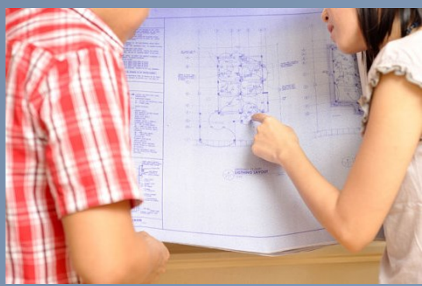
MEM09002B



Interpret technical drawing

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Conditions of Use:

Unit Resource Manual

Manufacturing Skills Australia Courses

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Forward your comments to:

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Sydney, NSW 2000

Aims of the Competency Unit:

When you have completed this unit of competency you will have developed the knowledge and skills to select the correct and interpret a technical drawing. As a result, you will be able to apply these skills to interpret technical drawing.

Unit Hours:

36 Hours

Prerequisites:

None.

Elements and Performance Criteria

1.	Select correct technical drawing	1.1	Drawing is checked and validated against job requirements or equipment.
		1.2	Drawing version is checked and validated.
2.	Interpret technical drawing	2.1	Components, assemblies or objects are recognised as required.
		2.2	Dimensions are identified as appropriate to field of employment.
		2.3	Instructions are identified and followed as required.
		2.4	Material requirements are identified as required.
		2.5	Symbols are recognised in the drawing as appropriate.

Required Skills and Knowledge

Required skills include:

Required skills include the ability to:

- checking the drawing against job requirements/related equipment in accordance with standard operating procedures
- confirming the drawing version as being current in accordance with standard operating procedures
- where appropriate, obtaining the current version of the drawing in accordance with standard operating procedures
- reading, interpreting information on the drawing, written job instructions, specifications, standard operating procedures, charts, lists and other applicable reference documents
- checking and clarifying task related information
- undertaking numerical operations, geometry and calculations/formulae within the scope of this unit

Required knowledge includes:

Competency includes sufficient knowledge to:

- application of AS1100.101 in accordance with standard operating procedures
- relationship between the views contained in the drawing
- objects represented in the drawing
- units of measurement used in the preparation of the drawing
- dimensions of the key features of the objects depicted in the drawing
- understanding of the instructions contained in the drawing
- the actions to be undertaken in response to those instructions
- the materials from which the object(s) are made
- any symbols used in the drawing as described in range statement
- hazard and control measures associated with interpreting technical drawings, including housekeeping
- safe work practices and procedures

Topic Program:

Unit hour unit and is divided into the following program.

Topic	Skill Practice Exercise
Topic 1 – Engineering Drawings:	MEM09002-RQ-0101
Topic 2 – Drawing Sheets:	MEM09002-RQ-0201
Topic 3 – Line Styles:	MEM09002-RQ-0301 to MEM09002-RQ-0302
Topic 4 – Dimensions:	MEM09002-RQ-0401
Topic 5 – Orthographic Projection:	MEM09002-RQ-0501 to MEM09002-RQ-0502
Topic 6 – Sections:	MEM09002-RQ-0601 to MEM09002-RQ-0602
Topic 7 – Scales:	MEM09002-RQ-0701 to MEM09002-RQ-0703
Topic 8 – Abbreviations, Symbols & Notes:	MEM09002-RQ-0801 to MEM09002-RQ-0802
Topic 9 – Reading Drawings:	MEM09002-RQ-0901 to MEM09002-RQ-0902
Topic 10 – Manufacturer's Catalogues:	MEM09002-RQ-1001
Practice Competency Test	MEM09002–PT-01

Contents:

Topic 1 – Engineering Drawings:

Required Skills:

On completion of the session, the participants will be able to:

- Name AS 1100 as the drawing standards setting out the basic principles of technical drawing practice.
- Identify the various types of drawings produced by drawing offices.

Required Knowledge:

- AS 1100 Drawing Standards.
- Development procedures for drawings.

1.1 Introduction:

Drawings are legal documents and are often referred to in a court of law therefore all drawings MUST be correct BEFORE being released from the office for production or construction.

A drawing is one method of presenting technical communication. Technical communication is an advanced form of communication whereby people of the same trade (profession) can convey messages to one another more accurately and precisely. To achieve this, a technical language (and jargon), which is well standardized, is needed (e.g. botanical names in Horticology and Latin for medical terminology, etc.).

Drawings have been used since the beginning of history for planning and producing art objects, architectural designs and engineering works. Since the Industrial Revolution a system for creating architectural and engineering drawings has evolved. While the pens, pencils, tools and papers for creating drawings have changed, the basic forms for presenting information have stayed the same. People producing technical drawings need to be familiar with the standard ways of presenting design information.

The ability to read and understand information contained on drawings is essential to perform most engineering-related jobs. Engineering drawings are the industry's means of communicating detailed and accurate information on how to manufacture/fabricate, assemble, troubleshoot, repair, and operate a piece of equipment or a system. To understand how to "read" a drawing it is necessary to be familiar with the standard conventions, rules, and basic symbols used on the various types of drawings. Before learning how to read the actual "drawing," an understanding of the information contained in the various non-drawing areas of a print is also necessary.

Draftspersons will inevitably be required to communicate with different people for different reasons as represented in Figure 1.1. In some situations, communications will be sufficiently taken care of by use of plain text. However in other situations, text alone may not suffice and a more specialized form of communication by a technical engineering drawing may prove irreplaceably useful.

Figure 1.1

1.2 Standards:

"*Standardization is the process of formulating and applying rules for an orderly approach to a specific activity for the benefit and with the cooperation of all concerned, and in particular for the promotion of optimum overall economy taking due account of functional conditions and safety requirements*." (International Organization for Standardization).

ISO or International Standards ensure that products and services are safe, reliable and of good quality. For business, they are strategic tools that reduce costs by minimizing waste and errors and increasing productivity. A standard is a document that provides requirements, specifications, guidelines or characteristics that can be used consistently to ensure that the materials, products, processes and services are fit for their purpose.

In Australia, **AS1100 Australian Drawing Standards** sets out the basic principles of technical drawing practice and covers:

- The use of abbreviations.
- Materials, sizes, and layout of drawing sheets.
- The types and minimum thicknesses of lines to be used.
- The requirements for distinct uniform letters, numerals and symbols.
- Recommended scales and their application.
- Methods of projection and of indicating the various views of an object.
- Methods of sectioning.
- Recommendations for dimensioning including size and geometrical tolerancing.
- Conventions used for the representation of components and repetitive features of components.

Some the major industry disciplines include mechanical, automotive, architectural, civil and aeronautical.

1.3 Development of the Drawing:

Interpreting information from drawings is an important skill. Engineers and architects must be able to look at a set of plans and mentally picture the shapes of objects. Skilled workers must have the same abilities. Reading a drawing involves a highly developed ability to look at lines on the page and convert the shapes from several pictures to form a three-dimensional mental image. A product basically passes through three main stages; The Concept, then the Drawing Production, and finally manufacture; other stages such as estimating, costing and testing are involved but are supplementary to the main design and production.


Concept Stage


Design/Detail Stage


Manufacture Stage

During the Design/Detail stage, the components and assemblies are constantly being modified and redrawn or edited and passed between designer, detailer and engineer. The drawings once completed and passed, are forwarded to the workshops for manufacture by the trades and production workers.

1.4 Types of Drawings:

Drawing is one of the basic forms of visual communication and is used to record objects and actions of everyday life in an easily recognizable manner. There are two major types of drawings: artistic drawings and technical drawings.

Artistic drawings are a form of freehand representation that makes use of pictures to provide a general impression of the object being drawn. There are no hard rules or standards in the preparation of artistic drawings.

Artistic drawings are simply drawn by artists, based more or less on one's talent and skills. Although these drawings are often very attractive, they find very limited use in engineering disciplines.

Technical Drawings are detailed drawings drawn accurately and precisely; they are views of objects that have been prepared with the aid of computer programs or technical drawing/drafting instruments in order to record and transmit technical information. The drawings provide an exact and complete description of things that are to be built or manufactured.

- Technical drawings do not portray the objects the way they directly appear to the eye.
- They make use of many specialized symbols and conventions in order to transmit technical information clearly and exactly.
- To understand and correctly interpret technical drawings, one needs to acquaint oneself with the fundamentals of technical drawing; hence the purpose of this unit of competency.

The presentation of engineering or technical drawings is accomplished through several varying types of drawings including Freehand Sketches, Detail Drawings, Assembly Drawings, Pictorial, Schematic Diagrams and Circuit Diagrams.

1.5 Freehand Sketch:

Sketching is the creation of graphic images that are graphical representations or models of objects drawn in proportion but to no particular scale. Freehand sketching is manual sketching with the minimum of tools such as paper and pencil. Technical sketching is the art of creating a technical drawing using freehand without special instruments. Technical sketching requires correct shape or form and more so correct size indication. Generally, drawing tools refer to the materials used as aids when creating drawings and they vary from simple to complex instruments and equipment. However, modern drawing needs have changed dramatically due to the availability of computers. Traditional design and drafting has largely given way to computer design drafting but design sketches will always be needed.

Sketches are helpful in capturing design ideas and trying out different solutions in a fast and inexpensive way; sketches are also useful for recording details of a job "on-site" which will be drawn correctly at a later date in the Drawing Office. Technical sketching is used as aid in conceptualization, spatial visualization and translating imagination into visual models. It could also be used as a means to amplify, clarify and record verbal explanations. Freehand sketching is an economic and effective means of formulating alternate solutions to a given problem so that a choice can be made on the best solution. Preliminary design studies are usually done with freehand sketches because accurate and detailed drawing of design options is expensive and time wasting at the initial stages of a project.

Artistic ability is an asset but anyone can learn to sketch by following basic techniques. Draftspersons and Engineers frequently use special sketching grids which help keep lines straight and in proportion.

Words and notes on sketches must be readable and placed using uppercase characters to assure clarity. Cursive or script writing is never used as it is often unreadable after sketches and memos are duplicated, emailed or faxed to another location. Vertical capital block form letters are preferred.

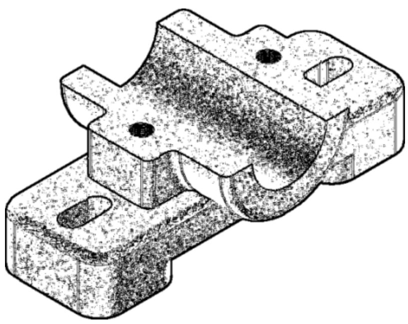


Figure 1.2

Figure 1.2 shows a freehand sketch of a Plumber Block Base; the sketch would normally include dimensions and notations but not the shading.

1.6 Detail Drawing:

A detail drawing is a print that shows a single component or part. It includes a complete and exact description of the part's shape and dimensions, and how it is made. A complete detail drawing will show in a direct and simple manner the shape, exact size, type of material, finish for each part, tolerance, necessary shop operations, number of parts required, and special notes for the manufacture or treatment after manufacture. A detail drawing is not the same as a detail view. A detail view shows part of a drawing in the same plane and in the same arrangement, but in greater detail to a larger scale than in the principal view.

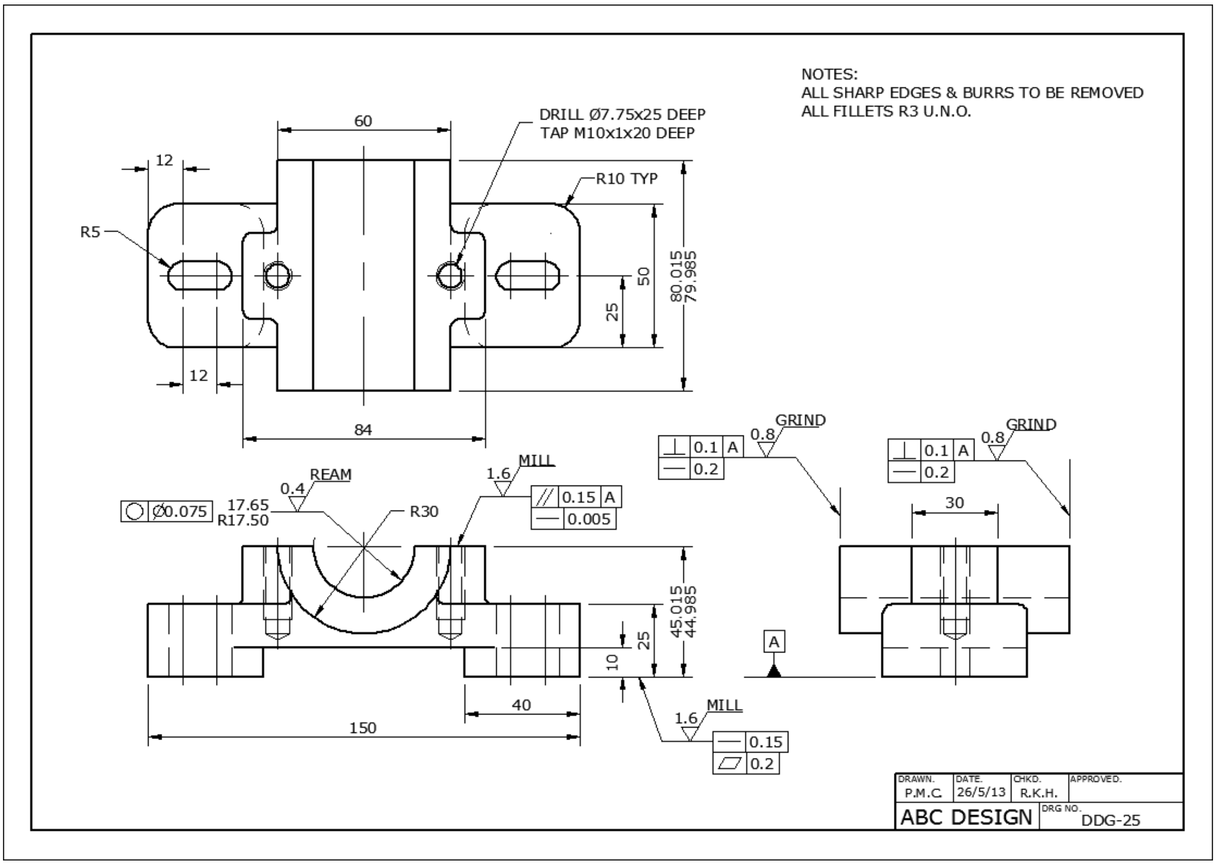


Figure 1.3

Figure 1.3 shows a detail drawing of the Plumber Block Base sketched in Figure 1.2. Three views have been provided to describe the shape while all dimensions, surface finish, general and geometric tolerances, and notations have been included on a completed drawing sheet.

1.7 Assembly Drawing:

An assembly working-drawing indicates how the individual parts of a machine or mechanism are assembled to make a complete unit. An assembly drawing serves the following purposes:

- Describes the shape of the assembled unit.
- Indicates how the parts of the assembled unit are positioned in relation to each other.
- Identifies each component that forms part of the assembled unit.
- Provides a parts list that describes and lists essential data concerning each part of the assembled unit.

- Provides, when necessary, reference information concerning the physical or functional characteristics of the assembled unit.

Assembly drawings may show one, two or three views to describe the assembled components; they must contain a Parts List (may also be called Material or Cutting List depending on the engineering discipline), cross-referencing (in balloons or circles), and General Notes pertaining to the assembly. The drawings normally show the over dimensions and centre-to-centre distances for specific assemblies.

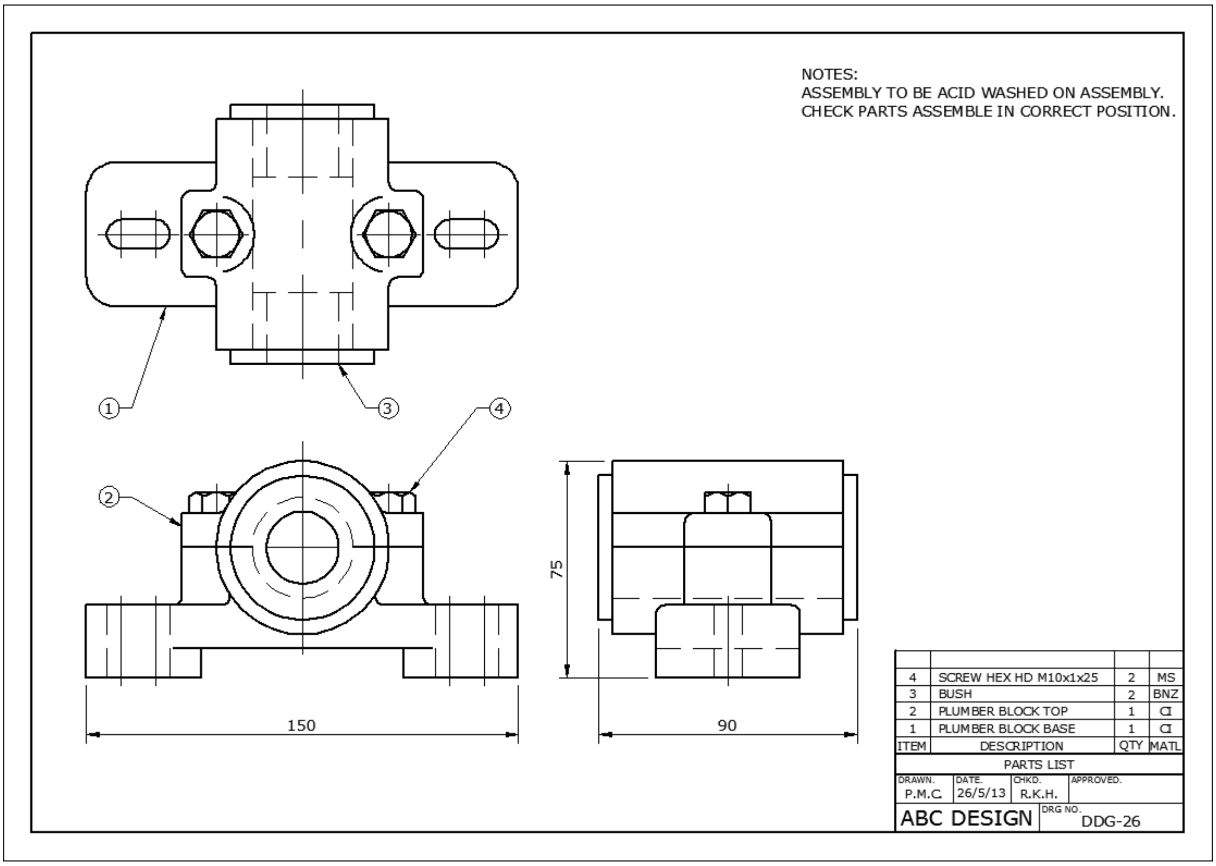


Figure 1.4

Figure 1.4 shows a completed assembly drawing with the Plumber Block Base, Plumber Block Top and Bushes drawn in place and secured with the Hexagonal Head Screws.

Most designs are commenced with an assembly drawing and when the concept of the design is finalised, the separate components can be broken out and detailed accordingly.

1.8 Pictorial:

Pictorial drawings are wrongly referred to as 3-D drawings. Pictorial drawings represent the shape of an object to show the three principal dimensions (length, width and height); it depicts the way people are used to viewing the object in everyday life but is drawn in 2-D. Characteristics of pictorial drawings are:

- The shapes are easier to visualise and intersections of surfaces can be seen.
- Used for advertising, technical and repair manuals, and for general information.
- Pictorials can distort the lengths of lines and angles at corners; due the distortion factor, pictorial drawings are rarely used for production drawings.
- Pictorial drawings are 2-D drawings where the length along the Z-axis is 0 (zero).

The majority of pictorial drawings are produced as Isometric, Oblique, Axonometric or Perspective drawings.

1.8.1 Isometric:

Isometric drawings show three sides in dimensional proportion, but none are shown as a true shape with 90° corners. All the vertical lines are drawn vertically but all horizontal lines are drawn at 30° to the base line. All entities are drawn to scale. Circles and arcs are drawn as ellipses. Isometric is an easy method for presenting 3-D shapes.

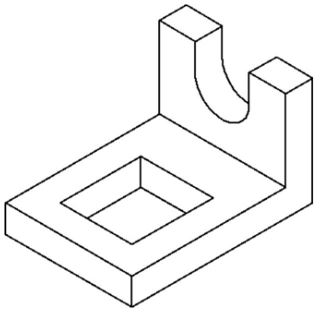


Figure 1.5

1.8.2 Oblique:

Oblique drawings are also designed to show a three dimensional view of an object. The widths of the object are drawn as horizontal lines, but the depth is drawn back at a 45° angle. Three types of oblique drawings can be used to depict the object, normal, cavalier and cabinet obliques.

- Cavalier drawings display the depth using the full measurement.
- Normal drawings display the depth using ¾ of the measurement.
- Cabinet drawings display the depth using ½ of the measurement.

Circles are easier to draw in oblique as the circles can be drawn using a compass.

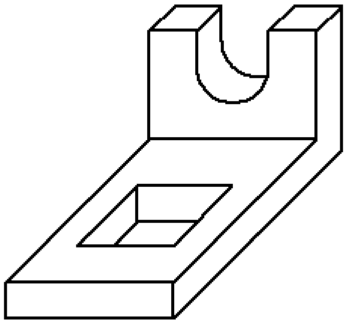


Figure 1.6 - Cavalier

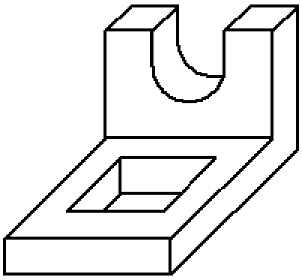


Figure 1.7 - Normal

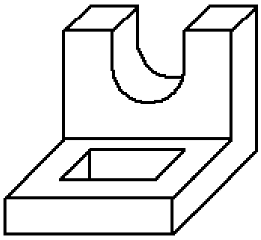


Figure 1.8 - Cabinet

Of the three images above only Figure 1.7 - Normal appears similar to the real-life object when viewed in oblique, Figure 1.6 - Cavalier appears too elongated while Figure 1.8 - Cabinet is too short or stubby.

1.8.3 Axonometric:

In Axonometric drawings, the object's vertical lines are drawn vertically, while the horizontal lines in the width and depth planes are shown at 30°-60° to the horizontal; in other words the Plan or Top View is rotated through 30° or 60°.

Many kitchen manufacturers utilise axonometric in conveying the proposed arrangement of a new kitchen to a client.

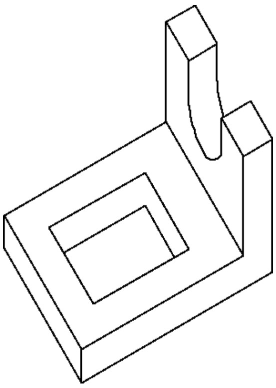


Figure 1.9

1.8.4 Perspective:

Perspective excels over all other types of projection in the pictorial representation of objects because it more closely approximates the view obtained by the human eye. Geometrically, a photograph is in perspective because the camera captures the same data an eye sees. Perspective is an important tool to designers, architects and engineers however is seldom used apart from architectural applications.

The elements required to produce perspective drawings can become quite daunting; these elements include Picture Planes, Station Points, Left & Right Vanishing Points and Horizon Plane.

Three types of perspective drawings are available, One-point, Two-point and Three point Perspective.

1.8.4.1 One-Point Perspective:

In one-point perspective, the object is placed so that two sets of its principal edges are parallel to the Picture Plane, and the third set is perpendicular to the Picture Plane. The third set of parallel lines will converge toward a single vanishing point in perspective.

1.8.4.2 Two-Point Perspective:

In two-point perspective, the object is placed so that one set of parallel edges is vertical and has no vanishing point, while the other two sets each have vanishing points. Two-point perspective is the most common type used and is especially suitable for displaying houses and large engineering structures.

1.8.4.3 Three-Point Perspective:

In three-point perspective, the object is placed so that none of its principal edges are parallel to the Picture Plane, therefore, each of the three sets of parallel edges will have a separate Vanishing Point. The Picture Plane is assumed approximately perpendicular to the centreline of the cone of rays.

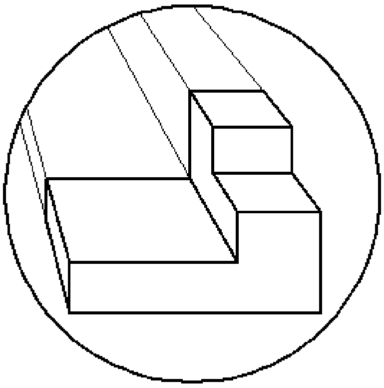


Figure 1.10 One-Point

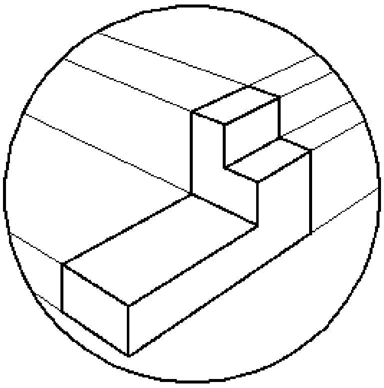


Figure 1.11 Two-Point

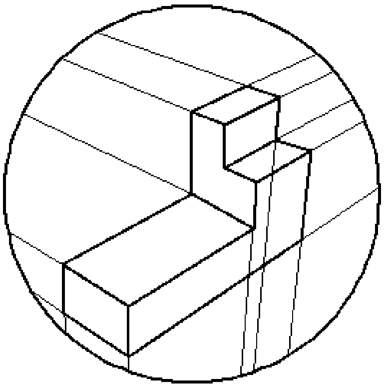


Figure 1.12 Three-Point

1.9 Schematic Diagram:

A schematic diagram represents the elements of a system using graphical symbols rather than realistic and detailed drawings. A schematic usually omits all details that are not relevant to the information the schematic is intended to convey, and may add unrealistic elements that aid comprehension. For example, a suburban bus map intended for passengers may represent a bus stop with a dot; the dot doesn't resemble the actual station at all but gives the viewer information without unnecessary visual clutter. A schematic diagram of a chemical process uses symbols to represent the vessels, piping, valves, pumps, and other equipment of the system, emphasizing their interconnection paths and suppressing physical details. In an electronic circuit diagram, the layout of the symbols may not resemble the layout in the physical circuit. In the schematic diagram, the symbolic elements are arranged to be more easily interpreted by the viewer.

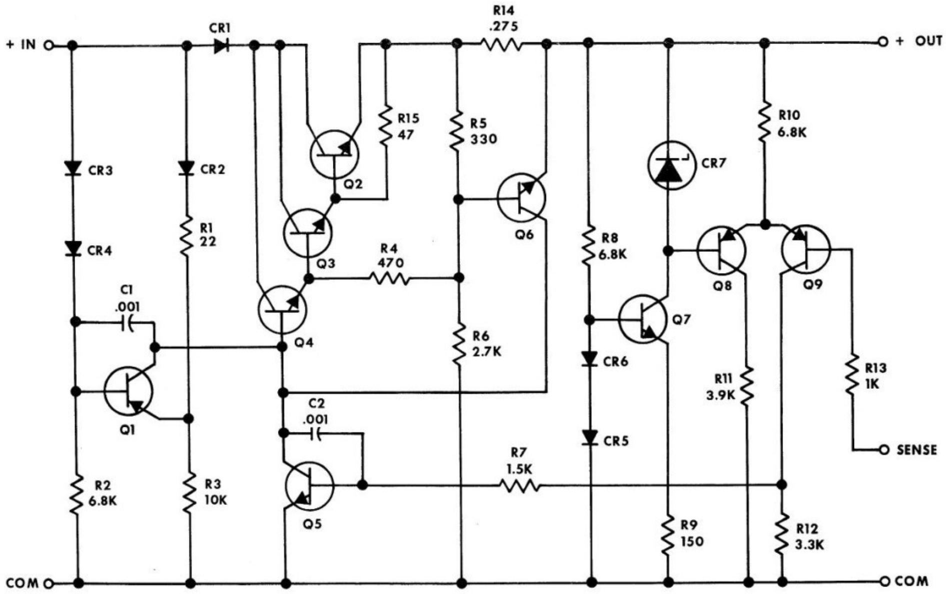
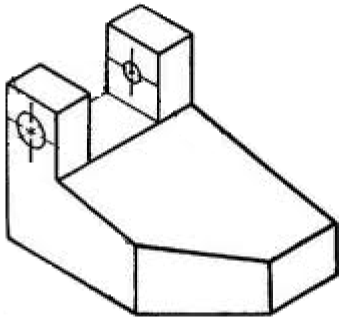

+ IN
CR1
R14
.275
+ OUT
CR3
CR2
R15
47
R5
330
R10
6.8K
CR7
Q2
Q6
CR4
R1
22
Q3
R4
470
R8
6.8K
Q8
Q9
C1
.001
Q4
Q7
R6
2.7K
CR6
R13
1K
Q1
C2
.001
R11
3.9K
CR5
SENSE
R7
1.5K
R2
6.8K
R3
10K
Q5
R9
150
R12
3.3K
COM
COM

Figure 1.13

Skill Practice Exercises:

Skill Practice Exercise MEM09002-RQ-0101:
Identify the following drawing types:



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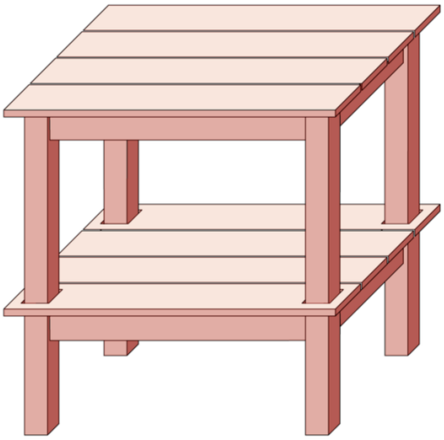
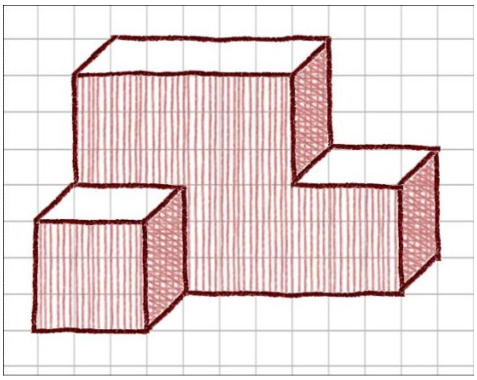


B.

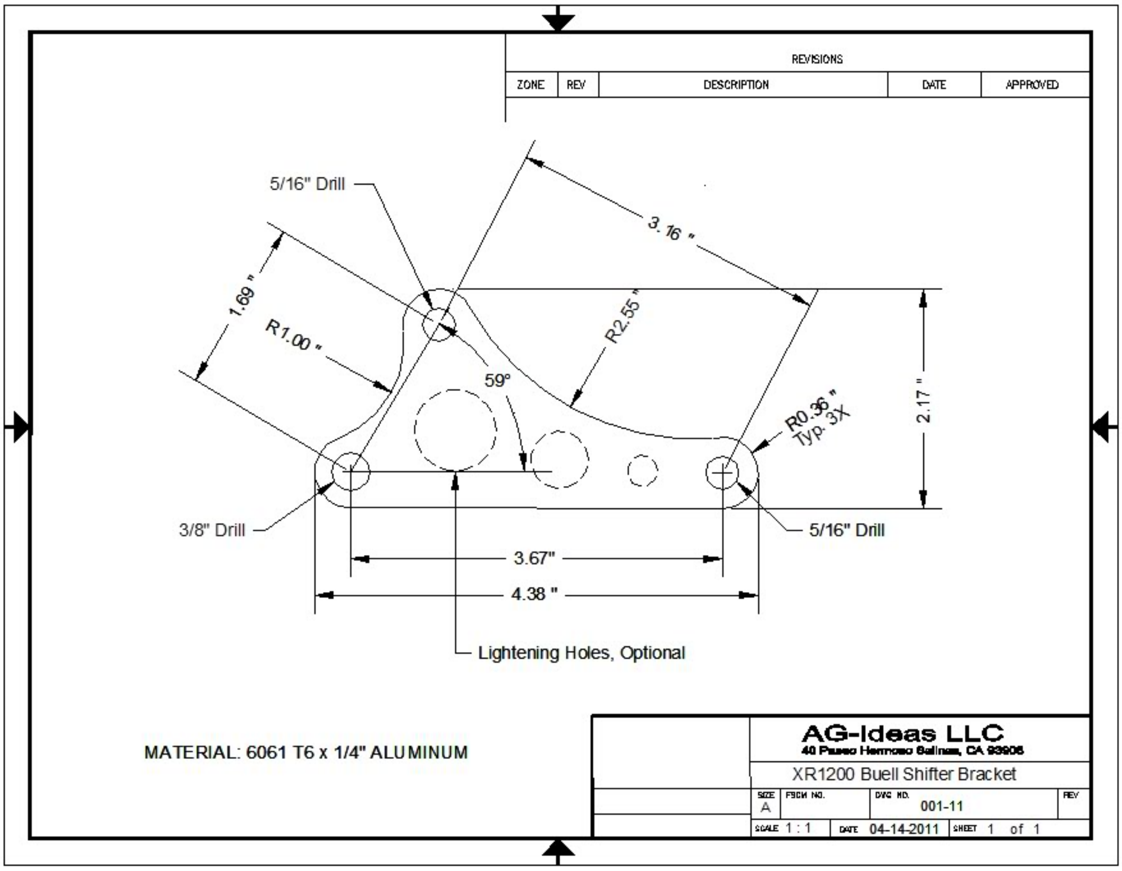
C.

D.

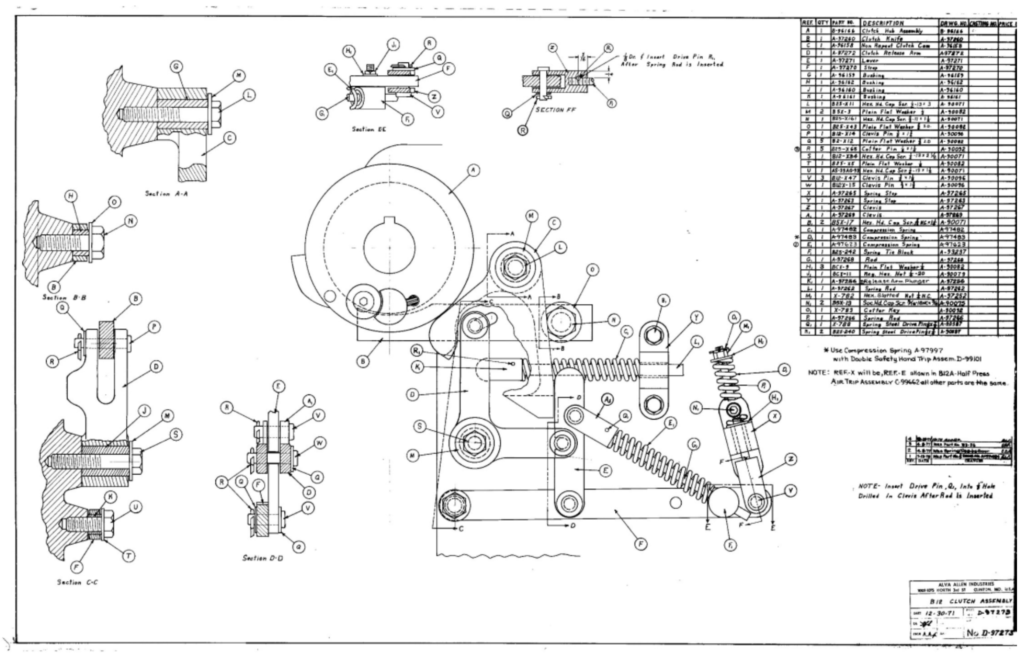


E.

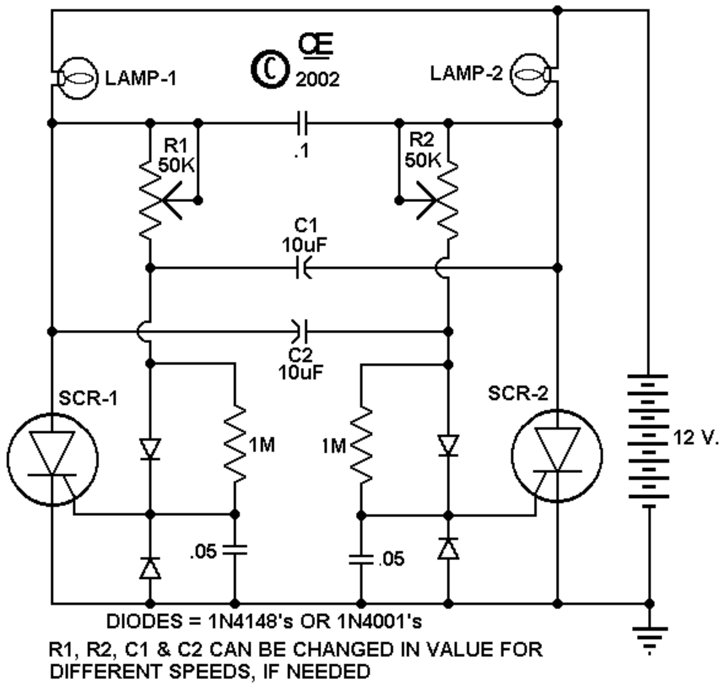
F.


REVISIONS
ZONE
REV
DESCRIPTION
DATE
APPROVED
5/16" Drill
3.16 "
1.69 "
R1.00 "
R2.55 "
59°
2.17 "
R0.36 "
Typ. 3X
3/8" Drill
5/16" Drill
3.67"
4.38 "
Lightening Holes, Optional
MATERIAL: 6061 T6 x 1/4" ALUMINUM
AG-Ideas LLC
40 Paseo Hermoso Salinas, CA 93906
XR1200 Buell Shifter Bracket
SIZE A
FSCM NO.
DWG NO. 001-11
REV
SCALE 1 : 1
DATE 04-14-2011
SHEET 1 of 1

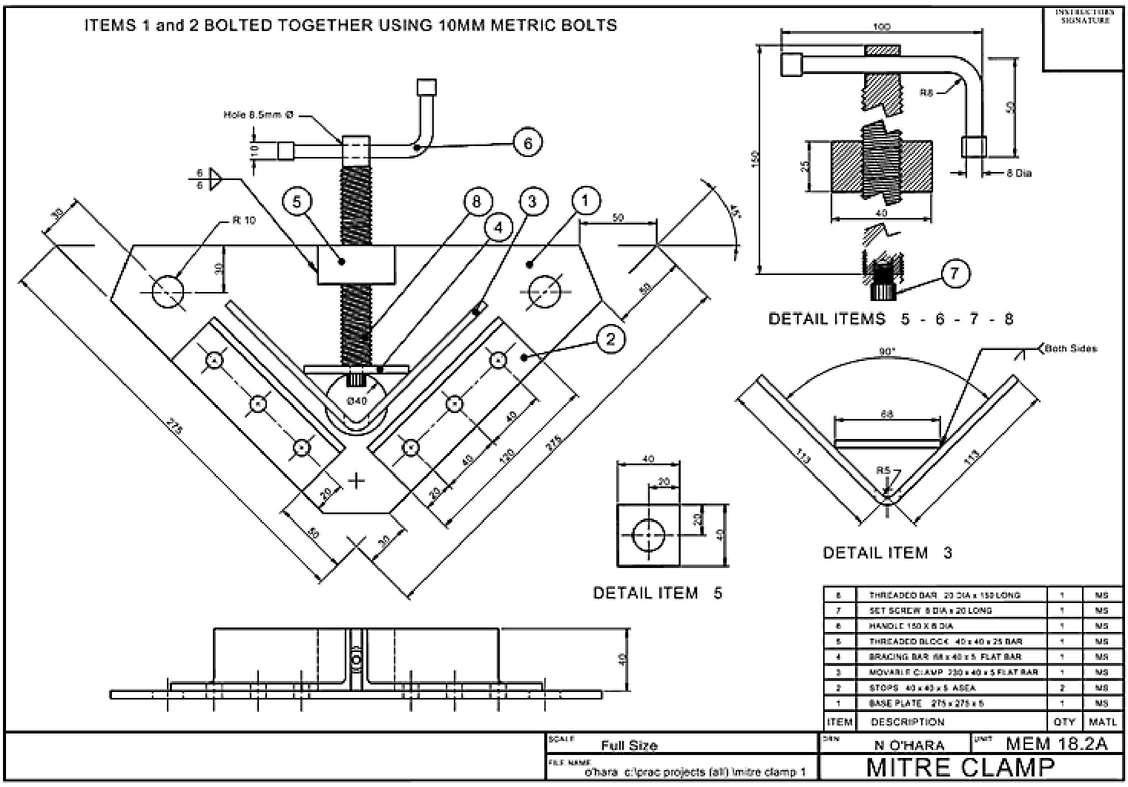
G. ______________________________


Section A-A
Section B-B
Section C-C
Section D-D
Section EE
SECTION FF
B12 CLUTCH ASSEMBLY

H. ______________________________

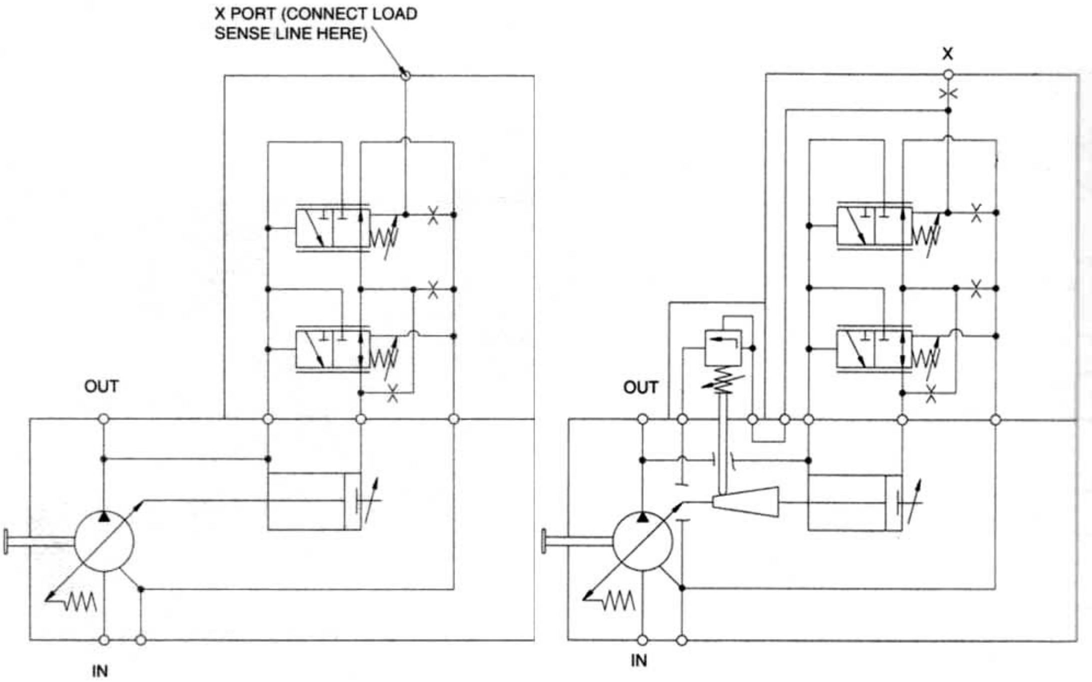

LAMP-1
2002
LAMP-2
R1
50K
.1
R2
50K
C1
10uF
C2
10uF
SCR-1
SCR-2
1M
1M
12 V.
.05
.05
DIODES = 1N4148's OR 1N4001's
R1, R2, C1 & C2 CAN BE CHANGED IN VALUE FOR
DIFFERENT SPEEDS, IF NEEDED

J. ______________________________

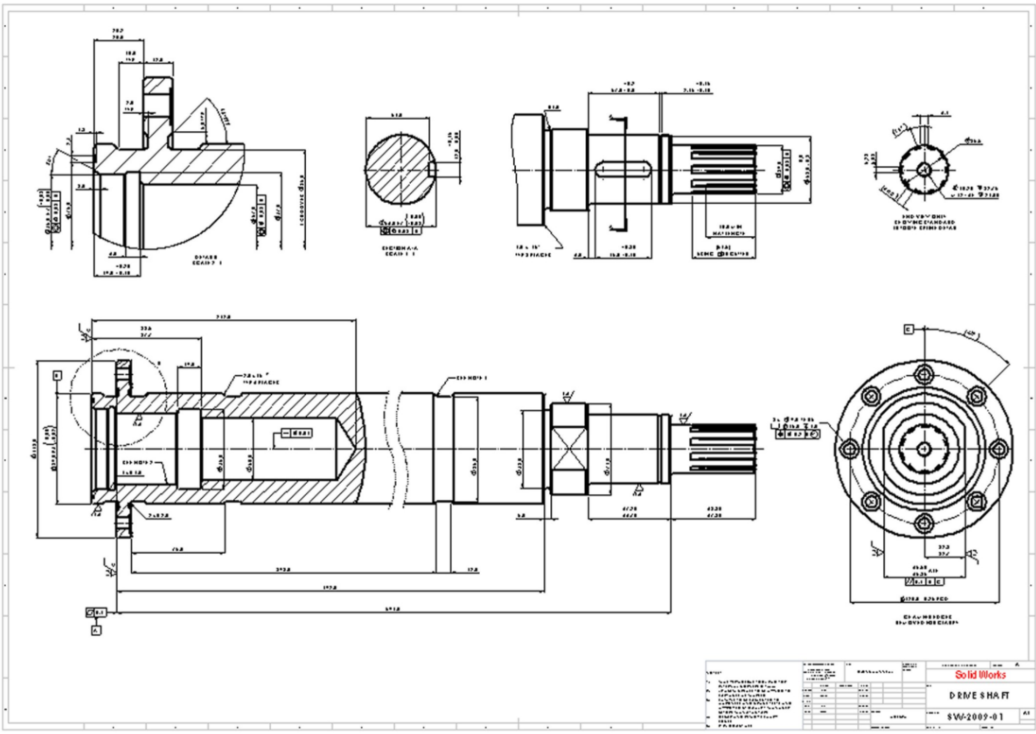

ITEMS 1 and 2 BOLTED TOGETHER USING 10MM METRIC BOLTS
INSTRUCTORS SIGNATURE
DETAIL ITEMS 5 - 6 - 7 - 8
DETAIL ITEM 5
DETAIL ITEM 3
8 THREADED BAR 20 DIA x 150 LONG 1 MS
7 SET SCREW 8 DIA x 20 LONG 1 MS
6 HANDLE 150 X 8 DIA 1 MS
5 THREADED BLOCK 40 x 40 x 25 BAR 1 MS
4 BRACING BAR 68 x 40 x 5 FLAT BAR 1 MS
3 MOVABLE CLAMP 230 x 40 x 5 FLAT BAR 1 MS
2 STOPS 40 x 40 x 5 ASEA 2 MS
1 BASE PLATE 275 x 275 x 5 1 MS
ITEM DESCRIPTION QTY MATL
Full Size
N O'HARA
MEM 18.2A
o'hara c:\prac projects (all) \mitre clamp 1
MITRE CLAMP

K. ______________________________

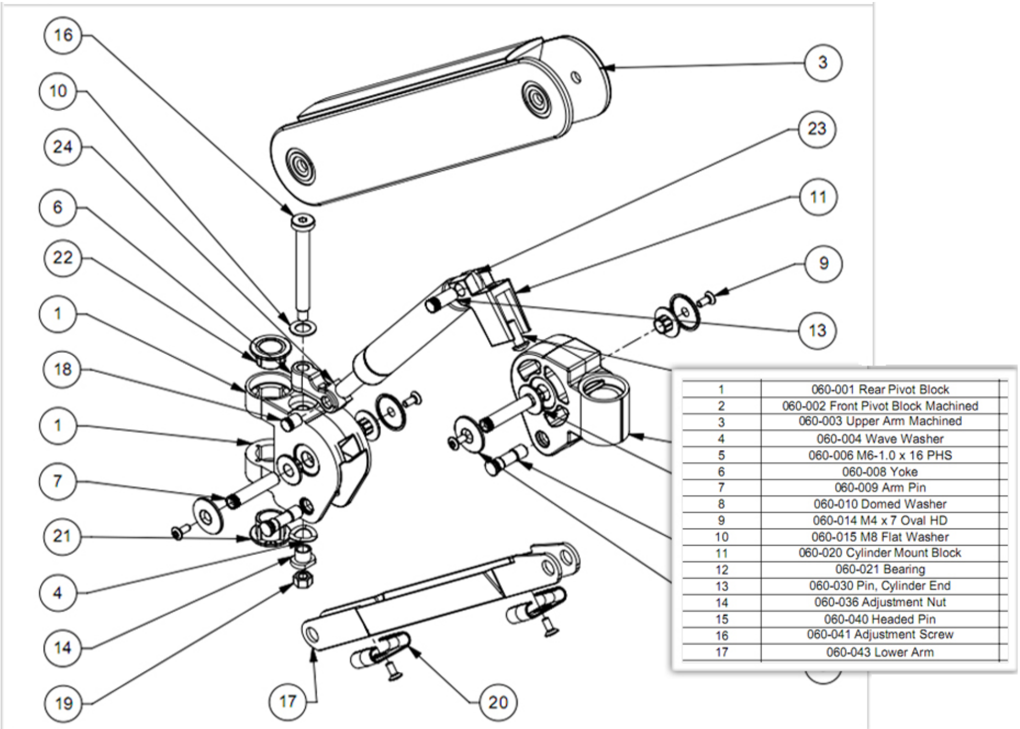
L. ______________________________________



M. ______________________________________


Solid Works
DRIVE SHAFT
SW-2009-01

N. ____

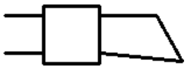

16
10
24
6
22
1
18
1
7
21
4
14
19
17
20
3
23
11
9
13
1 060-001 Rear Pivot Block
2 060-002 Front Pivot Block Machined
3 060-003 Upper Arm Machined
4 060-004 Wave Washer
5 060-006 M6-1.0 x 16 PHS
6 060-008 Yoke
7 060-009 Arm Pin
8 060-010 Domed Washer
9 060-014 M4 x 7 Oval HD
10 060-015 M8 Flat Washer
11 060-020 Cylinder Mount Block
12 060-021 Bearing
13 060-030 Pin, Cylinder End
14 060-036 Adjustment Nut
15 060-040 Headed Pin
16 060-041 Adjustment Screw
17 060-043 Lower Arm

O. ____

Name: ____

require sectioning. Although the parts may appear inside an assembled view, the parts

Miscellaneous Apparatus and Appliances:

Thermal Fire Alarm Detector Head		Motor	
Generator		Ceiling Fan	
Rectifying Unit DC Power Supply		Electric Bell	
Electric Buzzer		Siren	
Horn		Clock	

Cable Codes:

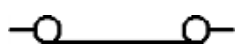
Electric Power	E	Telephony	F
Data Circuit	T	Video Circuit	V
Audio Circuit	S	Lighting	L
Street Lighting	SL		

Appendix 8 – Electronic Symbols:

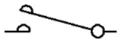
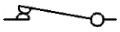
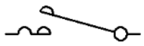
Indicating Instruments:

Ammeter		Voltmeter	
Frequency Meter			

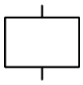
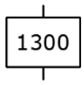
Contacts for Switches & Relays:

Make Contact		Break Contact	

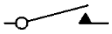
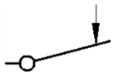
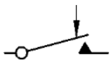
Switchgear:

Circuit Breaker		Make Contactor	
Break Contactor		Contactor with Coil Type Blow-Out Device	

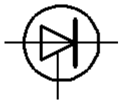
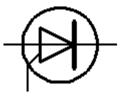
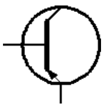
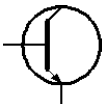
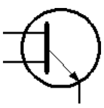
Coils for Telephone Type Relays:

General Symbol – Relay Coil		Relay Coil with 1300 ohm Winding	

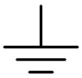
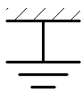
Contact Units for Telephone:

Make Contact Unit		Break Contact Unit	
Changeover Contact Unit (break before make)		Changeover Contact Unit (make before break)	

Diode Devices:

General Symbol – Preferred		General Symbol – Alternate	
Tunnel Diode		Thyristor	
Reverse Blocking Triode Thyristor – 'n' gate, Anode controlled		Reverse Blocking Triode Thyristor – 'p' gate, Cathode controlled	
pnp Transistor (also pnip transistor if omission of the intrinsic region will not result in ambiguity)		npn Transistor with collector connected to envelope	
Unijunction Transistor with 'p' type base			

Earth and Frame Connections:

General Symbol – Earth or Ground		Protective Earth	
Noiseless or Clean Earth Connection		Earth Connection	

Miscellaneous:

Direct Current or Steady Current – Preferred		Direct Current or Steady Current – Alternative	
Alternating Current		Conductor or Group of Condensors	
Positive Polarity	+	Negative Polarity	–
Flexible Conductor		Unconnected Cable or Conductor	
Unconnected Cable or Conductor Especially Insulated		Jumper	
Two Conductors	or	Three Conductors	or
'n' Conductors	n	Envelope (Tank)	
Boundary Line		Permanent Magnet	
Fault		Indicator	
Hot Cathode – Preferred		Hot Cathode – Alternate	
Photoelectric Cathode		Anode (Plate) or Collector	
Brush on Slip-Ring		Brush on Communicator	

Skill Practice Exercises:

Skill Practice Exercise MEM09002-RQ-0901

Refer to drawing STPL-12H-36 and answer the following questions:

1. What grid zone is the Detail of the Oil Grove located?

   ____

2. What dimension and grid zone is the dimension drawn “Not to Scale”?

   ____

3. What type of section is shown in the right side view?

   ____

4. What are the overall dimensions of the Body?

   ____

5. How many surfaces are to be machined?

   ____