

Fourth Edition

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# Modern Graphics Communication

# MODERN GRAPHICS COMMUNICATION

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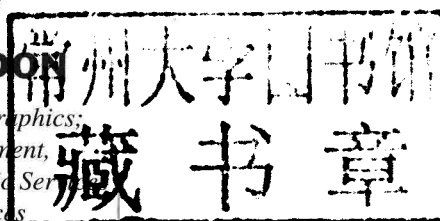
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# 4TH EDITION MODERN GRAPHICS COMMUNICATION

## — ABOUT THIS BOOK —

We have designed *Modern Graphics Communication* to present succinctly the practices and techniques of sketching, visualization, design, and CAD that are important to today's graphics curriculum. Based on the long-standing authoritative text on the subject, Giesecke's *Technical Drawing*, this text preserves many of the time-tested graphics techniques that remain fundamental to the class, and are so clearly explained in Giesecke's original volume. **Modern Graphics Communication** provides a shorter presentation that covers current course trends and pedagogy appropriate for the modern student.

The topics of sketching and visualization skills are this book's primary focus and provide a solid conceptual basis for the CAD instruction most graphics students receive. The new format uses on-the-page activities to help students visualize and retain key concepts, unifying art and text into powerful instructional tools easily digested by today's hurried students. Students who complete **Modern Graphics Communication** will leave with a full repertoire of graphical skills they will find invaluable both in education and industry.

### Updated Content

- Text has been updated to show current ASME standards.
- There are more examples of plastic and sheet metal parts.
- CAD coverage focuses on issues that arise in documenting design.
- There are many civil and architectural drawing examples.
- Full-color illustrations distinguish explanations from annotations that are part of a technical drawing.
- Consistent color use in illustrations helps readers understand drawings (e.g. cutting planes are always blue, folding lines are always tan, etc.).
- Illustrations are integrated closely with text (no more page turning to find a figure referred to in the text).
- Step-by-step explanations: Easily understood instructions with illustrations *right next to each step* walk readers through complex constructions.
- Color photos and examples show inspiring real-world applications.
- Full-color solid models help readers visualize and understand orthographic projections.

### Teaching/Learning Features

Visually oriented students and busy professionals will quickly locate content by navigating these consistent chapter features.

- **Splash Spread** An attention-getting chapter opener interests readers and provides a context for the chapter content to follow.
- **References and Web Links** Applicable references to standards and links to handy websites are at the start of each chapter.
- **CAD at Work Section** This breakout page includes tips related to using the 2D or 3D CAD model to generate drawings.
- **Portfolio Section** Examples of finished drawings wrap up the chapter by showing real-world application of topics presented.
- **Key Words** Boldfaced on first reference, key words are summarized at the end of the chapter.
- **Chapter Summary**
- **Review Questions**
- **Exercises** The excellent Giesecke problem set features updated exercises including plastic and sheet metal parts, updated assembly drawings from CAD models, and sketching problems.
- **Hands On Activities** Quick activities designed to be sketched on the pages to reinforce chapter content indicated by icons in the text.
- **Worksheets** Additional worksheets at the end of the text provide visualization and practice for chapter topics.

### Supplements

- **Companion Web Site** with new animations and models that match figures in the text.
- **Problem Workbooks**
- **Instructors' Materials** (Online Instructor's Manual, PowerPoint™ slides, and Test Bank.)

# USING THIS BOOK

## CHAPTER OPENER SECTIONS

Topics that you can expect to learn about in this chapter are listed here.

A large illustration and an interesting overview give you a real-world context for what this chapter is about.

CHAPTER ONE

## THE WORLDWIDE GRAPHIC LANGUAGE FOR DESIGN

**OBJECTIVES**

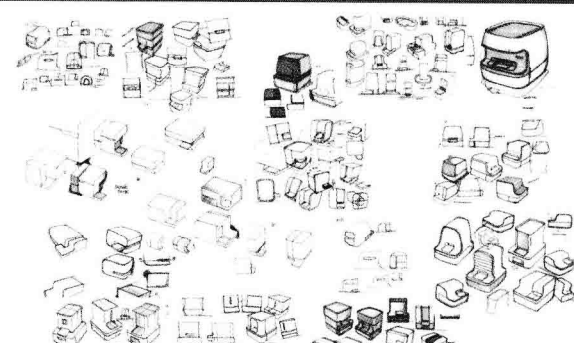
After studying the material in this chapter, you should be able to:

1. Describe the role of drawings in the design process.
2. Contrast concurrent versus traditional design processes.
3. List five professions that use technical drawings.
4. Describe four creativity techniques.
5. Explain why standards are important.
6. Identify uses of the graphic language.

Refer to the following standards:

- Y14.1-2004 Engineering Drawing Practices
- Y14.2-1992 Line Conventions and Lettering
- Y14.1-2005 Decimal Inch Drawing Sheet Size and Format
- Y14.1-2005 Metric Drawing Sheet Size and Format

THE WORLDWIDE GRAPHIC LANGUAGE FOR DESIGN 3



Conceptual Sketches. Exploring many design options through quick sketches is one method that Lunar, recently named one of the top 10 award winning American product design firms by *BusinessWeek* magazine, uses to create beautiful products and successful brands. *Courtesy of Lunar Design.*

**OVERVIEW**

Regardless of the language they speak, people all over the world use technical drawings to communicate their ideas. Graphic representation is a basic, natural form of communication that isn't tied to a particular time or place. It is, in a sense, a universal language.

Like carpenters who learn to use the tools of their trade, engineers, architects, drafters, designers, manufacturers, and technicians learn the tools of technical drawing. They learn specific methods to represent ideas, designs, and specifications in a consistent way that others can understand. By becoming an effective graphic communicator, you can ensure that the product, system, or structure that you envision is produced as you specified.

Regardless of the language they speak, people all over the world use technical drawings to communicate their ideas. Graphic representation is a basic, natural form of communication that isn't tied to a particular time or place. It is, in a sense, a universal language.

Accomplishing ideas, from the simplest to the most elaborate, requires teamwork. A new product, machine, structure, or system may exist in the mind of the engineer or designer, but before it can become a reality, the idea must be communicated to many different people. The ability to communicate design concepts quickly and accurately through technical drawings is key to meeting project budgets and time constraints. Effective graphic communication is also an advantage in the global marketplace where team members may not always share a spoken or written language.

Check the sites below for engineering graphics supplies and equipment:

- <http://www.reprint-draphics.com/>
- <http://www.tecdepot.net/~essco/draft/draft.htm>
- <http://www.graphic-design.com/type/index.html>
- Y14-40 Design Tools: <http://www.tiz40.com>

Drawing Standards that apply to this chapter are shown here.

Handy Web Sites that apply to this chapter are shown here.

### WEB SUPPLEMENT ICONS



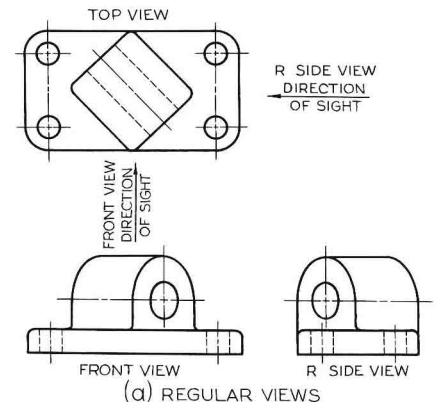
This icon of a solid modeled block tells you that a solid model to accompany this figure or topic is available online.



This icon of a film strip tells you that an animation that explains this figure or topic is available online.

### SOLID MODEL VISUALIZATION ART

Solid models bring views to life on the page to help you visualize the drawing.



## "STEP-BY-STEP" ACTIVITIES

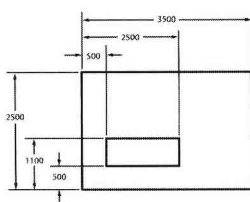
Throughout the book, complicated processes are shown as step-by-step activities with each illustration right next to the text that explains it.

"Step-by-Step" tab identifies these activities.

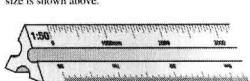
34 CHAPTER 2 LAYOUTS AND LETTERING

**STEP-BY-STEP**

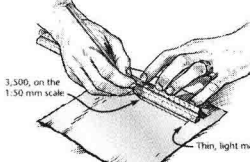
### MAKING MEASUREMENTS TO LAY OUT A ONE-FIFTH SIZE METRIC DRAWING



- Determine the full size measurements of the object you will draw. This example will lay out a 3500 x 2500 mm flat plate with a rectangular slot in it. A picture of the part to be drawn with dimensions representing its actual size is shown above.
- Find your 1:50 ratio metric scale, like this one.
- Continue to lay out the remaining lengths. Even slight errors in measurements when using a scale may accumulate to produce a significant error, so work carefully.



70 mm, on the full metric scale



3,500, on the 1:50 mm scale

Thin, light marks

To avoid cumulative errors, instead of setting off distances individually by moving the scale to a new position each time, position the scale once and mark all of the distances by adding each successive measurement to the preceding one.

This is useful in dimensioning drawings, too. Keep in mind that providing dimensions from one end to each successive location (say, in the case of building a wall) makes it easier for the worker to lay it out quickly and accurately.

Starting from the 0 end of the 1:50 scale, use a sharp pencil to make a thin, light, short line to mark off the length of the 3500 mm line. To make accurate measurements, be sure to place the scale edge parallel to the line you are measuring on the drawing, and make your dashes at right angles to the scale, at the correct graduation mark, as shown.

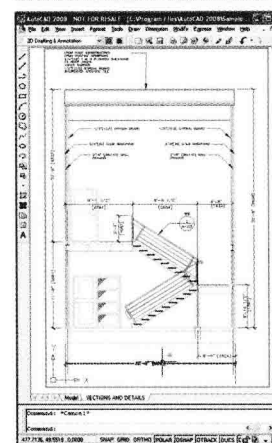
## "CAD AT WORK" PAGES

CAD at Work sections break out tips related to using the 2D or 3D CAD model to generate drawings.

A header with a "CAD at Work" tab identifies these pages.

**CAD at WORK**

### SCALING ANNOTATIONS AUTOMATICALLY USING AUTOCAD 2008



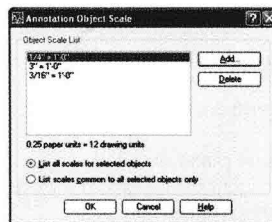
You might think that displaying text in a CAD drawing is one of the easiest things to do. You can quickly type in the text you want to display and select the font, height, slant, and rotation angle. That part is easy, but annotations are useless if nobody can read them.

When you create drawings that will be plotted on different sized sheets or at different scales, sizing the text can require a lot of planning. Take the plot architectural plan drawing shown in Figure A for example. When plotted to scale  $3'' = 1'-0''$ , the text showing dimensions is clearly visible. But when shown at one-twelfth of that size, scale  $1/4'' = 1'-0''$ , that same text becomes illegible.

The ability to reuse the same CAD data at different scales without having to recreate the drawing is one of its big advantages over pen and paper drawings. Yet, cumbersome workarounds were once necessary to make legible text at different scales. One workaround was to have several different sizes of the same text, which the user would turn on or off depending on what drawing scale was used.

Now, AutoCAD 2008 software provides a feature called annotation scaling. Here is how it works: Drawing objects that are commonly used to annotate drawings (provide text information) can have their annotation property turned on. This allows you to create one annotative object that displays at different sizes, based on scale properties.

In the AutoCAD software, object types that can have annotative object properties include Text, Mtext, Dimensions, Hatches, Tolerances, Multileaders, Leaders, Blocks, and Attributes.



(A) When plotted to scale  $1/4'' = 1'-0''$  on an  $8.5 \times 11''$  sheet, the text showing the dimensions is clearly visible. Courtesy of Autodesk, Inc. © 2006-2007. All rights reserved.

(B) Using the annotation scaling feature of AutoCAD 2008 software, annotative text can be made legible at various scales. Courtesy of Autodesk, Inc. © 2006-2007. All rights reserved.



**HANDS-ON**—This feature provides an opportunity for the student to practice a technique just learned by trying a quick and easy activity right on the page. These are great confidence builders.

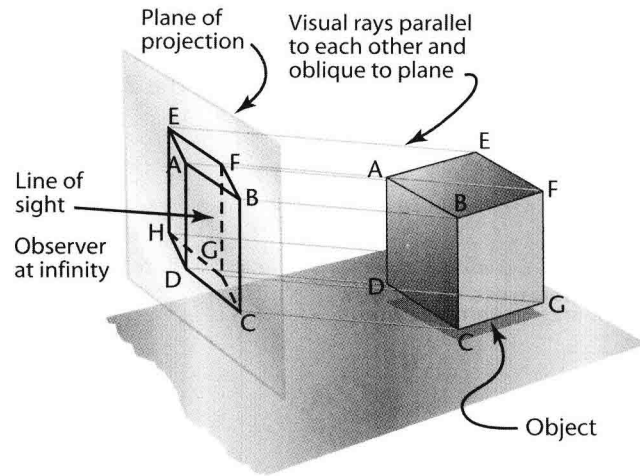


**TEAR-OUT WORKSHEETS**—Activities that help students visualize and retain information presented in the text are located at the end of the book.



## ILLUSTRATIONS

Colored callouts differentiate explanatory text from annotations in technical drawings. Consistent use of color helps differentiate the meaning of projection lines, fold lines, and other drawing elements. A color key is provided for easy reference.



## Color Key for Instructional Art

| Item                    | In instructional art | In a technical drawing       |
|-------------------------|----------------------|------------------------------|
| Callout arrow           |                      | *                            |
| Dimension line          |                      | a thin (0.3mm) black line    |
| Projection line         |                      | a lightly sketched line      |
| Folding line            |                      | used in descriptive geometry |
| Picture plane on edge   |                      | *                            |
| Plane of projection     |                      | *                            |
| Cutting plane on edge   |                      | (see Chapter 6)              |
| Cutting plane           |                      | *                            |
| Reference plane on edge |                      | used in descriptive geometry |
| Reference plane         |                      | *                            |
| Viewing direction arrow |                      |                              |
| Horizon + ground line   |                      |                              |
| Rotation arrow          |                      | 30°                          |

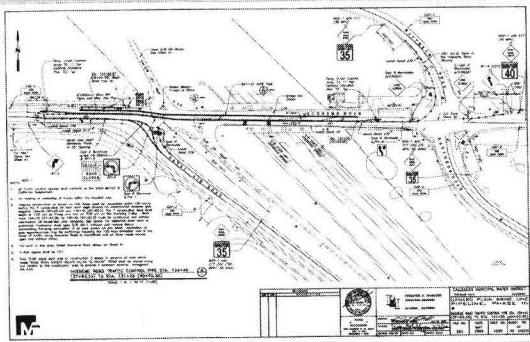
\* Not a typical feature of technical drawings. (Shown in this book for instructional purposes.)

## "PORTFOLIO" PAGES

This section offers examples of finished drawings showing real-world application of topics presented.

Look for the tan pages with a portfolio tab on the outer edge.

### CHAPTER 2 LAYOUTS AND LETTERING



A civil drawing showing approval blocks and engineers' stamp. Courtesy of Perrier and Ingosbee Consulting Engineers and Collegues Municipal Water District.

| WINDOW NUMBER | DATE     | BY       | CHKD | APP'D | DESCRIPTION     |
|---------------|----------|----------|------|-------|-----------------|
| 1             | 10/10/00 | J. Smith |      |       | Initial drawing |
| 2             | 10/10/00 | J. Smith |      |       | Revised drawing |
| 3             | 10/10/00 | J. Smith |      |       | Revised drawing |
| 4             | 10/10/00 | J. Smith |      |       | Revised drawing |
| 5             | 10/10/00 | J. Smith |      |       | Revised drawing |
| 6             | 10/10/00 | J. Smith |      |       | Revised drawing |
| 7             | 10/10/00 | J. Smith |      |       | Revised drawing |
| 8             | 10/10/00 | J. Smith |      |       | Revised drawing |
| 9             | 10/10/00 | J. Smith |      |       | Revised drawing |
| 10            | 10/10/00 | J. Smith |      |       | Revised drawing |

Window and door schedules are used in architectural drawings to list the manufacturer and other information. Courtesy of Frog Rock.

Exercises are easy to find. The color stripe on the outer edge of the page corresponds to the chapter so you can flip to them quickly.

## CHAPTER REVIEW PAGE

You will find Key Words, Summary, and Review Questions sections at the end of each chapter.

### 20 CHAPTER 1 THE WORLDWIDE GRAPHIC LANGUAGE FOR DESIGN

#### KEY WORDS

Visualization  
Communication  
Documentation  
Design Process  
Concurrent Engineering  
Life Cycle Design  
Computer-Aided Design  
Computer-Aided Engineering  
Computer-Aided Manufacturing  
Design for Six Sigma (DFSS)  
Define, Measure, Analyze, Improve, Control (DMAIC)  
Six Sigma  
Quality Function Deployment (QFD)  
Product Data Management  
Enterprise Data Management  
Engineering Change Orders  
Ideation  
Prototype  
Parametric Modeling  
Constraint-Based Modeling  
Feature-Based Modeling  
Rapid Prototyping  
Standards  
Reverse Engineering  
Coordinate Measuring Machine  
Functional Decomposition  
Patent Drawings  
Product Definition

#### CHAPTER SUMMARY

The members of the engineering design project team must be able to communicate among themselves and with the rest of the project team in order to contribute to the team's success.

The graphic language is the universal language used to design, develop, and construct products and systems throughout the world.

There are two basic types of drawings: artistic and technical. The design process is the ability to combine ideas, scientific principles, resources, and existing products into a solution for a problem. It consists of five specific stages.

Every technical drawing is based on standards that prescribe what each symbol, line, and are means.

The basic principles for communicating information using technical drawings are the same whether you are creating drawings by hand or using CAD.

Successful companies hire skilled people who can add value to their team. A thorough understanding of the graphic language is an essential skill that employers value.

#### REVIEW QUESTIONS

1. When is sketching used as graphic communication?
2. Why are standards so important for members of the engineering design team?
3. What is the design process?
4. What are the five phases of the design process?
5. Describe the difference between concurrent and traditional design process models.
6. What does PDM or EDM stand for? What are some advantages of PDM?
7. When are rapid prototypes useful?
8. List three ways a CAD database can be used.
9. List five techniques you can use to enhance creativity.

### SECTIONING EXERCISES 243

#### SECTIONING EXERCISES

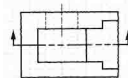
Any of the following exercises may be drawn freehand or with CAD. Study the chapter on dimensioning first if you are going to add dimensions to your drawings. Show cutting-plane lines for practice. Can you tell that in Exercises 6.4 number 2 and number 14 the cutting-plane lines should be shown to make the drawing easy to interpret?

#### Freehand Sectioning Problems

Exercises 6.1-6.4 are especially suited for sketching on 8.5" x 11" graph paper with appropriate grid squares. Sketch one or two problems per sheet, adding section views as indicated. To make your drawings fit on the paper easily, use each grid square as equal to either 6 mm or 1/4". An example is shown below.

#### Freehand Sectioning Exercise Example

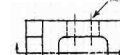
Exercise 6.1 Freehand Sectioning Problems. Redraw the given views and add the front section view.



Draw section view



Rotate side view into position



Bounded-end dot

Drilled hole

Exercise 6.2 Freehand Sectioning Problems. Redraw the top view, rotate the side view and move it into a position so that you can project the front view in section. Add the front section view. Each grid square equals 6 mm (1/4").



Exercise 6.3 Freehand Sectioning Problems. Use the same directions for Exercise 6.2.



## EXERCISES

The Giesecke problem set features updated exercises including plastic and sheet metal parts, updated assembly drawings from CAD models, and sketching problems.



# PREFACE

## ABOUT THE AUTHOR

Frederick Giesecke, founder of Texas's first formal architectural education program at what is today Texas A&M University, has been described as "a wunderkind of the first magnitude." He joined the A&M faculty at the age of 17, after graduating in 1886 with a B.S. in Mechanical Engineering



Frederick E. Giesecke as a cadet in the Texas A&M Corps of Cadets.



Frederick E. Giesecke, founder of Texas's first formal architectural education program.

and by the age of 19, was appointed head of A&M's Department of Mechanical Drawing.

Studying architectural drawing and design at Cornell University and Massachusetts Institute of Technology, respectively, he also served as head of the Department of Architecture and the official college architect at Texas A&M, designing many campus buildings that are still standing today.

A long-time admirer of Giesecke's legacy, Shawna Lockhart was honored to carry on the commitment to clear, engaging, thorough, and well-organized presentation that began with the original author.

Lockhart is known as an early adopter and authority on CAD technologies, as an instructor noted for outstanding dedication to students, and for encouraging a broad spectrum of individuals, particularly women and minorities, to follow careers in engineering related fields.

She now works full time to ensure that the Giesecke graphics series continually applies to an evolving variety of technical disciplines.

## ONLINE RESOURCES

To access supplementary materials online, instructors need to request an instructor access code. Go to [www.pearsonhighered.com/irc](http://www.pearsonhighered.com/irc), where you can register for an instructor access code. Within 48 hours after registering, you will receive a confirming e-mail, including an instructor access code. Once you have received your code, go to the site and log on for full instructions on downloading the materials you wish to use.

## SUPPLEMENTS

- **Instructor's Manual and Test Bank:** This manual includes answers to end-of-chapter problems, chapter worksheets, teaching outlines, and a test bank keyed to each chapter of the book.
- Online PowerPoint slides of key text figures.
- **Web Site:** [www.prenhall.com/giesecke](http://www.prenhall.com/giesecke): This Web site serves as an online study guide for students and features the following:
  - Dozens of animations created from art in the 4th edition
  - Self-grading concept questions: true or false, multiple choice, and fill-in-the blank questions for each chapter
  - Chapter summaries and objectives
  - Links to relevant websites for CAD and technical drawing

## WORKBOOKS

Three workbooks with additional problems are available. These workbooks are fully class-tested for effectiveness and relevance to the course. They range from traditional to more modern approaches.

- **Engineering Drawing Problem Series 1 (ISBN: 013658361):** Contains traditional mechanical workbook problems.

- **Engineering Drawing Problem Series 2 (ISBN: 0136588816):** Contains traditional problems with an emphasis on engineering concepts.
- **NEW 4th Edition Engineering Drawing Problem Series 3 with CD (ISBN: 0135134811):** The new edition of this workbook by Paige Davis and Karen Juneau contains more modern drawing problems as well as a CD with a disk of starter CAD files.

## SOFTWARE BUNDLES

This text may be packaged with a student version of CAD software. To request specific bundling information, as well as ISBNs and prices, please contact your local Pearson Professional & Career sales representative. For the name and number of your sales representative, please contact Pearson Faculty Services at 1-800-526-0485.

## ACKNOWLEDGMENTS

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