

ENGR1170
Working Drawings and
Assemblies

Chap 10
10.1-10.3

Working Drawings

Working Drawings

- ❑ Complete set of standardized drawings specifying the manufacture and assembly of a product based on its design
 - ❑ Complexity of drawings determine the number and types of drawings
 - ❑ May be on more than one sheet and may contain written instructions called ***specifications***
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Working Drawings

Working Drawings must

- a) Completely describe the parts visually and dimensionally
 - b) Show the parts in an assembly
 - c) Identify all the parts
 - d) Specify non standard parts
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Working Drawings

A Complete set of Working Drawings must include:

- a) Detail drawings of each nonstandard part
 - b) An assembly or subassembly drawing showing all the standard and nonstandard parts in a single drawing
 - c) A Bill of Materials (BOM)
 - d) A title block
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Detail Drawings

Detail Drawing

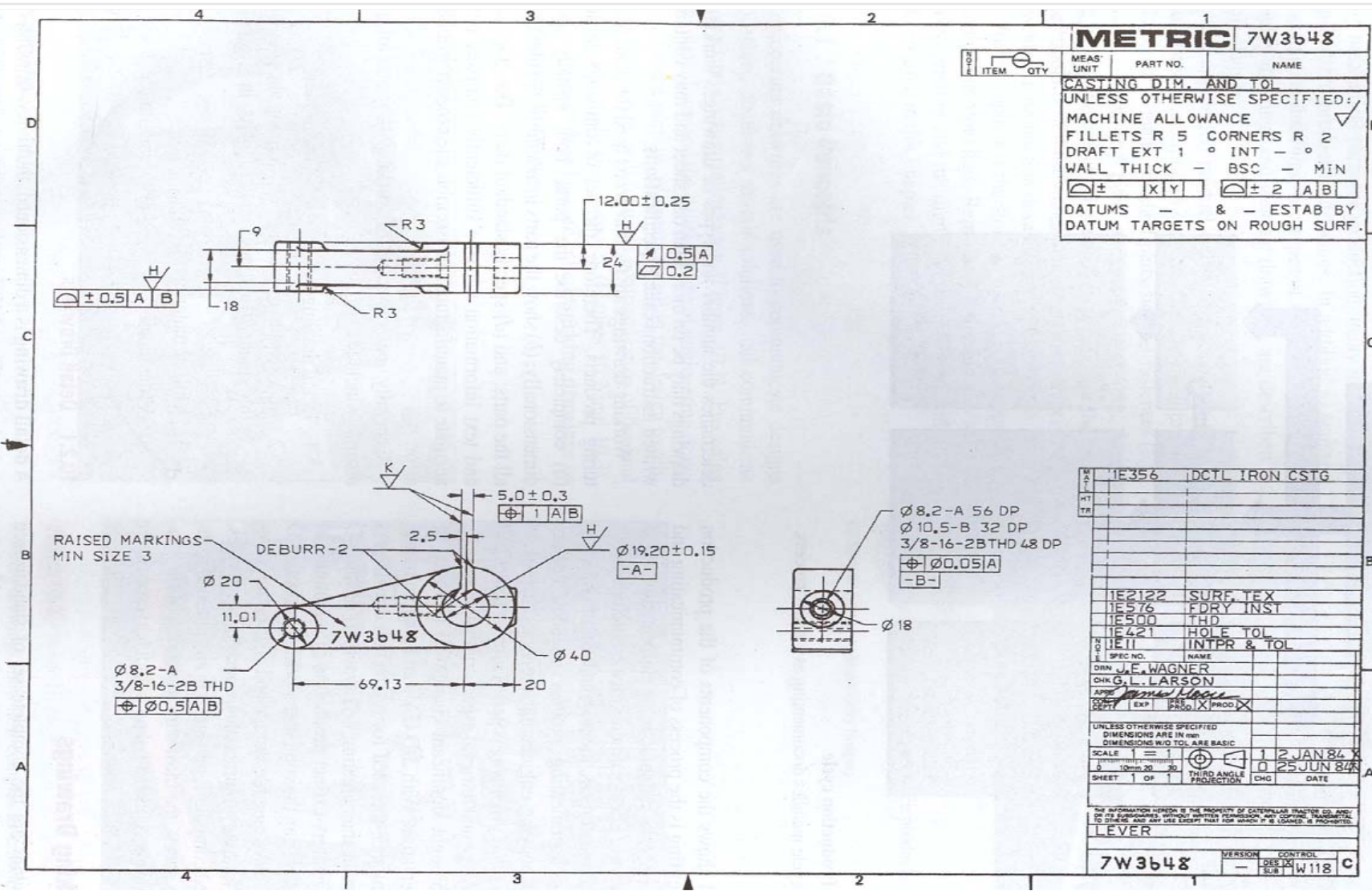
- Is a dimensioned, multiview drawing of a single part, describing the part in sufficient detail for the part to be manufactured based on the drawing alone.

 - Adhere to ANSI standards and the standards of the specific company (lettering, dimensioning, part numbers, notes and tolerances)
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Detail Drawings

What properties are described in a detail drawing?

1. shape
 2. size
 3. material
 4. finish
-

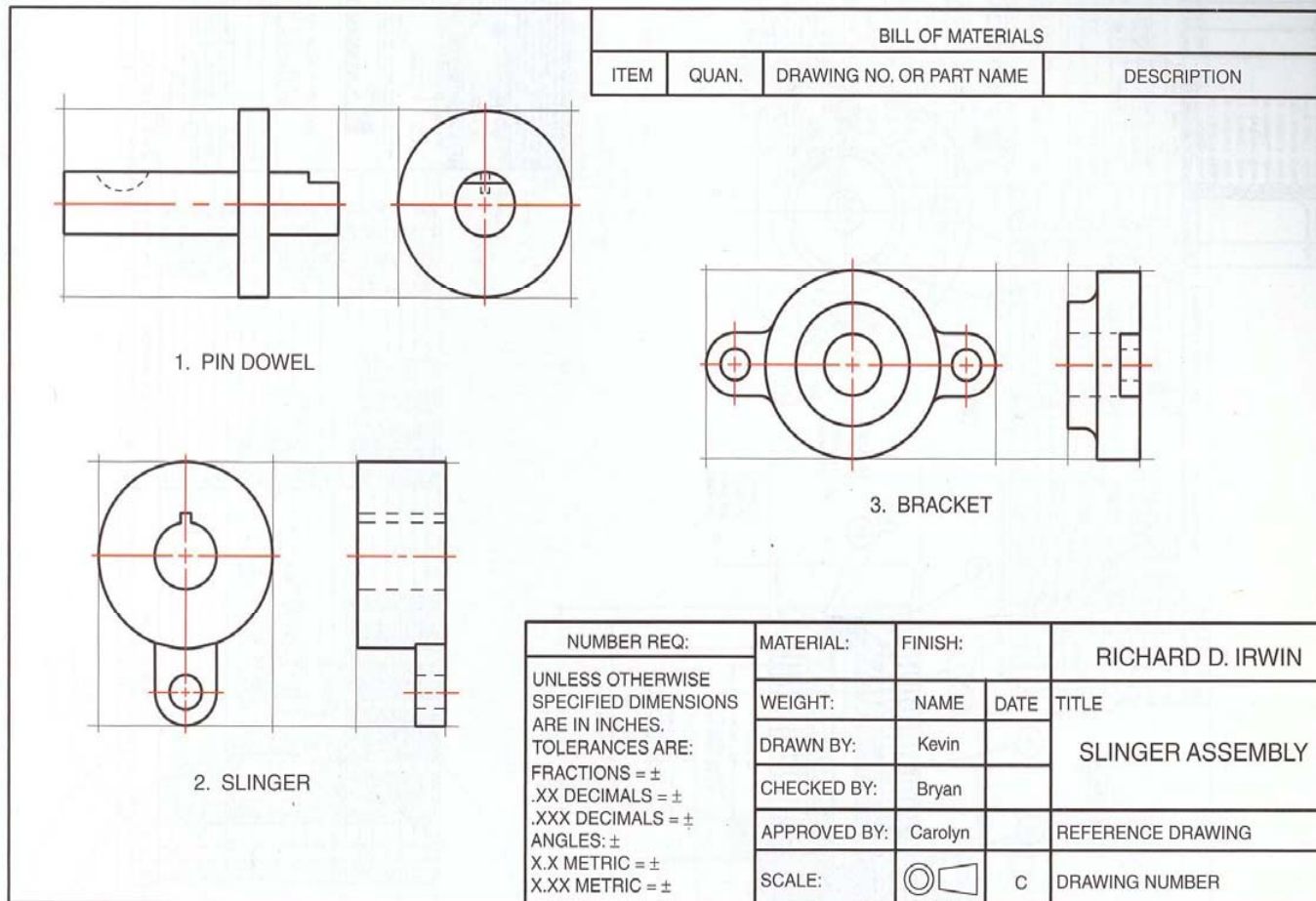


- Fig.10.5 A detail drawing of a single part called a lever arm
- Information includes: three orthographic views, metric dimensions, tolerances, finish information, material type, part number in title block

Detail Drawings

Note

- ❑ Standard parts (fasteners, bushings) are not drawn as details, but are shown in the assembly view
 - ❑ For large assemblies, details are drawn on multiple sheets and a separate sheet used for the assembly view
 - ❑ For simple or small assemblies, details can be placed on a single sheet. Multiple details on the same sheet are usually drawn at the same scale
 - ❑ Spacing between views is planned by blocking in the views for each detail using construction lines (see Fig 10.7)
-



□ Fig 10.7 Blocking in views to determine spacing requirements

Assembly Drawings

Assembly Drawings

- ❑ Shows how each part of a design is put together
 - ❑ If design is only part of a total assembly, it is referred to as a subassembly
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Assembly Drawings

Assembly drawings normally consist of:

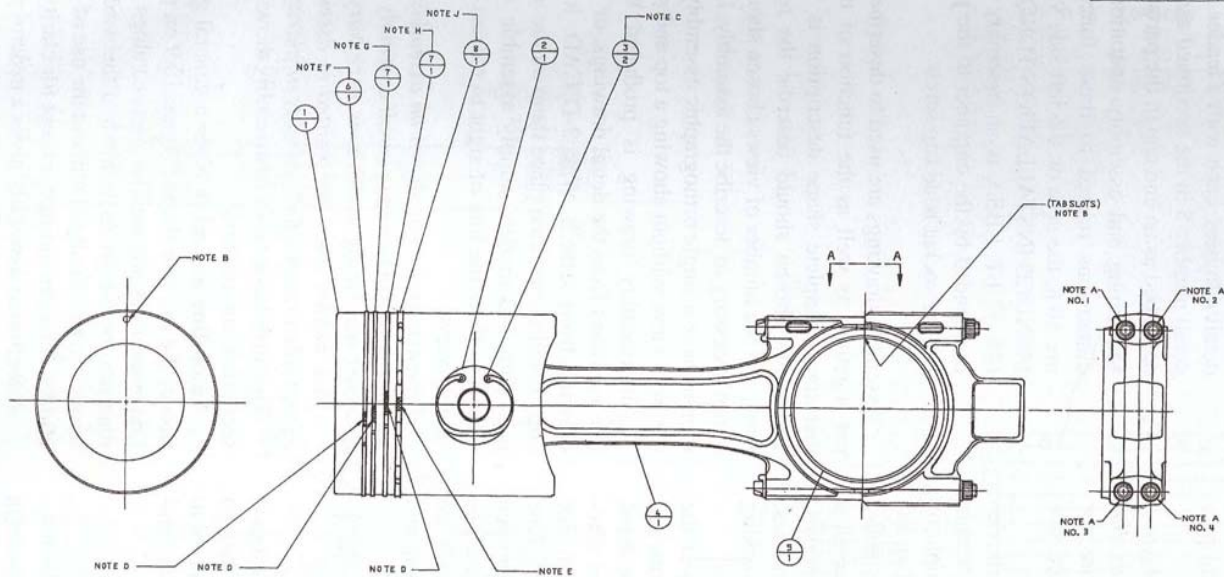
1. All the parts, drawn in their operating position
 2. A parts list or bill of materials (BOM)
 3. Leader lines with balloons, assigning each part a detail number (sequential order, keyed to parts list)
 4. Machining and assembly operations and critical dimensions related to these operations
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Bill of Materials

What information is contained in the bill of materials?

1. Detail number for each part
 2. Quantity needed for a single assembly
 3. Description or name of part
 4. Company part number
 5. Catalog number if it is a standard part
 6. Material type and other information such as weight, stock, size etc.
-

QTY		UNIT	PART NO.	NAME
PARTS LIST				
1	1		7E1645	PISTON AS.
2	1		TC1412	PIN
3	2		TC1413	RETAINER
4	1		4PA127-	ROD AS.
5	1		7E1628	BEARING
6	1		1M2501-	RING
7	2		1M2502-	RING
8	1		7M2509-	RING
9	1			



NOTE D: INSTALL WITH SIDE MARKED "UP" TOWARD HEAD OF PISTON. RING GAPS TO BE $120^{\circ} \pm 20^{\circ}$ FROM ADJACENT RING.

NOTE E: OIL RING SPRING ENDS TO BE ASSEMBLED 180° FROM RING END GAP.

NOTE F: TOP RING MUST BE INSTALLED WITH YELLOW COLOR STRIPE TO RIGHT OF RING END GAP (NOT FOR SERVICE).

NOTE G: SECOND RING MUST BE INSTALLED WITH GREEN COLOR STRIPE TO RIGHT OF RING END GAP (NOT FOR SERVICE).

NOTE H: THIRD RING MUST BE INSTALLED WITH GREEN COLOR STRIPE TO RIGHT OF RING END GAP (NOT FOR SERVICE).

NOTE J: WHITE COLORED PORTION OF OIL RING SPRING MUST BE VISIBLE AT RING END GAP.

NOTE A1: ROD BOLT TIGHTENING PROCEDURE:

1. LUBRICATE BOLT THDS, BOLT SHANK, AND NUT SEATING FACES OF CAP AND NUT WITH MOLYBLIENE BEFORE ASSEMBLY.
2. TIGHTEN NUTS NO.1 AND NO.2 TO 300 ± 30 Nm.
3. TIGHTEN NUTS NO.3 AND NO.4 TO 300 ± 30 Nm.
4. RETIGHTEN NUT NO.1 TO 300 ± 30 Nm, AND THEN TIGHTEN NUT NO.3 AN ADDITIONAL $180^{\circ} \pm 5^{\circ}$ TURN.
5. RETIGHTEN NUT NO.4 TO 300 ± 30 Nm, AND THEN TIGHTEN NUT NO.4 AN ADDITIONAL $180^{\circ} \pm 5^{\circ}$ TURN.
6. TIGHTEN NUTS NO.1 AND NO.2 AN ADDITIONAL $180^{\circ} \pm 5^{\circ}$ TURN.

OPTIONAL ROD BOLT TIGHTENING PROCEDURE:

1. LUBRICATE BOLT THDS, BOLT SHANK, AND NUT SEATING FACES OF CAP AND NUT WITH MOLYBLIENE BEFORE ASSEMBLY.
2. TIGHTEN NUTS NO.1 AND NO.2 TO 300 ± 30 Nm.
3. TIGHTEN NUTS NO.3 AND NO.4 TO 300 ± 30 Nm.
4. RETIGHTEN NUTS NO.3 AND NO.4 TO 300 ± 30 Nm.
5. TIGHTEN EACH NUT AN ADDITIONAL $180^{\circ} \pm 5^{\circ}$ TURN.

NOTE B: ASSEMBLE ROD TO PISTON SO THAT THE ROD BEARING TAB SLOTS ARE ON THE SAME SIDE AS THE DOWEL. ON TOP OF THE PISTON, INSTALL PISTON IN CYLINDER SO THAT THE "V" MARK ON BLOCK AND PISTON DOWEL ARE ALIGNED.

NOTE C: ASSEMBLE RETAINER WITH WORD "DUT" VISIBLE. AFTER ASSEMBLY, 0.05 MM MINIMUM CLEARANCE MUST BE MAINTAINED BETWEEN PISTON PIN AND RETAINER.

VIEW A-A
CONNECTING RODS AND CAPS TO BE MARKED (BY ETCHING ONLY) WITH THE NUMBER OF THE CYLINDER IN WHICH THEY ARE USED. NUMBERS ARE TO BE ON THE SAME SIDE OF RODS AND CAPS AS BEARING TAB SLOTS.

CERTIFICATION
NO PORTION OF DRAWING
SHALL BE REPRODUCED

NO.	REVISION	DATE	BY	CHKD.	APP'D.
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

1M2509-1
1M2502-1
7E1628
4PA127-1
TC1413
TC1412
7E1645

- ❑ Fig 10.6 Assembly Drawing of a piston and rod containing eight parts
- ❑ Shows how each part in the assembly fits together and includes assembly information

Assembly Drawings

Note

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

- Three Basic Types of Assembly
 - Outline Assembly
 - General graphic description of the exterior shape
 - Sectioned
 - Gives a general graphic description of interior shape by passing a cutting plane through all or part of the assembly
 - Pictorial Assembly
 - Gives a general graphic description of each part and uses center lines to show connections (typically isometric view)
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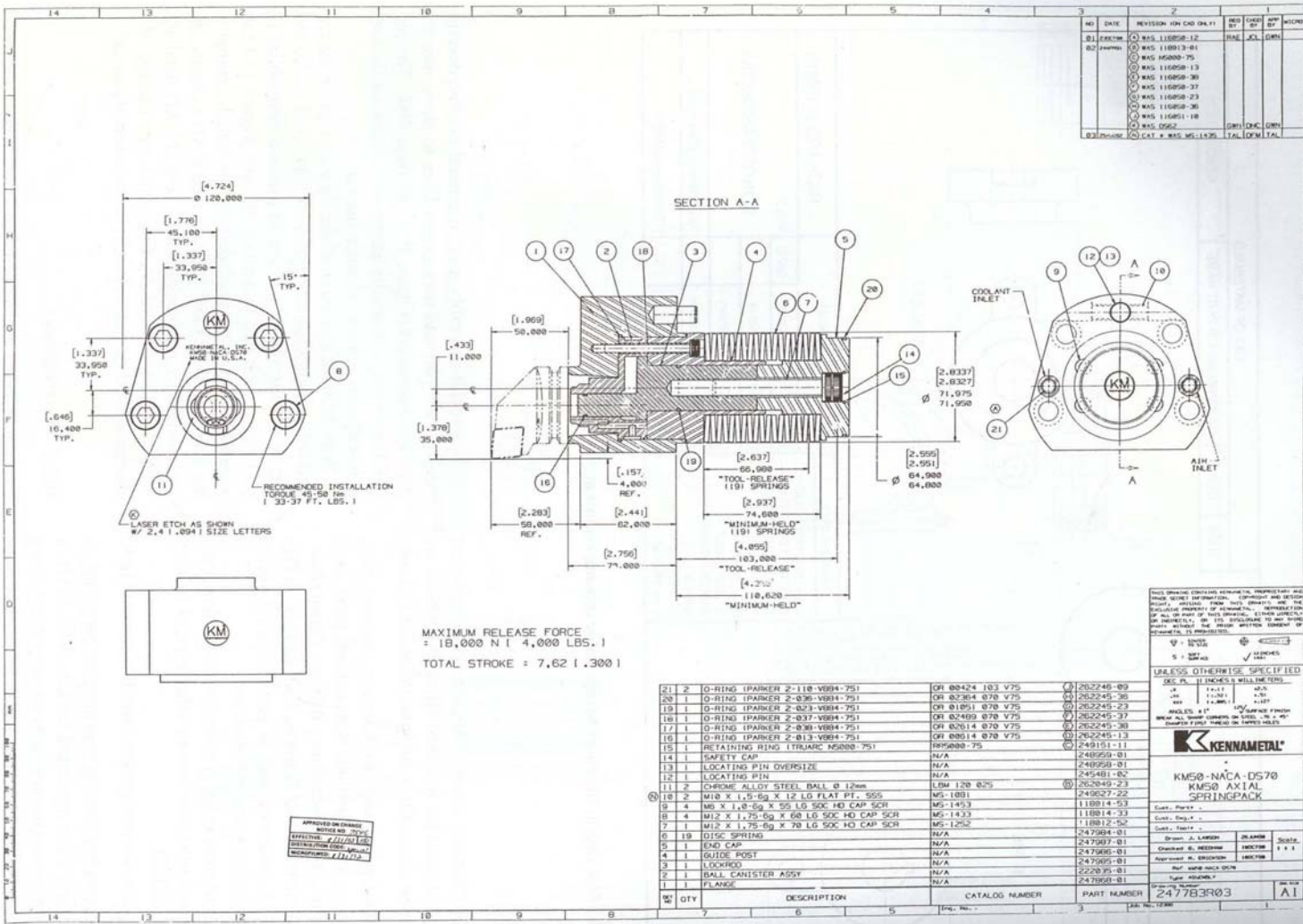
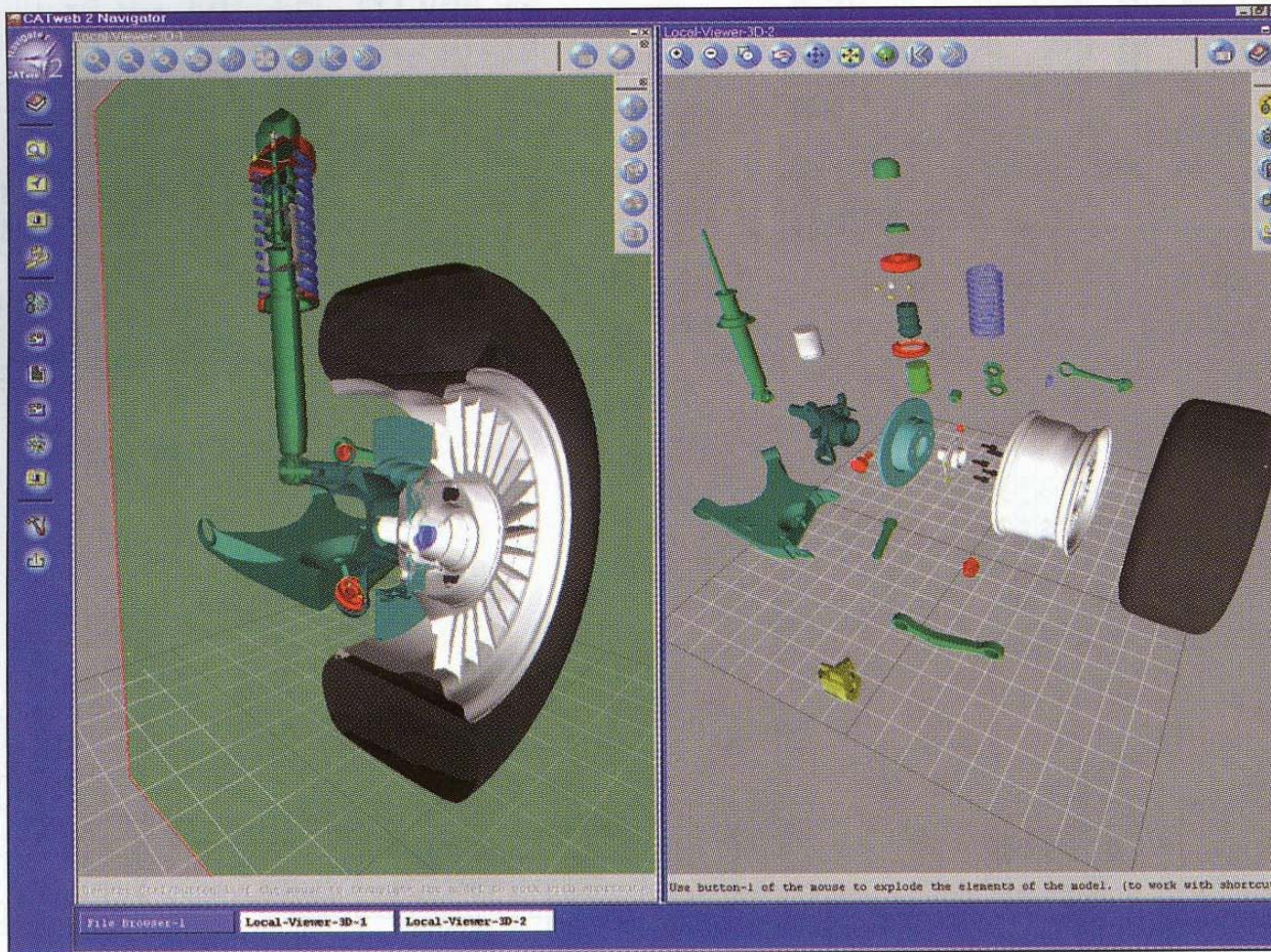
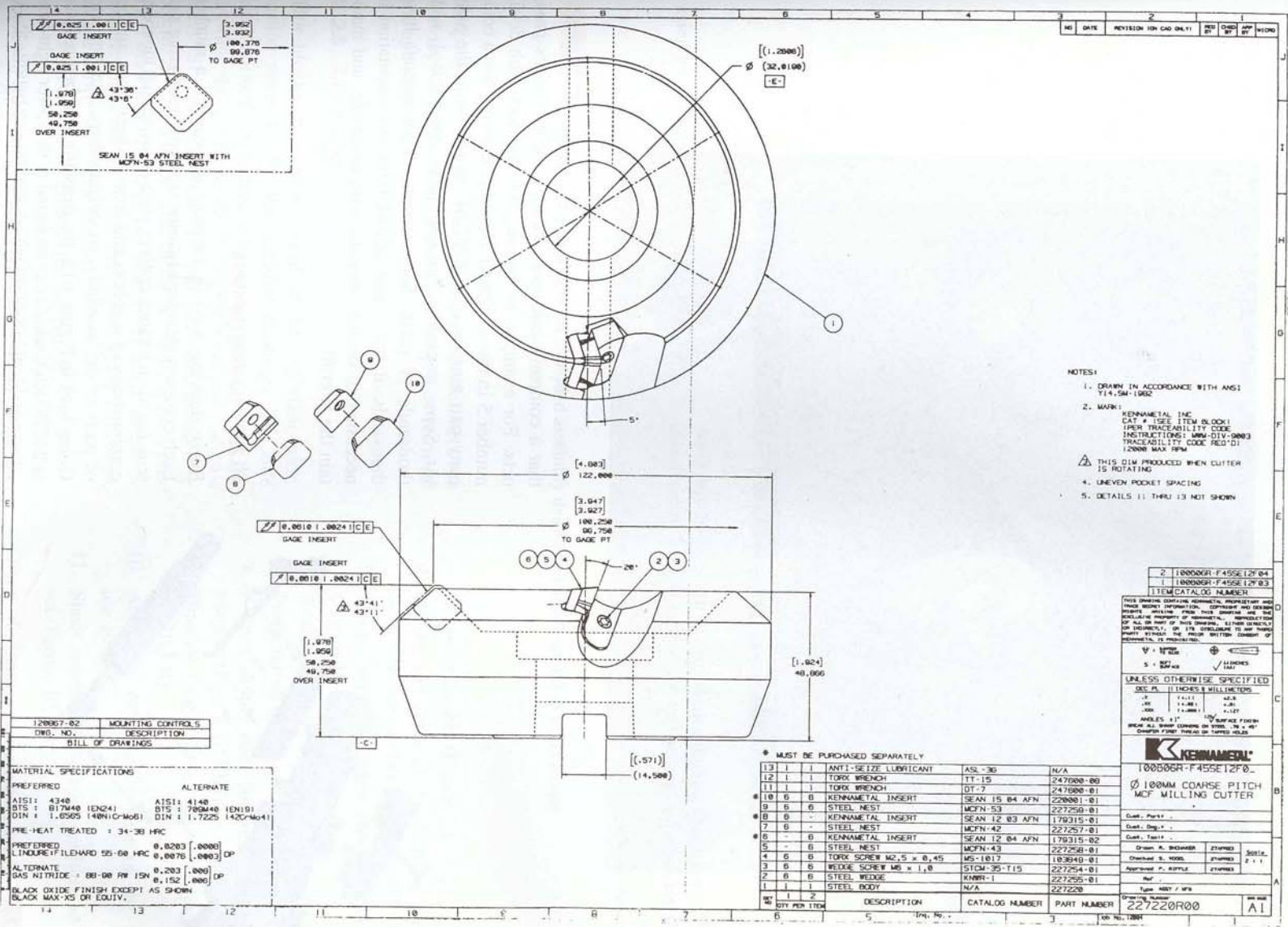


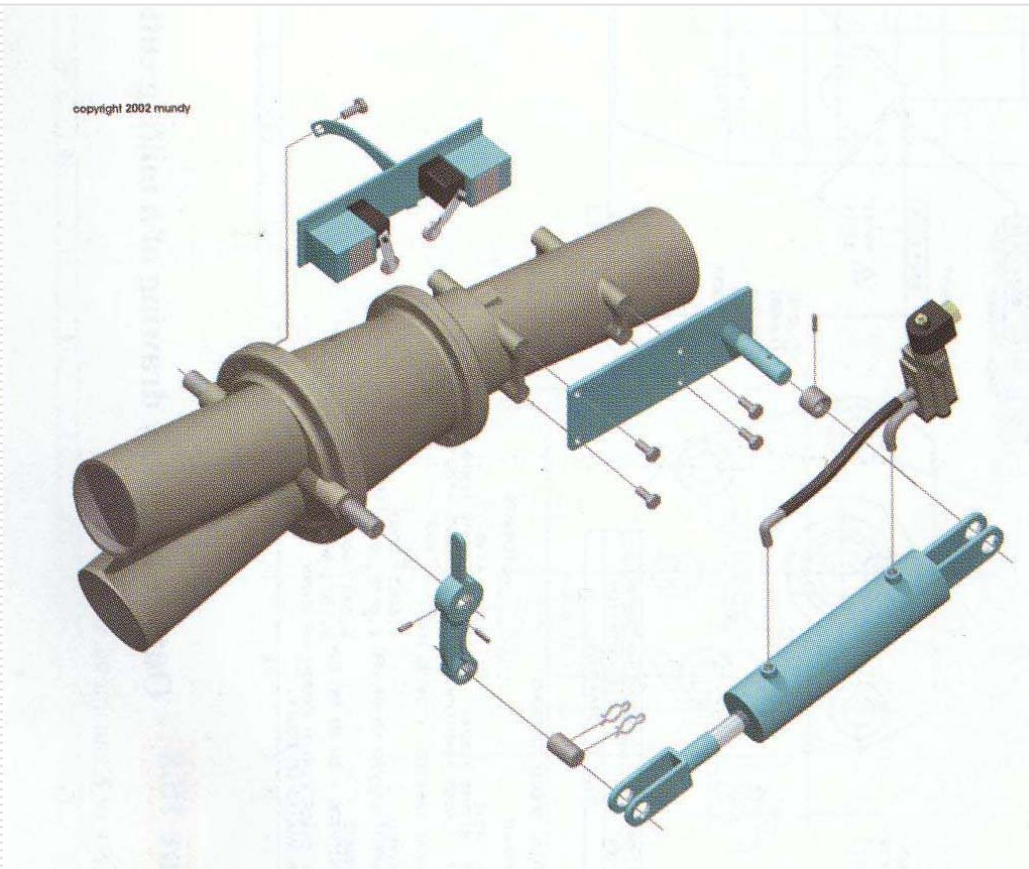
Fig 10.8 Multiview Sectioned Assembly Drawing of a Spring Pack



□ Fig 10.10 Sectioned Assembly 3D Model (left)



□ Fig 10.9 Outline Assembly of a Milling Cutter



- Fig 10.11 Pictorial Assembly (maintenance manual: Northwind Engineering)
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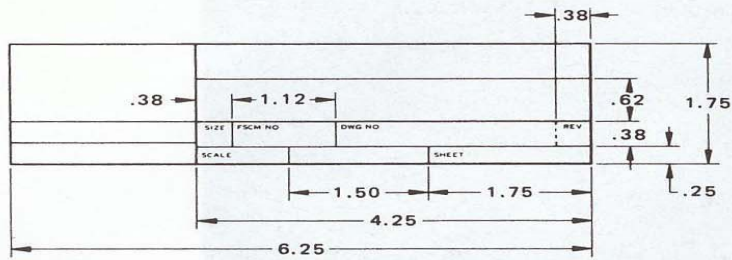
Assembly Drawings

1. Part numbers are assigned so that a company can keep accurate records of its products
 2. Drawing numbers are used to simplify retrieval and updating
 3. Title blocks are used to record all the important information necessary for the working drawings
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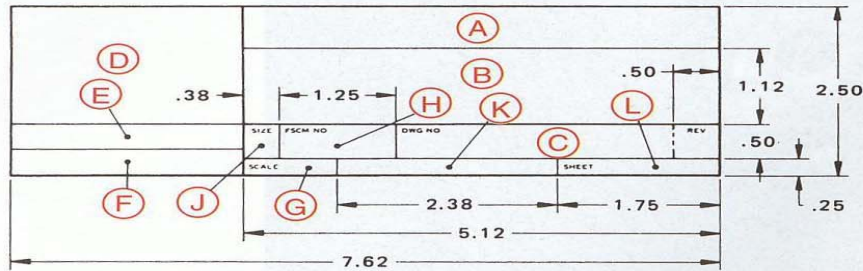
Title Blocks

Will have some or all of the following (letters correspond to Fig 10.13)

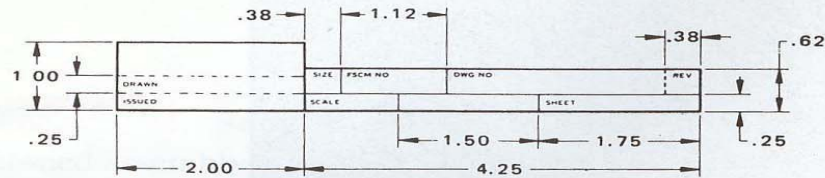
- A. Name and Address of Company
 - B. Title of drawing
 - C. Drawing number
 - D. Names and dates of the drafters, checker, issue date, contract number etc.
 - E. Design Approval
 - F. additional Approval
 - G. Predominant drawing scale
 - H. Federal supply code for manufacturers
 - J. Drawing letter sheet size letter designation
 - K. Actual or estimated weight
 - L. Surface finish, hardness of material, heat treatment, weight
 - M. Sheet number
-



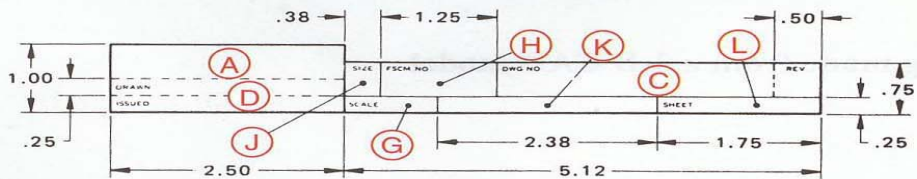
NOTE: All dimensions are in inches. 1 inch = 25.4 mm.
TITLE BLOCK FOR A, B, C, AND G – SIZES



NOTE: All dimensions are in inches. 1 inch = 25.4 mm.
TITLE BLOCK FOR D, E, F, H, J, AND K – SIZES



NOTE: All dimensions are in inches. 1 inch = 25.4 mm.
CONTINUATION SHEET TITLE BLOCK FOR A, B, C, and G – SIZES



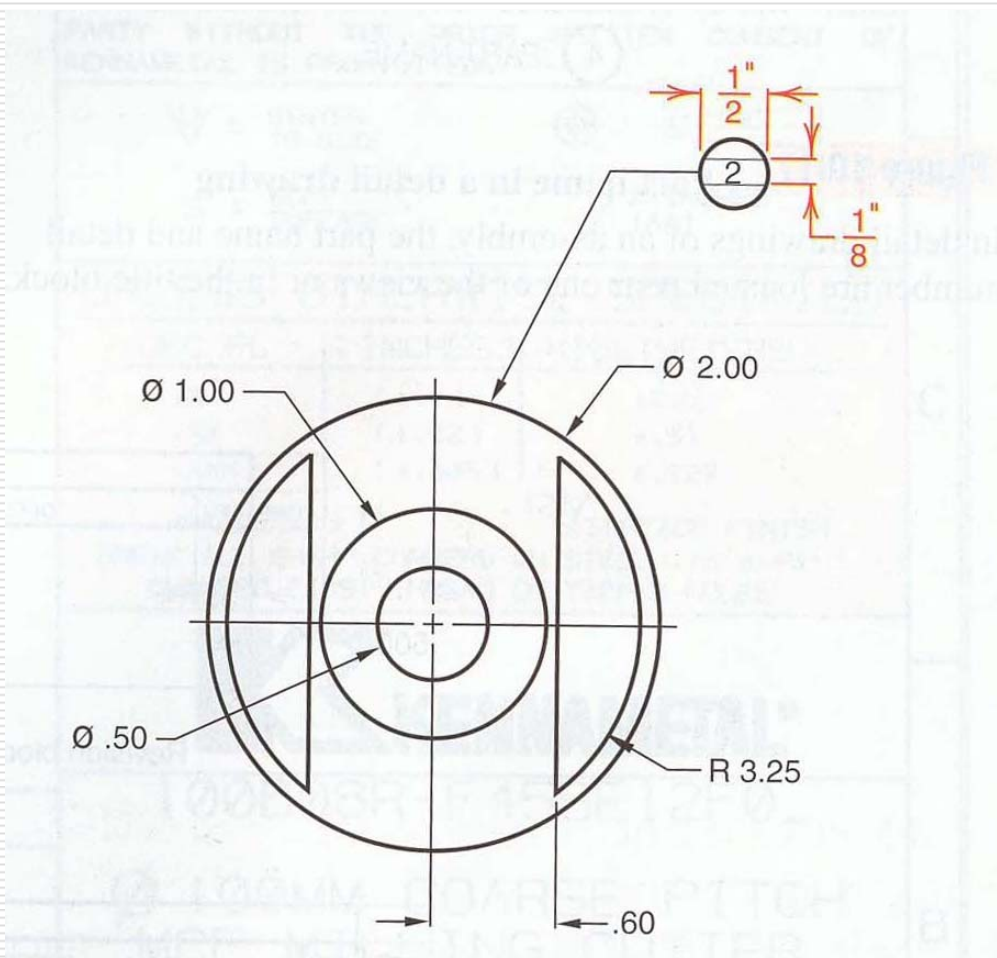
NOTE: All dimensions are in inches. 1 inch = 25.4 mm.
CONTINUATION SHEET TITLE BLOCK FOR D, E, F, H, J, AND K – SIZES

□ Fig 10.13 ANSI Standard Title Blocks

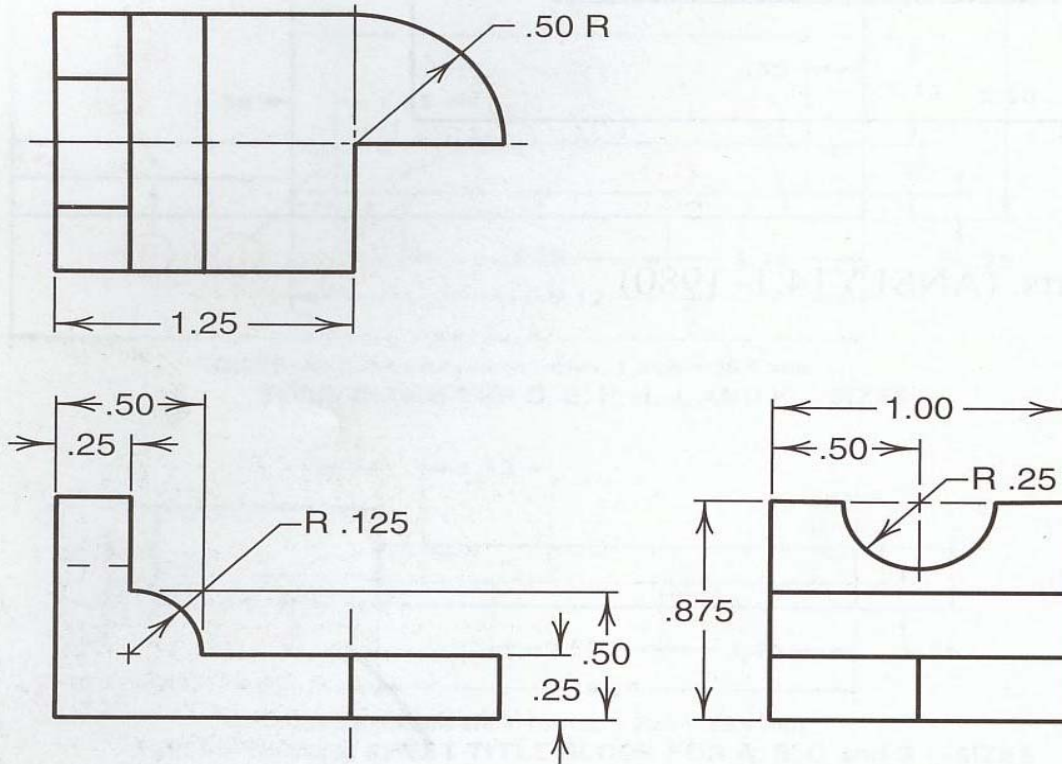
Parts List or BOM

Based on ANSI should be located in the lower right corner above the title block

- a) Listed in general order of size or importance
 - b) Parts are identified using a leader line with a balloon (Fig 10.16)
 - c) Information for standard parts should include part name, size and catalog number
 - d) Part names are given and placed as close to part as possible (Fig 10.17)
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□ Fig 10.16 Balloons in an assembly



④ PART NAME

□ Fig 10.17 Part name in a detail drawing

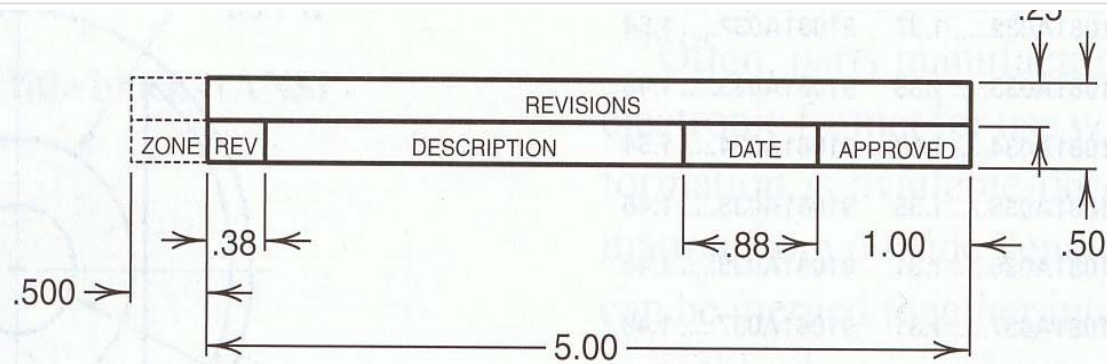
Revision Block

When might a drawing need to be revised?

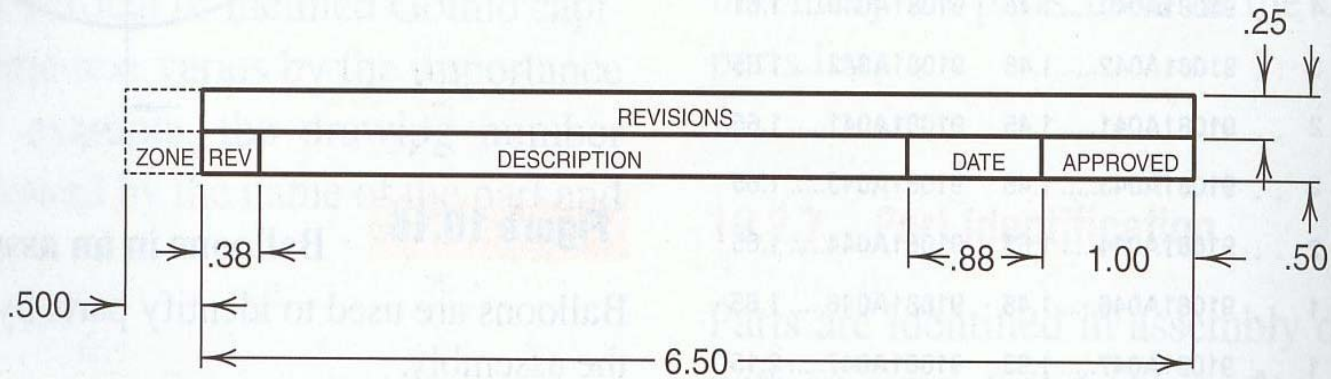
1. Customer requests
2. errors
3. Material changes
4. Tooling changes
5. Design improvements

The revision block, normally in the upper right corner, should contain

- Name of person making the change
 - Date
 - Description of change
 - Change number
 - Approval
-



Revision block for A, B, C, and G - sizes



Revision block for D, E, F, H, J, and K - sizes

□ Fig 10.18 Standard Revision Block (ANSI Y14.1-1980)

Engineering Change Orders (ECO)

1. Identification of what has been changed in the form of part numbers, part names, and drawing numbers
 2. An explanation of the need for the requested change
 3. A list of all documents and departments that is affected by the change
 4. A description of the change including before and after drawings
 5. Approval of the changes by project managers
 6. Instructions describing when the changes should be made
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Tolerance Specs./Other Drwgs.

- Tolerances are specified using tolerance dimensions (see Tolerance Chapter 9)

 - Tabular Drawings
 - Used when similar parts have common features.
 - Parts can be grouped together in a family of parts

 - Working Assembly Drawing
 - Combines on a single sheet the detail drawing and the assembly drawing
 - Used for simple assemblies
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