Dimensioning Systems and Practices

Unit: Orthographic and Multi-View Projection

Problem Area: Representations of Orthographic and Multi-View Projections

Lesson: Dimensioning Systems and Practices

Student Learning Objectives.

Instruction in this lesson should result in students achieving the following objectives:

1. **Identify and describe dimensioning systems.**
2. **Describe correct dimensioning techniques.**

List of Resources.

The following resources may be useful in teaching this lesson:

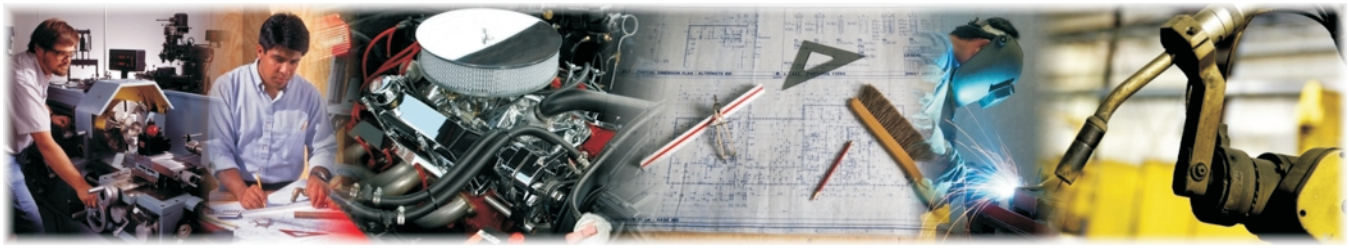
American Society of Mechanical Engineers. Home page. Accessed Jan. 29, 2008. <http://www.asme.org>.

Dimensioning and Tolerancing. American Society of Mechanical Engineers, 1994.

Giesecke, Frederick E., et al. *Technical Drawing*, 12th ed. Pearson Prentice Hall, 2003.

I.D.E.A. Curriculum. Illinois Drafting Educators Association. Accessed Jan. 29, 2008. <http://www.idea-online.org/curriculum.html>.

Madsen, David A., David P. Madsen, and J. Lee Turpin. *Engineering Drawing & Design*, 4th ed. Thomson Delmar Learning, 2007.



List of Equipment, Tools, Supplies, and Facilities

- ✓ Overhead or PowerPoint projector
- ✓ Visual(s) from accompanying master(s)
- ✓ Copies of sample test, lab sheet(s), and/or other items designed for duplication
- ✓ Materials listed on duplicated items
- ✓ Computers with printers and Internet access
- ✓ Classroom resource and reference materials

Terms.

The following terms are presented in this lesson (shown in bold italics):

- aligned dimensioning
- arrowless dimensioning
- chamfer
- chart drawing
- controlled radius
- ordinate dimensioning
- tabular dimensioning
- taper
- unidirectional dimensioning

Interest Approach.

Use an interest approach that will prepare the students for the lesson. Teachers often develop approaches for their unique class and student situation. A possible approach is included here.

> *As with everything else, there are right and wrong ways to dimension a drawing. Dimensions that are placed incorrectly on a drawing are just as wrong as if the numbers making up the dimension text were wrong. Have students make a list of dimensioning do's and don'ts. Present this list on the writing surface.*

SUMMARY OF CONTENT AND TEACHING STRATEGIES

Objective 1: Identify and describe dimensioning systems.

Anticipated Problem: What are the different types of dimensioning systems?

I. There are five dimensioning systems: aligned, arrowless, chart drawings, tabular, and unidirectional.

A. Aligned dimensioning

1. ***Aligned dimensioning*** requires that all dimension text (i.e., numerals, figures, and notes) be aligned with the dimension lines. This allows the text to be read from the bottom for horizontal dimensions and from the right side for vertical dimensions.
2. Aligned dimensioning is typically used in architectural and structural drafting.

B. Arrowless dimensioning

1. ***Arrowless dimensioning*** (also known as ***ordinate dimensioning***) is a system in which features are identified with letters and keyed to a table. Location dimensions are established with extension lines as coordinates from determined datums.
2. Arrowless dimensioning is often referred to as dimensioning without dimension lines.

C. Chart drawings

1. A ***chart drawing*** is used when a particular part has one or more dimensions that change depending on the specific application.
2. The dimension that changes is usually labeled on a drawing with a letter in the place of the dimension. The letter can then be found on a chart where the changing values are identified.
3. Chart drawings are often used in vendor or specification catalogs for alternate part identification.

D. Tabular dimensioning

1. ***Tabular dimensioning*** is a system in which location and size dimensions from datums or coordinates (i.e., x, y, z axes) are found in a table identifying features on a drawing.
2. Tabular dimensioning and arrowless dimensioning are similar in that both methods involve letters that identify features and corresponding tables.

E. Unidirectional dimensioning

1. ***Unidirectional dimensioning*** requires that all dimension text be lettered horizontally and read from the bottom.
2. Unidirectional dimensioning is typically used in mechanical drafting.

Many techniques can be used to help students master this objective. Refer to Figures 11.8, 11.9, 11.11, 11.12, and 11.13 in Engineering Drawing & Design, 4th ed., to illustrate the different methods of dimensioning. Use VM–A as a visual aid during a class discussion of this topic.

Objective 2: Describe correct dimensioning techniques.

Anticipated Problem: What are the correct techniques to use when dimensioning?

II. Special dimensioning techniques are used for angles, arcs, chamfers, conical shapes, and hexagons.

A. Angles

1. Angular surfaces may be dimensioned as angles in degrees, as coordinates, or as a flat ***taper*** (the slope of a plane surface).
2. Angles are calibrated in degrees (°). There are 360 degrees in a circle.
   a. Each degree consists of 60 minutes (').
   b. Each minute contains 60 seconds (").
   c. 1° = 60' and 1' = 60"

B. Arcs

1. Arcs should be dimensioned with leaders and radius dimensions in the views in which they are shown as arcs.
   a. The leader may extend from the center to the arc or point to the arc.
   b. The letter R should precede all radius dimensions.
2. Arcs may be dimensioned with or without their centers located, depending on the situation.
3. When an arc lies on an inclined plane and the true representation is not shown, the note "True R" should be used to indicate the actual radius. However, it would be better to dimension the arc in an auxiliary view of the inclined surface.
4. The letters CR should be used to indicate controlled radius.
   a. ***Controlled radius*** means the limits of the radius tolerance zone are tangent to the adjacent surfaces and there are no reversals in the contour.
   b. The CR control is more restrictive than the R radius symbol; the latter allows for reversals in the contour of the radius.
5. The letters SR should precede the numerical value to indicate a spherical radius.

C. Chamfers

1. A ***chamfer*** is a beveled or sloping edge used to relieve a sharp corner.
2. Chamfers measuring 45 degrees should be dimensioned with a note because both sides of a 45-degree angle are equal.
3. Other chamfers require an angle dimension and a size dimension or two size dimensions.

D. Conical shapes—Whenever possible, conical shapes should be dimensioned in the view in which the cone appears as a triangle.

E. Hexagons

1. Hexagons and other polygons should be dimensioned across the flats in the views in which the true shape is shown.
2. A length dimension should be provided in the adjacent view.

Many techniques can be used to help students master this objective. Refer to Figures 11.28 through 11.37 in Engineering Drawing & Design, 4th ed., to illustrate the proper dimensioning of angles, chamfers, conical shapes, hexagons, and arcs. Use VM–B as a visual aid during a class discussion of dimensioning do's and don'ts. Assign LS–A.

Review/Summary.

Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Questions at the ends of chapters in the textbook may also be used in the review/summary.

Application.

Use the included visual masters and lab sheet to apply the information presented in the lesson.

Evaluation.

Evaluation should focus on student achievement of the objectives for the lesson. Various techniques can be used, such as student performance on the application activities. A sample written test is provided.

Answers to Sample Test:

Part One: Matching

1. g
2. d
3. c
4. b
5. f
6. e
7. a

8. h

Part Two: True or False

1. T
2. F
3. F
4. F
5. T
6. F

Part Three: Short Answer

1. The R radius symbol allows for reversals in the contour of the radius.
2. ordinate dimensioning

Sample Test

Name _____

Dimensioning Systems and Practices

Part One: Matching

Instructions: **Match the term with the correct definition.**

a. taper
b. chamfer
c. aligned dimensioning
d. tabular dimensioning
e. unilateral dimensioning
f. chart drawing
g. controlled radius
h. arrowless dimensioning

_____1. The limits of the radius tolerance zone are tangent to the adjacent surfaces and there are no reversals in the contour

_____2. A system in which location and size dimensions from datums or coordinates are found in a table identifying features on a drawing

_____3. Requires that all dimension text be aligned with the dimension lines

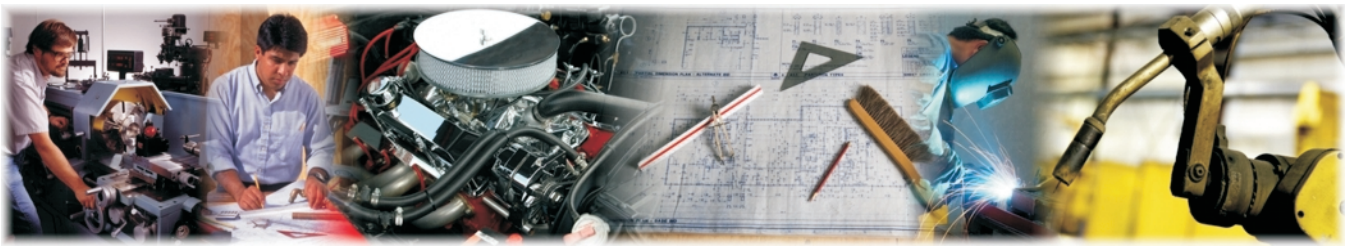
_____4. A beveled or sloping edge used to relieve a sharp corner

_____5. Used when a particular part has one or more dimensions that change depending on the specific application

_____6. Requires that all dimension text be lettered horizontally and read from the bottom

_____7. The slope of a plane surface

_____8. A system in which features are identified with letters and keyed to a table



Part Two: True or False

Instructions: **Write T for true or F for false.**

_____1. Conical shapes should be dimensioned in the view in which the cone appears as a triangle.

_____2. Aligned dimensioning is typically used in mechanical drafting.

_____3. The abbreviation SR stands for “surface radius.”

_____4. There are 180 degrees in a circle.

_____5. Unidirectional dimensioning is typically used in mechanical drafting.

_____6. 1° = 1'

Part Three: Short Answer

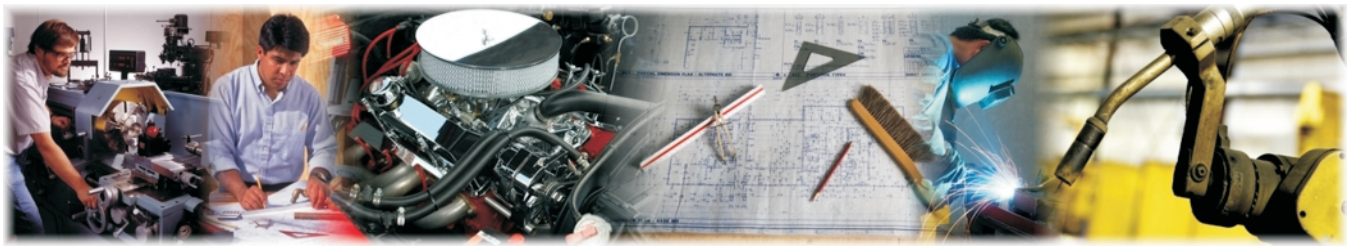
Instructions: **Complete the following.**

1. Why is the R radius symbol less restrictive than the CR (controlled radius) control?

2. What is another name for arrowless dimensioning?

DIMENSIONING SYSTEMS

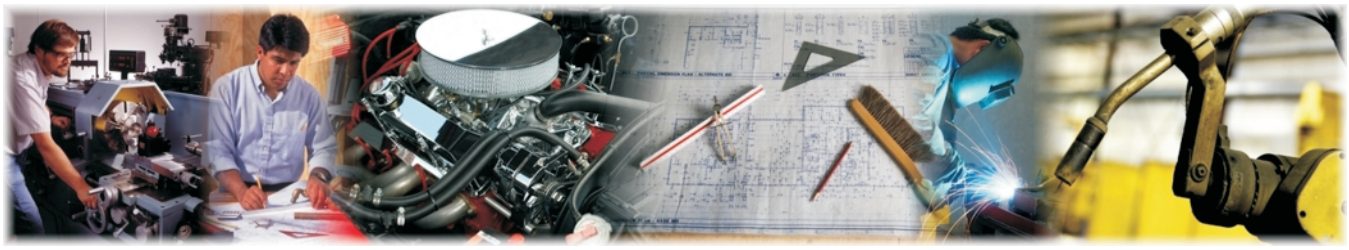
- Aligned dimensioning
- Arrowless dimensioning (also known as ordinate dimensioning)
- Chart drawings
- Tabular dimensioning
- Unidirectional dimensioning



DIMENSIONING DOS AND DON'TS

- Avoid crossing extension lines, but do not break them when they do cross.
- Never cross extension lines over dimension lines, or break the extension line over the dimension line when there is absolutely no other solution.
- Break extension lines when they cross over or near an arrowhead.
- Avoid dimensioning over or through the object.
- Avoid dimensioning to hidden features.
- Avoid unnecessary long extension lines.
- Avoid using any line of the object as an extension line.
- Dimension between views when possible.
- Group adjacent dimensions.
- Dimension to views that provide the best shape description.

(From: Engineering Drawing & Design, 4th ed., p. 309)



LS–A

Name _____

Dimensioning an Angle

Purpose

The purpose of this activity is to dimension an angle using each of the three methods for dimensioning angles.

Objectives

1. Dimension an angle using the angular method.
2. Dimension an angle using the coordinate method.
3. Dimension an angle using the flat taper method.

Materials

- drawing paper
- drafting instruments
- lab sheet
- writing utensil

Procedure

1. Angular surfaces may be dimensioned as angles in degrees, as coordinates, or as a flat taper.
2. Draw an object with an angular surface.
3. Dimension the angular surface using each of the following:
   a. Angular method
   b. Coordinate method
   c. Flat taper method