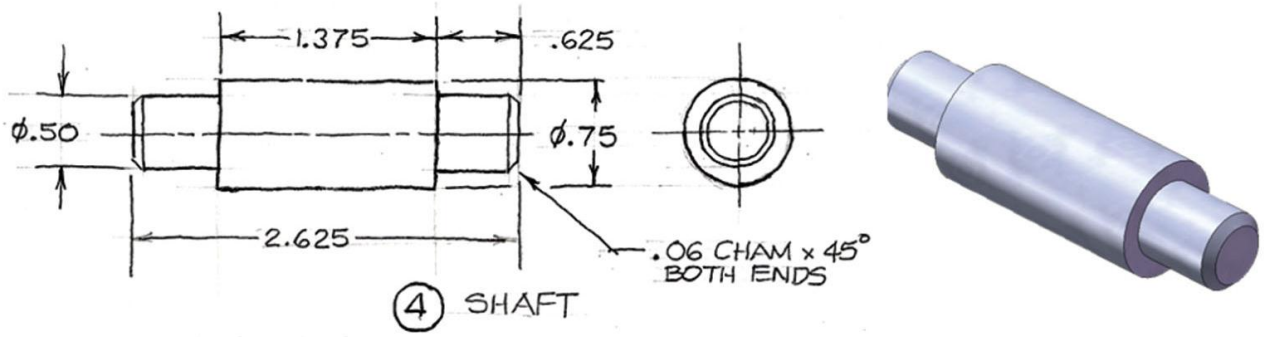
Sketch for Part Number 2: BRACKET

Roller Guide Assembly

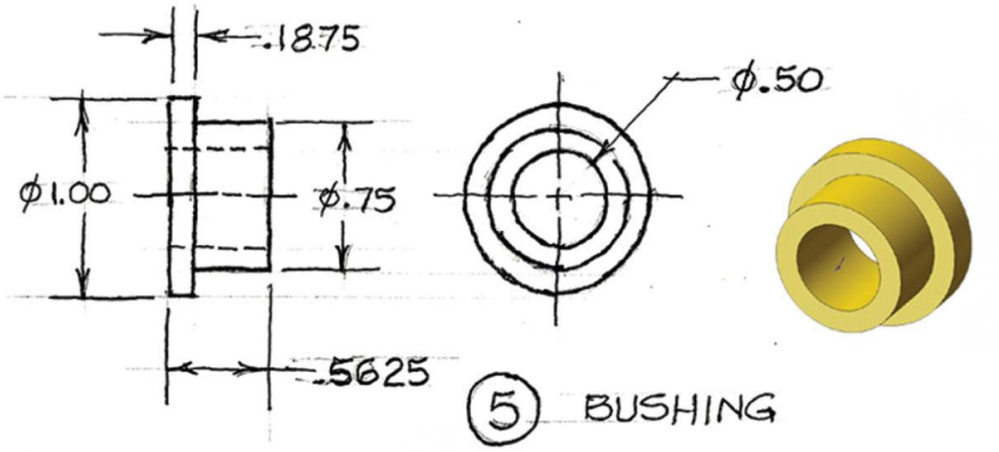


Sketch for Part Number 3: ROLLER

Roller Guide Assembly

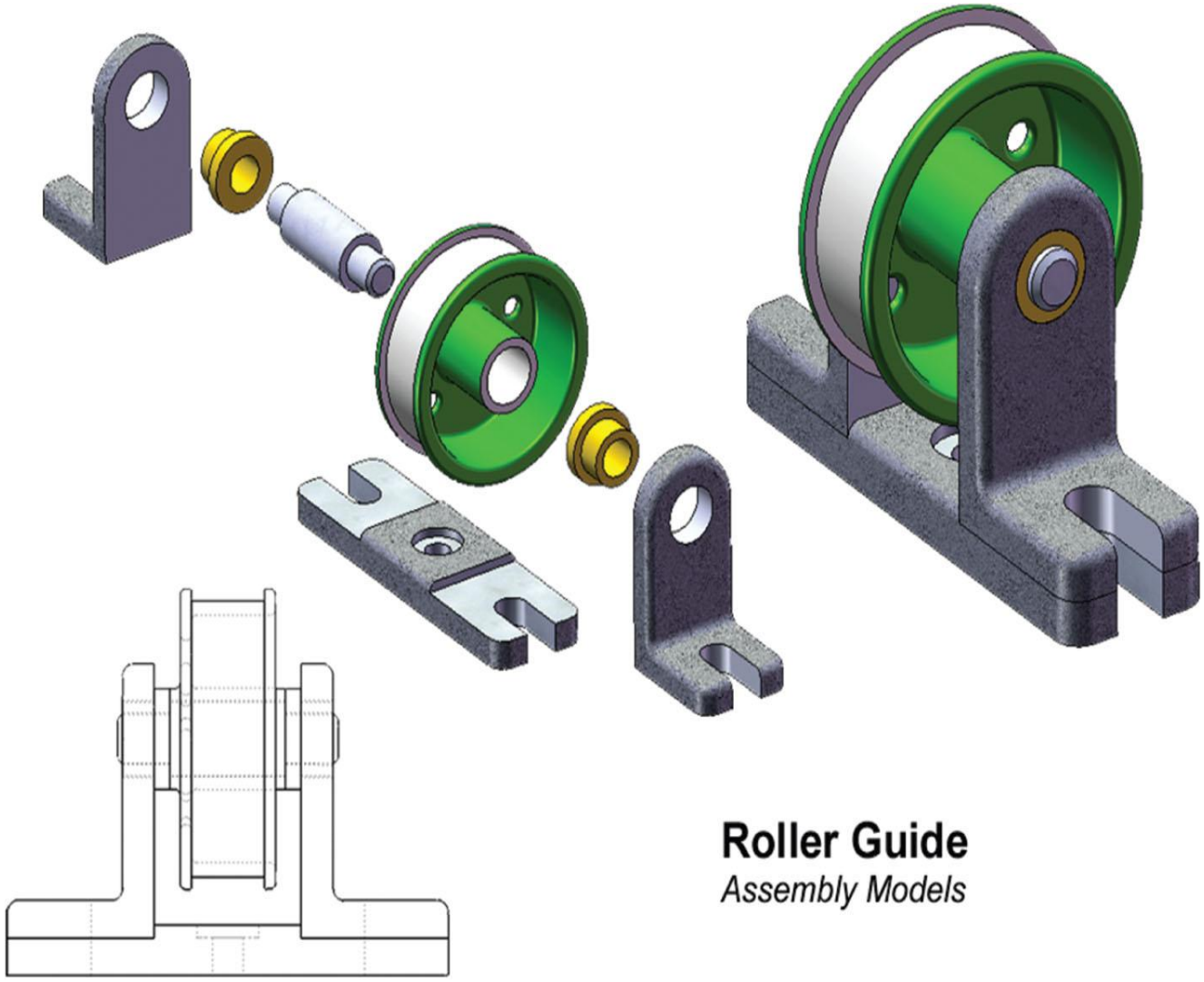


Sketch for Part Number 4: SHAFT



Sketch for Part Number 5: BUSHING

Roller Guide Assembly



Roller Guide – Assembly Models

English – Turkish Dictionary

Working drawing	Uygulama çizimi, ayrıntılı çizim	**Production drawing**	İmalat resmi	**Assembly drawing**	Montaj resmi
specifications	şartname	**blueprint**	Ozalit baskısı, ayrıntılı plan	**Bill of material**	Malzeme listesi
Title block	İsim bloğu	**Detail drawing**	Ayrıntı çizimi, detay resmi	**subassembly**	Alt montaj
Surface finish	Yüzey tesviyesi	**roller**	merdane	**mate**	eşleme
align	hizalama	**joining**	birleştirme	**Degree of freedom**	Serbestlik derecesi
milling	frezeleme	**cutter**	Keski, kesici	**fixture**	Bağlama düzeni
Worm gear	Sonsuz vida dişlisi	**idle**	avare	**valve**	Vana, subap
sprocket	Zincir dişlisi, cer dişlisi	**spring**	yay	**Clamping unit**	Kıskaç, kenet
vibration	titreşim	**Hold-down**	baskılama		